

Structured Notes According to

FMT

Revision friendly **Fully Colored Book/Structured Notes**

For Best results, watch the video lectures along with reading notes



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(Author)

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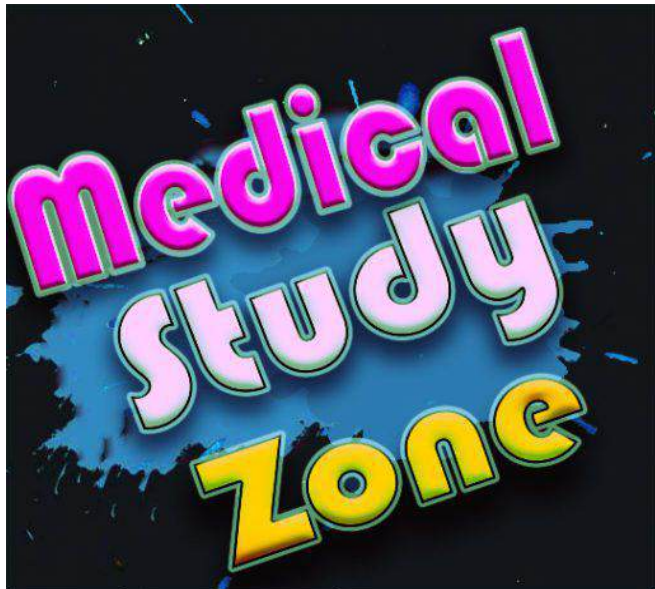
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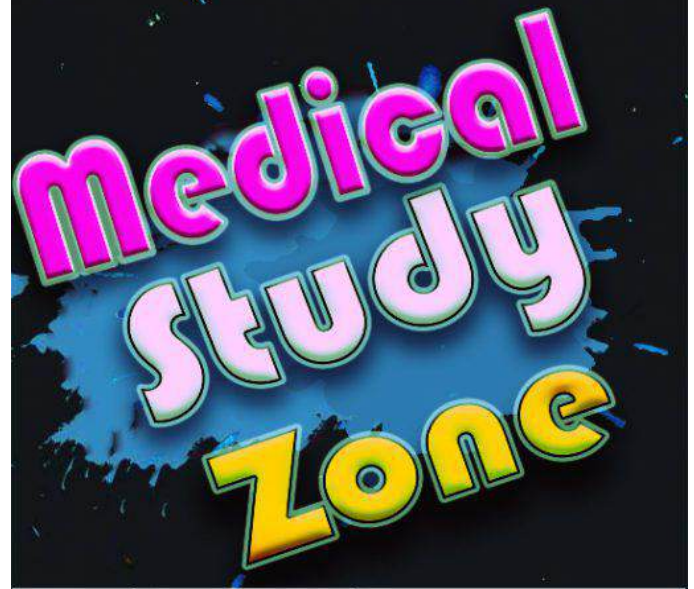
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LIST OF IMPORTANT TOPICS

- ☛ **IPCs (very Important)** Relevant to medical practice
- ☛ **Forensic Thanatology**
 - Suspended animation
 - Eye changes
 - Pattern of Algor mortis
 - Livor mortis & poisoning
 - Rules in Rigor mortis & distribution of rigor mortis
 - Colour Changes in Decomposition
- ☛ **Autopsy**
 - Techniques of organ dissection
- ☛ **Human identification**
 - Race determination indicators from bone & teeth
 - Sex determination of bones (skull & pelvis)
 - Indices for sex determination from bones
 - Dentition - Ages estimation methods
 - Other techniques for identification like dactylography, poroscopy, rugoscopy
- ☛ **Asphyxial deaths**
 - PM findings in Hanging, Strangulation
 - Hyoid fractures
 - Various terms (methods) in strangulation
 - Types of drowning
 - PM findings in drowning (specific findings & non specific findings)
- ☛ **Forensic traumatology**
 - Ageing of abrasion, contusion
 - Laceration, Stab injury
 - Hesitational, defence & fabricated injuries
 - Skull fractures
 - Various types of gunpowder
 - Appearance of wound in different ranges.
- ☛ **Forensic toxicology**
 - Atypical bullets
 - Legal duties of a doctor in poisoning
 - Diagnosis of poisoning during autopsy (from hypostasis, smell, appearances of organs)
 - Metallic poisons (mercury, Lead & arsenic- most important)

☛ **Forensic traumatology**

- Cardiac poisons
- Delirients
- Insecticide poisoning
- Snake bite envenomation
- Plant irritants

☛ **Sexual jurisprudence**

- Rape - examination of accused & victim
- Associated Legal sections
- Various terms in sexual perversions
- Tests for live birth

☛ **Forensic Psychiatry**

- Various rules for criminal responsibility of insane person

☛ **Legal procedures & law**

- Inquests
- Powers of criminal courts
- Recording of evidence in the court of law & relevant sections
- Infamous conduct
- Declarations
- Various doctrines involved in medical negligence

☛ **Blood stains & seminal stains**



LEARNING OBJECTIVES



UNIT-1- FORENSIC TRAUMATOLOGY

1. Mechanical injuries

- Abrasion
- Types of abrasions
- Contusions
- Types of contusions
- Laceration
- Types of lacerations
- Incised wound
- Hasitational cuts
- Stab wounds
- Hara-kin
- Chop wounds
- Defense wounds
- Fabricated wounds

2. Regional injuries-1

- Introduction
- Skull fractures
- Types of skull fractures
- Glancing bullet
- Skull base fractures

3. Regional injuries-2

- Extra-dural hemorrhage
- Differences b/w extra-dural& subdural hemorrhage
- Sub-arachnoid Hg
- Punch Drunk Syndrome and Dementia Pugilistica
- Coup and Contrecoup Injuries

4. Forensic ballistics

- Different types of Ballistics
- Introduction
- Firearms
- Breach
- Classification of guns
- Calibre
- Bore/gauge
- Ammunition
- Types of gun powder
- Types of lead shots
- Discharge of a gun

- Range determination
- Effects & Dispersion
- Atypical dispersion
- Entry VS exit wound
- Bevelling of the skull
- Different types of Bullets
- Bullet fingerprinting
- Gunshot residue test

5. **Explosion injuries & scalds**

- Bomb
- Molotov's Cocktail
- Types of Blast Injuries
- Scalds

6. **Thermal injuries-1**

- Injuries d/t cold
- Injuries d/t heat
- General increase in heat
- Heat stroke

7. **Thermal injuries-2**

- Local effects of heat
- Burns
- Degree of burns
- Estimation of TBSA
- Cause of death
- Post-mortem & antemortem findings of burns
- Internal findings & Non-Specific findings of burns

8. **Electrical injuries**

- Important points about electricity
- Causes of death
- Post-mortem findings
- Lightning Injuries
- Sledge hammer effect
- Filigree burns
- Kerauno-paralysis

9. **Cold injuries**

- Types of cold injuries
- General vs Local Effects of cold
- Hypothermia
- Paradoxical undressing
- Hide & die syndrome
- Local effects
- Frostnip
- Frostbite
- Treatment of frost bite
- Trench foot

10. Transportation injuries

- Classification of RTA Injuries
- Pedestrian Injuries
- Primary Impact Injuries
- Secondary Impact Injuries
- Tertiary Impact Injuries
- Occupants Injuries
- Head Impact
- Whiplash Injury
- Steering Impact
- Seat Belt Injury
- Seatbelt Syndrome

11. Torture methods

- Legal provisions against torture
- Different Methods of torture
- Images



1

MECHANICAL INJURIES

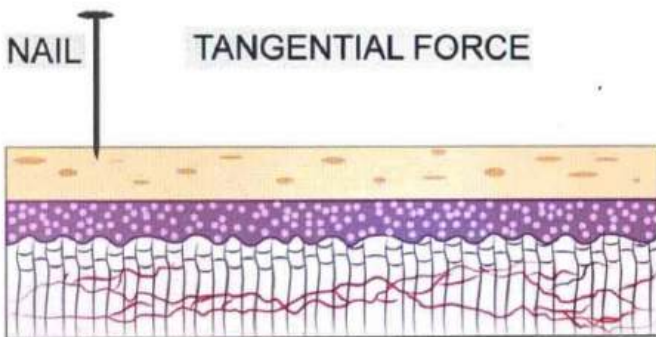
CLASSIFICATION OF MECHANICAL INJURIES

Blunt force trauma	Sharp force trauma	Weapon with pointed end
<ul style="list-style-type: none"> • Abrasion • Contusion • Laceration • Fractures & Dislocations 	<ul style="list-style-type: none"> • Incised wound <ul style="list-style-type: none"> ○ Produced by Light cutting weapon ○ E.g: Surgical blade • chop wound <ul style="list-style-type: none"> ○ Produced by Heavy cutting weapon ○ E.g: Axe, Chopper 	<ul style="list-style-type: none"> • Produces stab wound • Weapon need not to be sharp. It should just have pointed tip • E.g: Pencil

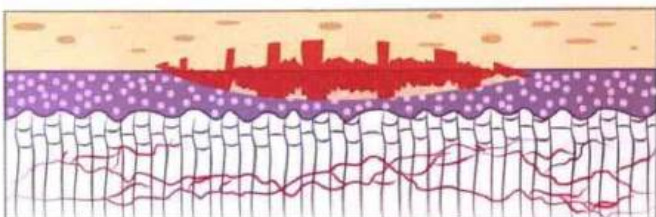
ABRASION

00:05:13

- Abrade means Scrape. Abrasion means Scraping of the epithelium
- Force acts tangentially on skin & scrapes the epithelium
- Only epidermis is affected
- Bleeding/ Scarring is absent [thus, it heal easily]



ABRASION



Mechanism

- 2 types
 - Force acts tangentially & scrapes the skin
 - E.g.
 - Scratch abrasion
 - Grazed abrasion
 - Force acts perpendicularly & crushes the epithelium of the skin
 - E.g.
 - Pressure abrasion
 - Patterned abrasion



TYPES OF ABRASION

00:08:54

Tangential Pressure Abrasions

1. Scratch abrasion [Simplest abrasion]

- Produced by Pin, Thorn, Nail etc



Scratch

2. Grazed abrasion

- MC seen among Road traffic accidents
- Occurs when skin is rubbed against the rough surface [i.e. when a person is dragged on rough road]
- Multiple scratches over wide area are seen
- It is MC type of Abrasion
- Aka Gravel rash/ Brush burn/ Sliding abrasion / Scraping

abrasion



Grazed abrasion (healing)

GRAZED ABRASION [Multiple scratches over wide area]



Perpendicular Pressure Abrasions

3. Pressure Abrasion

- Crushing of the epithelium is seen d/t continuous application of pressure perpendicularly
- E.g. Ligature mark, Bite mark etc

Ligature mark [pattern of ligature mark can't be seen]: Pressure abrasion



Bite Mark

4. Patterned abrasion (Imprint abrasion)

- Crushing of epithelium by perpendicular pressure + Pattern of weapon imprinted on the skin are seen
- E.g.: Radiator grill mark, Tyre mark, Ligature mark [sometimes]

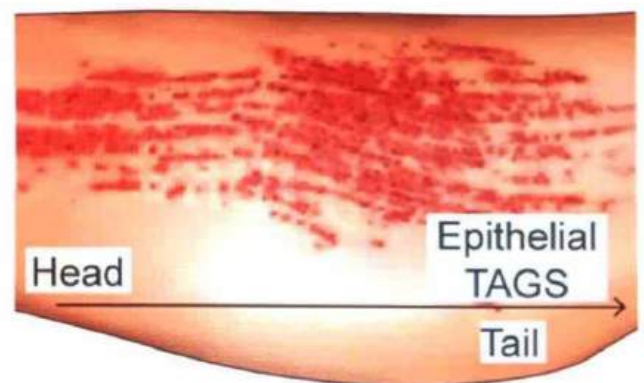
Ligature mark [pattern of ligature mark is seen]: Patterned Abrasion



Medical importance

On examining an abrasion, we can find

- **Direction of force**
 - Head end is broad & tail end is narrow
 - Scraped epithelium is collected at tail end of abrasion k/a Epithelial tag/Heaping of epithelium
- **Ageing of Abrasion**
 - It is based on the healing pattern & colour of the scab
 - Any abrasion heals within 1 week
 - During this 1 week, scab [dried lymph] keeps on changing its colour



GRAZED ABRASION

Change in colour of abrasion	Time taken
• R – Raw [no scab]	< 12 hours
• R – Reddish Scab	> 12 hours
• RB - Reddish Brown scab	2-3 days
• B - Brown scab	4-5 days
• B – Black scab	6-7 days

How to remember

• R, B₁

- After a week, scab falls off leaving a hypopigmented area
- When RTA Pt. comes to the casualty & says that he had met with an accident 3days back. Examine the pt.
 - If the abrasion is raw & reddish, it means abrasion was sustained just recently. Thus, history doesn't correlate with the findings
 - It indicates that the pt. is telling lie
- **Manner of the death**
 - Depends on the location & distribution of the abrasion

Distribution of Abrasion	Suspected manner of death
Peri-oral abrasions	Smothering
Multiple grazes all over the body	Road Traffic Accident [RTA]
Genital abrasions	Sexual assault
Crescentic nail abrasions over neck	Throttling / Manual strangulation

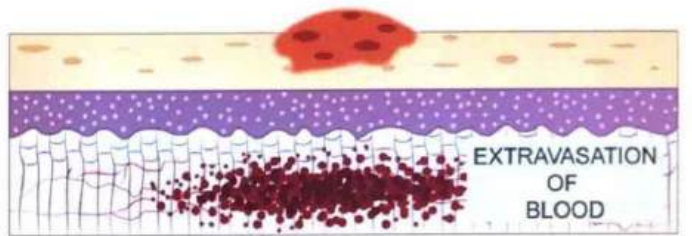
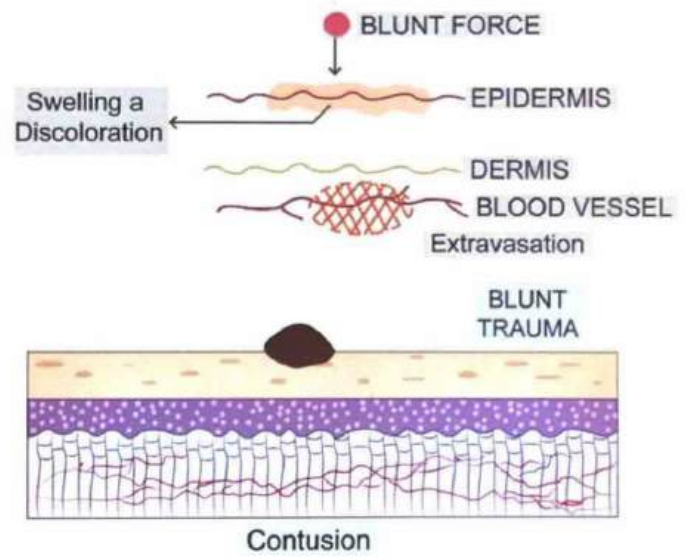
D/D of Antemortem abrasions

- Antemortem bite marks
- Excoriations
- Post-mortem abrasions
 - MC located at bony prominences
 - Inflammatory/Vital reaction is absent
- Medically, the most significant wound is Abrasion [as it gives much information]

CONTUSION aka BRUISE

- When a blunt force acts on the skin, blood vessels rupture resulting in accumulation/ Extravasation of blood under

- the skin [not in epidermis] k/a Contusion/ Bruise
- Margins are irregular
 - Extravasation results in swelling & discoloration of the skin



Important Information

- Contusion is injury to dermis
- Epidermis isn't injured
- Margins are irregular [this differentiates contusion from other conditions]

Factors influencing the development of bruise

- 1. Site**
 - At some sites, smaller force can produce severe bruising
 - E.g.
 - At Bony Prominences
 - Loose tissue like scrotum, eyelids etc
 - At some sites, higher force can produce less bruising
 - E.g: Thicker tissues like palm, soles etc
- 2. Age**

- In children & elderly (two extremes of ages), minimal force can cause severe bruising d/t delicate subcutaneous tissue

3. Sex

- Females tend to bruise more easily than males [d/t nature of subcutaneous tissue]

4. Complexion

- Bruises are clearly visible in ppl with Fairer complexion
- In dark complexion, contusion isn't clearly visible



Epidermis is looking almost normal in above image



But, when we incise, extravasation of blood is seen

CLASSIFICATION OF BRUISES, BASED ON THEIR LOCATION

- Intradermal bruise: Bruise is close to Dermo-epidermal junction
- Subcutaneous bruise
- Deep bruise: Bruise is deeper to muscle planes
 - Deep bruise might come out after 1/ 2 days k/a Come-out bruise / Delayed bruise

SPECIAL TYPES

00:31:56

1. Ectopic bruise / Migratory bruise

- If a bruise develops at another site, other than the site of the impact, it is k/a Ectopic or Migratory bruise [i.e blood

migrates]

- E.g.

◦ Black eye

- Impact is at frontal region. But contusion is seen at Peri-orbital region



◦ Battle's sign

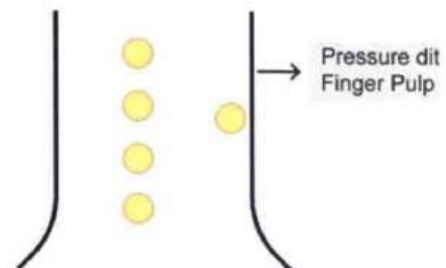
- Post-auricular ecchymosis [Ecchymosis is seen at mastoid area]
- Classically seen in Middle Cranial Fossa fracture

2. Patterned Bruise

- Suggests the pattern of the weapon
- E.g.

◦ Six Penny bruise

- Shape & size of bruise looks like six penny coins.
- This bruise is d/t pressure of fingertips
- Discoid/ round bruise is seen over the neck. It is classical to Throttling/ Manual strangulation
- It is also seen in Battered Baby syndrome



◦ Butterfly bruise

- Shape of the bruise looks like wing of the butterfly

- Classically seen d/t skin pinching
- Seen in Battered Baby syndrome/ Child abuse
- o **Tram line Bruise (aka Railway line bruise)**
 - Any weapon which is longitudinal like stick, Cane, Lathi can produce this bruise
 - This bruise looks like Tram-line/ Railway-line. Hence, k/a Tram line Bruise/ Railway line bruise
 - These patterns help us in identifying the weapon causing it

3. Artificial bruise [Fake bruise]

- Produced by application of plant juices like
 - o Marking nut
 - o Calotropis
 - o Plumbago etc
- These juices are highly inflammatory
- When these juices are applied over skin, blisters are formed d/t inflammation
- **Features of Artificial bruise**
 - o Well-defined
 - o Regular margins
 - o Blisters
 - o Acrid serum [inflammatory fluid present in the blisters]
 - o Itching
 - o Usually located at accessible parts of the body
- By the above features, it is differentiated from true bruise



Important Information

Q. A girl presented to casualty with bruises, stating that she had been assaulted. Bruises are well-defined with regular margins, located at the accessible parts of the body. Inflammatory fluid is present in the blisters. You are the medical officer examining the pt. These are true bruises or false bruises?

Ans: False bruises

2. Ageing of Contusion

- As the contusion is healing, color of contusion changes
- Thus, ageing of contusion is determined by color change of contusion
- Color of contusion depends upon the pigment inside

Pigment responsible	Color of Contusion	Time taken
Oxyhemoglobin	Red	Fresh

Deoxyhemoglobin	Blue	Few hours to 3days
Hemosiderin	Brown/ violet	4-5 days
Biliverdin	Green	6-7 days
Bilirubin	Yellow	7days- 2 weeks



Important Information

- Bruise heals in 2 weeks
- Color change starts from the periphery to the center
- No color change is seen in Sub-conjunctival hemorrhage as it is continuously exposed to Oxygen
- If a pt. presents with multiple bruises with varying colors, it represents Chronic trauma. It is typical to Battered baby syndrome [Child abuse]

Q. A person presents with a bruise & states that it was attained 4 days back. You as a doctor examined the bruise which showed color of the bruise to be green. What is your interpretation?

Ans. Green color of the bruise is attained in 6-7 days after the injury. At 4th day, it should be of brown color. Thus, the pt. is telling lie

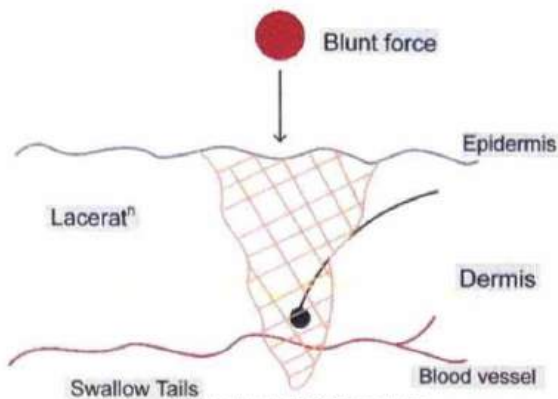
- When we examine a dead body, color change can be observed, which can be d/t Hypostasis or Contusion. These 2 are differentiated by following features

Features	Hypostasis	Bruise
Cause	Post-mortem change	Trauma
Site	Dependent parts	Anywhere
Color change	Absent	Present
Blanching	Present	Absent
Margins	Regular	Irregular
Extravasation	Absent	Present
Incise & pour water	Wash away	Persists [as it is clotted blood]

LACERATION

- Lacere means to Tear

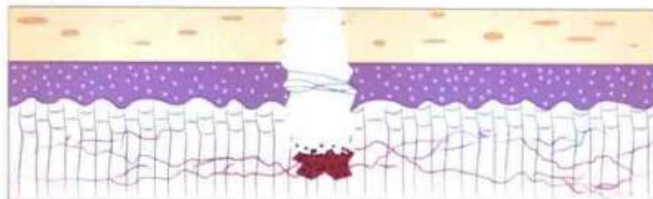
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Incised Looking Laceration

Features

- Irregular margins with contused edges
- At Floor: all the structures [Vessels /Nerves/ Hair bulb] are Crushed
- Tissue bridges: Tissue fragments connecting both the edges [confirms the diagnosis]
- Swallow tail: small split from the edge of the laceration is seen



TYPES OF LACERATION

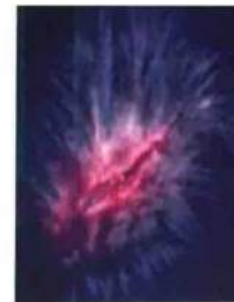
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1. Split Laceration

- Aka Incised looking laceration
- Sites involved are Bony prominences [i.e., skin is close to the bone & subcutaneous tissue is minimal]
 - Pre-tibial region/ Shin
 - Scalp
 - Forehead
 - Zygoma
 - Iliac crest
 - Posterior aspect of the elbow etc.
- When examined with a naked eye: margins look regular
- When examined with magnifying lens: Irregular margins & crushing of structures at floor are seen
- Has Medico-legal importance

? Previous Year's Questions

Q. Identify the injury shown in the images?
(AIIMS June 2020)



- A. Incised wound
- B. Lacerated wound
- C. Abrasion
- D. Contusion

2. Stretch Laceration

- Seen d/t overstretching of the skin
- Occurs when heavy force is delivered into the skin at Acute angle
- Flapping is seen
- When a person is kicked, force is delivered at an angle resulting in Stretch laceration
- In Compound fracture, where bony fragments come out, stretch laceration is seen



Stretch Laceration

3. Avulsion Laceration / Grinding laceration

- Occurs d/t Rotational Force aka Run Over Injury [Tyre running on the body part]
- Flaying [i.e. flap coming out d/t rotational force] is seen



Important Information

Degloving injury

- Type of Avulsion laceration
- Separation of skin & subcutaneous tissue from the underlying structures is seen

4. Cut Laceration

- Occurs d/t combination of blunt & sharp force (looks like Chop injury)
- Caused by Heavy weapon with sharp edge. Eg: Axe
- Edges of the wound are Bruised & crushed
- Underlying tissues are crushed
- Underlying bone is fractured

5. Tear Laceration

- Simple tearing of skin is seen
- E.g.: Laceration d/t impact with doorknob



Previous Year's Questions

Q. Rupture of the skin and subcutaneous tissue is?
(FMGE May 2018)

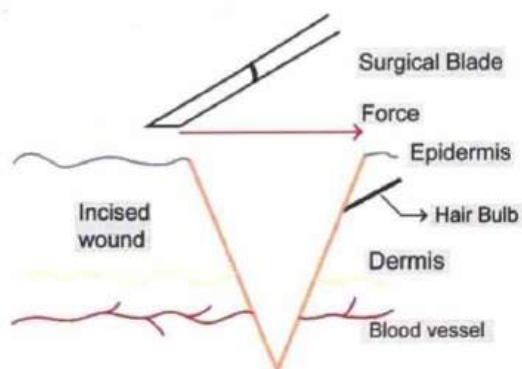
- A. Incised wound
- B. Abrasion
- C. Lacerated wound
- D. Contusion

SHARP FORCE TRAUMA

Incised wound

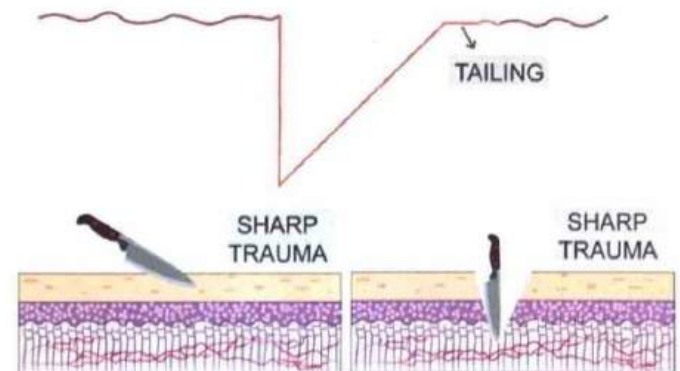
🕒 01:08:29

- Aka Cut injury/ Slash injury/ Slice injury
- Produced by light cutting weapon with sharp edges
 - E.g. surgical blade.



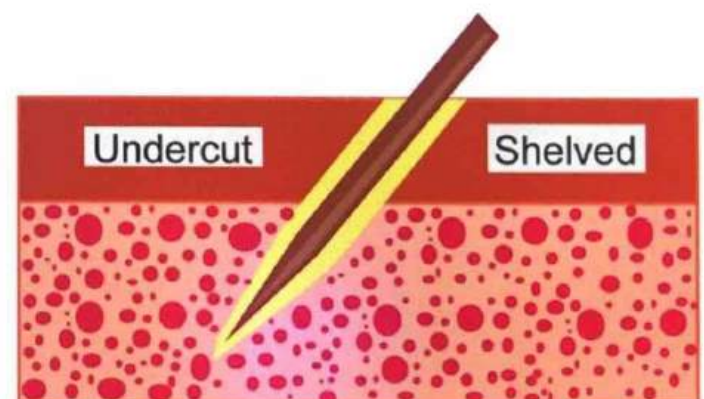
Features

- Margins are clean cut & regular
- Structures at the floor of the wound [vessels, nerves, hair bulb etc] are cut. Thus, profuse hemorrhage is seen
- Length > Breadth > Depth of the wound
- At one end of the wound, skin is superficially cut. This phenomenon is k/a Tailing.
- Tailing
 - At head end, wound is deep
 - As we go to the tail end, wound becomes superficial & at one point, skin alone is superficially cut k/a Tailing
 - Tailing helps in finding the direction of the force



Medico-Legal Importance of Incised Wounds

1. Direction of the force is determined by Tailing
2. Beveling
 - When a blade cuts the skin at oblique angle, wound with undermining edges is seen k/a Beveling
 - It is suggestive of Homicide



3. Dating of incised wound

- On examining an incised wound under microscope, we can find the age of the wound

Age of the wound	Microscopic finding
Fresh	Neutrophil margination/ migration
12 hours	Monocytes in the exudate
24 hours	Vascular buds & Endothelial layer formation
2-3 days	Granulation tissue formation
4-6 days	Fibrils formation
>7 days	Scar formation

4. Manner of the death [i.e. Accidental/Homicidal/Suicidal]

- Beveling, cuts in genitalia/ scrotum are suggestive of homicide
- Hesitational cuts are suggestive of Suicide



Important Information

Hesitational cut / Intentional cuts/ Tentative cuts/ Feelers stroke 01:19:15

- When a person is about to commit suicide, in intense anxiety & emotional stress, person initially makes multiple superficial cuts & then later one deep cut which may damage the underlying vessel & results in death.

Features of hesitational cuts

- Multiple cuts
- Superficial, linear/ parallel cuts
- Seen in accessible parts of the body [Forearm, neck, thigh, abdomen etc]
- Suggestive of suicidal tendency



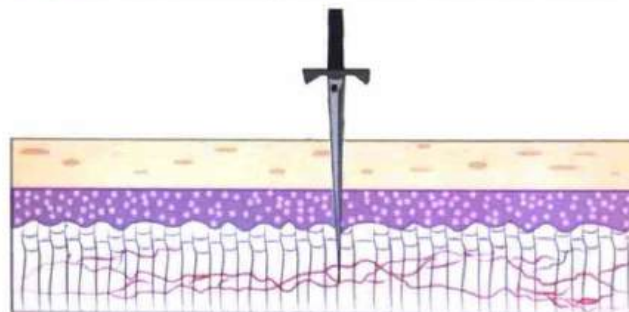
SCARS PRODUCED BY HESITATIONAL CUTS

STAB WOUND

01:21:52

- Any weapon with pointed end can cause Stab injury

- Depth of the wound is greater than other dimensions



STAB WOUND



Types of Stab Wounds

i. Punctured wounds

- Any stab injury that enters/ punctures the tissues

ii. Penetrating wounds

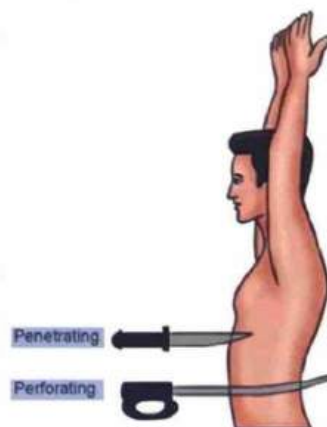
- Occurs when stabbed into the cavity [e.g. abdominal cavity, Thoracic cavity etc]
- Only Entry wound is present



Tailing is seen while withdrawing the weapon

iii. Perforating wounds

- Stab injury enters & exists the cavity
- Thus, both Entry & Exit wounds are present.



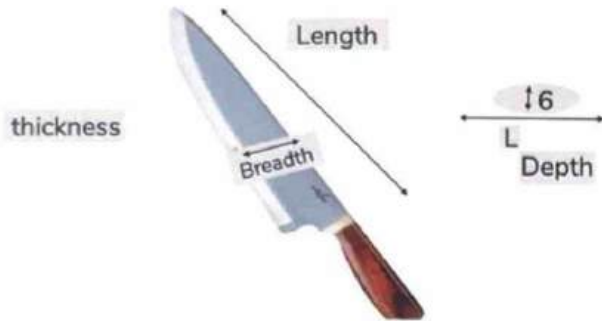
Difference b/w Entry & Exit wounds

Features	Entry Wound	Exit Wound
Size	Larger	Smaller
Margins	Inverted	Everted

Characteristics of stab wound

- Injury should be correlated with the weapon

i. Dimensions



- Length of the blade corresponds to the depth of stab wound [approximately]
- Breadth of the blade corresponds to the length of the stab wound
- Thickness of the blade corresponds to the breadth of the stab wound

ii. Shape

- Shape of the stab injury depends upon the type of the weapon used

Single edge Knife	Double edge Knife
<ul style="list-style-type: none"> Knife having sharp edge on one side Produces wedge/ Triangle shaped wound (One end is acute, another end is blunt) 	<ul style="list-style-type: none"> Knife having sharp edges on both the sides [double-edged weapon] Produces oval/ spindle shaped injury (Both ends are acute)



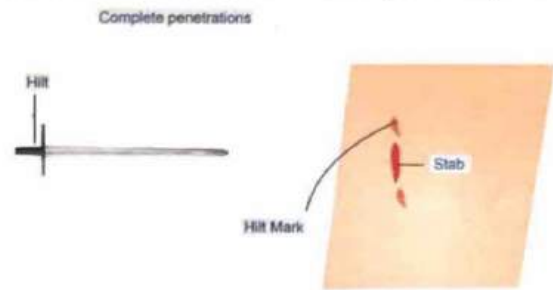
B = Blunt edge

S = Sharp edge

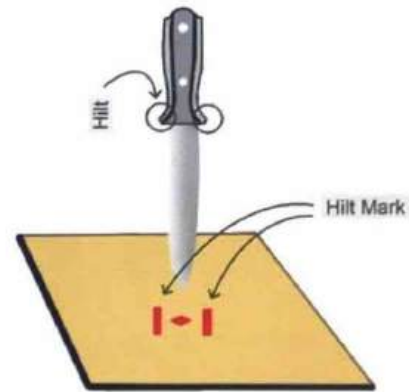
- Small splitting is seen at one edge of the wound, which looks like tail of a fish. Hence, k/a Fish tailing
 - It is produced by blunt edge of the knife

Hilt mark

- Patterned abrasion/ bruise produced by hilt of the weapon on sides of the stab injury
- Occurs when complete penetration by the weapon is seen



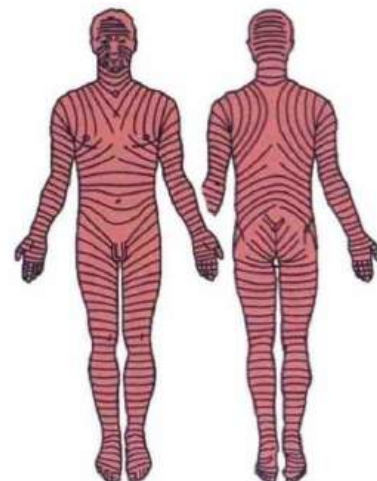
- Hilt mark determines the direction of force of the weapon



- Gap produced d/t stab injury is k/a Gaping
- Gaping depends on the Lines of Langer

Lines of Langer

- Imaginary lines, based on the arrangement of collagen fibers in the body
- If the stab injury is parallel to these lines, Gaping is less
- If the stab injury is perpendicular to these lines, Gaping is more [as fibers are cut].



Hara-kiri/Seppuku

🕒 01:38:54

- It is a method of suicide, generally practiced by Japanese soldiers
- It is self-inflicted, stab injury to the abdomen [abdominal wall is cut; contents of abdomen fall outside & the pt. dies immediately]
- It's a method to commit Instantaneous death
- Cause of death is d/t Evisceration & Cardiovascular collapse/Hypotension



HARAKIRI

Chop wound

🕒 01:40:20

- It is the combination of heavy blunt & sharp forces
- Caused by Axe [heavy weapon with sharp edge]
- Margins of the wound are sharp, but the edges are bruised/contused
- Crushing of the underlying tissues & fracture of the underlying bones are seen at the floor of the wound [d/t heaviness of the weapon]
- Direction of the assailant can be determined
- If we see depth of the chop wound.
 - It is deeper towards the side of assailant
 - It is superficial towards the other side
- Gaping is seen



Defense wound (chop injury)



Previous Year's Questions

Q. A dead body with a wound on the neck with clean cut edges, crushed tissues with disrupted vertebra body portions. Identify the type of the wound?
(FMGE Aug 2020)

- A. Cut wound
- B. Chop wound
- C. Laceration
- D. Avulsion

DEFENSE WOUNDS

🕒 01:43:06

- These are caused d/t the result of defending
- If the weapon grasped while defending, Palmar surface of 1" webspace is the MC site effected. This is k/a Active defense injury
- If the person just tries to protect himself without grasping the weapon, Medial/ Ulnar margin of the forearm is MC affected. It is k/a Passive defense injury
- Though Presence of defense injury is diagnostic to homicide, it is not Mandatory to present in all cases
- Defense injuries are absent when pt. is
 - Attacked from behind
 - Unconscious
 - Asleep

FABRICATED/FICTIOUS INJURIES

🕒 01:46:14

- These injuries are either self-inflicted [done by himself] or self-suffered [inflicted with the help of others]
- It can be differentiated from other injuries by following features
 - MC type of injury seen is Incision
 - Some Motive is always present
 - History doesn't correlate with the findings of injuries
 - Clothes aren't affected normally
 - Defense injuries are absent
 - MC seen at Accessible parts of the body



CLINICAL QUESTIONS



Q. A 15 year old boy was examined by the team doctor after he sustained an injury to his knees and shin during the ongoing cricket match. He had attempted a difficult fielding where he had instinctively dived and skidded on his knees for a short distance on the rough unkept school playground. Examination of his legs revealed multiple parallel and longitudinal scratches that had some avulsed skin gathered at the edge of the wound near the apex of the patella. The doctor identified them to be a Graze wound which are a type of ?

- A. Contusion
- B. Abrasion
- C. Lacerated wound
- D. Incised wound

Answer: B

Solution

Types of abrasion

- Scratch**
 - Caused by a sharp, pointed object.
 - Surface layers of skin are heaped up in the direction of movement, so epithelial tags can be seen at the end.
 - eg fingernails, pins or thorns
- Graze or Brush burn or gravel rash**
 - Most common type.
 - A collection of innumerable scratch abrasions. Due to violent rubbing of skin on a rough surface (eg. dragging over the road).
 - Comprise of uneven, longitudinal parallel lines with epithelium heaped up at the end of these lines. This heap up indicate the direction of the force. eg Roadside accident, Glancing kick
- Pressure**
 - Caused when a relatively less amount of force is applied for a relatively long time.
 - Corneal abrasions due to contact lens, Ligature mark in hanging, Shoe bite, Teeth Bitemark, Nappy abrasions
- Impact**
 - Caused when a relatively large amount of force is applied for a relatively short span of time.
 - Slightly depressed below the surface
 - The dermis is damaged - underlying bruise
 - eg Headlamp rim marks in a head-on collision, Recoil/muzzle impression in contact gunshot injury, Tire marks of a car, bus or truck in run-over accidents
- Patterned**
 - The pattern of the object causing reproduced on skin. Eg Bicycle chain,

If ligature material has some specific pattern, it can cause a patterned pressure abrasion in case of hanging

Reference: Review of Forensic Medicine & toxicology; Gautum Biswas; 3rd edition; page 189

Q. A 35 year old married woman had arrived at the police station complaining of domestic abuse by her husband. The investigating medical officer noticed bruises on the forearm, shoulder and back on examination. She also had blackening with swelling and puffiness around her left eye, which made it difficult for her to open her eye. The blackening around the eyes is caused by?

- A. Friction abrasion
- B. Patterned abrasion
- C. Penny bruise
- D. Ectopic bruise

Answer: D

Solution

Ectopic/Migratory/Deep/Delayed bruise

The depth at which the bruise is situated affects its appearance on the surface. Bruises in the subcutaneous tissues are quite easy to appreciate but deep bruises may take a long time to become visible (k/as delayed bruising)

Also they may not appear on the actual point of impact. Blood coming out from the damaged blood vessels tracks along the path of lowest resistance and may make its appearance hours or even days after the impact, at a place where tissue layers become superficial. known as migratory or ectopic bruising.

E.g.

Site of Impact	Bruising site
Forehead injury → blood gravitating downwards over the supraorbital bridge → presents as haemorrhages into the soft tissues of the eyes and eyelids	Periorbital (Blackeye/ spectacle hematoma/ Racoon eye)
fracture of middle cranial fossa	bruise at the mastoid process (Battle sign)
Iliac crest (Fracture pelvis)	bruise may appear in the lateral aspect of thigh
Trauma to the calf muscles	bruise around the ankle (behind tendo-calcaneum)

#Site of bruise does not always indicate the site of injury



Racoon Eye

Friction abrasion: Synonymous to Pressure abrasion

Patterned Abrasions: If a weapon with patterned surface hits the body or body falls on a rough hard patterned surface, the abrasions will usually have the pattern of the object.

Six penny bruise - Multiple small bruises on trunk and or limbs caused by fingertips of the assailant, produced while overpowering the victim.

Reference:

Review of Forensic Medicine & toxicology; Gautum Biswas; 3rd edition; page 233.

Textbook of forensic medicine and toxicology, 5th edition Krishan Vij, page 217



2

REGIONAL INJURIES-1

🕒 00:00:13

CRANIAL INJURIES

- Divided into 2 types depending on the integrity of Dura
 - Open injuries: Dura is torn
 - Closed injuries: Dura is intact
- This division doesn't depend on the integrity of the skull vault.

SKULL FRACTURES

🕒 00:01:46

- MC bone to get fractured is Temporal bone [as it is thinnest bone]

Types of Skull Fractures

🕒 00:02:27

1. Fissure fracture

- Thin, linear fracture line is seen on the skull vault
- M/C type of skull fracture
- As it is very thin, 10-15% of these skull fractures are missed even on CT scan
- These are obvious during autopsy only



2. Depressed fracture

- Caused by heavy weapon with a small striking surface [Eg. Hammer]
- D/t the impact of the weapon, bone gets fractured & the fractured segment is depressed inside
- Pattern of the weapon [i.e striking surface] can be identified from the pattern of the Fractured segment. Hence, this fracture is k/a Signature fracture/ Fracture alae signature
- Depressed fracture segment can cause cerebral injuries

[lacerations/ contusions]

- Rx: Surgery: Lift the fractured segment & repair the dura if needed



3. Comminuted fracture / Spider web fracture

- Caused d/t repeated blows with heavy force
- Presents with multiple fracture lines intersecting each other
- Multiple fractured segments with displacement are seen



4. Sutural fracture

- Sutural separation d/t blow on the skull [fracture lines run along the sutural line]

- Aka Diastatic fracture
- MC seen in young adults
- MC suture involved is Sagittal suture



5. Pond's fracture

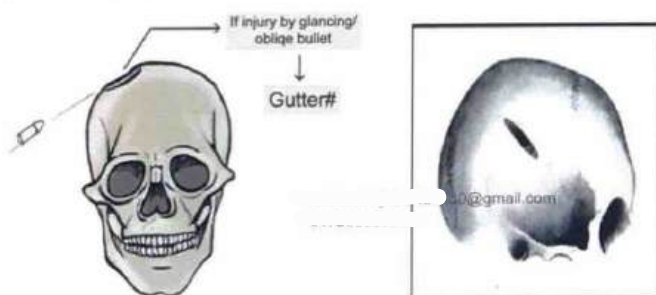
- MC seen in Children/ Infants, as they have elastic skull
- If a bone is hard, impact results in breaking of the bone
- But in children, as skull is elastic & pliable, blow on it causes dent in the skull
- Hence, k/a Indented fracture/ Ping-pong ball fracture
- MC seen in babies with obstetric forceps delivery [d/t pressure on the skull]



6. Gutter fracture

🕒 00:12:20

- Caused by oblique bullet travelling tangentially to the skull
- Aka Glancing bullet
- Bullet doesn't enter the skull. It just grooves the skull, producing a gutter like fracture



Previous Year's Questions

Q. In entry wound of skull beveling is seen in?

(FMGE Dec 2019)

- A. Inner table
- B. Outer table
- C. Inner table and outer table
- D. Multiple small fracture

SKULL BASE FRACTURES

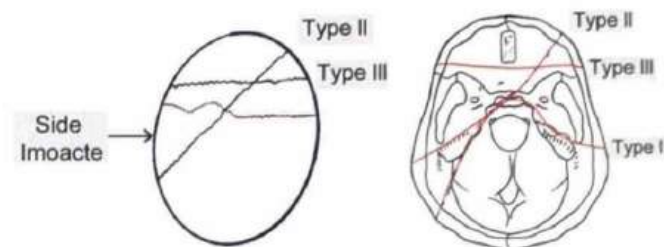
🕒 00:13:11

1. Ring fracture

- Associated with fall from the height & landing on the foot
- All the force is transmitted from the leg, vertebral column to the base of the skull
- Fracture line is seen around the foramen magnum like a ring. Thus, it is k/a Ring fracture
- Fracture of legs [femur], vertebral column can also be seen

2. Motor cyclist fracture/ Hinge fracture

- When Impact is seen from the side of the head, fracture line starts from one side of the temporal region goes to other side, bisecting the skull base into 2 halves
- Commonly seen in motorcyclist riders. Aka Type-1 Hinge fracture. Fracture line is along the Middle cranial fossa
- Type-2: Fracture line traverses skull base
- Type-3: Fracture line is towards anterior side

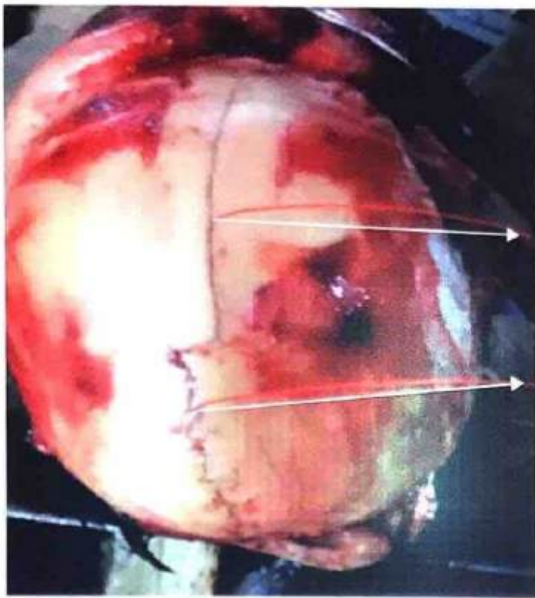


IMAGES

🕒 00:18:20

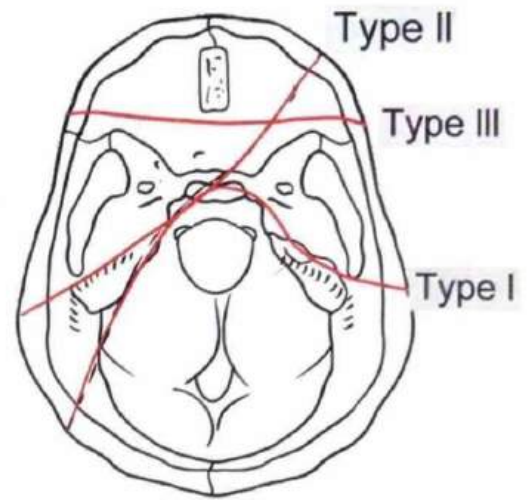


FISSURE FRACTURE [MC type]



Tissue#

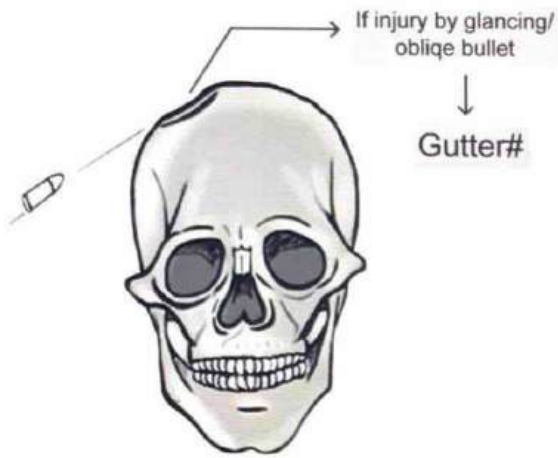
Skeletal



Type II

Type III

Type I



If injury by glancing/
oblique bullet

Gutter#



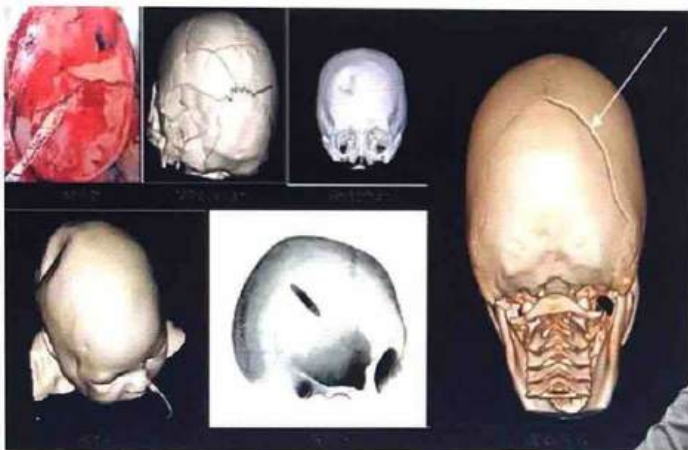
Previous Year's Questions

Q. Identify the sign?

(NEET Jan 2020)



- A. Battle sign
- B. Racoon sign
- C. Romberg's sign
- D. McEwan sign



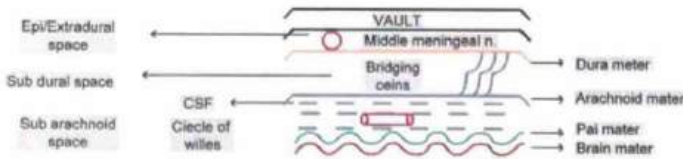


3 REGIONAL INJURIES-2

INTRACRANIAL HEMORRHAGES

00:00:15

Anatomy



- From inside to outer surface, we have Brain tissue → Pia mater → Arachnoid mater → Dura mater → 2 tables of skull vault
- Epidural/ Extradural space: Space b/w skull vault & Dura mater
- Subdural space: Space b/w Dura & Arachnoid mater
- Subarachnoid space: Space b/w Arachnoid & pia mater

Space	Contents
Epidural space	<ul style="list-style-type: none"> • Normally, Dura is adherent to the under-surface of the skull vault. There is no potential space present • Pterion is a point where Middle meningeal artery is present
Subdural space	<ul style="list-style-type: none"> • Veins are present which drains the subarachnoid space, pass through the subdural space & drains in the Dural-venous sinuses • These are k/a Bridging veins
Subarachnoid space	<ul style="list-style-type: none"> • CSF • Arterial system i.e, Circle of Willis



Important Information

- Likely source of bleeding in Extradural hematoma [EDH] is Middle meningeal artery
- Likely source of bleeding in Subdural hemorrhage [SDH] is Rupture of Bridging veins
- Likely source of bleeding in Subarachnoid hemorrhage [SAH] is Circle of willis/ artery

EXTRA DURAL/ EPIDURAL HEMORRHAGE [EDH]

00:05:58

- Lies b/w skull vault & Dura mater

Patho-physiology

- Any blow/trauma to the side of the head, particularly at pterion results in fracture of temporal bone, leading to the rupture of Middle meningeal vessels
- This causes bleeding into Extradural space
- As this hematoma extends, it causes brain compression & the pt. may die d/t respiratory failure

Clinical features



- Above image is showing an 18year old man, who was hit on the head by a ball while playing the cricket. He immediately fell down & became unconscious. After 1-2 mins he woke up with pain, swelling & redness over injured area. He discontinued playing & was taking rest while waiting for his friends. After 1-2 hrs, he started feeling drowsy & lost his consciousness. He was immediately taken to the nearest hospital where he was declared dead on arrival. On autopsy contusion on right side of the cheek is noted. On opening the skull vault, huge Extradural hematoma compressing the brain is seen, which is the cause of his death.



Lucid interval

- Period of consciousness between 2 Unconsciousness is k/a Lucid Interval
Unconscious → Conscious → Unconscious → Death
- If the pt. had immediately taken to the hospital after the injury & CT-scan was done, Extra-Dural hemorrhage would have been diagnosed on time & surgery could have saved his life
- It has medico-legal importance
- i.e. If the doctor fails to diagnose this Lucid interval, Doctor can be prosecuted for Death d/t Medical Negligence
 - 304 (A) IPC: 2yrs with imprisonment & fine
- If a person commits crime during this Lucid interval, person is liable to be punished
- A person can write a valid will during this interval
- A person can give valid evidence in the court of law during this interval
- MC seen in EDH > SDH

Diagnosis

- NCCT shows Lens-shaped or Bi-convex shaped opacity, which confirms EDH

Treatment

- Immediate surgical management i.e. Aspiration of clot by Burr-hole or Craniotomy

Autopsy findings of EDH

- Usually, Unilateral
- Usually, a Coup Injury [i.e occurs at the site of impact]
- EDH presents as reddish clot



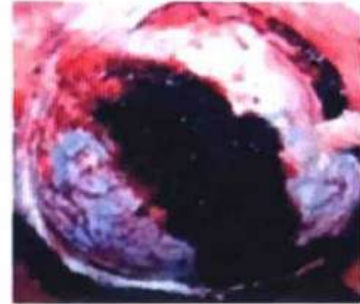
- EDH should be differentiated from heat hematoma

EDH	Heat hematoma
<ul style="list-style-type: none">• Occurs d/t coup injury• Unilateral• Reddish in color	<ul style="list-style-type: none">• Occurs d/t burns• Bilateral• Chocolate brown hematoma with honey-comb appearance

? Previous Year's Questions

1. Identify the condition? (FMGE - Dec - 2019)

- A. Extra Dural hemorrhage
- B. Subdural hemorrhage
- C. Subarachnoid hemorrhage
- D. Intracerebral hemorrhage



Q. Cricket player was hit in the head then becomes unconscious. after sometimes he becomes conscious. After the match, he lost consciousness and was taken to the hospital. The diagnosis could be? (FMGE - DEC - 2020)

- A. Extradural hemorrhage
- B. Subdural hemorrhage
- C. Subarachnoid hemorrhage
- D. Intracerebral hemorrhage

SDH (SUB DURAL HEMORRHAGE) ⏱ 00:18:10

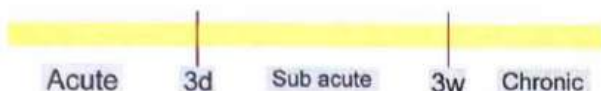
- Hemorrhage b/w Dura & Arachnoid mater
- Usually, it is traumatic
- Occurs d/t rupture of Bridging veins [sometimes d/t cortical vessels]
- Traumas responsible are
 - Acceleration/ deceleration
 - Shaking
- Age
 - Commonly seen among extremes of age i.e children & elderly
 - Children
 - Caused by Shaken Baby Syndrome /Battered baby syndrome
 - Intense shaking causes acceleration & deceleration, resulting in rupture of bridging veins & subdural hematoma
 - Elderly
 - Occurs after a minor trauma [falling in washroom etc]
 - Just after the fall, pt. might not develop immediate

symptoms

- Development of symptoms occurs only after a few weeks from trauma & the pt. presents with chronic subdural hematoma
- As the age increases, there is senile cortical atrophy of the brain, subdural space increases & intervening bridging veins loses their support
- Thus, even a small trauma can cause SDH

Types of SDH

- Acute SDH: 0-3days
- Sub-acute SDH: 3days to 3weeks
- Chronic SDH: >3 weeks



Shaken baby syndrome

🕒 00:20:05

- A 6-month-old female unconscious child is brought to the casualty by her father. A history of fall from the height is given by the father. Eventually, the child died.
- On autopsy
 - cigarette marks are seen through out the body of the child.
 - All the injuries are at different stages of healing.
 - When thoracic cavity is dissected, multiple fractures of ribs are seen, which are under various stages of healing.
 - On opening the cranial cavity, SDH is seen, which is the cause of death
- Though SDH correlates with fall from the height, remaining findings aren't correlating
- Father was taken into the custody.
- During interrogation, father confesses that he is a single parent, he has some psychiatric element & he used to constantly abuse the child. On that particular day he was frustrated & threw the child from 1st floor to the ground. That's why the child died
- Thus, if a child is brought with injuries at varying ages, we should be extra careful during examining the child
- In these cases, history doesn't correlate with the findings
- There will be unusually long gap b/w the injury & seeking of medical attention, which can't be explained by the guardian.

Elderly

- Occurs even after a minor trauma
- After a few weeks, pt. presents with

- of pupil on ipsilateral side
- NCCT Mental confusion [MC symptom]
- Drowsiness
- Hemiparesis on contralateral side
- Dilation shows Concavo-convex, Hyperdense opacity
 - Subacute SDH can be isodense
 - Chronic SDH can be hypodense as well
- **Treatment**
 - Surgical management
 - Do decompression if there is any compression with mid-line shift

How to differentiate b/w EDH & SDH with CT 🕒 00:26:49

EDH	SDH
<ul style="list-style-type: none">• Convex towards the brain• Limited by the sutural lines	<ul style="list-style-type: none">• Concave towards the brain• Not limited by the sutural lines

SAH (SUB ARACHNOID HEMORRHAGE)

🕒 00:27:35

- Bleeding in subarachnoid space [i.e b/w Arachnoid mater & Pia mater]
- **Incidence**
 - It can be d/t Trauma [MCC] / without trauma i.e. spontaneous

Traumatic SDH	Spontaneous SDH
<ul style="list-style-type: none">• Occurs d/t rupture of arteries	<ul style="list-style-type: none">• Occurs d/t rupture of aneurysm/ AV malformation

Clinical features

- Pt presents with severe headache [excruciating, worst headache of the lifetime] k/a Thunder-clap headache, Nausea/Vomiting at the time of impending rupture
- After rupture, pt presents with worst headache f/b
 - Sudden loss of consciousness or
 - Seizures or
 - Focal neurological deficit/Photophobia

Investigation

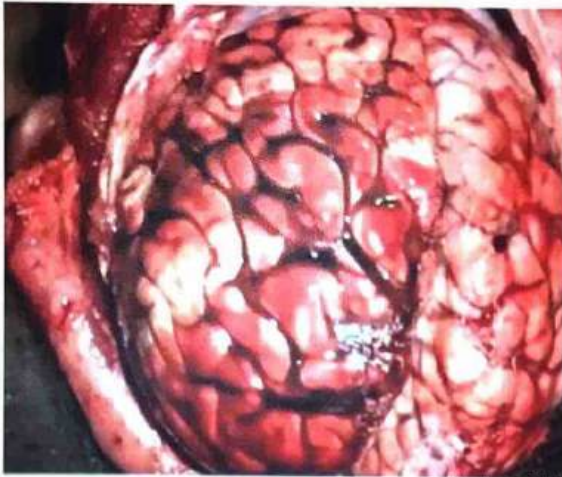
- NCCT shows bleed in the subarachnoid space
- If there is no mass effect, Lumbar puncture can be done,

which shows blood-stained CSF k/a

- Xanthochromia in 4-6hrs

Treatment

- Endovascular coiling/ Clipping of aneurysm



- Brain atrophy
- Neurofibrillary tangles [like Alzheimer's disease]

Coup injury / contre coupe injury

00:35:35

- Seen in brain [MC], heart, lungs etc
- Occurs d/t a blow from side of skull / due to the fall
- Commonly occurs in mobile head
- Injury at the site of impact is coup injury
- Injury opposite to the site of impact is Contre- coup injury
- Best possible theory to explain these injuries is struck hoop theory
 - It is based on Vacuum theory
 - D/t the impact, there is creation of vacuum on opposite side of the skull, which is responsible for hemorrhage on same side

Possibilities

Coup injury	Associated Contrecoup injury
• Mild	• May be Severe
• No coup injury	• Severe contrecoup Injury may be seen
• Occipital impact	• Frontal lobes contusion (M/C contrecoup injury)
• Frontal lobe impact	• no occipital injury
• Temporal lobe of 1 side	• Temporal lobe of contralateral side
• Temporal lobe of 1 side	• Contralateral surface of ipsilateral lobe

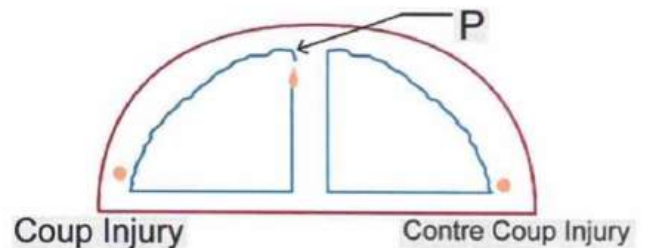
How to differentiate b/w SDH & SAH

- If the bleed gets washed off with water, it is SDH
- If the bleed doesn't get washed off & remains, it is SAH

PUNCH DRUNK SYNDROME / DEMENTIA PUJILISTICA/ CHRONIC TRAUMATIC ENCEPHALOPATHY

00:32:01

- Encephalopathy d/t chronic trauma
 - i.e the pt is subjected to repeated trauma to the head over several years
 - Or d/t repeated concussions
- MC Seen among the Boxers
- Clinical features
 - Short term memory loss
 - Mood disturbances [Mood swings, depression etc]
 - Disorientation
 - Parkinsonism [Tremors, stiffness & slowing of movements]
- Autopsy findings





CLINICAL QUESTIONS



Q. Autopsy reports of the 45 year old man found dead in his farm house, describes a wound over the right parietal area that was approximately square shaped and 5x5 cm by dimension. The forensic expert safely assumes that the shape of the wound indicates the weapon used, which most probably was the hammer found with blood stains in the shed behind the house. Further investigation of the wound confirms the expert's guess that it is indeed a "Fracture ala signature" which in simple terms will be documented as?

- A. Gutter fracture
- B. Depressed fracture
- C. Ring fracture
- D. Sutural separation

Answer: B

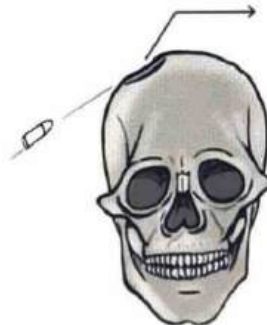
Solution

Depressed Fractures:

- Usually caused by a moving item striking the cranial vault.
- Any blunt item travelling at a slower speed, such as a hammer or a brick, may only make a small depression that absorbs the majority of the energy.
- A violent blow with the entire striking area in use, such as with a hammer, may detach almost the same diameter of bone, which is driven inwards, producing a pattern that is often consistent with the offending object.
- A violent blow with the entire striking area in use, such as with a hammer, may detach almost the same diameter of bone, which is driven inwards, producing a pattern that is often consistent with the offending object..

Gutter fracture

- A furrow in the outer table of the skull, ordinarily the result of a glancing blow by a **bullet** from a rifled firearm.
- A part of the thickness of the skull bone is removed so as to form a gutter/ channel/ trench.
- Usually accompanied by the comminuted depressed fracture of the inner table of skull and the fragments causing injury to the meninges and brain



Ring fracture: Fracture around the foramen magnum

Q. Identify the type of skull fracture in the image given below.



- A. Fissure fracture
- B. Depressed fracture
- C. Mosaic fracture
- D. Diastatic fracture

Answer: C

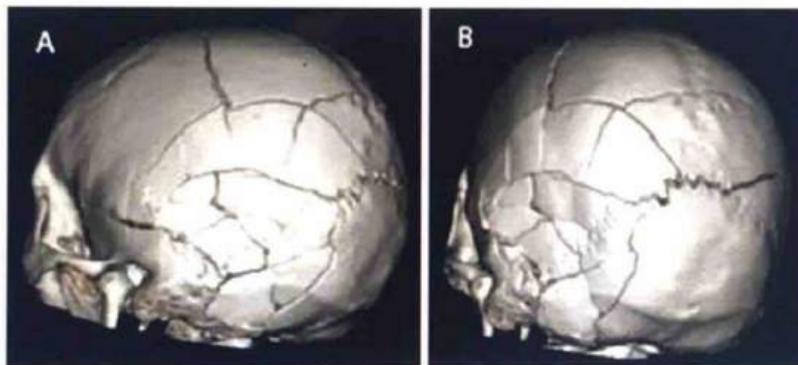
Solution

The image shows mosaic fracture of skull

- It is also known as comminuted fracture/ Spider web fracture

Comminuted fracture/spider web fracture

- Multiple fracture lines intersecting each other
- Multiple fractures with displacement



Reference: The essential of forensic medicine and Toxicology K.S Narayan Reddy, B.P. Murty 33rd edition



4 FORENSIC BALLISTICS

BALLISTICS

🕒 00:00:35

- Science that deals with motion of a projectile [i.e., motion of bullet/ lead pellets]

FORENSIC BALLISTICS

🕒 00:00:48

- Science that deals with the investigation of firearms, ammunition & wounds produced by firearms



Important Information

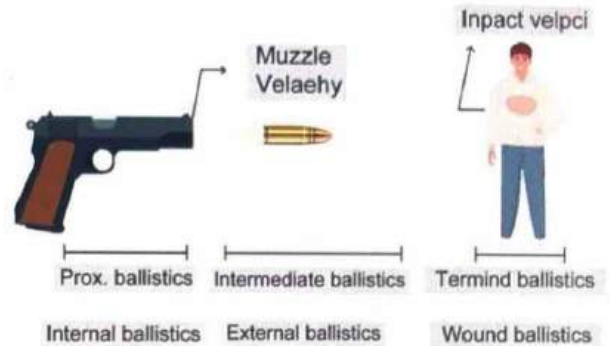
- Father of forensic ballistics is Calvin Goddard

- When trigger of a gun is pulled, bullet is fired, which hits the target

Terms	Definition
Proximal ballistics/ Internal ballistics	<ul style="list-style-type: none"> • Study of structure of a firearm or • Study of movement of the projectile within the firearm is k/a Internal ballistics
Intermediate ballistics/ External ballistics	<ul style="list-style-type: none"> • Study of motion of the bullet • As bullet has come outside the gun, it is k/a External ballistics
Terminal ballistics/ Wound ballistics	<ul style="list-style-type: none"> • Study of effects of the bullet on the target [Changes occurring in the projectile itself on impact] is k/a Terminal ballistics or • Study of Changes occurring in the tissues because of the impact is k/a wound ballistics

- Velocity with which the bullet is released from the gun [i.e velocity at muzzle] is k/a Muzzle velocity

- Outer end of the firearm bore is k/a Muzzle
- Velocity with which the bullet impacts on the target is k/a Impact velocity



TYPES OF FIREARMS

🕒 00:04:31



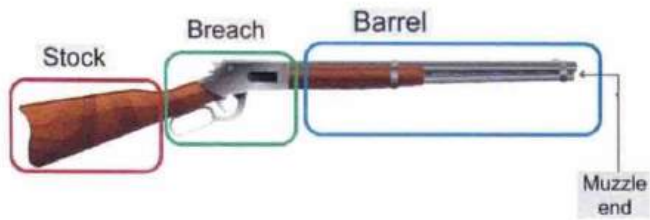
- Above image is showing a firearm which is the primitive version for all the firearms
 - Long iron tube is seen within which we can put iron/ lead balls
 - Gunpowder blasted in the back produces lots of energy which pushes the ball outside
 - It is the principle of Canon, which is used in all the firearms



- All the firearms have 3 basic parts

RIFLE

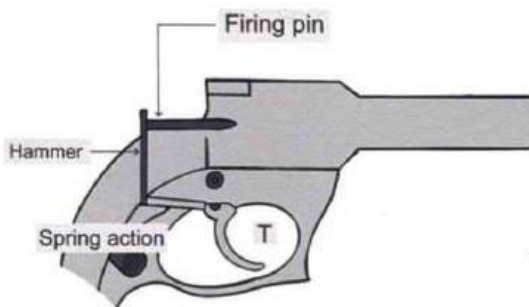
00:05:31



- Barrel:** Long metal tube connected to the breach
- Bore:** Inner diameter of barrel
 - Central part is k/a Breach
 - It is very important part as trigger, hammer, firing pin etc. are present here
 - Long metal tube present in front of the breach is k/a Barrel
 - Outer end of the barrel is k/a Muzzle end
 - Inner end of the barrel close to the breach is k/a Breach end
 - Stock is meant for handling/ support

Section of the Breach

00:06:40



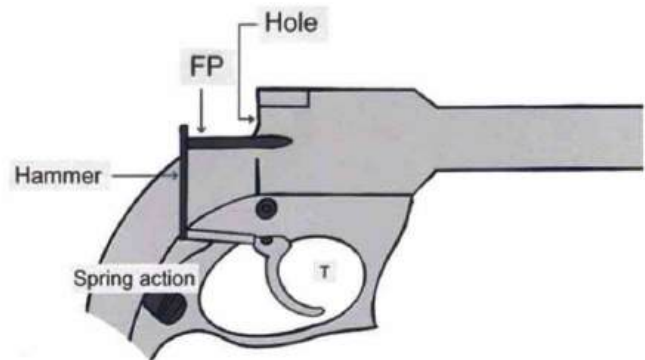
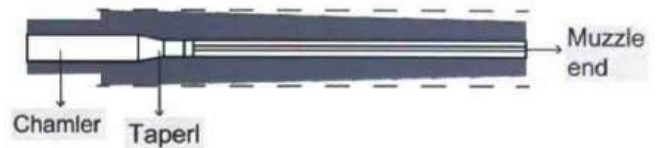
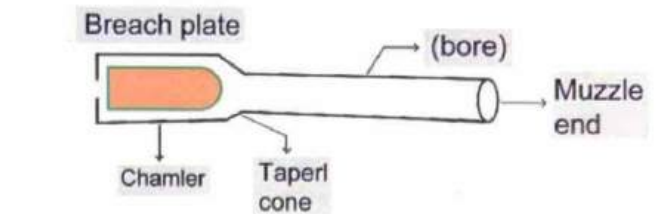
- Trigger is attached to the hammer
- Hammer is a vertical pin.
- Horizontal pin is k/a Firing pin/ Percussion pin, which can move forward & backward
- When trigger is pulled, hammer moves upward & the percussion pin moves forward

Barrel

- Long metal tube, present in front of the chamber is k/a barrel/ bore
- Internal structure of the barrel is k/a bore
- Chamber is the place where Cartridge/ bullets are loaded
- Chamber narrows down to form the barrel, which is k/a Taper/ Cone
- Back-end of the chamber is closed by a plate k/a Breach

plate

- Small hole is present at the center of the breach plate which is meant for firing pin to enter the chamber
- Firing pin enters through the hole, hits & pushes the bullet outside [i.e. through Muzzle end]



CLASSIFICATION

00:11:18

Based on the no. of barrels

- Single barreled



- Double barreled



- Triple barreled



- Multi barreled



Based on loading

🕒 00:12:06

- It is based on the end from which you are going to load the gun
- I.e Whether you are going to load from Muzzle end or breach end
- **Breach loading:** loading from breach or back side
- **Muzzle loading:** loading from muzzle or front side



Breach loading

Based on action

🕒 00:13:06

Sequence of firing

- Pull the trigger firing unloading loading
- Loading and unloading is known as action. Based on it there are 3 types

1. Lever action

- Once we fire, we need to open up the lever, used cartridge will be ejected out & new cartridge is loaded into the chamber



2. Bolt action

- When bolt is rotated, chamber is opened
- When it is pulled backwards, used cartridge will be ejected
- When it is pushed, new cartridge is inserted into the chamber
- Then, the chamber is closed



3. Pump action

- Every time we fire, we need to pull the pump out
- When we pull the pump out, it will eject the fired cartridge & load a new cartridge



Based on whether single shot or repetitive shots

🕒 00:15:37

1. Single shot

- After firing you have to manually extract it and place a new shot i.e. manually do loading and unloading.



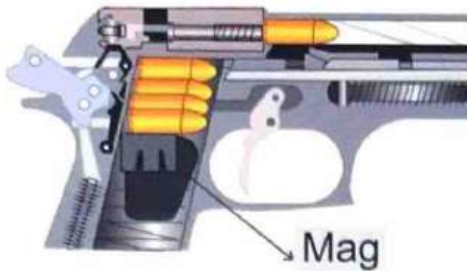
2. Revolver (Repetitive)

- Multiple bullets can be placed in the cylinder near firing pin



3. Pistol

- Contain multiple bullets in magazine



4. Semi-automatic

- After pulling the trigger; firing, unloading and loading happens automatically and then to fire again we have to pull the trigger again.



5. Automatic

- Pull the trigger and keep on holding the trigger
- Firing, unloading and loading happens automatically until you release the trigger.



FIRE ARM (BASED ON INNER SURFACE OF FIREARM)

00:19:51

- 2 types
 - Rifle
 - Smooth Bored / Shot Gun
- **Helixometer:** Instrument to examine the inner surface Of Barrel
- Spiral grooving completely smooth

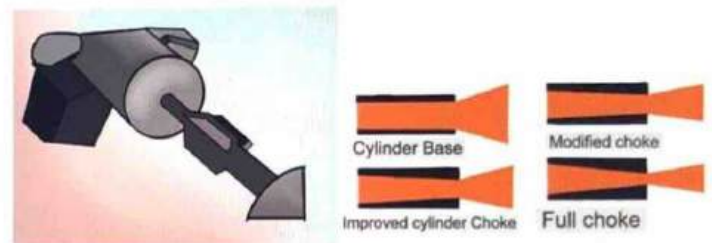
Rifling

Completely smooth till muzzle end [Smooth-bored]

- Spiral grooving Starts from breach end Till the muzzle end k/a Rifling
- Bullets used are made from lead
- Lead shots / pellets are used
- When bullets come through this grooving, it will spin the bullet
- It decreases the dispersion and increases the range
- It will give gyroscopic effect to bullet (spin the bullet)
- It ↑ Range & ↑ Stability

Types of choking

- Unchoked gun (cylinder)
- Improved cylinder
- Modified cylinder
- Fully choked



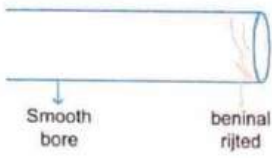
Method of rifling



Spinning effect

PARADOX GUN (MIXED GUN)

- It is basically a smooth bored gun but terminal end is



Eg of rifled gun

- Revolver – 200 yards
- Pistol – 400 yards
- Military rifle – 2000 yards

Eg: of Shot gun

- Single bore
- Double bore
- 50-60 yards



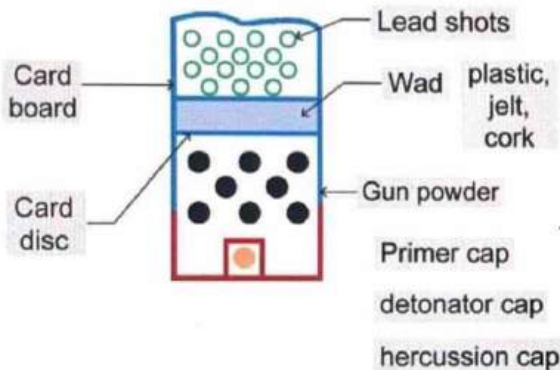
R
P
M
Range increases

Refer Table 4.1

AMMUNITION

Shot gun cartridge

00:38:24



Wad

- Separates lead shots from gun powder
- Seals the air (obturation)
- Acts like a piston
- Acts as a lubricant

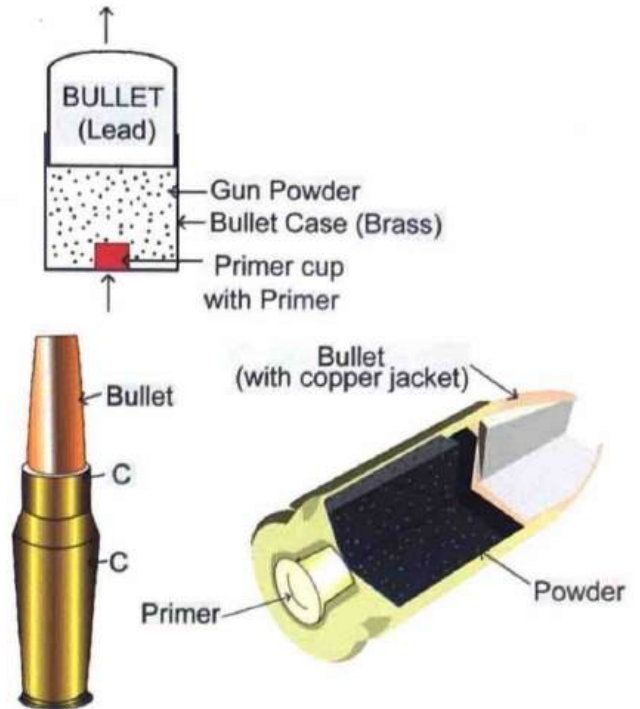


- Primer: Impact sensitive and is highly inflammable
 - It will burn into flame when hit, it will explode the gun powder & Lead shots will move away

RIFLED GUN-BULLET

00:46:13

- When primer is hits, it burns the gun powder
Gun powder explodes & Pushes the bullet forward



GUN POWDER

00:50:32

3 different types of gun powder

1. Black gun powder

- Contain
 - K+ - Potassium nitrate – 75%
 - C - Charcoal – 15%
 - S - Sulphur – 10%
 - Produce ↑ smoke, ↓ power
 - 1 gm. of black gun powder produces 3000 – 4000 cc/gas

2. Smokeless gun powder

- Contain
 - Nitrocellulose (NC)
 - Nitroglycerine (NGL)
 - Nitroguanidine (NGU)
 - Single base: N.C
 - Double base: N.C + NGL
 - Triple base: N.C + NGL + NGU
 - ↓ smoke is produced
 - 1 gm of gun powder produces 12,000 – 13000 cc/gas

3. Semi smokeless gun powder

- Black (80%) + smokeless (20%)

Gun powder can be termed by

- FG
- FFG
- FFFG
- FFFFG
 - F – indicates fineness
 - As fineness increases, power increases



PRIMER

Constituents of primer

- B – Barium nitrate
- L – Lead peroxide
- A – Antimony sulphide
- S – Styphnate (lead styphnate)
- T – Tetrazine

00:55:58



How to remember

BLAST



Smokeless Gun Powder



Percussion Cup/ Primer Cup

TYPES OF LEAD SHOTS

00:58:54

Depending on the material

1. Soft shots: Fully made of lead
2. Hard shots/ Chilled shot: lead + Antimony
3. Steel shot: Steel is used

Depending on the size

Dust shot < Bird shot < Buck shot



Slug Shot

DIFFERENT TYPES OF WADS

01:00:56



Sequence of firing event

- Pulling of trigger
- Hammer release
- Hitting percussion pin
- Ignition of primer
- Production of flame
- Ignition of gun powder

- Gas production
- Propelling of the shots/bullet/pellet.

- Bullet piercing the skin perpendicularly gives circular abrasion collar
- Oblique shot gives oval abrasion collar

Refer Flow Chart 4.1

DISCHARGE COMING OUT OF GUN 🕒 01:02:28

1. Flame produces burns / charring / singeing of hair
 2. Smoke: blackening of skin
 3. Unburnt gun powder: Tattooing / peppering
 4. Projectile
 - Shot gun: fires lead shot and wad
 - Rifle gun: fires Bullet
 - It produces punctured wound
- Stippling: Deposition of gun powder on the skin

Collars produced by bullet

1. Grease collar/ dirt collar/ bullet wipe

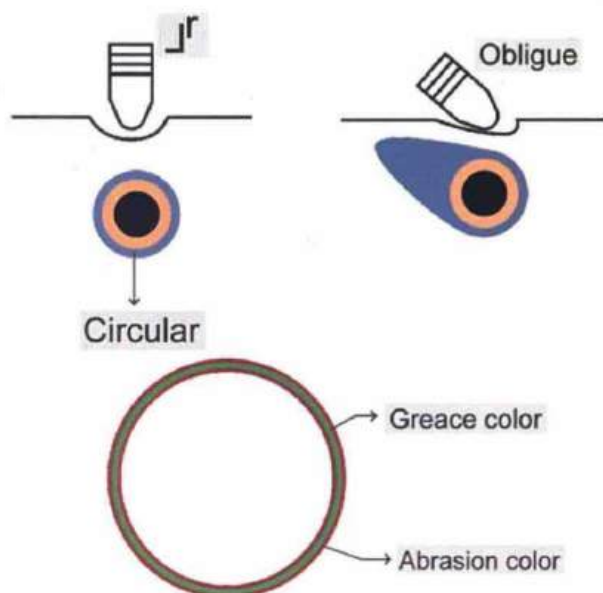
- When bullet enters the skin, grease from the bullet surface deposits on margins of wound

2. Abrasion collar

- Because of spinning effect of bullet, bullet drills into the skin.
- When it is entering into skin, there is friction between the spinning bullet and skin
- This makes rim of abrasion around entry wound.

Entry wound of bullet

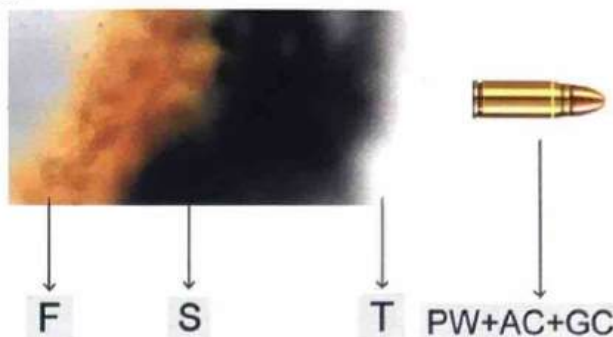
- First layer is grease collar
- Around this layer abrasion collar is present, on outside
- Grease collar is more specific of entry wound.
- Shape/ diameter of abrasion collar tells about angulation & caliber of the bullet



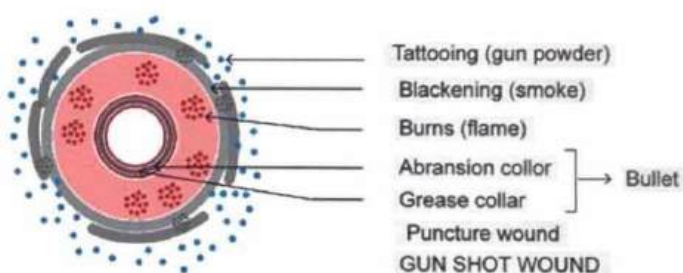
FOULING

- Metallic fragment from the gun, which are present on surface of the bullet gets deposited around the entry wound.

Effects



	Rifle	Shotgun
Flame	7 cm	15 cm
Smoke	30 cm	45 cm
Gun powder	60-90 cm	60-90 cm
Wad	-	2 m

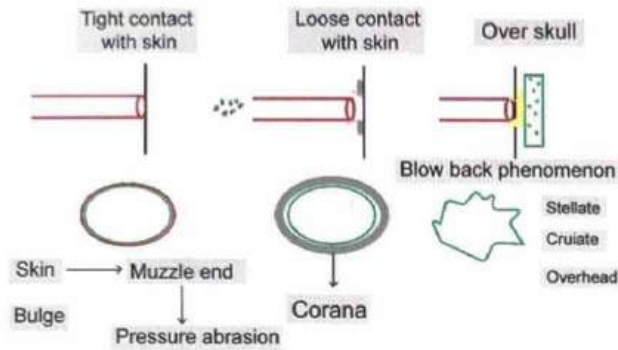


RANGE DETERMINATION 🕒 01:20:48

In Rifled gun

- **Contact shot**
 - Muzzle is in tight contact with skin
 - All the discharges that are coming out has to go into the tissues
 - Only circular entry wound is seen
 - Skin is bulging due to expanding gases forms pressure abrasion (muzzle impression) on skin

- When gun is in loose contact with skin, there is small gap between gun and skin from which smoke and flames try to escape. This smoke deposits on adjacent skin. This appearance of smoke around wound is known as **corona**.
- When contact shot is over skull, gases expand between scalp and skull bone and causes rupture of skin around wound. This is known as **Blow back phenomenon**.
- Skin splits due to energy and expanding gas produces **stellate/cruciate margins**
- Burns, blackening and tattooing is seen inside the wound



• **Back spatter**

- In contact shot when you fire, some blood and tissues are sucked back into the barrel of gun. it is k/a Back spatter

• **Close shot**

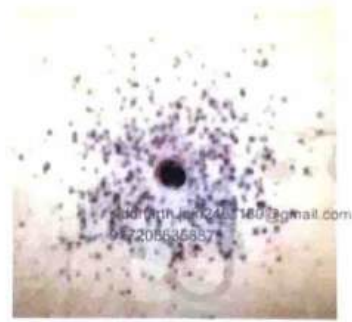
- Gun is fired inside the range of flame
- Circular punctured wound is seen
- 2 collars (grease and abrasion collar) are seen
- Burns, blackening and tattooing all are seen outside the wound



• **Near shot**

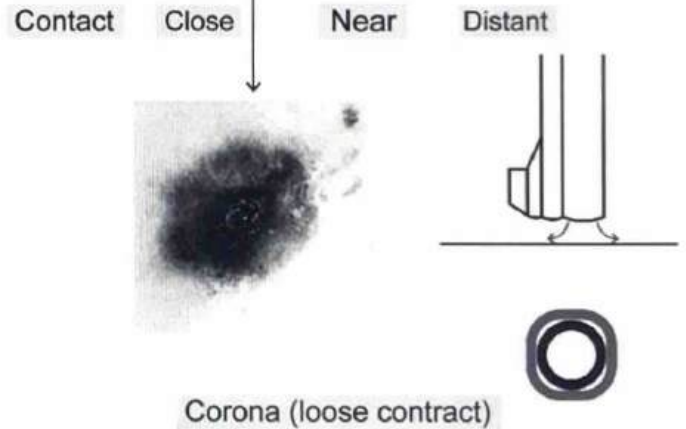
- Person is at range out of the flame but is inside the range of gunpowder
- Bullet hole with 2 collars
- Tattooing is observed

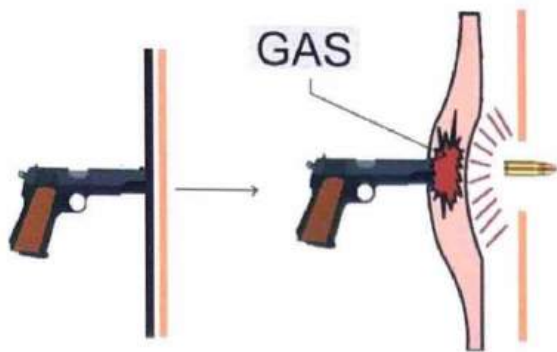
○ **Blackening ±**



• **Distant shot**

- Outside the range of gun powder
- Bullet hole with 2 collars is seen



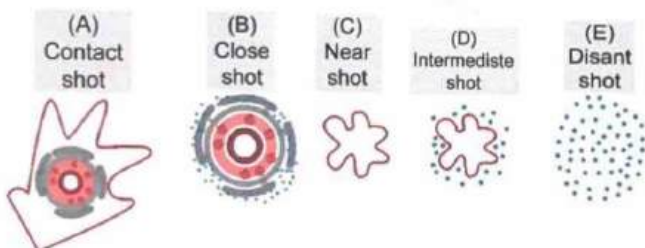
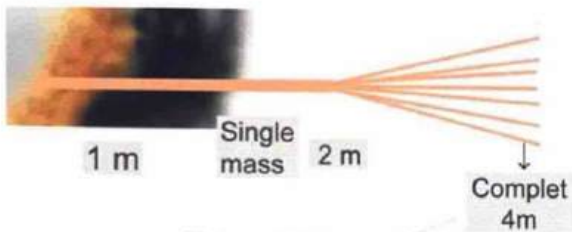


Blow Back Phenomenon

Range determination in a Shotgun

- Contact: Gun is kept tightly on the skin
- Close: <1 m
- Near: 1-2 m
- Intermediate: 2-4 m
- Distant: >4 m
 - Gun powder can travel up to 60-90 cm
 - Till 1 m – flame, smoke, GP is seen
 - From 2 m – dispersion starts (satellite holes)
 - 4 m – complete spread / dispersion

01:41:14



a. Contact shot

- Shows stellate wound with cruciate margin



b. Close shot

- Burns, blackening and tattooing are observed

c. Near shot

- Only the palate hole is observed
- Dispersion has not started yet (<2m)
- Single hole with irregular margins is seen
- Scalloping of margins, rat hole appearance, nibbling of margins is seen

d. Intermediate shot

- Dispersion starts
- Central hole with satellite palate hole is observed
- No cruciate margins are seen
- No burns / blackening / tattooing
- One central hole with surrounding multiple small holes is seen
- Incomplete dispersion is observed (2-4 m)

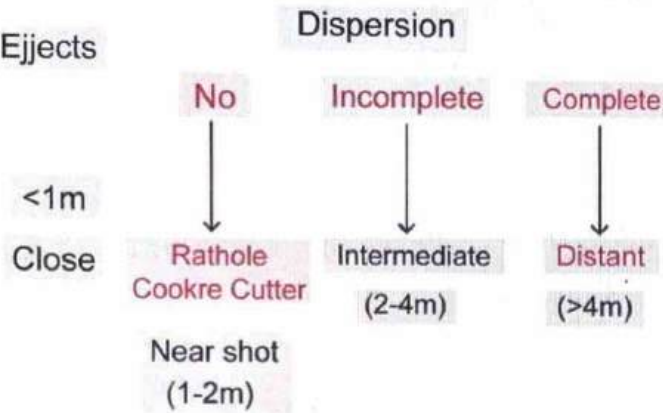


e. Distant shot

- Lead shots enters into the skin as separate holes.
- Complete dispersion is seen
- Distance is > 4 m



Ejects



KRONLEIN SHOT

02:05:21

- In Close shot to the skull, there is expansion of gases inside the cranial cavity leading to fracture of skull and evisceration of brain.

ENTRY & EXIT WOUNDS FROM BULLET

02:06:58

Entry	Exit (out shoot wound)
<ul style="list-style-type: none"> Margins: Inverted Size: smaller 	<ul style="list-style-type: none"> Margins: Everted Size: Larger
<ul style="list-style-type: none"> In contact shot entry will be larger because it is stellate Flame [burns], Smoke [blackening], Gun powder [tattooing] are only seen at entry wound Abrasion collar/ Grease collar is found only at entry wound ↑ bleeding 	<ul style="list-style-type: none"> Bleeding and tissue pertusion is more with exit wound

ATYPICAL PATTERN

01:57:21

- These patterns will make it difficult to determine range (incorrect range determination)

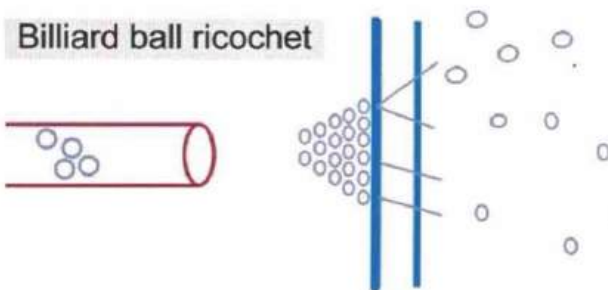
Balling/welding of shot

- In distant range, certain shots will stick together and others disperse. These group of lead shots enter in a single wound
- It occurs because of more lubricant or melting of shots because of excess heat
- This wound looks like an intermediate range wound or maybe 2 firearms are used.

Billiard ball ricochet effect

- If lead shots go through intermediate surface like glass, thick clothes, these shots face resistance and this causes erratic dispersion because of collision, leading to widespread dispersion in tissues.

Billiard ball ricochet



Erratic dispersion



Leadsnow storm



Entry



Exit

Exception

- Shored exit wound**
 - When victim is standing with some support like wall or firm surface and a bullet is hit, entry will be normal but at the exit wound skin gets crushed as the bullet can't come normally d/t firm surface

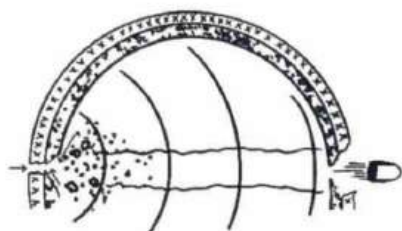
- This forms an abrasion at exit wound. This is known as shored exit wound
- Abrasion collar is absent, if bullet is not spinning or entry wound is in palm and soles.

Entry and Exit Wound of Skull

02:12:35



Entry wound	outer table	inner table
	Clean hole	beveling present
Exit wound	Inner table	outer table
	Clean hole	beveling present



Entrance Wound



Exit Wound

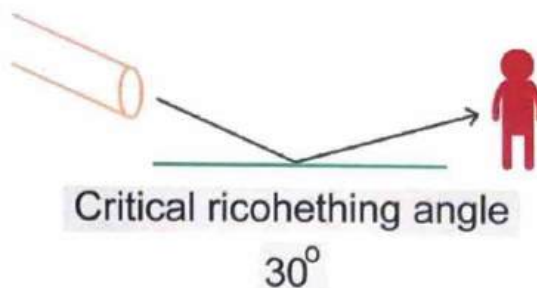
DIFFERENT TYPES OF BULLETS

02:18:48

1. **Round nose bullet:** Have round tip
2. **Sharp nose bullet:** Have pointed tip
3. **Fully jacketed bullet**
 - Fully covered with a copper jacket
4. **Semi-jacketed bullet**
 - Partially covered with a copper jacket
 - Dum Dum bullet: from top of bullet jacket is removed
 - Hollow point bullet
 - These 2 bullets expand inside tissues
5. **Wad cutter**
6. **Poison bullet:** curare/resin are used
7. **Ricochet bullet**
 - Deflected bullet from an intermediate surface. Bullet

loses its spinning ability.

- Therefore, no abrasion collar, and there can be keyhole entry wound. Flames, blacking or tattooing are absent.
- Angle between the surface and bullet is known as **critical ricocheting angle** (should be around 30 degree for bullet to ricochet)



Critical ricocheting angle

30°

8. Tumbling bullet

- Bullet rotates end to end

9. Yawning bullet

- Bullet travels in irregular fashion

10. Frangible bullet

- Made up of copper or iron and when it hits object it breaks into multiple fragments.

11. Souvenir/ sleeping bullet

- Bullet is retained inside the body. Not causing any harm as such.
- But as bullet contain lead, it can cause plumbism in long term

12. Duplex bullet

- Two bullets are present inside the cartridge.

13. Tandam bullet/ piggy back bullet

- In old firearm, 1st bullet got struck in barrel and 2nd bullet pushes the 1st along and two bullets come out at once

14. Incendiary bullet

- Contains white phosphorus and on impact it catches fire

15. Tracer bullet

- Trace the path of bullet.
- On base of the bullet, it contains illuminant substance

16. Kennedy phenomenon

- Iatrogenic alteration of gunshot wound.
- There is Difficulty in range determination.

17. Rayalaseema phenomenon

- After stabbing, bullet is put inside the wound



Sharp nose bullet

Semi Jacketed



Semi jacketed Hollow Point



Wad cutter



Duplex Bullet



Tracer bullet



Ricochet Bullet

BULLET FINGER PRINTING

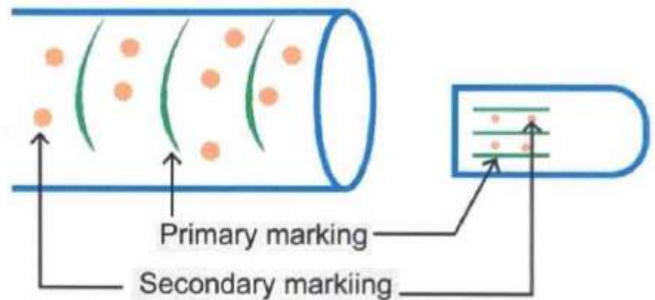
02:36:35

Primary marking

- Occurs d/t rifling pattern.
- It can tell us about model of gun
- Primary markings are also k/a class characteristics
- Rifling of 1000 guns from a same brand will be having same primary markings

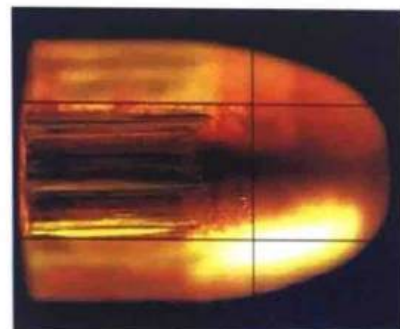


Number of land & Grooves
Twist
Wioth of the land & grooves
Depath of the grooves



Secondary marking

- Occurs d/t irregularities in the barrel
- It is specific to individual gun
- Can be due to metallic fouling Or irregularities due to manufacturing process.
- Secondary marking are also called as individual characteristics



- A test bullet from a suspected gun and the crime bullet are observed under a comparison microscopic and checked for the similarities in the markings.
- If the markings are matching the bullet had come from the same gun.



Comparison microscope



Notmatch



100% Comparison match

Test bullet and crime bullet are from same gun

- Never use toothed forceps and use rubber forceps because it may produce artifacts on bullet.



GSR TEST [GUNSHOT RESIDUE]

02:46:15

- "Firing HANDS"
 - F - Flameless atomic absorption spectrometry (FAAS)
 - H - Harrison and Gilroy
 - A - Atomic absorption spectrometry (AAS)
 - N - Neutron activation analysis
 - D - Dermal nitrate test
 - S - SEM-EDXA (most specific)



How to remember

HANDS



Previous Year's Questions

- Q. Assertion: Range of shot can be determined by the spread of pellets.
Reason: Shotgun cartridge contains pellets?
(AIIMS May 2019)
- Both assertion and reason are correct and reason is correct explanation of assertion.
 - Both assertion and reason are correct but reason is not a correct explanation of assertion.
 - Reason correct assertion wrong
 - Both assertion and reason are wrong

? Previous Year's Questions

Q. A middle aged lady was found in a robbed room lying in a pool 0-6 blood. On forensic examination there was an entry wound of Size around 2 x 2 cm on the left temporal region with tattooing and blackening right temporal region. On further examination two bullet fragments were found inside the brain parenchyma. Which of following could be used to determine the distance from which the weapon was hired? (AIIMS Nov 2017)

- A. Hair
- B. Clothes
- C. Bullet fragments
- D. Blood

? Previous Year's Questions

Q. Bullet wipe term is used for? (AIIMS May 2019)

- A. Gutter fracture of skull
- B. Blackening
- C. Tattooing
- D. Dirt from barrel

? Previous Year's Questions

Q. Bullet fingerprinting is? (AIIMS Nov 2018)

- A. Human fingerprints on bullet
- B. Primary marking
- C. Secondary marking
- D. Distorted bullet

? Previous Year's Questions

Q. The poisoning caused by bullet retained inside the body is? (FMGE Dec 2019)

- A. Iron
- B. Phosphorus
- C. Nitro cellulose
- D. Lead

Table 4.1

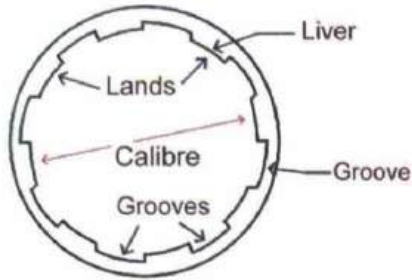
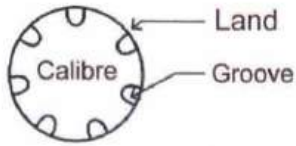
Rifled Gun

Calibre (in mm or inch)

00:32:34

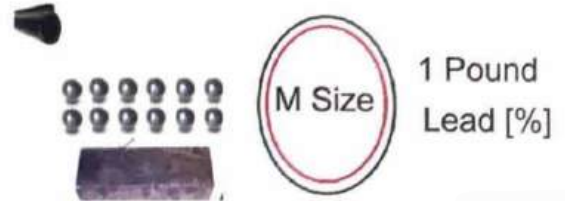
Shot Gun

Gauge / bore



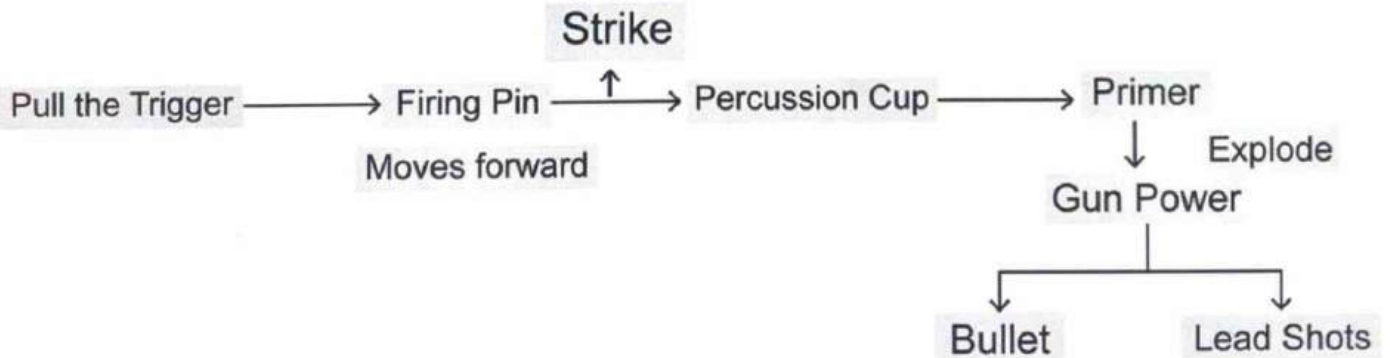
- Distance b/w 2 opposite lands – caliber

- Direct method: Measure the internal diameter directly.
- Indirect method



- No. of balls that can be made from one pound of lead
 - o If 12 - 12 bore gun
 - o 18- 18 bore gun
 - o 24- 24 gauge gun
- No. of balls made from 1 pound of Pb – gauge
- Bore \propto 1/size
- As the no. of balls are increasing, diameter is decreasing.

Flow Chart 4.2





CLINICAL QUESTIONS

1. During the autopsy of a homicide victim, the doctor notices a circular wound on the left temporal area with a crater-like outer table and a punched-out inner table. There is no evidence of singeing of hair or tattooing present. There are also tissue tags along the irregular edges of the wound. What type of wound is the doctor observing?
- A. Chop wound
 - B. Pond fracture
 - C. Entrance wound
 - D. Exit wound

Answer: D

Solution

Gunshot wounds on Skull:

- Skull has an outer table & inner table.
- When the bullet enters the skull, bevelling occurs in the second layer.
- In entry wound, the bevelling is present in the inner table of skull.
- In exit wound, the bevelling is present in the outer table of skull.
- **Entry wound:** Shows a punched-out hole (clean cut) on the outer table and bevelled (crater) appearance on the inner table.
- **Exit wound:** the inner table shows clean-cut hole and the outer table shows bevelling since the bullet is leaving so the outer table is raised.

	Entry wound	Exit wound
Skull Outer table	Clean cut hole	Bevelled opening
Skull Inner table	Bevelled opening	Clean cut hole

Reference:

Forensic Medicine & toxicology; Gautam Biswas; 3rd edition; Pg – 221

2. The forensic team has began its investigations at the crime scene. A well-known politician was found dead by gun-shot wound in his bedroom. The relatives and the political friend circle are alleging that he was murdered. On initial investigation, the victim was found with the shot gun lying next to his right hand and there was also a clear hand written suicide note by the side of the bed. Which among the following tests would help the team confirm it to be suicidal in nature ?
- A. Finger print on the gun
 - B. Blood on the gun

- C. Gun in hand
- D. Gunshot residues in the hand

Answer: D

Solution

Gun Shot Residues (GSR) on suspects hands

- GSR on the hands may be visible to naked eyes can be observed and described.
- If not visible special techniques can be used to demonstrate invisible GSR.

Various tests for detecting GSR-

- Paraffin test (dermal nitrate test/diphenylamine test)
- Harrison and Gilroy test
- Neutron activation analysis
- Atomic absorption spectroscopy (AAS)
- Flameless atomic absorption spectrophotometry (FAAS)
- Scanning Electron Microscope- Energy Dispersive X-ray spectrometry (SEM-EDX)

1. Paraffin test (dermal nitrate test/diphenylamine test)

- hands are coated with a layer of paraffin.
- After cooling, the casts are removed and treated with an acid solution of diphenylamine (to detect nitrates and nitrites that originate from the gun powder)
- blue flecks in the paraffin → positive test
- The test was discarded due to false-positive results because of widespread distribution of nitrates and nitrites in the atmosphere.

2. Harrison and Gilroy

- qualitative colourimetric chemical test
- detect barium, antimony and lead (originating from the primer) on the hands of suspect.
- hand is swabbed with a square of white cotton cloth moistened with HCl,
- The swab was treated with
 - Triphenyl-methyl-arsonium iodide for the detection of antimony
 - sodium rhodizonate for the detection of barium and lead.
- Not in use due to limited sensitivity

3. Neutron Activation Analysis

- A sample is obtained by use of paraffin or by washing hands with dilute acid.
- It is then exposed to radiation from a nuclear reactor emitting neutrons.
- Secondary radioactivity is induced in the materials and by making an appropriate counts at different energy levels, the elemental composition of the residues can be determined
- Advantage: extremely sensitive
- Limitation:
 - It can analyse the only antimony and barium but not lead and thus had to be used with FAAS
 - expensive (need of nuclear reactor)

- Was discarded by 1990s

4. FAAS

- Antimony, barium, and lead from the primer, as well as copper vaporised from the cartridge case or bullet jacketing, are all detectable.
- Four cotton swabs wet with hydrochloric acid are used to swab the palms and backs of the hands
- The metallic components are then identified using a fifth swab that has been wet with acid as a control.
- Advantage: easy for analysis, carries adequate sensitivity and low cost.
- Based on the distribution and quantity of antimony, barium, and lead found on the four surfaces of the hands, one may determine if the deposits are consistent or inconsistent with gunshot residues and, thus, weapon firing..
 - residue deposited on the back of the hand → suspect fired the gun.
 - residues on the palm of the hands.

residue is often detected on the nonfiring hand that he has been used to steady the muzzle of rifles and shotguns against the body

5. SEM-EDX (Most specific)

- the gunshot residues are removed from the hands using the adhesive lifts.
 - The material removed is scanned with SEM for gunshot residues particles.
- X-ray is used to identify the chemical elements
- Advantage:
 - not as time-dependent as FAAS and neutron activation analysis.
 - positive up to 12 hours after firing.
- Limitation:
 - laborious procedure
 - inability to quantitate.

Reference:

Forensic Medicine & toxicology; Gautum Biswas; 2nd edition; Pg –229

- ♣ defensive gesture rather than of firing a gun.
- ♣ cradling the gun with this hand at the time of firing in suicides with handguns



5 EXPLOSION INJURIES & SCALDS

EXPLOSION

🕒 00:06:13

- Occurs d/t blast of a bomb

Bomb

- Bomb is a container filled with explosive mixture & missiles fired by a detonator/fuse



Incendiary bomb

- Purpose of this bomb is to induce fire
- This bomb is filled with phosphorus/ magnesium & is thrown on a surface
- On hitting the surface, it catches fire

Molotov's cocktail

- It is a petrol bomb
- Container/ bottle is filled with petrol/ any other inflammatory material
- Rag is present which serves as a wick



- The bottle isn't completely filled with petrol. It is only half-filled
- We just have to soak the rag, ignite it & throw it

TYPES OF BLASTS

🕒 00:02:13

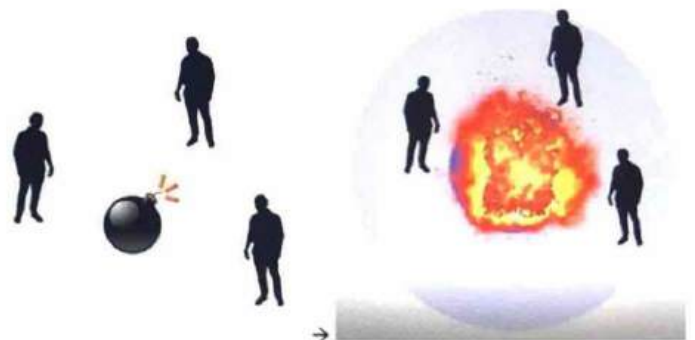
1. **Air blast:** It occurs in the air/ ground itself
2. **Immersion blast:** It occurs under the liquid medium. Particularly it is an underwater blast
3. **Solid blast:** Occurs when the body part is in contact with a solid vibrating surface [the blast is occurring on other side of the surface in contact with the body part]. The person is injured d/t shock

PRODUCTS OF BLAST EXPOSURE

🕒 00:04:16

1. Blast wave/shock wave
2. Flying projectiles/ missiles
 - D/t bomb blast, the furniture gets broken. These broken pieces fly at a high speed & injure the victim
 - Terrorists may implant the sharp objects/ lead shots/ screws/ nails into the bomb. When the bomb gets exploded, these sharp objects fly & injure the victims
3. Wind resulting in victim displacement
4. Miscellaneous

Blast wave



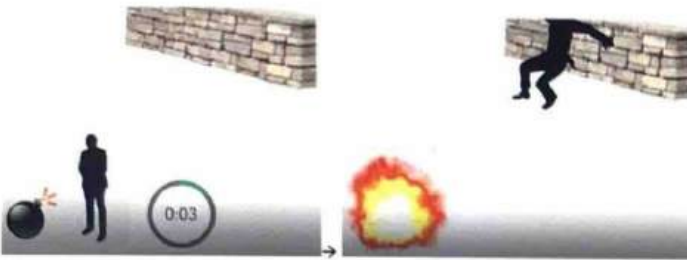
- After explosion, blast wave passes through the body of the ppl
- Organs having air inside it are predominantly affected i.e. ear, lungs, GIT, brain etc.

Flying missiles



- Flying objects injures the victim

Wind displacing the victim



- When the wind displaces the victim, he might hit stationary objects like tree/ wall/ ground etc & sustain skeletal injuries

INJURIES PRODUCED BY THE PRODUCTS

🕒 00:07:33

Blast wave

- Injuries produced by the blast wave are k/a Primary blast injuries
- Organs predominantly affected are
 - **Ear**
 - Barotrauma to the ear results in
 - Rupture of tympanic membrane is MC injury seen in air blast
 - Bleeding from the ear
 - Disruption of ossicles
 - **Lungs**
 - Disrupt all the alveoli, capillaries & basement membrane & results in Diffuse lung injury k/a ARDS
 - It is the most fatal injury caused by a blast wave
 - Thus, this is k/a Blast lung

- **GIT**

→ Pt. may have vomiting, hematemesis, melena etc
→ Colonic perforation can occur

Flying missiles

- Injuries because of flying missiles are k/a Secondary blast injuries
- Small objects flying in a high speed can injure the person
- If the person is facing towards the blast, anterior side suffers from injuries
- If the person is facing opposite to the blast, posterior side suffers from injuries



Important Information

Marshal's triad

- **Abrasion, Contusion & Laceration** seen on same side of the body d/t flying missiles is k/a Marshal's triad

Wind resulting in displacement

- Injuries produced by victim displacement are k/a Tertiary blast injuries
- Skeletal fractures are MC injuries seen here

Miscellaneous

- Injuries produced by miscellaneous factors are k/a Quaternary blast injuries
- Victim can have traumatic asphyxia d/t collapse of building, burns d/t fire etc



Important Information

QUINARY BLAST INJURIES

- These are **delayed effects** d/t environmental contaminants
- E.g.
 - Radiation exposure d/t nuclear bomb
- **Bacterial/ chemical warfare**



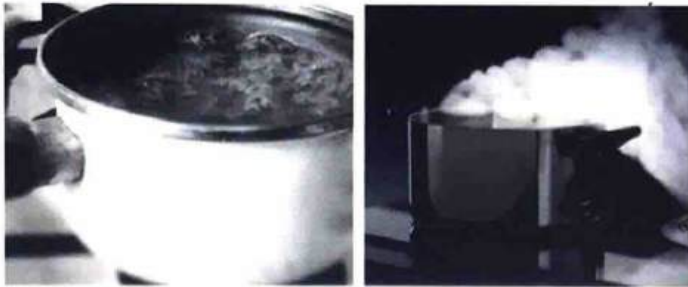
Important Information

- MC organ affected/ injury in air blast is **rupture of tympanic membrane of the ear**
- MC organ affected in under water blast d/t blast wave
 - If the head is under the water. MC injury encountered is **ear trauma**
 - If the head is above the water level. **GIT** is MC injured

SCALDS

00:14:00

- Scalds are injuries produced from moist heat
- Dry heat produces burns
- Moist heat can be hot liquid or hot steam
- Hot liquid is very dangerous. If the water is $>70^{\circ}\text{C}$, contact of even 1 second can cause damage



TYPES OF SCALDS

00:15:06

- A person can have scalds d/t

1. Immersion into hot liquid
2. Splashing of hot liquid
3. Exposure to steam

Injuries

- When there is exposure to hot liquid, initially there is only erythema [redness]
- In 2nd level, a blister is seen

- Blister might rupture, resulting in an ulcer



Typical features of scalds

00:16:30

1. No charring is seen
 2. No singeing of hair
 3. Soddening of the skin
 4. Injury is seen at/ below the level of contact [steam exposure can cause injury at & above the level of contact]
 5. Signs of splashing
 6. Lines of blisters
 7. Cloths are wet & intact
- If injury is d/t fire, cloths are burnt



6

THERMAL INJURIES-I

HEAT INJURIES

General effects

1. Heat Cramps
2. Heat Exhaustion
3. Heat Stroke

Local effects


1. Burns (d/t Dry Heat)
 2. Scalds (d/t Moist heat)
- Collectively these are known as heat related syndromes

HEAT RELATED SYNDROMES

1. Heat Cramps

00:00:29

Signs and symptoms of Heart Cramp



Normal to slightly elevated heartbeat

Weakness or fatigue

Normal mental status

Sweaty skin

Possible nausea

Normal body core temperature

Normal blood pressure

Stiff, boardlike cramp abdominal muscles

Severe muscular cramp and pain, especially of the arms, fingers, legs calves and abdomen

Refer Table 6.1

00:02:28

Heat stroke / thermic fever/sun stroke/heat hyperpyrexia


Autopsy findings

- Deaths are accidental
- Post mortem caloricity (PMC) is seen i.e body remains warm for 1 or 2 hrs even after death
- It is classically seen with heat stroke pts.



- Exposure to sun results in excessive sweating
- This results in loss of electrolytes (Na^+ , K^+) which causes Muscle Cramps
- Aka Fireman's cramps/ Miner's cramps
- Rx: Electrolyte Replacement

Table 6.1

	2. Heat Exhaustion	3. Heat Stroke
Pathophysiology	<ul style="list-style-type: none"> Excessive sweating causes dehydration, decreased venous return, resulting in cerebral hypo-perfusion 	<ul style="list-style-type: none"> Impaired heat regulation is seen [as regulation centre/ hypothalamus is lost]
C/F	<ul style="list-style-type: none"> Dizziness Light Headedness/ fainting 	<ul style="list-style-type: none"> Altered Mental Status Disorientation Loss of consciousness
		
Body Core temperature	<ul style="list-style-type: none"> Normal [as hypothalamus is normal] 	<ul style="list-style-type: none"> Hyperthermic
Pupil	<ul style="list-style-type: none"> Dilated 	<ul style="list-style-type: none"> Constricted
Skin	<ul style="list-style-type: none"> Moist, Cold d/t sweating 	<ul style="list-style-type: none"> Dry, hot
Sweating	<ul style="list-style-type: none"> Increased Sweating 	<ul style="list-style-type: none"> Absence of sweating (Anhidrosis) d/t excessive dehydration
Rx:	<ul style="list-style-type: none"> Leg Elevation Fluid Replacement 	<ul style="list-style-type: none"> Remove the dress Evaporative Cooling [AC/ fan] Apply Ice, Packs Give Oral/IV fluids Ice water bath (complex)



7 THERMAL INJURIES II

LOCAL EFFECTS OF HEAT

00:00:13

- Burns are due to dry heat (Flames)
- Scalds are due to moist heat (Hot Liquids, Steam)

BURNS

00:01:06

- If the temperature is more, even shorter duration of contact can produce deeper injuries

Eg:

- 45°C for 6 hrs exposure causes Deep burns
- 64°C for 45 Sec exposure causes Deep burns

Commonly used classifications are

1. Dupuytren's classification – 6 degrees
2. Wilson's classification – 3 degrees

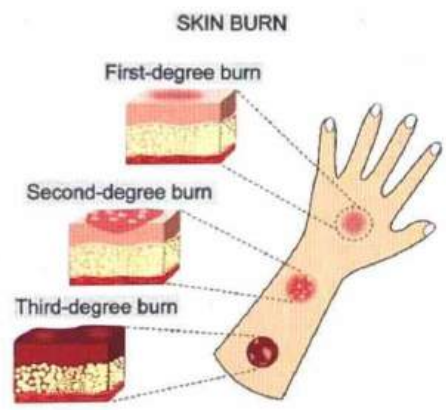
Wilson's classification

00:02:46

- 1° Burns aka Epidermal burns
- 2° Burns aka Dermo epidermal burns
- 3° Burns aka Deep burns

Refer Table 7.1

- 4th Degree burns: Complete charring of tissues



ESTIMATION OF TBSA [TOTAL BODY SURFACE AREA] IN BURNS

00:09:53

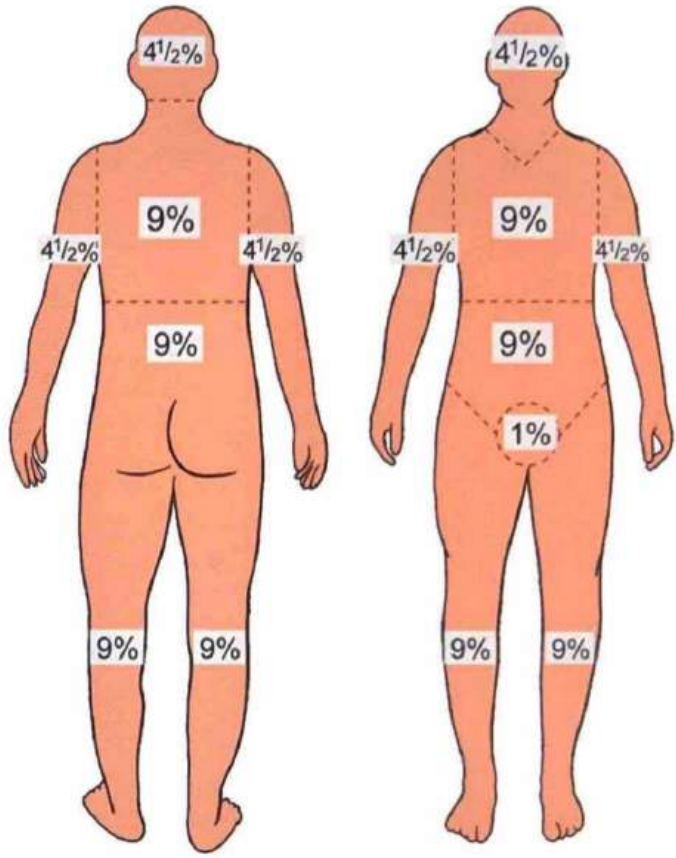
- Done mainly to calculate amount of IV fluid to be given for resuscitation

Methods for estimation

1. Rule of nine / Rule of Wallace (Less Reliable)

- Adults – 11 '9's + 1 = 100%

- 9% - for head & Neck
- 9% - for front of chest
- 9% - for back of chest
- 9% - for front of abdomen
- 9% - for back of abdomen
- 9+9% - for upper limb
- 9+9% - for front of Lower limbs
- 9+9% - for back of Lower Limbs
- 1% for Genitalia / Perineum

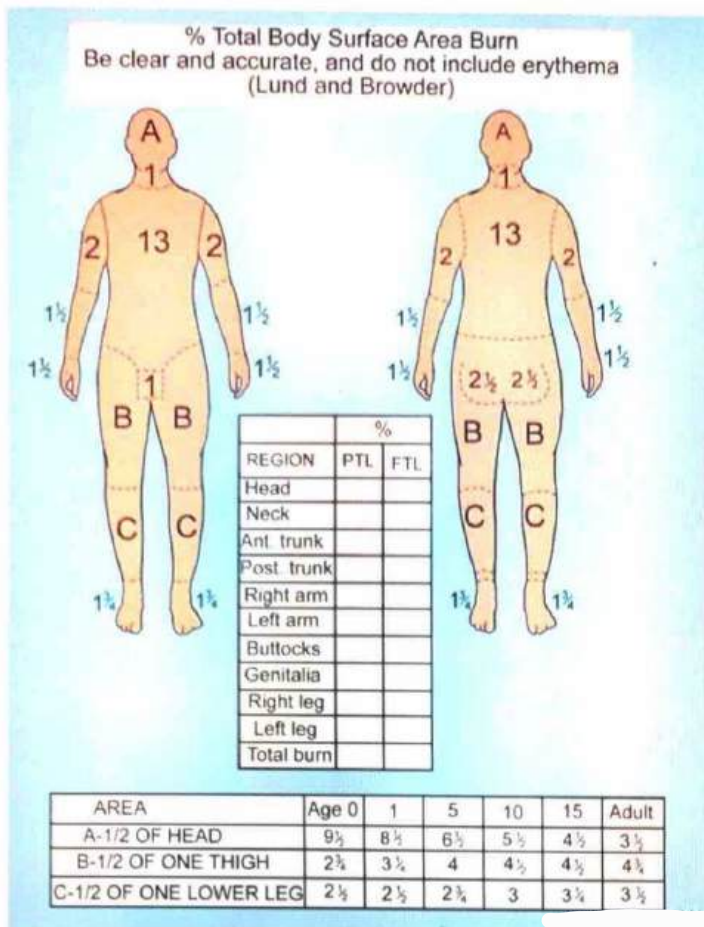


• Child [Modification of Rule]

- 18% - for head & Neck
- 13.5% for each lower limb
- Remaining body parts are same as adults

2. Lund & Browder's chart

- Best chart used for estimation of TBSA in children



Important Information

- MCC of death in burns is **Septicemia**
- MC organism responsible is **Pseudomonas**

PM FINDINGS IN BURNS

00:20:48

- It is important to find out whether the burns are antemortem burns/post-mortem burns

External findings

1. Perceive smell of petrol/Kerosene

2. In completely Charred body

- Algor Mortis
 - Livor mortis
 - Rigor mortis
- } cannot be assessed in burn victim

3. Face findings

- Crowfeet's sign
 - Sparring of skin around eye [as the person closes the eyes tightly]
 - This states that the person was alive at the time of burns/fire



Sparring of skin

No Smoke
No Burns

3. Rule of palm

- If size of burnt area is equal to size of pts. palm then, it is approx. $\approx 1\%$
- Used in case of patchy burns

PARKLAND'S FORMULA

- 4 ml/kg / % of burns
- It is fluid requirement for 24 hours
- Half of this fluid is given in 1st 8hrs & remaining half is given in next 16 hrs
- Fluid of Choice is Crystalloids i.e Ringer Lactate

CAUSES OF DEATH IN BURNS

00:17:36

1. If the pt. dies instantaneously during burns, cause of death is d/t
 - Laryngeal Spasm (Asphyxia)/
 - CO intoxication/
 - Neurogenic shock
2. 1st day d/t hypovolemic shock
3. 2nd day d/t Acute Renal Failure
4. 3rd - 4th day d/t septicaemia

4. Examination of burns

Typical signs of antemortem burns

- F – Fluid in blisters (\uparrow proteins & chloride)
- I – Inflammatory reaction/ vital reaction, infection/ signs of healing [granulation tissue]
- R – Line of Redness
- E – Elevated enzymes



How to remember

- FIRE

Difference b/w antemortem [burns] & post-mortem blisters [decomposition]

	Ante mortem blisters	Post-mortem putrefaction blisters
Content	Inflammatory fluid (+), rich in protein & chloride	Gas bubble (+)
Edges	Line of redness (+)	Line of redness (-)
Base	Erythemic/ hyperemic base	Pale

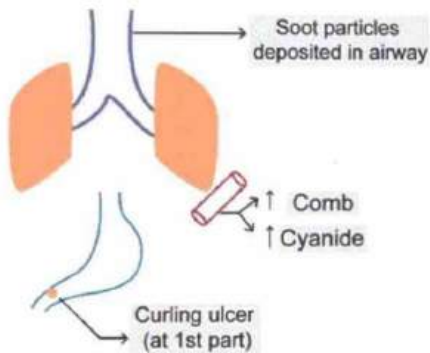


Internal findings

00:28:11

- If the person is alive at time of fire, following are seen

 - Carbon particle / soot particle
 - Co gas
 - Cyanide gas



4 'c' are seen

- Carbon/ soot deposition in airway
- Co combines with Hb & forms Carboxy-hemoglobin (> 10 mg%)
- Some amount of carboxy-Hb is seen in smokers [<10 mg%]
- Elevated serum Cyanide levels
- Curling's Ulcer in stomach
- It is erosive gastritis d/t mucosal ischemia

Non-specific signs

00:33:20

- These are seen both in antemortem & post-mortem

burns

- All these features come with word 'HEAT'
- Aka Heat artefacts

 - Heat stiffening / Pugilistic attitude / Boxer's attitude / Fencers attitude / Defence attitude**
 - When muscles are exposed to Heat > 65°C (Burns), all proteins undergo coagulation resulting in stiffening
 - It looks like a boxer. Hence, k/a boxer's attitude
 - It can be mistaken for Rigor mortis
 - Heat rupture**
 - When skin is exposed to heat for longer duration, it results in dehydration & coagulation of skin
 - It results in splitting of skin
 - It can be mistaken for incised wound / laceration
 - Heat hematoma**
 - D/t excess heat, veins rupture in the cranium, resulting in Hematoma in epidural space
 - It can be mistaken for traumatic extradural hematoma
 - Heat fracture**
 - Excessive exposure of heat to bones/ shrinkage of muscle results in fracture of bones
 - It can also be d/t drying, dehydration etc
 - It can be seen over the skull/ long bones
 - If it is seen in long bones, it is k/a Street & avenue fracture
 - It can be mistaken for traumatic bony fracture

PUPPET ORGANS

00:39:00

- When there is complete charring of the body, the Internal organs (in burns) will be cooked/firm/hard
- These are k/a Puppet organs



Antemortem burn



Antemortem blister with inflammatory fluid



Soot particles inside the airway

- Sometimes soot particles can be absent even in antemortem burns
- Eg.
 - Hospitalized/ intubated pts. [soot particles are washed off]
 - Smoke escapes when burns occur in open area

Table 7.1

	1 st degree	2 nd degree		3 rd degree
		Superficial burns	Deep burns	
Skin Layers involved	Epidermis alone is affected	Epidermis + Papillary Dermis	Epidermis + Reticular Dermis	Epidermis + Dermis + SC tissue
Redness	+	+	+	
Pain	Tender	+	+	(-) painless
Blisters	Absent	+	±	No Blisters
Blanching	Present	+	(-)	No blanching
Healing pattern	Heals Spontaneously (1 week) without any scar	Heals with scar in 2 weeks	Heal with scar in >3 weeks	Heal with Eschar Formation & is prone for Contractures Rx: Escharotomy



CLINICAL QUESTIONS



Q. The body of the 28 year old woman who had allegedly committed suicide by self-immolation was observed by the forensic doctor. There were multiple large splits in the skin on the abdomen and in the buttock regions. There was no bleeding in the wounds. How will the margins of these heat ruptures be on observation?

- A. Irregular margin
- B. Clear regular margin
- C. Contused margin
- D. Abraded margin

Answer: A

Solution

HEAT RUPTURE HAS IRREGULAR MARGINS WITH NO CONTUSION OR ABRASION



Heat Rupture/splits

- Due to excessive heat, severe burning/ charring, skin contracts and ruptures
- Irregular margins, may resemble lacerations (rarely even incised wounds)
- Sites: Fleshy areas, Extensor surfaces & joints.
- Multiple, Large (several centimetres)
- No Bleeding in the wound
- Coagulated blood in the vessels (by heat)
- Intact nerves, blood vessels in the floor of heat rupture.
- Vital reaction is absent
- No bruising/abrasion in the margins

Reference: The essentials of forensic medicine and toxicology; Dr. KS Narayana Reddy, 33rd edition ; page 323

Q. 4 members of the same family were burnt to death when their hut had caught fire, allegedly from embers that had been blown around from the bonfire they had lit earlier that evening to warm themselves. The bodies were seen with their hips flexed at the hip and knees. Their hands were held in a defensive pose and with clenched fists. This posture in burn victims is because of?

- A. Coagulation of proteins and present in ante-mortem burn
- B. Coagulation of proteins and present in post-mortem burn
- C. Coagulation of proteins and present in both ante-mortem and post-mortem burn
- D. none of the above

Answer: C

Solution



Pugilistic or Boxer's attitude (fencing or defence attitude) Heat Stiffening

- **Attitude**
 - legs are flexed at the hips and knees,
 - arms are flexed at the elbows and held out in front of the body and
 - fingers are hooked like claws (like a boxer)
- Occurs due to Shortening and stiffening of the muscles due to **coagulation of proteins of the muscles** (temp > 65° C) and dehydration which cause contraction.
- The dead body has characteristic posture with flexion of elbows, knees and clenching of hand into a fist.
- Because flexor being bulkier than extensor, contracts more, due to which joints of all limbs are flexed.
- Contraction of paraspinal muscles causes opisthotonos
- This is one of the condition simulating rigor mortis
- It occurs whether the person was alive or dead at the time of burning.
- So it is non-specific, hence **Cannot differentiate between antemortem & postmortem burn.**
- Much more intense as compared to Rigor Mortis.
- If heat stiffening occurs, then rigor mortis does not occur.

Reference: The essentials of forensic medicine and toxicology; Dr. KS Narayana Reddy, 33rd edition ; page 322



8

ELECTRICAL INJURIES

TYPES OF ELECTRICITY

🕒 00:00:17

- AC & DC are the two forms of electricity.
- AC is more dangerous than DC (4-5 times dangerous)

TERMINOLOGY

Voltage

- Injuries are directly proportional to the voltage [Voltage \propto Injury]
- As the voltage increases, injury & fatality increases

Amperage/ Current

- Injuries are directly proportional to amperage
- As the amperage increases, injury & fatality increases
- It is the most important factor for death in electrocution
 - Because it causes Tetanoid contractions particularly at the range of 10 - 20 mA
 - These contractions result in with-hold spasm/ hold-on spasm [i.e victim tightly grasps & couldn't release the wire resulting in increased chances of death]

Resistance

- Resistance is inversely proportional to the injury
- As resistance increases, chances of electrocution decreases
- As resistance decreases, chances of electrocution increases

CAUSES OF DEATH IN ELECTROCUTION

🕒 00:03:15

- Depends on the route of the current
- MCC of death is Cardiac arrhythmias
 - When the heart becomes part of the circuit, heart develops arrhythmias & the person may die
- Respiratory failure
 - When the current passes through the brainstem, pt may die of respiratory failure or
 - If the current passes through the diaphragm, it may go into spasm resulting in respiratory failure
- Most Resistant Tissue for Electrocution: Dry Skin > Bone > Moist Skin

Dangerous circuit

🕒 00:04:30

- From Left arm to Left foot [more chances of cardiac arrhythmias]

PM FINDINGS

🕒 00:04:45

Skin findings

- Low voltage with tight contact to the skin

Joule burn (Endogenous burn)

🕒 00:11:21

- Electricity passes from conductor into the skin d/t tight contact, resulting in generation of heat in the body
- This heat results in burns [Thus, k/a endogenous burn]
- Appearance: central depressed floor [compressed blister] surrounded by pale, peripherally raised margins
- Metallization of entry wound
 - Deposition of metallic ions in the entry wound, when the current is passing from metallic conductor into the skin.
- Current pearls
 - Deposition of metallic ions into the subcutaneous tissues

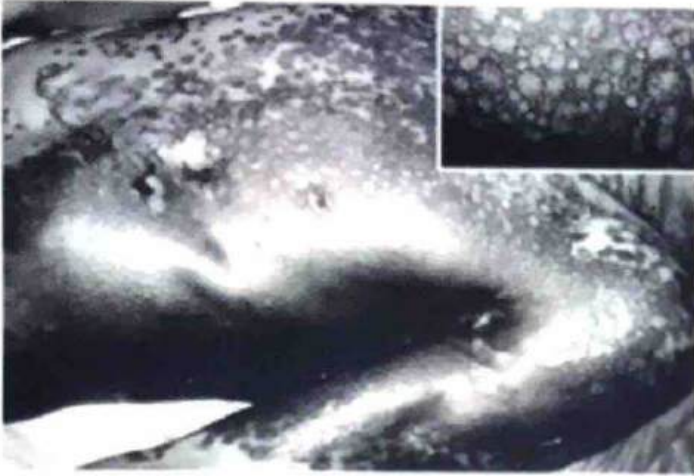


Joule Burn

High voltage loose contact burns

- Even with loose contact with the skin, burns occur
- **Flash Burns:** Diffuse patchy burns

- **Crocodile Burns:** Multiple, circular, pitted burns



MUSCLE FINDINGS

- Passage of electricity through muscle leads to Rhabdomyolysis
- This results in Myoglobinuria

BONE FINDINGS

- Wax drippings/ Bone pearls

Medico-legal importance

- Deaths in electrocution are usually accidental
- Suicide & homicide by electrocution are very rare
- Judicial execution by Electrocution is practiced in some states of US (United States)

LIGHTENING INJURIES

🕒 00:11:57



- Lightning: Electrical discharges from the clouds to the

ground

- It is DC type of current [but discharge in high voltages]
- **Injuries can be d/t**
 - Direct Strike: Lightning directly hits the person
 - Side Strike: Hits the object first & then hits the victim
 - Contact with the object: Victim might be leaning to the object, to which lightning strikes

Sledge-Hammer Effect

- Compressed Air coming in front of the lightning current is k/a **Sledge-Hammer Effect**
- **Possible Injuries / Effects**
 - Blunt force injuries/ Head Injury
 - Flame burns

Filigree Burns

- Aka
 - Ferning
 - Arborescent markings (looks like branch of a leaf)
 - Lichtenberg markings
 - keraunographic markings
- Pink, erythematous, branching markings on the skin [Ferning pattern]
- Seen upto 24 hrs
- It should be differentiated from Marbling

	Filigree burns	Marbling
Color	• Erythematous, pink	• Green
Pattern	• Doesn't follow the vessel wall [on the surface of the skin]	• Follow the vessel wall

Mechanisms

- Electrical discharges
- Hemoglobin staining etc

Keraunoparalysis

- Transient paralysis / weakness of Lower limbs following a lightning strike

Medicolegal Importance of death d/t lightning

- It is accidental Injury



CLINICAL QUESTIONS



Q. A 16-year-old male was found unconscious under the tree and was brought to the emergency department where he regained consciousness. He said that he had taken shelter under a tree during a storm. He also said that he had remembered nothing after the sound of the lightning. His arterial BP was 135/70 mmHg, his pulse was 80 per minute, and his fingertip O₂ saturation was 98%. The results of a neurological examination were normal and his GCS score was 15. His hearing and the tympanic membrane are normal. There were significant Lichtenberg figures on the patient's back, extending over the right scapula. These characteristic burns are also known as?



- A. Crocodile flash burn
- B. Adipocere
- C. Lightning tattoo
- D. Filigree burns

Answer: D

Solution

Filigree burns or **Arborescent** or **fern-like** injury or **Lichtenberg** figures

- Pathognomonic for **lightning injury**
- Superficial, irregular red marks, may follow skin creases, especially if damp from sweating. (fern-like pattern).
- The erythematous marks are not burns.

Cause: Different authors have suggested different causes

1. The lesion occurs when an individual struck by the negative lightning bolt is then hit by a secondary positive flashover from a nearby grounded object.
2. It represents an entrance point in an individual struck by a positively charged lightning bolt.
3. Slight staining of tissues by haemoglobin from lysed red blood cells along the path of electric current.

Option 1, Crocodile flash burns: Multiple burnt or punched-out lesions are produced due to the air dancing over the body surface over large areas.

Option 2, Adipocere: a variation of putrefaction. It is seen most commonly in bodies immersed in water or in damp, warm environments. In adipocere, fat undergoes the hydrolysis to the free fatty acids by virtue of bacterial enzymes and endogenous lipases.

Option 3, Mummification: Another modified form of putrefaction, where drying and desiccation of the tissues occur instead of liquefaction, depending upon the conditions prevalent at the terminal stages.

Reference:

Textbook of forensic medicine and toxicology, 5th edition, Krishan Vij, page 161

Di Maio's Forensic pathology, 2nd edition, page 418

Knight's Forensic pathology, 4th edition, page 336

Q. Which among the following is/are true statement(s) about Joule burn :

- A. Exogenous thermal burn
- B. Diagnostic of contact with electricity
- C. At point of entry and exit of the current.
- D. Cause is heat generated in the body from electricity
- E. Most commonly found at mucocutaneous junctions

Answer: B, D

Solution

JOULE BURN:

- It is specific and diagnostic of contact with electricity
- It is an endogenous thermal burn
- Cause: heat generated in the body from electricity.
- Site: **point of entry** of the current.
- When current flows through the body the flexor muscles go into spasm, any object held in the hand involuntarily clenched that may be live wire or source of electricity and current continues to flow, known as "**HOLD-ON EFFECT**"

Reference: Essentials of forensic medicine and toxicology; Dr. KS Narayana Reddy, 33rd edition ; page 330



9 COLD INJURIES

Types

🕒 00:00:29

- Dry Cold Injuries
- Moist Cold Injuries → More dangerous (d/t more rate of heat loss)

- Under the bench (or)
- Under the bed (or)
- Under the wardrobe
- Resembles a case of robbery or assault

GENERAL EFFECTS OF COLD

🕒 00:01:10

- Hypothermia

LOCAL EFFECTS

- Frost Bite (d/t dry cold)
- Trench Foot (d/t moist cold)

LOCAL EFFECTS

🕒 00:11:11

1. Chill Blain (PERNIO): Red, itchy skin lesions over the extremities
2. Local Cold Injury
Frost nip → superficial frost bite → Deep frost bite

General Effects Hypothermia

🕒 00:02:04

- When Body Core temperature $< 35^{\circ}\text{C}$
- More Seen in
 - Extremes of age
 - Alcoholics
 - Pre-existing diseases

Frost Nip

🕒 00:13:11

- Superficial
- Non-Freezing
- D/t vasoconstriction
- Seen over extremities
- Not a permanent damage

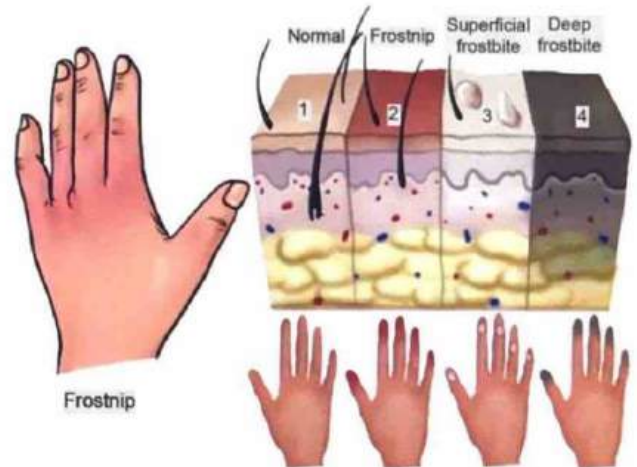
Effects

Temperature → b/w $32^{\circ}\text{C} - 24^{\circ}\text{C}$

- Disorientation
- Clouding of Consciousness
- Loss of reflex
- \downarrow RR, \downarrow HR, \downarrow BP

PM Findings

- PM Hypostasis → Pink
- Skin is Pale (Hypothermic deaths aka White deaths)
- Internal Organs are Congested
- Stomach shows Wischnewski Spots (Multiple Mucosal Hemorrhages)



PHENOMENA

1. Paradoxical Undressing

🕒 00:06:49

- Seen with hypothermic death
- Naked / Semi naked in Cold climates
- Hypothermia → Disorientation → Confusion → Undressing
- May resemble sexual offence

C/F

- Pallor
- Numbness
- Burning sensation

Rx: Rewarming

2. Hide & Die Syndrome

🕒 00:09:30

- Seen in Hypothermic death
- Dead bodies are found

Superficial Frost Bite

🕒 00:15:19

- Permanent damage
- D/t freezing temperature

2.5°C → Freezing of skin → ice crystal formation → ischemia
↓ Gangrene

3. TRENCH FOOT / IMMERSION FOOT

00:20:41

Superficial Frost Bite

- Affects skin & Subcutaneous tissues
- Numbness, itching, burning sensation, painless blisters with clear fluids

Deep Frost Bite

- Effects deeper structures
- Firm skin, tenderness, burns haemorrhagic blisters, gangrene

- D/t moist cold
- D/t prolonged immersion
- Seen in Soldiers during warfare times, Sailors
- Can develop necrosis & gangrene
- Seen around 5-8°C
- Also involves hand → Trench Hand

- Frost Bite Injuries Are Always Ante Mortem

Treatment of Frost Bite

- Rewarming
- Protection of body parts
- Anti-Infective measure



TRENCH FOOT - NECROSIS



TRENCH FOOT - GANGRENE



Deep frost Bite



Deep frost Bite amputation



TRENCH FOOT - GANGRENE



Superficial Blisters



Frost Bite



CLINICAL QUESTIONS



Q. Wischnewski ulcers are:

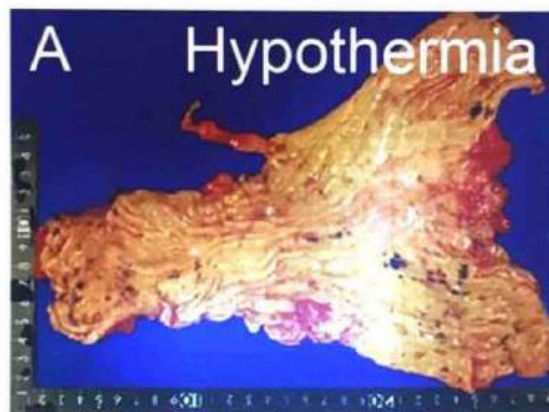
- A. Gastric ulcers in hypothermia
- B. Gastric ulcers in burns
- C. Duodenal ulcers in hypothermia
- D. Duodenal ulcers in burns

Answer: A

Solution

Autopsy Findings in hypothermia:

- Postmortem lividity is pinkish – due to persistent oxy-hemoglobin in the capillaries. Due to cold, there is low metabolic activity and cold tissues fail to take up the delivered oxygen.
- Rarely skin is pale (white) and thus hypothermic deaths are also called as "white deaths".
- Skin may show erythematous (irregular red or violet) patches on exposed parts of body. They are often present over extensor surfaces of large joints, such as the outer side of hips, elbows and knees and at flank and face.
- **Gastric mucosa may show small haemorrhages and ulceration (Wischnewski ulcers)**
- Kidneys may show signs of acute tubular necrosis
- Urinary catecholamine levels are elevated in hypothermic deaths ----> indicate prolonged agonal stress.
- There is hyperglycemia with glucose in urine.



Reference: Principles of forensic medicine & toxicology, Rajesh Bardale, Page no : 259

Q. Patient complaining of numbness of his feet. Physical examination of the feet reveals erythema, edema, and the presence of several clear blisters. Peripheral pulses are palpable. Which of the following is the most likely diagnosis?

- A. Frostnip
- B. First-degree frostbite injury
- C. Second-degree frostbite injury
- D. Third-degree frostbite injury

Answer: C

Solution

The given condition is of **second-degree frostbite injury**

Frostnip	superficial freeze injury that causes no tissue loss. rewarming quickly reverses the symptoms.
First-degree frostbite	partial skin freezing, erythema, edema, no blisters , and desquamation several days later
Second-degree frostbite	full-thickness skin freezing, erythema, edema, clear blisters . Patients complain of throbbing and numbness.....
Third-degree frostbite	extends into the subdermal plexus. The skin is blue or gray, hemorrhagic blisters
Fourth-degree frostbite	extend into the subcutaneous tissue, muscle, and bone .no edema and the skin is mottled and cyanotic

Reference: Review of Forensic Medicine & toxicology; Gautum Biswas 3rd edition; page 264



10 TRANSPORTATION INJURIES

- Any injury d/t any mode of transport i.e by road/ water/ air etc

00:00:44

INJURIES D/T RTA (ROAD TRAFFIC ACCIDENTS)

Include injury to

1. Pedestrians
2. Occupants
3. Motor cyclist

INJURY TO PEDESTRIAN

00:01:25



- When a vehicle hits a pedestrian from behind, injuries depends on

1. Speed of the vehicle

- If the vehicle hits a person at
 - Low speed: (20km/hr) victim falls on the ground & sustain an injury/ the vehicle may run over on the victim
 - Moderate speed: person falls on the vehicle & sustain injuries
 - High speed: the pedestrian will be scooped up & thrown on the road

2. Point of impact i.e the level of centre of gravity

- Center of gravity is at the level of pubic symphysis
- If the point of impact is below the center of gravity, the person scoops up & falls on the vehicle, then the person falls on the ground & sustain injuries
- If the point of impact is above the centre of gravity, i.e at chest/ back etc; as the vehicle is at height (trunk/ Laury/ bus/ tall car etc), the person will be thrown on the road & sustain run-over injuries

IMPACTS THAT DETERMINE THE INJURY IN THE PEDESTRIANS

00:05:18

1. 1st impact with the vehicle

- It is usually below the center of gravity
- As the bumper is at lower level, it will hit the legs
- These are k/a Primary impact injuries



2. 2nd impact with the vehicle

- The person falls on the Bonet/ the wind shield & sustain injury
- These are k/a Secondary impact injuries



3. Ground impact/ impact with the road

- D/t movement of the vehicle, the person slides & falls on the ground & may be dragged on the road
- These are k/a Tertiary impact injuries or Secondary injuries



PRIMARY IMPACT INJURY

- Normally, the bumper (protruding part of the car) hit the legs of the pedestrian
- Thus, the injuries produced here are k/a Bumper injuries
- Possible injuries can be
 - Abrasions
 - Contusion of soft tissues
 - Lacerations
 - Sometimes fracture in the legs.
- Bumper may not always hit the legs.
- It depends upon the height of the pedestrian & the height of the vehicle
- If the pedestrian is a child, then the primary impact would be at the level of femur as well
- In adults, it is usually at legs

Medico-legal importance of fracture

- Normally, fracture produced here is k/a Bumper fracture
- MC, it is seen in Tibial plateau
- Other sites are femur, fibula etc depending on the height
- Shape of the bumper fracture is wedge / triangular



- Base of the triangular fracture segment indicates the point of impact
- Apex of the triangle indicates the direction in which the car was moving
- Location of the bumper fracture gives so many clues regarding the accident
i.e it tells the direction of the vehicle
 - If the bumper injury is at the back of the legs, it indicates that vehicle was moving from behind
 - If vehicle is moving from right to left & hits the pedestrian from lateral side, bumper injury is at lateral aspect of the right leg
 - If the vehicle is moving from left to right side & hits the pedestrian, bumper injury will be at the lateral aspect of the left leg
 - If the vehicle hits from the front, injuries will be at front of the legs
 - If the bumper injuries are at the same level on both the legs, it indicates that the person is standing at the time of impact

- If the bumper injuries are at different levels in each leg, it indicates that the victim is either walking/running at the time of impact
- Height of the bumper injuries from the ground indirectly reflects the approximate height of bumper from the ground
- Sometimes, bumper injuries can be at little Lower level. This is because at the time of crash, the driver will be applying brakes which makes the vehicle bend
- But, if the driver is accelerating then the bumper injury can be at higher level as well

SECONDARY IMPACT INJURIES

00:17:20



- It is d/t 2nd impact with the vehicle
- Victim may fall on Bonnet / wind shield & sustain injuries
- Any protruding objects of the car can also cause injury
- Injuries
 - Head injury
 - Cervical injury
 - Skeletal fractures d/t impact with the hard objects of the vehicle

TERTIARY IMPACT INJURIES / SECONDARY INJURIES

00:19:00

- It is d/t impact on the road or d/t dragging on the road



- Injuries include
 - Head injuries d/t fall on rough surface
 - Skeletal fractures
 - Extensive abrasions & lacerations
→ D/t dragging on the road, grazed abrasions can be seen
- Vehicle with high chassis i.e the gap b/w the road &

under surface of the chassis is little higher (ground clearance is higher).

- Eg. Laury, Bus etc produces run-over injuries (i.e vehicle run over the victim)
- **Possible injuries are**
 - Tyre mark (intra-dermal bruise) on clothing/body part. It is most specific for run over injuries
 - Brush burns. These are gravel rashes d/t intense friction
 - Crushing injuries d/t heavy weight of the vehicle
 - Crushing of head
 - Deep crushing of internal organs
 - Sometimes body part is amputated and separated
 - Avulsion injury: It is a type of laceration Where force is applied in a tangential manner
 - Skin & subcutaneous tissue is ripped off from underlying muscle/bone
 - Flaying is seen
 - Burning/ blackening/ grease stains are seen d/t impact of hot exhaust of the vehicle on the body part



- Vehicle with low chassis (car etc) can't cause run over injuries as ground clearance is very less. It causes rolling injuries where the victim is rolled on the ground by the vehicle



- Possible injuries are
 - Circumferential grazed abrasions d/t rolling
 - Skeletal fractures
 - Grease staining/ Burning
 - As victim is rolled b/w the road & under surface of the chassis, sometimes patterned abrasions similar to under surface of the chassis is seen

INJURIES TO THE OCCUPANTS OF THE CAR

00:28:00

Include

1. Injury to the driver
2. Injuries to front seat passenger

Acceleration injuries

- When a heavy vehicle violently hits the vehicle at rest, passengers in it are suddenly put under acceleration from rest
- The injuries d/t this are k/a acceleration injuries



Deceleration injuries

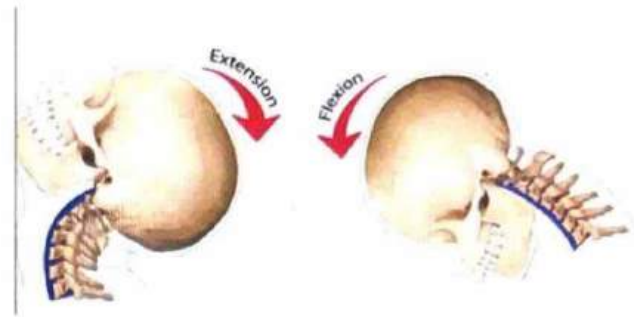
- When a fastly moving vehicle suddenly hits an stationary object (sudden stop), it results in Deceleration injuries



- When the victim is driving at high speed & suddenly hits a stationary object, following injuries occurs d/t impact (remember it in sequence)
 1. Impact on head d/t windshield
 2. Violent shaking movements of the neck
 3. Steering impacts into the chest
 4. Seatbelt produces compression injuries
 5. Leg on the accelerator can produce injury



Acceleration injury: Hyperextension followed by hyper flexion occurs.



Deceleration injury: Hyper flexion followed by reactionary hyperextension occurs.



Injuries in neck include

- Contusion of soft tissues in cervical spine mainly at Ant. longitudinal ligament.
- Fatal contusion of spinal cord without fracture of spine usually at C5 and C6 levels.
- Fracture of cervical vertebrae.

INJURIES TO THE DRIVER

00:32:54

- Above sequence of injuries can be seen in the driver as he would be holding the steering wheel

1. Broken windshield

- When the victim is ramming into the windshield, windshield would be broken
- This produces spherical/ cubicle glass fragments, which impact into the face of the victim & produces multiple, small, superficial, punctate lacerations
- This pattern resembles Sparrow foot marks. Thus, these are k/a Sparrow foot injuries



Broken wind shield



sparrow foot marks

- Now a days chances of this injury is low as
 - Driver is wearing seat belt [he won't hit wind shield directly]
 - Wind shield in recent days is made up of 3 layers of glass.
- **Dicing injury**
 - It is the term used for injuries caused by broken window glasses hitting the face of driver.

2. Neck movements

00:37:36

- Violent shaking of neck leads to whiplash injury.
- Hyper flexion and hyperextension of neck occurs due to acceleration and deceleration.

3. Steering Wheel impact shows

00:44:15

- Fracture of wrist and forearm bones
- Patterned bruise on chest
- Sternum and rib fracture
- Injuries to heart, lungs and aorta

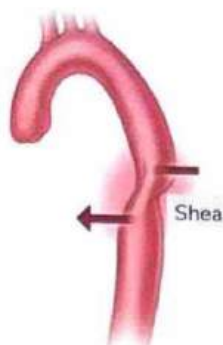
Injury to aorta

- Occurs due to direct impact of steering wheel or due to deceleration force.
 - Direct impact causes torsion force which causes direct injury.
 - Deceleration force causes shearing and stretching force on aorta resulting in injury



Important Information

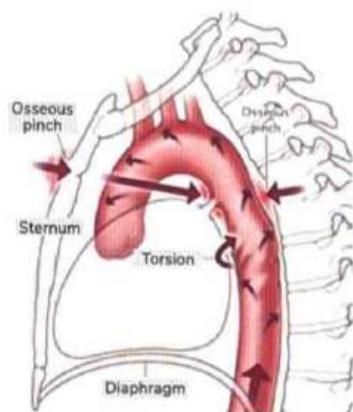
Hyperextension is more risky than hyper flexion in causing these neck injuries.



Shearing force on aorta due to deceleration.

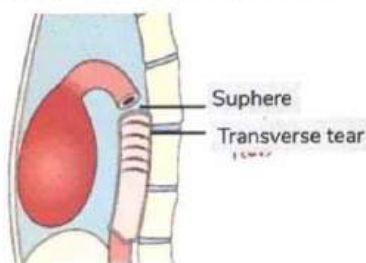


Stretching force on aorta due to deceleration.



Torsion force due to direct impact of steering wheel.

- In direct impact due to steering wheel, aorta gets compressed between sternum in front and thoracic vertebrae in back called as osseous pinch.
- This can cause aortic rupture at isthmus of aorta
- In total aortic rupture there is transverse tear in intima.
 - It looks like ladder rung.
 - Thus, it is also known as ladder rung tear.



4. Seat Belt Injuries

Seat belt syndrome

- It is combination of
 - Seat belt sign (patterned bruise on chest because of belt)
 - Intra-abdominal injuries &
 - Vertebral injuries.



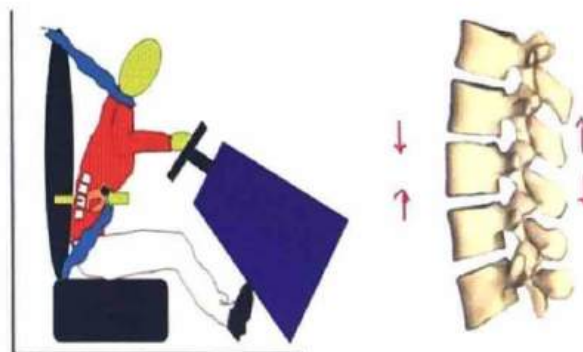
Seat belt sign

Intra-abdominal injuries

- It occurs d/t sudden deceleration or due to sudden compression of organs because of seat belt.
- These include Injury to
 - Mesentery (MC injury)
 - Small intestine
 - Spleen
 - liver
- In small intestine, most commonly injured areas are duodenojejunal flexure and ileo-caecal junction.
- Vertebral [Lumbar] fracture is commonly due to hyper flexion of spine (mostly occurs in lap type seat belt).

Flexion and distraction force

- Compression force anteriorly and distraction force posteriorly leads to transverse fracture along the vertebral body
- This is known as Chance fracture/fulcrum fracture.





- Fracture of foot/ legs can also be seen

INJURIES TO OCCUPANTS OF CAR

Front seat passenger

01:00:47

- Most of the injuries will be same as driver like
 - Wind shield injuries
 - Neck injuries/ Whiplash injuries
 - Seat belt injuries
 - But no steering wheel injury.
 - There will be dash board injuries to passenger.
- As the passenger's hip and knees are flexed; when he hits the dash board suddenly, there are injuries to knee and hip. These are k/a Dashboard injuries
- Injuries include
 - Fracture of patella
 - PCL tear
 - Posterior dislocation of hip (dash board fracture)



- Here, knee is flexed, ACL is relaxed and PCL is taut.
- Thus, PCL is injured more commonly.

MOTORCYLIST INJURIES

1. Tail gaiting

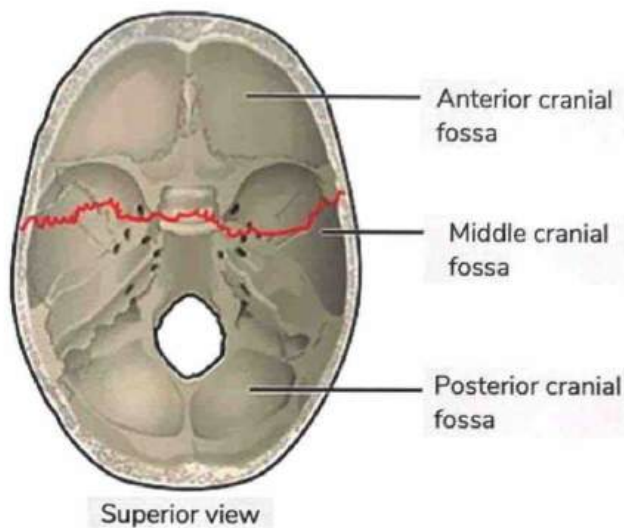
01:03:58

- Car or motor-cycle tends to follow so closely to the heavy vehicle in front of them
- If this heavy vehicle is stopped suddenly, car or bike at back rams into heavy vehicle
- It is called as under-running.



- This can lead to fatal injuries to face, chest and other parts of the body.
- If the force is so severe, even decapitation can occur

2. Hinge fracture



- Side impact on skull leads to fracture line, which goes from one side of the base of the skull to another side
- Entire base of the skull is divided into 2 parts [front & back of the skull are separated]
- It can be moving like a hinge; hence it is k/a hinge fracture. [Type-1 hinge fracture]
- It is commonly seen in motorcyclist riders. Hence it is k/a Motor-cyclist fracture



CLINICAL QUESTIONS



Q. A 30-year-old pedestrian is hit by a car and sustained injuries. He is noted to have tibial fracture on the left leg and contusion over the scalp on the right side. The tibial fracture in this patient is a result of?

- A. Primary impact injury
- B. Secondary impact injury
- C. Tertiary impact injury
- D. Quaternary impact injury

Answer: A

Solution

- The tibial fracture in a pedestrian hit by a car, is a result of primary impact injury.

Pedestrian injuries

Primary impact injury (1st impact)

- Usually at the level of legs, due to bumper impact .
- Bumper fracture affects tibia.
- It helps the examiner to find the direction of the vehicle.

Secondary impact injury (2nd impact)

- Due to bonnet / windshield impact
- Leads to head injury, skeletal fracture or cervical injury

Tertiary impact injury (3rd impact / ground impact)

- Leads to head injury, abrasions & laceration.

Reference: Knight's Forensic Pathology, 4th edition Page no 289

Q. Judging by the direction of the multiple short, punctate wounds on the face of the victim, the forensic doctor concluded that the 50 year old woman was in the passenger seat. They had a random, bizarre, pattern and also had some glass pieces embedded in some of the wounds. Which among the following statement is not true about such injuries?

- A. Also called as dicing injuries
- B. Multiple incised wounds on the face
- C. Due to shattering of windscreen glass
- D. Relatively superficial

Answer: B

Solution

Sparrow foot marks or dicing injuries

- The face of front-seat occupants often suffers multiple lacerations from contact with the shattered windscreen glass.
- These lacerations are usually bizarre shaped or 'sparrow-foot' patterned. (Multiple short linear, punctate lacerations)
- Relatively superficial injury
- Thin pieces of windscreen glass may be embedded in the wounds or may be present in clothing
- The side of the injuries helps in determining whether the victim was driver or front seat passenger.

Reference: The essentials of forensic medicine and toxicology; Dr. KS Narayana Reddy, 33rd edition ; page 281



11 TORTURE METHODS

LEGAL PROVISIONS AGAINST TORTURE

00:00:18

- Guidelines for medical professional in terms of torture is given by → Declaration of Tokyo
- Istanbul protocol
 - Gives all the guidelines related to
 - Dealing with the patients
 - Dealing with the victim
 - Reporting the injuries
 - Documentation &
 - Intimation to higher authorities

IMPORTANT LEGAL SECTIONS

- 330 IPC: Punishment for causing hurt during torturing the victim
- 331 IPC: Punishment for causing grievous hurt during torturing the victim

METHODS OF TORTURE

00:01:46

1. Telefono

- Repeated slapping over the ears



2. Falanga/ Bastinado

- Beating over the soles



3. Dry submarine

- Plastic bag asphyxiation [covering the plastic bag around the head of the victim & making the victim suffocate]



4. Wet submarine

- Forced immersion of head of the victim under the water. [sewage/ bad quality water is normally used]



5. Parrot's perch

- Suspension of the victim [by means of ankle, wrist, sometimes knees] through a horizontal rod/ pole



6. Sawhorse

- Forced straddling [i.e person is made to sit on a sharp platform]
- Heavy weight is tied to the legs of the victim to pull down



7. Black Slave

- Insertion of hot metal [screwdriver/iron rod] into the anus of the victim

8. EL Planton

- Prolonged standing



9. Cattle's prod

- Giving electric shock to the genitalia of the victim



10. Ghotna

- Rolling a heavy wooden log over the legs

11. Dunking

- Forced Immersion of whole body under the water. [In Wet submarine, only head is immersed into the water]
- Particularly done to extract confession from the victim



CLINICAL QUESTIONS



Q. A form of torture where the legs and thighs are tied very tightly with bamboo sticks:

- A. Chepuwa
- B. Saw horse
- C. Black slave
- D. Ghotna

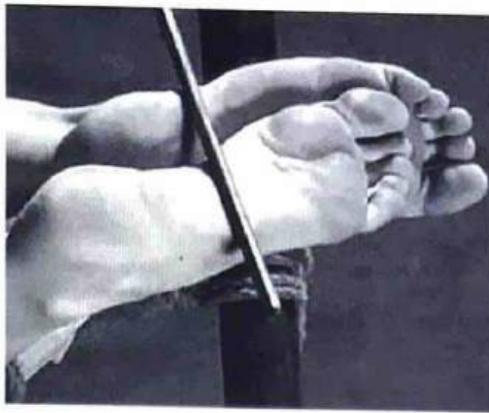
Answer: A

Solution

- **CHEPUWA:** The legs and thighs are tied very tightly with the bamboo sticks to induce the severe pain
- **GHOTNA:** Rolling a wooden log over the thighs up & down, while the log is weighed by one or two policemen standing on it
- **BLACK SLAVE:** Heated metal skewer inserted into the anus
- **SHAM EXECUTION:** Victim is blindfolded and asked to stand before a wall and then threatened that a vehicle is going to hit him. He hears the sound of a vehicle very near to him, causing fear and shock.
- **DUNKING:** Victim is immersed in the water, taken out after some time and given a chance to confess
- **LA BANDERA:** Suspension by wrist.
- **MURCIELAGO:** Suspension by ankles.
- **EL PLANTON:** Prolonged standing.
- **SAW HORSE:** Forced straddling on a bar



- **Cattle prod:** Electric shock especially over the genitals
- **FALANGA/ BASTINADO:** the soles of the feet of the victim are beaten by stick or blunt object, Findings: Hematoma on the sole of the feet



- **TELEFONO:** Repeated slapping on the ears
- **DRY SUBMARINE:** Plastic bag asphyxiation
- **WET SUBMARINE:** Forced immersion of head underwater, polluted with excreta, urine, vomit or blood
- **PICANA:** Electric shock torture.
- **PARROT'S PERCH:** Person is suspended head down from a horizontal pole placed under the knees with wrists bound to ankles.
- **Telephono:** beating both ears simultaneously may also be used.
- **Witness torture:** The victims are forced to witness the torture of another prisoner or of family members

#Doctors can alleviate violations of human rights being among the first to become aware of these violations, particularly Torture

*##The physician shall not aid or abet torture nor shall he be a party to either infliction of mental or physical trauma or concealment of torture inflicted by some other person or agency in clear **violation of human rights**.*

Reference: Review of Forensic Medicine & toxicology; Gautum Biswas 3rd edition; page 447

Q. Which of the following proposes the guidelines for medical professional in terms of torture?

- A. Declaration of Tokyo
- B. Declaration of Istanbul
- C. Declaration of Taipei
- D. Declaration of Helsinki

Answer: A

Solution

Legal provisions against torture:

- Guidelines for medical professional in terms of torture is given by → **Declaration of Tokyo**
- All the guidelines related to dealing with the patients, dealing with the victim, reporting of injuries, documentation, intimation to higher authorities given by → **Istanbul Protocol**

Reference: The essentials of forensic medicine and Toxicology.



LEARNING OBJECTIVES



UNIT-2- INDIAN LEGAL SYSTEM & MEDICAL JURISPRUDENCE

1. Indian legal system & court procedures

- Different Types of Cases
- Offences
- Different Criminal Courts in India
- Death Sentence
- Inquest
- Types of Magistrate
- Types of Witness
- Summon
- Priority for Summons
- Conduct Money
- Hostile Witness
- Exemptions of Oral Evidences
- Dying Declaration
- Dying Deposition

2. Legal sections

- Indian penal code
- IPC Related to Poison Patient
- IPC Related to Victim of Sexual Offences
- IPC 269-270
- IPC 272-273
- IPC 274-275
- IPC 284
- IPC Related to Culpable Homicide
- Definitions and Punishments
- Sections Related to Voluntary Miscarriage / Abortion
- Sections Related to Hurt / Grievous hurt
- Sections Related to Sexual Harassment
- Criminal Responsibility
- IPC Related to consent
- Transplantation of Human Organs Act
- Consumer Protection Act
- Juvenile Justice Act
- Protection of Children from Sexual Offences Act
- Euthanasia
- Living Will

3. Medical jurisprudence part-1

- Introduction to medical ethics
- Medical Ethics in Detail
- Warning Notice
- Disciplinary Control of Infamous Conduct
- Professional Secrecy
- Privileged Communication
- When Can a Doctor Advertise?
- Consent in Medical Practice
- Doctrine of Full Disclosure
- Doctrine of Informed Refusal
- Doctrine of Therapeutic Privilege
- Exceptions for Consent
- Rules for Consent

4. Medical jurisprudence part-2

- Professional negligence
- Last Clear Chance Doctrine
- Avoidable Consequences Rule
- Durga Pandey Vs Management of Nagarmal Seva
- Defences for Medical Negligence
- Doctrines
- Loco Parentis
- Medical Records
- Declarations

5. Medical certification of cause of death

- Importance
- Definition of Death
- Death Certificate
- Registration Practices
- Reporting of the Event
- Doctor's Role
- MCCD Form
- Illustration
- Legal Provisions
- When not to Issue
- General Rules
- Self-Assessment



12

INDIAN LEGAL SYSTEM & COURT PROCEDURE

BASIC TERMS

🕒 00:00:13

1. IPC - Indian Penal Code
2. CrPC - Criminal Procedure Code
3. IEA - Indian Evidence Act

Indian Penal Code: (IPC)

- Given in 1860
- Contains both definition / punishment of offences
- IPC contains 511 sections

CRIMINAL PROCEDURE CODE (CRPC) 1972

- Different procedures followed in case of crime
- In a Murder case, following are done in order
 - Inquest (by the police at the scene of crime)
 - Arrest (the accused)
 - Trial (Conducted by Court)
 - Judgment (By court)
 - Execution of Punishment

INDIAN EVIDENCE ACT

- Enacted in 1872
- It tells about different types of evidences & procedures for recording of evidence

CASES

🕒 00:06:52

Civil case	Criminal case
<ul style="list-style-type: none"> • Case b/w 2 parties • Plaintiff Vs. Defendant (Plaintiff is the person who files the case in the court) 	<ul style="list-style-type: none"> • Crime done against the state • State Vs. Accused

OFFENCES

🕒 00:08:49

Cognizable offence (2(c)CrPC)	Non – cognizable offence (2 (L)CrPC)
<ul style="list-style-type: none"> • Police can Arrest without warrant • Include <ul style="list-style-type: none"> ○ M - Murder ○ D – Dacoity ○ R – Rape, Robbery, Ragging ○ D – Dowry Death 	<ul style="list-style-type: none"> • Police can arrest only with Warrant • Include Hurt



How to remember

MDRD

Summon cases

Cases related to offences in which the Punishment is less than 2 years

Warrant cases

Cases related to the offences in which the Punishment is >2 years

Bailable Offences

Police can give Bail

Non-Bailable Offences

Only Magistrate can give Bail

Compoundable offence

- Offences where 2 parties can come to mutual agreement
- Less serious offences Eg. Defamation, Adultery, Simple hurt

Non- compoundable offence

- Parties cannot enter into agreement
- More serious offences Eg. Murder, Rape

Plaintiff (Victim)

- Files the case
- Prosecution Lawyer
- Prosecution side

Defendant (Accused)

- Defends the case
- Defence lawyer
- Defence side

CRIMINAL COURTS IN INDIA (*HIERARCHY)

🕒 00:17:17

	Imprisonment	Fine
Supreme court (National level)	Any sentence in book of law	Unlimited
High court (state level)	Any sentence	Unlimited
Sessions Judge / additional sessions judge (Dist. Level)	Any sentence	Unlimited
Assistant sessions judge	10 years	Unlimited
Chief Judicial Magistrate	7 years	Unlimited
1 st class Judicial Magistrate	3 years	Rs. 10,000
2 nd class Judicial Magistrate	1 years	Rs. 5,000

- Apex court of the country → Supreme court
- Apex court of the state → High court
- Apex court of the district → Sessions court
- Supreme Court, High court and Sessions court can give any sentence authorized by law

IMPORTANT POINTS

- Death sentence can be given by Sessions court but needs to be confirmed by high court
- Sessions court is the lowest court which can give death sentence
- Chief Judicial Magistrate (CJM) in metropolitan cities is K/a metropolitan magistrate
- FTC (Fast track courts) are equal to sessions court in power
- Child < 18 yrs are considered as juvenile (Crime conducted by juvenile is dealt by Juvenile justice board)



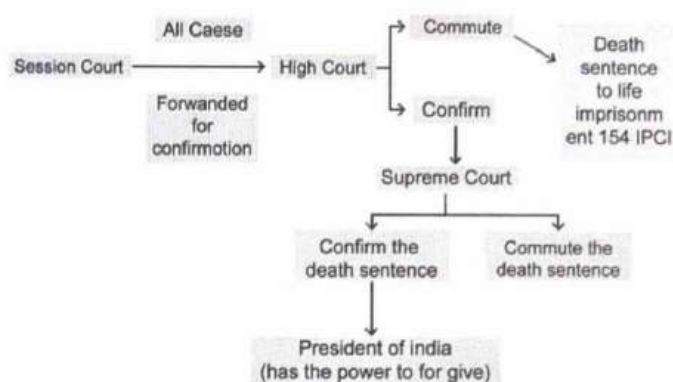
Important Information

- Lowest court for giving death sentence → sessions court
- All cases including murder cases can be handled by sessions court
- Any punishment given by lower courts can be increased or decreased (commutation) by higher courts.

DEATH SENTENCE

🕒 00:29:08

- In India, method of execution is judicial hanging.
- All the cases of death sentence given by sessions court will be forwarded to high court for confirmation.



- 53 IPC include all punishments
- 416 CrPC: Postponement of Death Sentence in pregnant female

INQUEST

🕒 00:34:15

- Inquiry into the cause of unnatural death

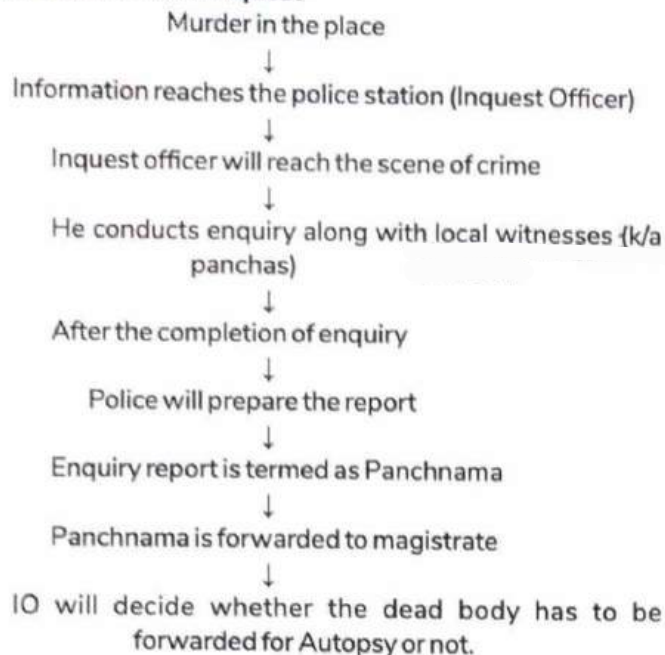
Types of inquest

Police inquest	Magistrate Inquest
• 174 CrPC	• 176 CrPC
• Most common inquest in India	• Best inquest

Police Inquest

- Minimum rank for police for conducting Inquest in India is senior Head Constable (Station House Officer)
- Police Constable cannot conduct inquest. (Only head constable can conduct inquest)

Procedure of Police Inquest



MAGISTRATE INQUEST

00:39:45

Types of Magistrates

Judicial	Executive
<ul style="list-style-type: none"> In the court of law (for conducting trial) Appointed by high court 	<ul style="list-style-type: none"> In maintaining law & Order in the society Appointed by state govt. Designated as District magistrate (DM) Following govt. officials can be appointed as executive magistrate <ul style="list-style-type: none"> District Collector Tehsildar RDO Deputy collector

- Judicial Magistrate is superior to executive magistrate
- Magistrate inquest is superior type of inquest in India

Judicial magistrate	Executive magistrate
Can conduct inquest in <ul style="list-style-type: none"> Custodial death Custodial Rape 	Can conduct inquest in <ul style="list-style-type: none"> Suspected dowry death Definition of dowry death <ul style="list-style-type: none"> Death of a Married Female within 7 years of Marriage under Suspicious circumstances Suicide Exhumation

Conditions for Magistrate inquest

- A - Death in Asylum
- B - Death in Borstals
- C - Custodial death / rape
- D - Dowry Death
- E - Exhumation



How to remember

ABCDE

- Coroner Inquest is Abolished in India
- ### Medical Examiner System
- Practiced in Few States of US
 - Not Done in India
 - Best Inquest system all over the world



Important Information

Best inquest system in India is Magistrate Inquest.



Previous Year's Questions

Q. A 14-year-old girl was kidnapped by a male. While the police arrested him, he died in police custody. The inquest is conducted by?

(FMGE-Aug-2020)

- A. Judicial magistrate
- B. Medical examiner
- C. Police
- D. Coroner



Previous Year's Questions

Q. The time limit for ordering an exhumation in India is?

FMGE - MAY - 2018

- A. 1 years
- B. 10 years
- C. 20 years
- D. No limit



Previous Year's Questions

Q. In case of death in lock up. The inquest is held by?
(FMGE MAY - 2018)

- A. A Police officer
- B. Magistrate
- C. Panchayat officer
- D. District attorney

WITNESSES

🕒 00:47:06

Common witness (Lay Man witness)

- Any Person who perceived the fact by his own senses.
- Eyewitness (Any person who has seen the crime) (eye witness is superior to hearsay witness)
- Hearsay witness (not valid in India except in certain circumstances)
- Can give evidence only about the facts perceived by them (No opinions)
- Any person irrespective of age / sex including insane person can be common witness (provided he can understand the questions)
- First-hand knowledge rule is applicable
- Volunteering of statement cannot be done

Expert witness

- Any Person who has got training, skill, knowledge, experience in a particular field (Expert)
- Finger print expert, bomb blast expert
- Can express opinions / conclusions based on the findings
- Only expert can become expert witness
- Not applicable
- Volunteering of statement can be done



Important Information

- Doctor can serve as both common witness & expert witness
- Firsthand knowledge lies with common witness



Previous Year's Questions

Q. Firsthand knowledge refer to?
(AIIMS-MAY-2018)

- A. Opinion of a doctor in court
- B. Handwriting expert
- C. Common witness
- D. Fingerprint expert

PROCEDURES IN RECORDING OF EVIDENCES

Summons

🕒 00:57:43

- Also k/a subpoena (meaning under penalty)
- Summon is a written document issued by the court compelling the attendance of the witness at the particular date & time for the purpose of giving evidence.
- Under Penalty: After receiving the summon, if the person intentionally donot obey summon, then he can be penalized
- Under Penalty is valid for both civil and Criminal Cases

Two types of summon

i. Subpoena Ad testificandum

- Witness is called to court for giving evidence

ii. Subpoena Ducus tecum

- Need to produce document
- After receiving summon, If one is not able to attend the court, Inform the court
- Willful disobedience to summons is punishable. Court can either give notice warning / warranty / fine / imprisonment
- Punishment for not attending the summon is given under 174 IPC

PRIORITY FOR SUMMONS RECEIVED ON SAME DATE

🕒 01:01:15

1. Higher Courts > Lower Court Summon
2. Criminal court summon > civil Court
3. Two Summons of Equal Status
 - Attend the summon of 1st Court received
 - Inform the other court

CONDUCT MONEY (DIET MONEY) 01:02:43

- Money given to the witness to meet the expenses for attending the court

Civil Cases

- Money will be paid while serving the summon itself
- Amount is fixed by the court
- Paid by the party
- In Criminal Cases; only expert witness will be paid for travelling allowances

RECORDING EVIDENCE IN THE COURT OF LAW

Victim	Accused/ Defendant
<ul style="list-style-type: none">• Prosecution witness / govt.• Public prosecutor (Lawyer)	<ul style="list-style-type: none">• Defense witness• Defense Lawyer

Procedure for giving evidence

1. OATH- 51 IPC
 - Witness has to take oath
 - i.e "I do swear in the name of God"
 - Truth
 - Whole truth
 - Nothing but the truth
 - Atheists should also take the oath but may not be in the name of God
 - i.e "I do solemnly affirm that"
 - Taking oath is Compulsory (51 IPC)
 - Not taking oath is Punishable under 178 IPC
 - Child < 12 yrs is Exempted from taking oath

After oath,

2. Examination in chief is done by the same side lawyer (direct examination)
3. Cross examination is done by opposite side lawyer
4. Re - examination is done by same side lawyer (redirect examination)

Order of trial in the court of the law

- Oath → Chief Examination → Cross examination → Re - Examination
- Given by 138 IEA

Eg.:

- **For Prosecution witness**

Witness takes Oath



Chief examination is done by public prosecutor



Cross examination is done by defense lawyer

↓
Reexamination is done by public prosecutor

- **For Defense witness**

Witness takes oath



Chief Examination is done by defense lawyer



Cross Examination is done by public prosecutor



Reexamination is done by defense lawyer

- Questions by the judge can be at any stage of the trial
- It is given under 165 IEA




Important Information

Leading Questions

- These are questions, which has got answer / Suggestion in it
- These are answered as Yes/No
- Eg: Was length of the incised wound during autopsy is 7cms?
- Permitted only in cross examination (not permitted in chief / Reexamination)
- Exception
 - Hostile witness/ Adverse witness/Unfavorable witness
 - Any Witness who is contradicting his own statement / not favoring the prosecution side
- 154 IEA: Only in hostile witness, Leading questions are permitted in chief & Re-examination

- Person who prepared the normal document has to come to the court for giving evidence

EXEMPTIONS FROM ORAL EVIDENCE

 01:20:20

- Dying declaration
- Textbook treatise / opinions
- Chemical examiner
- Bomb blast examiner
- Public health records
- Doctor, testified in lower court proceedings

SECTIONS UNDER INDIAN EVIDENCE ACT

- 138 IEA → Gives Order of Trial
- 141 IEA → Leading Questions Definition
- 142 IEA → Leading Questions not permitted in chief examination / reexamination

- 143 IEA → LQ Permitted in cross examination
- 165 IEA → Questions by the judge
- 154 IEA → Leading questions to Hostile witness
- [D] of Perjury i.e False evidence after taking oath is given under 191 IPC
- [D] of Fabricating Evidence → 192 IPC
- [P] for False evidence, fabrication is given under 193 IPC

DYING DECLARATION

🕒 01:21:33

- Given by 32(1) IEA
- It is Written/ oral statement made by a dying person related to the crime.
- It is a type of hearsay witness

Preliminaries

1. Prime Duty of a Doctor is to certify "compos mentis" i.e. person is in composed mind during the start & throughout the whole recording (Composed Mind)
 2. Anyone of the following can record Dying declaration
 - i. Victim (if possible)
 - ii. Magistrate
 - iii. Doctor
 - iv. Police
 - v. Public
- Recording is done in the presence of 2 witnesses
 - However, Validity decreases in the above order

Procedures for recording dying declaration

1. Oath is not needed
 2. Leading questions are not permitted
 3. Verbatim (has to be recorded word by word)
- Dying declaration is invalid if
 - Victim is not in composed mentis state
 - If patient survives after dying declaration
 - Incomplete dying declaration is also valid

DYING DEPOSITION

🕒 01:27:37

Judge / Magistrate → Only can record

1. Recording is done in the presence of Accused / Defense Lawyer
2. Oath is taken
3. Cross examination is present
4. Leading Questions are permitted
 - Dying Deposition is superior to Dying declaration

(Dying deposition is practiced in developed countries. It is not practiced in India).



Previous Year's Questions

Q. When the victim is dying because of unlawful act, the police recorded dying declaration. The doctor certified that the victim was conscious and mentally oriented. Under what circumstances, the dying declaration is invalid?

(FMGE - Aug - 2020)

- A. If the victim is not dead
- B. Victim didn't sign the declaration
- C. Declarant is not expecting death
- D. It is done by the doctor



CLINICAL QUESTIONS



Q. The lawyer who is defending the suspect, is making inquiries with the suspect to gather information to support his bail plea. Among the details he is looking for, is the method in which the police inquest was carried out. All the statements regarding a police inquest is true except?

- A. Senior head constable can investigate
- B. Most common inquest
- C. Panchnama has to be signed by IO
- D. IO cannot summon

Answer: D

Solution

Police inquest is held by a police officer (Investigation Officer—IO) not below the rank of senior head constable in all cases of unnatural deaths with the exceptions mentioned under Magistrate inquest.

Police inquest (174 CrPC) :

- Most common type of inquest.
- Minimum cadre of police for conducting inquest is station officer (Senior Head Constable)
- Panchanama - enquiry report
- Can summon

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr. O. P. Murty, 33rd edition, Page no.6.

Q. The trial of Mr. Gupta is in the court now. After having thoroughly studied the case, the judge declared that a magistrate inquest was not needed in this case. What among the following could be the offense Mr. Gupta is being charged for ?

- A. Homicide
- B. Exhumation
- C. Police custody death
- D. Dowry death

Answer: A

Solution

Magistrate inquest: 2 types

Judicial magistrate (By Court)

- Lock up death/ Custodial death
- Death in a psychiatric hospital
- Death in prison

Executive magistrate (By Govt.):

- Dowry death
- Exhumation
- Encounter death

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no.6



13 LEGAL SECTIONS

IPC

🕒 00:01:35

- IPC = Indian Penal Code
- Gives definition and punishment for offence
- 44 IPC
 - Gives definition [D] of Injury
 - Any harm, illegally done to person's
 - Body, (physical harm)
 - Mind
 - Reputation &
 - Property is injury.
 - Anything which is legally done, with the consent of the person [i.e surgery, stiches etc] isn't considered as injury
- 45 IPC is about Life
- 46 IPC gives definition of Death
 - It is permanent disappearance of all signs of life, i.e. respiration, circulation, brain function

Legal Proceedings

- 174 IPC: Punishment for non-obedience to summons
- 178 IPC: Gives punishment for not taking Oath (Failure to take oath)
- 191 IPC: Gives definition of Perjury i.e giving false evidence after taking oath
- 192 IPC: Fabricating evidence
- 193 IPC: Punishment for false evidence / Fabrication of evidence [Maximum Punishment → 7 yrs imprisonment]
- 197 IPC: Punishment (P) for issuing false certificates
- 198 IPC: Punishment (P) for using false certificates
- 201 IPC: (P) for causing disappearance of evidence
- Eg:
 - In poisoning cases, we need to preserve vomitus, gastric contents, clothings etc
 - Not preserving gastric lavage material amounts to disappearance of evidence
 - Embalming of a poisoning case before autopsy amounts to disappearance of evidence
 - Embalming is artificial method of preserving the body by infusing embalming fluid/ formalin
 - While doing this the poison in the body would be disrupted & chemical/ toxicological analysis shows false reports

- 228 (A) IPC: (P) for disclosure of identity of rape victim [2 yrs imprisonment]
- 269 IPC: (P) for any negligent act resulting in transmission of fatal disease
 - Eg:-Covid pt didn't wear the mask by means of negligence, leading to transmission of COVID-19
 - A Doctor in his clinic used unsterilized needle [negligence atc], because of which person suffered HIV Infection.
- 270 IPC: (P) for malignant act [intentionally done] resulting in the transmission of fatal disease
 - Eg: Patient (Inspite of knowing that he is COVID +ve) intentionally does not wear mask and spreads disease.
- 272 IPC: (P) for adulteration of food
- 273 IPC: (P) for sale of noxious food (Contaminated / spoiled food), knowingly
- 274 IPC: (P) for adulteration of any drug intentionally
- 275 IPC: (P) for sale of adulterated drug
- 284 IPC: Any rash / Negligent act regarding the poison, which is likely to endanger the life of the person or likely to cause death / hurt, is punishable under 284 IPC
- Eg:
 - if you keep Sulfuric Acid bottle which is unlabeled is left on table [it isn't kept safely].
 - It is accidentally drunk by another person leading to damage to that person
 - This, negligence of handling the poison by you is Punishable under 284 IP

Homicide

- Killing of another human being is k/a Homicide
- 299 IPC: Gives definition [D] for Culpable (punishable) homicide
- Culpable homicide is of 2 types [i.e amounting to murder & not amounting to murder]
- 300 IPC: Gives (D) for culpable homicide amounting to murder

SITUATIONS WHERE CULPABLE HOMICIDE AMOUNTS TO MURDER

🕒 00:19:48

1. Act done with the intention of causing death
2. Act done with the intention of causing injury, which is

likely to cause death

3. Act done with the **intention** of causing injury, sufficient to cause death in the ordinary course of nature
4. Act done with the **intention** of causing injury, which is **Imminently dangerous** to life.

EXCEPTIONS OF 300 IPC

🕒 00:22:45

- When the death is caused d/t
 1. Self-defense
 2. Sudden / grave provocation
 3. Done by Public servant executing the law (Judicial Hanging)
 4. Without premeditation (i.e Without any motive)

	Definition	Punishment
Culpable Homicide	299 IPC	304 IPC
Culpable Homicide Amounting of murder	300 IPC	302 IPC

SECTIONS D= Definition/ P= Punishment

- | | |
|---------|---|
| 299 IPC | • (D) for culpable (punishable) homicide |
| 300 IPC | • (D) for culpable homicide amounting to murder |
| 302 IPC | • (P) for murder |
| 304 IPC | • (P) for culpable homicide not amounting to murder |
| 304 A | • Punishment for causing death due to rash / negligent act
• Death due to medical negligence is punishable under this section
• Gives 2 yrs imprisonment ± fine |
| 304 B | • Punishment for dowry death |
| 305 IPC | • (P) for Abetment [influencing/ forcing] to suicide of children / insane |
| 306 IPC | • (P) for Abetment to suicide of an adult
• Attempt to suicide is not punishable |
| 307 IPC | • (P) for attempting a murder |
| 308 IPC | • (P) for attempt to commit culpable homicide |

VOLUNTARY MISCARRIAGE (CRIMINAL ABORTION)

🕒 00:31:11

- Abortion done under provisions of MTP act is legal. [MTP=Medical Termination of Pregnancy]
- Abortion done outside the per-view of MTP act is k/a criminal abortion and it is punishable



Important Information

- 312 IPC: (P) for criminal abortion with **consent of the woman**
- 313 IPC: (P) for criminal abortion **without the consent of the woman**
- 314 IPC: (P) for criminal abortion resulting in the **death of the woman**

HURT & GRIEVOUS HURT

🕒 00:34:05

- 319 IPC: Gives definition of hurt
 - **Hurt:** Any person who causes **bodily pain/ disease/ infirmity [disability]** to another person is said to have caused hurt
 - Hurt & injury are not interchangeable
 - Hurt is a physical component
 - Injury is broad term. It includes body, mind, reputation, property
- 320 IPC: Gives (D) of Grievous Hurt
 - **It has 8 Classes**
 - I. Emasculation
 - Loss of potency of a person
 - injury to genitalia /spinal cord)
 - II. Permanent privation [loss] of sight of any one of the eye
 - III. Permanent privation of hearing of any one of ears.
 - IV. Permanent privation of any member / Joint (e.g. Amputation of U.L etc.)
 - Joints include wrist joint/ elbow joint/ shoulder joint etc
 - Any part of body which has a **specific function** is a member [little finger, upper lip, nose etc]
 - Nail is not a member of the body.
 - V. Permanent destruction power of any member / Joint
 - VI. Permanent disfiguration of face & head
 - VII. Fracture [even hairline fracture] / dislocation of bone / tooth
 - VIII. Any hurt which
 - Endangers life/
 - If the person is in severe bodily pain/
 - If the person is **unable to do routine activities** (like taking bath, eating food, changing dress etc.) for a

period of 20 days

- A mere hospitalization for 20 days isn't considered as grievous hurt, unless if he is unable to do routine activities

SECTIONS DEFINITIONS

323 IPC	<ul style="list-style-type: none">• Punishment for voluntarily causing hurt• Gives 1yr imprisonment
324 IPC	<ul style="list-style-type: none">• Punishment for voluntarily causing hurt with dangerous weapon• Any weapon used for cutting, stabbing, shooting, firing, bomb explosions, Poison, weapon of offence / likely to cause death are considered as dangerous weapons• Gives 3yrs imprisonment
325 IPC	<ul style="list-style-type: none">• Punishment for voluntarily causing grievous hurt• Gives 7yrs imprisonment
326 IPC	<ul style="list-style-type: none">• Punishment for voluntarily causing grievous hurt with dangerous weapon• Gives 10yrs imprisonment
326 (A) IPC	<ul style="list-style-type: none">• Punishment for vitriolage (acid attack)
326 (B) IPC	<ul style="list-style-type: none">• Punishment for attempt to cause acid attack
334 IPC	<ul style="list-style-type: none">• Punishment for causing hurt on provocation
335 IPC	<ul style="list-style-type: none">• Punishment for causing grievous hurt on provocation
336 IPC	<ul style="list-style-type: none">• Punishment for any act causing endangering injury
337 IPC	<ul style="list-style-type: none">• Punishment for any rash / negligent act resulting in hurt
338 IPC	<ul style="list-style-type: none">• Punishment for any rash / negligent act resulting in grievous Hurt
351 IPC	<ul style="list-style-type: none">• Punishment for causing assault• Using any gesture / word by force [i.e criminal force], to create fear in another person is k/a Assault of the person• Examination of the patient by a doctor without consent is also considered as an assault
354 IPC	<ul style="list-style-type: none">• Gives punishment for indecent assault• Use of criminal force to outrage the modesty of a female amounts to indecent assault

Subsections of section 354 IPC

- 354 A: (P) for sexual harassment
 - Examples of Sexual Harassment
 - I. Any physical contact with sexual intent/
 - II. Sexual demands/
 - III. Showing pornography to a female without consent/
 - IV. Sexually colored remarks
- 354 B: Gives (P) for Usage of criminal force to disrobe a woman [removing the dress]
- 354 C: (P) for Voyeurism. Aka peeping tom
 - Watching / capturing image of private acts of a female is k/a Voyeurism
- 354 D: Gives punishment for stalking

Stalking

- Following / contacting / Attempting to contact/ monitoring her through email / social media etc repeatedly inspite of her clear disinterest is k/a stalking
- For 354 C & 354 D IPC,
 - 1st offence is cognizable (police can arrest that person without arrest warrant) & bailable (police can themselves give the bail)
 - 2nd / repeated offence is cognizable & non bailable [he can't get the bail; he has to go to the court]

Kidnapping & abduction

- The term kidnap is given by section 359 IPC
- Kidnapping from India comes under 360 IPC
- Kidnapping from legal guardianship comes under 361 IPC
 - If we take a boy < 16 yrs. of age/ girl < 18 yrs of age from their legal guardian, it is k/a kidnapping
 - It is punishable under 363 IPC [gives 7 yrs imprisonment]
- 362 IPC deals with abduction

Abduction

- Forcing / compelling / inducing a person by deceit to move from one place to another place is k/a abduction
- Kidnapping has a specific age applicable [from their legal guardianship]
- There is no specific age for abduction [generally it is applicable after 18 yrs of age]

Sections

- 375 IPC: Gives definition of rape
- 376 IPC: Gives punishment for rape
- 377 IPC: Gives punishment for unnatural sexual offences
- 498 (A) IPC: Gives (P) for causing physical/ mental cruelty

of a woman by husband / relatives

- 509 IPC: (P) for uttering a word / sound/ making gesture/ action, primarily with an intension to insult the modesty of a woman
- Indecent assault outraging the modesty of a female comes under section 354 IPC
- 510 IPC: (P) for causing public nuisance under the influence of alcohol

SECTIONS RELATED TO CRIMINAL RESPONSIBILITY / LIABILITY OF A PERSON

🕒 01:04:20

Criminal responsibility

- If a person commits a crime, whether he is liable to punishment / not comes under criminal responsibility

Sections related to Age

- 82 IPC: Any crime done by a person, who is <7 yrs of age is not liable to be punished
- 83 IPC: In crime done by a person b/w (7-12 yrs) of age, Liability depends on mental maturity of the person, determined by the court of law.
(Whether person has/ has not attained sufficient mental maturity to understand the nature of crime. This is decided by the court)

Section related to Soundness of Mind

- 84 IPC: Any crime done by an insane person / the person who is with unsound mind, is not liable to be punished

Section related to Intoxication

- 85 IPC: Involuntary drunkenness/ Intoxication
 - Crime done by a person d/t intoxication by any substance which was administered to him without his knowledge / against his will, is not punishable (not liable)
- 86 IPC: Voluntary drunkenness/ Intoxication
 - Person, himself is taking the substance voluntarily (with his knowledge) & got intoxicated & commits a crime, then he is liable for punishment

CONSENT

🕒 01:09:53

- 88 IPC: Any act done in good faith, not intended to cause death should be done with consent of the person.
- 89 IPC: Any act done in good faith for a child < 12 yrs/ insane person, require consent from the guardian
- 90 IPC: Consent given by a child < 12yrs/ due to insanity/ Intoxication/ Under the Influence of threat/ fear is an invalid consent
- 92 IPC: In emergency/ life-threatening situations,

consent is not required (law given consent)

TRANSPLANTATION OF HUMAN ORGANS ACT

🕒 01:13:58

- It is enacted in 1994
- Latest amendment in 2014 is THOTA [Transplantation of Human Organs & Tissues Act]
- It mainly controls the removal, storage & transplantation of human organs for therapeutic purpose
- Also prohibits the commercial dealings of human organs.

Human Organ

- Any part of the human body, which if removed cannot be replicated by the body.
- This act also enables about brain stem death declaration

Types of Donations

1. Living donation

I. Near relative donation

- Can donate to Near relative
- I.e Son, daughter, parents, brother, sister, grand-parents, grand children
- It is done based on attachment & affinity

II. Unrelated donation

- Approval from authorization committee is needed.

2. Cadaveric Donation

- It is done if donor is brain stem dead patient

Donor

- Any person > 18 yrs with sound mind can be a donor
 - I. Donor: (> 18 yrs with sound mind) can authorize the removal of organs for therapeutic purpose
 - II. Donor: Before his death, the donor if has expressed his willingness in writing, in the presence of the two witnesses
 - Then removal of organs can be done after his death
 - Consent is needed from person, who is lawful possession of the body
 - III. If the person has not shown any kind of willingness, we can directly get the consent from the nearby relative / the person who is lawful possession of the body.
 - IV. If it is unclaimed body / unknown body for > 48 hrs, Hospital in-charge can authorize the removal of the organs
 - V. If the body is sent for post mortem examination for medicolegal autopsy / pathological autopsy
- The doctor has to intimate the police

- Approval from post mortem doctor is needed i.e Approval of Autopsy Surgeon is mandatory

BRAIN STEM DEATH DECLARATION 🕒 01:25:10

- Team consists of 4 numbers
 1. Doctor treating the patient
 2. Doctor in charge of the hospital
 3. Neurologist/Neurosurgeon
- Intensivist / Anesthetist / Physician can be in the team if neurologist / neurosurgeon are not available in the hospital
- 4. Independent medical specialist nominated by the govt. (govt. here implies appropriate authority)

How to certify brain stem death

- Two Examinations are done (with minimum 6 hrs interval)

	Cranial nerves examined	Part of brain examined
Light reflex	2,3	Midbrain
Dolls eye reflex	3,6,8	Midbrain, pons
Vestibulo-ocular reflex	3,6,8	Midbrain, pons
Corneal reflex	5,7	Pons
Gag reflex	9,10	Medulla
Apneic test	Respiratory center	Medulla

- If all the above reflexes are negative, the Person can be declared as brain stem dead.

Offences / Penalties of the Act is violated

1. Any unauthorized removal of human organs is punishable with 5 years' imprisonment ± fine
 2. If there is any commercial dealing / trading of human organs, it is punishable with 2 years' imprisonment
 3. Any other contraventions of provisions of act is punishable with 3 years' imprisonment
- If any doctor is convicted of unauthorized removal of human organs, Doctor's name will be removed from state medical register (Penal erasure)
 - For the first time, name will be removed for 2 years (temporary erasure)

- For 2nd time i.e If he repeats the offence, name will be permanently removed

CONSUMER PROTECTION ACT, 2019

🕒 01:34:26

- It came into force from 20th July 2020



Why new ACT?

- Consumer Protection Act, 2019 is a law to protect the interest of the consumers.
- This act was inevitable to resolve a large number of pending consumer complaints in consumer courts across the country
- The consumer protection Act, 2019 replaced the old Consumer protection Act, 1986. The new bill was passed by the president on Aug 06, 2019

Purpose of this Act?

- To protect the interest of consumers
- To establish authorities to protect consumers
- Timely and Effective Administration
- Settlement of Consumer Disputes
- To Stop Consumer Exploitation

Right of a consumer

- Right to be protected
 - Against the marketing of goods or services which are hazardous to life and property
- Right to be informed
 - About the quality, quantity, purity, standard, potency and price of goods or services
- Right to be assured
 - Access to a variety of goods, products or service at competitive prices
- Right to be heard
 - Consumer's interests will receive due consideration at appropriate fora.

- Right to seek redressal
 - Against unfair trade practice
- Right to consumer awareness

Key Features

- 6 New Rights to Consumer
- The District Forum is renamed as District Commission.
- E-Filing of Complaints
 - A Consumer can file a case wherever he resides
- Product liability
- The limitation period for filing of appeals to the State Commission has been increased from 30 days to 45 days
- E-Commerce is included
- Establishment of Central Consumer Protection Authority (CCPA).
- Penalty for Misleading Advertisement

HIERARCHY

🕒 01:39:12



- **Limitation Period**
 - Consumer has to file a case within 2 years from the date of act/ Services
- If the consumer is not fine with the order given by the district consumer disputes redressal commission
 - ↓
 - He can go the state & appeal has to be filed within 45 days
 - ↓
 - If the consumer is not fine with the order giving by the state consumer disputes redressal commission
 - ↓
 - He can file appeal to the national level within 30 days
- Time limit for the completion of the case is 3 months
- If any Lab test has to be done, time frame is 5 months
- Any appeal has to be completed within 90 days

- If the consumer is not fine with National consumer disputes redressal commission, He can file a case in the Supreme Court

Particulars	Value
District Commission	1 Crore
State Commission	1-10 Crore
National Commission	> 10 Crore

- Appeal

District level → State Level → National Level
 45 days → 30 Days

JUVENILE JUSTICE ACT 2015

🕒 01:45:35

- Care and protection of children
- **Juvenile**
 - Any person who has not completed 18 years of age is considered as juvenile (irrespective of sex)
- It states
- Child who is in need of care / protection
 - i.e Punishment for cruelty against children (who are victims of physical abuse, employing the children etc)
- Child who is in conflict with law
 - Any child who is not 18 years & has committed an offence is handled by juvenile justice board
 - This board contains 3 members
 1. First class judicial magistrate
 2. Two Social workers (atleast one is female)
 3. Juvenile justice board

Juvenile justice board can order for

- Counselling
- Group counselling
- Community services
- Fine
- release on probation of good conduct
- Order for special homes

Note: Juvenile can't be given punishment of life imprisonment under any situation

Juvenile justice act describes 3 different types of offences

1. Petty offence: punishment is <3 years
2. Serious offence: punishment 3-7 years
3. Heinous offence: punishment >7 years

Age determination

1. Physical appearance
2. Birth certificates
3. Age estimation by medical examination

Eg.

- If Child (16-18 years) had committed a heinous offence (Eg. Rape, murder), Juvenile justice board will send this child for assessment
- After assessment this child will be tried as an adult (these cases tried under children court)

PROTECTION OF CHILDREN FROM SEXUAL OFFENCES ACT (2012)

🕒 01:52:41

(POCSO ACT)

- Latest amendment -2019

Purpose

- To protect children from offences of sexual assault, sexual harassment and pornography.
- To establish special courts for trial in such offences
- Give provision for child friendly environment

Child

- A "Child" means any person below the age of 18 years (irrespective of sex)

Types of offences

- Penetrative sexual assault (PSA)
- Sexual assault (SA)
- Sexual harassment (SH)
- Child pornography

1. Penetrative sexual assault

- Penetration of penis, any object or applies mouth, into the vagina/ mouth/ urethra/ anus of a child or makes the child to do so with him or any other person.
- Penetration of
 - Penis into vagina, Anus, mouth urethra
 - Body part/ object into vagina, anus, urethra
 - Application of mouth into vagina, anus urethra
 - Manipulates any part of the body of child to induce penetration

2. Sexual assault

- Whoever with the bad intention touches the private parts of a child or makes the child to do so or

- Any act with a sexual intent which involves physical contact with private parts of child without penetration
- Administration of hormones to children to attain early sexual maturity

3. Sexual harassment

- Any person with sexual intent
 - Utters any word / sound or makes any gesture or exhibits any object or
 - Exposing any part of body to the child
 - Makes a child to exhibit the body
 - Shows any object to a child for pornographic purposes [Section 93 IPC]
- Repeatedly follows a child either directly or through electronic means

Aggravated Penetrative Sexual Assault or Sexual Assault

- If the sexual assault is done by
 - Police officer
 - Member of the armed forces
 - Public servant
 - Management or on the staff of a jail, Remand home, protection home
 - Management or staff of a hospital
 - Management or staff of an educational institution or religious institution
 - A gang
 - Taking advantage of a child's mental or physical disability
 - On the child more than once or repeatedly; or
 - On a child <12yrs of age
 - Relative of the child / Person in a position of trust or authority of a child

T - Done by a person of trust (Authority)

R - Relative / Repeatedly done

A - by a child < 12 yrs

I - done on Insane Child

T - done by > Two persons (gang)



How to remember

- TRAIT

- Any Attempt/ Abetment to commit an offence is also punishable

SPECIAL COURTS

- There are designated special Courts for the trial of the cases
- There are child friendly mechanisms for reporting, recording of evidence, investigation and speedy trial of offences
- In camera trial of cases is done
- The child is not to be called repeatedly to testify in court
- A case of child sexual abuse must be disposed of within one year from the date the offence is reported
- No person in any media should disclose the details regarding the identity of the child.

REPORTING OF CASES

🕒 02:06:40

- Any person who knows about the offence, should inform to the special Juvenile Police Unit (SIPU) or local Police immediately.
- Failure to inform is punishable
- The local police should report the matter to the child welfare committee within 24 hours of recording the complaint
- The child should be taken for medical examination within 24 hrs by local police
- Failure to report to police is punishable with 6 months imprisonment or fine or with both.
- If any person in charge of institution fails to report, he/she is punishable with 1 yr imprisonment & fine.

MEDICAL EXAMINATION

🕒 02:08:30

- Medical examination can be done even before filing FIR.
- Medical examination is to be done as per 164 A CrPC
- For Medical Examination
 - Informed consent must be taken from parent / guardian
 - Examination has to be done in the presence of the parent/ any person of trust
- If the child is female, she has to be examined by a female doctor only
- While doing examination, police should not be present
 - Collect Swabs (while doing examination)
 - Send the child for Rx if needed

EUTHANASIA

🕒 02:11:49

- Giving good death to the patient suffering from incurable terminal illness.
- Aka Mercy killing
- Article 21 of Indian constitution give Right to live [no article gives right to death]

Types

- Active euthanasia:** Drug administration to cause death of patient
- Passive euthanasia:** Death of pt. by withdrawing life support measures

Other classification

1. Voluntary euthanasia

- Done as per the patient's will, with the consent of the patient (patient wants to terminate the life)

2. Non-voluntary euthanasia

- Patient is not in a condition to express the will for euthanasia (eg: Patient is in a coma)
- Legal guardian can decide

3. Involuntary Euthanasia

- It is illegal
- Done against the will of the pt. (pt. doesn't give consent)
- Similar to committing murder

LEGAL STATUS OF EUTHANASIA IN INDIA

🕒 02:18:15

- On 9/3/2018, the Supreme Court has permitted Passive Euthanasia

LIVING WILL

🕒 02:19:02

- Document written by the person regarding treatment options in case of terminal illness/ Coma
- He can nominate a representative to decide on the treatment options [if he is incapable]
- Any person who is of > 18 yrs age and is of sound mind (major) can write in this document in the presence of 2 witnesses
- Should be attested by first class judicial magistrate
- Multiple steps are there to decide whether to do euthanasia/ not



CLINICAL QUESTIONS



Q. IPC for causing abortion without women's consent:

- A. 312
- B. 313
- C. 314
- D. 315

Answer: B

Solution

Criminal Abortion is dealt under Section 312–316 IPC:

Sec. 312 I.P.C. whoever voluntarily causes criminal abortion is liable for imprisonment up to **three years, and/or fine**; and if the woman is quick with child the imprisonment may extend up to seven years. It is necessary that the woman should be pregnant and that abortion should be carried with her consent. Both the person causing the abortion and the woman are liable for punishment.

Sec. 313 IPC: if the miscarriage is caused without the consent of the woman, the imprisonment may be up to ten years.

Sec. 314 IPC: if a pregnant woman dies from an act intended to cause miscarriage, the offender is liable to be punished with rigorous imprisonment which shall not be less than ten years and also fine up to two lakh rupees.

Sec. 315 IPC: a person doing an act intended to prevent the child from being born alive or to cause to die after its birth, is liable to be punished with imprisonment up to ten years.

Sec. 316 IPC: causing death of quick unborn child by any act amounts to culpable homicide, and the punishment may extend up to ten years imprisonment.

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no.400

Q. One of the victims of the fire which had destroyed 6 huts in a nearby slum has decided to give a dying declaration. The doctor was called in as part of the team to record the statement. Which among the following is the role of the doctor ?

- A. To assess compos mentis
- B. To record statement even in presence of magistrate
- C. Cross examine the person
- D. Put person under oath before declaration

Answer: A

Solution

- **Dying declaration** : written or oral statement of a person, who is dying as a result of some unlawful act, relating to the material facts of the cause of death or the circumstances surrounding it.
- The law does not provide who can record a dying declaration, nor is there any prescribed form, format or procedure for the same.
- **The doctor should certify that the person is conscious and his mental faculties are normal, i.e. he is in compos mentis.**

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no.10

Q. The lawyer who is defending the suspect has fought the initial trial, for the suspect to be excused under IPC 84, which was derived from McNaughton RULES. What is the basis of argument and request for excuse according to the section appealed under?

- A. Criminal responsibility of insane person
- B. Criminal responsibility of drunken person
- C. Criminal responsibility of intoxicated person
- D. Criminal responsibility of Child

Answer: A

Solution

Section 84 IPC

1. It defines Criminal responsibility of mentally ill. According to this section, nothing is an offence done by a person who is incapable of knowing that he is doing is wrong due to mental illness.
2. The law presumes every individual to be sane and responsible for his criminal acts unless the contrary is proved in the court. In criminal cases, where mental illness is raised as a plea of exemption from liability, the burden of proving it lies on the defence.
3. Initially, McNaughton RULES were drafted in England which laid guidelines on considering the criminal responsibility of mentally ill. The section 84 IPC is derived from these McNaughton RULES

Sections For Criminal Responsibility

82 IPC : Nothing is an offence which is done by a **child <7 years of age**

83 IPC : Nothing is an offence which is done by a child between **07-12 years** seven years of age, who has not attained sufficient maturity to judge of the nature of the act.

84 IPC. – Criminal responsibility of mentally ill

Nothing is an offence done by a person who is incapable of knowing that he is doing is wrong due to mental illness.

85 IPC. Offence caused after **Involuntary intoxication** is not an offence

86 IPC. Offence caused after **Voluntary intoxication** is an offence

Reference: Indian Penal code, bare act, 1860



14 MEDICAL JURISPRUDENCE-1

MEDICAL ETHICS

🕒 00:00:14



- Ethics is duty of a physician towards the pt.

HIPPOCRATIC OATH

- Ethics is based on 4 main principles
1. Autonomy (Patient has a right to choose)
 2. Justice (Equitable distribution of the justice across the society)
 3. Beneficence (Doing good to the patient)
 4. Nonmaleficence (Doing no harm to the patient)

MEDICAL ETHICS

🕒 00:02:52

- It is a set of moral principles, which a doctor should be followed in dealing with
 - Doctor: Patient relationship
 - Doctor: Doctor relationship
 - Doctor: Society relationship
- Any violation of medical ethics is Punishable
- If a doctor has done some Unethical act, it is termed as Infamous conduct aka Professional misconduct

Warning notice

- It is a list of unethical acts done by a doctor
- It is incomplete
- Examples of unethical acts

1. 6'A's

- A - Abortion (conducting criminal abortion)
- A - Association (with unqualified people)
- A - Advertisements (Giving Inappropriate adds)
- A - Alcohol (Treating the patient under the influence of alcohol)
- A - Addiction (Treating the patient under the influence of addiction)
- A - Adultery (doctor having relationship with pt.)

2. B - Bribery

3. C - Covering (i.e assisting unqualified people)

4. D - Dichotomy (Fee Splitting/ getting commissions/ giving commissions etc)

5. E - Euthanasia (Mercy killing)



Important Information

- Conducting Active euthanasia is unethical
- Passive Euthanasia is legalized in India

6. F - Issuing False Certificates

7. G - Accepting Gifts

DISCIPLINARY CONTROL FOR INFAMOUS CONDUCT

🕒 00:08:09

- If any doctor is found guilty of infamous conduct, The State Medical Council can punish the doctor
- If any complaint is filed in the State medical council against the doctor for infamous conduct, the State Medical council will form a committee of doctors
- This committee of doctors will decide whether the act is ethical/Unethical
- If it is Unethical Infamous Conduct, then State Medical Counsel [SMC] can give the punishment
- Initially, SMC can just give a warning to not to repeat the offence again
- Or SMC can give Penal erasure (Removal of the name of the doctor from the state medical register)
- After penal erasure, the doctor cannot practice

- Penal Erasure can be
 1. Temporary suspension or
 2. Permanent removal of the name of the doctor
 - Permanent removal of name is done only in case of serious professional misconduct
 - The doctor can never practice again
 - This is known as professional death sentence
- If the doctor is not convinced by the judgement, he can appeal to the higher level, which is Central health Ministry
- But at the initial level, the punishment is given only by the state Medical Council

PROFESSIONAL SECRECY

00:10:54

- Patient's Information is meant to be kept confidential
 - Even if a person's wife is getting treatment from you, you can't reveal it to him without her consent
 - Disclosure of the information is punishable
 - **Privileged communication**
 - It is an exception to professional secrecy
 - It is disclosure of patient's information to some other person even without patient's consent.
 - Privileged communication is allowed only in following circumstances
1. **Community interest**
 - E.g.:
 - I. **Notifiable disease**
 - I.e. cholera, plague, polio, corona virus etc.
 - We need to inform the public health authorities [consent isn't necessary]
 - II. **Crime**
 - ACC to 39 CRPC, If we are aware of any crime, it is our duty to intimate the police
 - Consent isn't necessary
 - III. **Infectious diseases**
 - If the pt. is likely to spread the infectious disease, we can inform the ppl who are at risk
 - IV. **Venereal diseases**
 - If the pt. is suffering from HIV, Hepatitis etc, in the interest of the community, we can inform the partner
 - V. **Employees**
 - If a color blind/ epileptic pt. is working as a driver, we need to inform the employee in the interest of society
 2. **In the interest of the patient**
 - Eg: If the pt. has suicidal tendencies & is not taking

the treatment, we need to inform the guardian

3. In the court of law

- Eg: - In Medical negligence cases, Inform the court of law if the judge is asking about patient's details
- If we didn't inform, it will be contempt of Law
- If the court of law is sending you for medical examination, no professional secrecy is maintained

WHEN CAN A DOCTOR ADVERTISE

00:17:20

- Giving inappropriate advertisements by a doctor amount to infamous conduct
- A doctor can advertise in following situations
 - During starting a practice
 - Temporary cessation of practice
 - Change of address / change of the type of practice
 - General public health awareness information

CONSENT IN MEDICAL PRACTICE

00:18:58

- It is given by Indian Contract Act, Section 13
- The term consent means Agreement / Permission / Compliance

Types of Consent

1. Expressed Consent

- Consent is expressed either orally or in written format

2. Implied consent

- Consent is given by means of a gesture / an act

3. Blanket / Open Consent

- Getting consent for all the procedures / steps in the treatment during an admission itself
- It is legally invalid in India
- Separate consent for all the procedures is required in India



Important Information

- **Best Consent is Written Informed consent**
- **Informed consent:** Pt. has been informed about the condition, treatment, alternate treatment available, cost etc
- I.e. everything is informed to the pt. & then we are getting the consent

Doctrine of full disclosure

00:23:31

- Doctor discloses everything to the patient about the patient's condition
- I.e we disclose about patient's

- Diagnosis
- Prognosis
- Treatment options available
- Proposed treatment
- Alternate treatment options available
- Risk & benefits of the treatment
- Risk of not getting treated
- After listening to everything, patient has got the right to accept or to refuse
- If patient refuses after being informed about everything, it is K/a Doctrine of informed refusal

Doctrine of Therapeutic Privilege

- It is an exception to doctrine of full disclosure
- Doctor can reveal only relevant information to the patient
- But, if he is not revealing some information to the patient, it has to be informed to the guardians
- Doctor has the right to decide how much information is given to the pt. depending on the condition of the pt.

EXCEPTIONS FOR CONSENT

🕒 00:27:14

- Conditions where consent isn't required are
- 1. Emergency/ life: Threatening situations
- 2. Waiver: Pt. has waived his right for consent

3. Doctrine of extended consent: Done in an unanticipated situation, where immediate action is required for patient's benefit

RULES FOR THE CONSENT

🕒 00:28:51

- Any Procedure should to be done with the consent of the patient / legal guardian
 - Section 88 IPC: Any act done in good faith can be done with the consent of the patient
- The minimum age for giving the consent for physical examination is 12 years
- For any major procedures minimum age for giving the consent is 18 Years
- 89 IPC: Any act done in good faith for a child < 12 years / insane person, can be done with the consent of the legal guardian
- Any consent given by
 - A person d/t insanity/ intoxication/ influence of drugs or threats or by a child < 12 yrs of age is invalid consent
 - It is given under 90 IPC
- In case of emergency situations, there is no need to get consent
 - It is given under 92 IPC



15

MEDICAL JURISPRUDENCE – 2

PROFESSIONAL NEGLIGENCE/ MEDICAL NEGLIGENCE

00:00:15

- Aka Professional Malpraxis
- Professional misconduct & professional negligence are different terms
- Professional misconduct means unethical act done by a doctor
- During the treatment of the patient, if there is absence of reasonable skills & care by the physician, that leads to the damage to the patient is k/a Professional negligence
- Damage suffered by the patient can be
 - Pain
 - Disability
 - Death
 - Prolonged Suffering
 - Monetary Loss etc



Important Information

Essential ingredients of medical negligence

- Include 4 'D's
 1. Duty owed to the patient
 2. Dereliction of duty (Deficiency of duty)
 3. Direct Causation
 4. Damage

Example

- Patient Comes to the doctor for the treatment of his illness. When the doctor takes up the case, there comes 1st D i.e Duty
- Doctor, while treating the pt has given a wrong prescription. This is dereliction of duty
- Because of this wrong prescription, the pt. suffered from side effects resulting in worsening of the existing condition. This means that the pt. has suffered damage
- This damage is directly d/t the dereliction of duty from the doctor
- Thus, it is k/a direct causation
- Whenever a case of medical negligence is filed in the court of law, we need to see if 4 essential ingredients are present or not

- If the duty & dereliction of duty is present, but the pt. didn't suffer any damage. Then, it isn't considered as a case of medical negligence
- Commission of wrong things & omission of right things by a doctor, resulting in damage to the pt. is said to be the case of negligence

TYPES OF MEDICAL NEGLIGENCE

00:08:04

1. Civil Negligence

- Simple lack of skills & care while treating the patient, resulting in damage to the patient is k/a civil negligence
- E.g.
 - Doctor has given wrong prescription
 - Doctor has given wrong doses
 - Doctor has given wrong information etc.
- These cases are tried under Civil / Consumer Courts
- Punishment will usually be monetary fine/ compensation
- Burden of proof lies on the patient

2. Criminal Negligence

- Gross carelessness / utter carelessness / willful negligence by the doctor, which results in severe damage to the pt. [even death of the pt.]
- E.g.
 - Doing wrong Surgery
 - Doing surgery on a wrong patient
 - Doing surgery on Wrong Side
 - Wrong blood transfusion etc.
- These cases are tried under criminal courts
- Punishment will usually be Imprisonment ± fine
 - 336 IPC, 337 IPC: Punishment for causing hurt due to rash & negligent act
 - 338 IPC: Punishment for causing grievous hurt due to rash & negligent act
 - 304 (A) IPC: Causing death due to rash and negligent act (2 years imprisonment)

3. Contributory Negligence

- Doctor is negligent. But the patient has also contributed to the negligence
- Eg.
 - No follow up by the patient
 - Patient has not taken the treatment properly
 - Patient gives incomplete history etc.
- It is only a partial defense (not complete defense) i.e

Amount of compensation given to the doctor will be reduced depending upon the contribution done from the patient's side

- Burden of proof lies on the doctor

DOCTRINES ASSOCIATED WITH CONTRIBUTORY NEGLIGENCE

🕒 00:16:44

1. Last clear chance doctrine

- E.g.:
 - Snake bitten patient is admitted in the ward, who has very tight ligature on his limb
 - But the doctor even on seeing the tight ligature, did not do anything
 - After sometime there is occlusion of vascular supply & development of gangrene of that limb d/t the tight ligature
 - In this, the doctor had a last clear chance to prevent the complications
 - I.e if the doctor would have removed the ligature, there would not be development of gangrene
 - As the doctor didn't do it, he is responsible for this damage

2. Avoidable consequences rule

🕒 00:19:52

- Snake bitten patient is admitted in the ward with a very tight ligature around the limb
- Doctor advised to remove the ligature
- But the patient did not remove the ligature resulting in damage to the patient
- Patient is responsible for the damage (doctor advised, but patient did not follow it)

🕒 00:21:52

Durga Pandey Vs Management of Nagarmal Seva

- In 2003, Mrs. Durga pandey was admitted to Nagarmal Modi Seva sadan for the delivery of her first child and delivered a male child by cesarean section under general anesthesia with ether.
- However, following the delivery, she continued to remain unconscious and developed severe respiratory distress and was shifted to the ICCU. Suddenly she Was told to be shifted to another hospital.
- On arrival to the other hospital, she was diagnosed with Mendelson's syndrome, which is basically aspiration of gastric contents during anesthesia, especially in pregnant women.
- She was treated in the second hospital and gradually improved and was discharged.
- A law suit was filed against the anesthetist of Nagarmal Seva Sadan.

- During the trial, it was found that the anesthetist had not placed ET tube prior to GA, or giving H2 blocker to prevent gastric aspiration.
- The court of law convicted the anesthetist for medical negligence for not providing the basic skill & care.
- The Anesthetist was convicted and was liable for compensation.
- The OGcian however, had exercised her duties without any issues and hence was not liable for compensation.
- This is a classical case of civil negligence

DEFENSES FOR MEDICAL NEGLIGENCE

🕒 00:25:10

- These are the points the doctor can have for defending himself

Refer Table 15.1

THERAPEUTIC MISADVENTURE

- During the treatment of the patient, any accident / mischance results in damage to the patient inspite of adequate precautions
- I.e the patient has suffered a damage accidentally/unintentionally
- Therapeutic misadventure can be
 - Diagnostic
 - During colonoscopy, sigmoid colon fecal perforation may occur & the patient may land up in fecal peritonitis
 - Therapeutic [during treatment of the pt.]
 - Experimental
- Doctor is not liable



Important Information

Res Indicata [Limitation period]

- Limitation period for filing a case by a patient against the doctor is 2 years from the discovery of the negligent event/damage

Res Judicata

- Things that have been already decided in one court cannot be claimed in any other court.

DOCTRINES IN MEDICAL NEGLIGENCE

🕒 00:35:18

1. Res Ipsa Loquitur

- The fact speaks for itself
- Negligence act is so gross that there is no need of expert

witness

- E.g.:
 - Retaining the foreign body inside the cavity
 - Doing surgery on the wrong side / wrong pt.
 - Mismatched blood transfusion etc.

2. Doctrine of common Knowledge

- It is a variant of Res Ipsa Loquitur
- Everyone knows that it is a negligible act [i.e. common knowledge]
- No need of expert witness
- E.g.:
 - Not giving TT Injection to Injury patient
 - Not giving IV Fluid to patient in case of severe dehydration


3. Doctrine of Calculated Risk

- Every procedure / treatment has its own inherent risk of damage, which is unavoidable.
- It is basically a defense for the doctor

4. Novus Actus Interveniens

- New act intervening, changes the consequences [i.e., chain of events]
- E.g. 1
 - Assault pt. is having arterial injury resulting in severe blood loss & shock
 - Doctor is transfused the blood, artery is repaired
 - Then the pt. got recovered & discharged
 - The responsibility of the cut injury lies within the accused
- E.g. 2
 - Another assault pt. while in severe shock, the doctor has given mismatched blood transfusion
 - D/t this the pt. developed complications & dead
 - Here, the responsibility lies not only on the accused, but also on the doctor who did blood transfusion

5. Vicarious Liability

 00:43:27

- Aka Respondent Superior / Let the master answer / Master servant Rule
- Superior is responsible for the mistake done by a junior
- Senior is responsible for the negligent conduct of junior
- Applicable only if:
 - There is Employer – Employee relationship
 - Negligent act should occur while he is on the job
 - Negligent conduct should be within the scope of employment

- E.g. 1: Vicarious Liability: Krishnakumar Vs Dr A (orthopedician)
 - In September, 1997, Mr. Krishna kumar had sustained a fall from height, about 60ft!!!. He sustained a spinal injury and fractures of both bones in bilateral legs.
 - He presented to a hospital run by Dr. X, a neurosurgeon, who performed the spinal surgery on Mr. Krishnakumar. Then neurosurgeon, referred to another orthopedician, who is working in his hospital.
 - Dr. A, the orthopedician, who after thorough evaluation, applied a POP cast over his legs.
 - Patient had to stay in the hospital for 15 days, at the end of which, the orthopedician reviewed him and made a small window of 4x4 over the cast and asked him to retain the pop for 2 more months.
 - The patient returned after 2 months with severe pain over his legs, and his orthopedician said, the leg was completely gangrenous and had to be amputated.
 - In this case, Dr. X was convicted with vicarious liability, as, though he was not related to the patient's present status, he had employed the orthopedician Dr. A, whose treatment was not satisfactory.
- E.g.2: Neurologist held liable for the negligent act of Assistant
 - Nirmal Kumar Jain Vs Indraprashta Appollo hospitals (2001 CPJ274NC)
 - National Consumer Disputes redressal Commission
 - The neurologist deputed his assistant for lumbar puncture to a patient.
 - Assistant to the neurologist tried to aspirate CSF, through lumbar puncture without anesthesia.
 - The procedure had to be abandoned, as the patient reacted violently in pain and there was to nervous injury.
 - During the procedure, neurologist was not even present. The attending doctor will be held liable for negligent ac his subordinates, irrespective of whether he had carri procedure of not.

Which doctrine suits most appropriate in this case?

Vicarious liability

1. Borrowed Servant doctrine

- Employer is responsible for the negligent acts of

temporary employee as well

- E.g.
 - Hospital (Employer) appoints the staff nurse (Employee)
 - Hospital is responsible for any negligent act done by the staff nurse
 - During a surgical procedure, this staff nurse is working under a Surgeon
 - During surgery, if the staff nurse is making negligent act, surgeon is held liable for the negligent act of the staff nurse. (Surgeon has borrowed the staff nurse from the hospital for the surgical procedure, Staff nurse is temporary employee of the surgeon)
 - After the surgery, if staff nurse is doing any negligent act, Hospital is responsible for that negligent act

2. Loco Parentis

00:51:44

- Term Loco parentis means in the place of the parent
- If the parents are not present, the consent can be obtained from the person in charge
- E.g.: Teacher/ headmaster can give consent when student is ill & the parents are unavailable



Previous Year's Questions

Q. While doing hysterectomy after informed consent for uterine fibroids. Ureter is damaged intraoperatively even after diligent measures. A doctor is not responsible under which doctrine?

(FMGE Dec 2020)

- A. Medical maloccurrence
- B. Novus actus interveniens
- C. Physician error
- D. Res ipsa loquitur

DECLARATIONS

00:56:08

Declaration	Gives guidelines about
Geneva	• Modified Hippocratic oath (Medical Ethics)
Tokyo	• Torture • Gives guidelines for physician in case of torture • Istanbul protocol also deals with torture
Helsinki	• Human Experimentation [Ethics]
OSLO	• Therapeutic abortion • Abortion can be done by a competent person in authorized institution
Sydney	• Declaration of death & Human organ Harvesting
Venice	• Terminal Illness • In terminal illness patient's autonomy is to be respected • Patient has right to refuse the treatment • Patient has right to decide on palliative treatment • Doctor should take 'advance directive' into consideration
Lisbon	• Rights of Patients to choose
Malta	• Hunger Strikes. Can a doctor do force feeding/ not
Washington	• Biological Weapon
Hong Kong	• Elderly abuse
Ottawa	• Child's health



Previous Year's Questions

Q. A doctor takes consent. before surgical procedures and also. he may go beyond the consent if he feels the need for patients benefit?

(AIIMS Jun 2020)

- A. Doctrine of extended consent
- B. Doctrine OF conjugated consent
- C. Res ipsa loquitur
- D. Doctrine of anticipation

MEDICAL RECORDS

00:53:53

- Medical records are documented evidences
- As per IMC regulations, medical records has to be preserved up to a period of 3 years
- If any patient requests for the copy of the medical records, the copy has to be supplied within 72 hrs
- As per DGHS (Directorate General of Hospital Services) guidelines present in the hospital manual,
 - Department records have to be preserved for 5 years
 - IP department records have to be preserved for at least 10 years

Table 15.1

	Duty owed to the patient	Deficiency of Services / Care	Direct Causation	Damage
Defenses available	<ul style="list-style-type: none"> No duty owed to the patient [i.e the doctor isn't on duty. Thus, there is no need for doctor to treat the pt.] 	<ul style="list-style-type: none"> Treatment was given as per standards/ it is an error of judgment 	<ul style="list-style-type: none"> Damage of the pt. is d/t Therapeutic misadventure/ Contributory negligence 	<ul style="list-style-type: none"> It is d/t Product's liability When the damage of the patient is due to the defective product / instrument, then the responsibility lies with the manufacturer of the defective product



CLINICAL QUESTIONS



Q. An inpatient of the hospital suffers burns injury when hot bottles were used for the treatment. In the case, the hospital incharge was also charged for the negligence under the doctrine of ____

- A. Vicarious liability
- B. Res ipsa loquitur
- C. Novus actus interveniens
- D. Contributory negligence

Answer: A

Solution

Vicarious Liability/Respondeat Superior

- A doctrine that holds an employer legally responsible for the wrongful acts of an employee, if such acts occur within the scope of the employment
- An employer is responsible not only for his own negligent act, but also for the negligent act of his employees by the principle of 'respondeat superior' or '**Master-Servant Rule**'.
- In medical practice, usually, the principal doctor becomes responsible for any negligence of his assistants (both medical and para-medical). Both may be sued by the patient, even though the principal has no part in the negligent act.

Res ipsa loquitur (Latin for "the thing speaks for itself"): Doctrine of common knowledge

- the very nature of an accident or injury itself proves the negligent action of the physician.
- specialized knowledge or understanding of technical matters of the medical profession is not required
- Application of common knowledge is sufficient to understand the negligence
- eg Forceps inside the abdomen postoperatively

Novus actus interveniens: "new act intervening" breaking the chain of causation such that even if the defendant has acted negligently, a subsequent intervening action breaks the chain of causation with the loss or damage sustained and so the defendant is not liable.

Contributory negligence:

- the plaintiff failed to take reasonable care of his own safety and this factor contributed to the harm ultimately suffered by the plaintiff.
- The burden of proof lies with the defendant (doctor in this case)
- Damages awarded by the court may be reduced
- Negligence of both patient and doctors.
- e.g Doctor puts tight plaster on patient (Doctor Negligent). The patient develops numbness but does not inform doctor and suffers injury (patient negligent).

with this much understanding, you can easily deduct that Contributory negligence can be a defence for the doctor in civil negligence case but not in criminal cases.

Other rules related to Contributory Negligence

1. **Last clear chance doctrine**—Both doctor and patient are negligent but doctor had the last chance to avoid injury but he did not use this chance. Doctor will have to pay damages
2. **Avoidable consequences rule:** Negligence of patient occurs after he has sued the doctor for negligence. The doctor will not be responsible for the further damaged caused by the negligence of patient. Patient should have taken appropriate steps to reduce the further consequences of injury

Reference: Review of forensic medicine & toxicology, Gautam Biswas 3rd edition, Page no : 21.

Q. A 42-years-old patient wants to file a case against a doctor. In such a case of civil negligence against a doctor. Who bears the burden of proof?

- A. Doctor
- B. Patient
- C. Police inspector
- D. Magistrate

Answer: B

Solution

- In the case of civil negligence, the burden of proof is on the patient.
- The question of civil negligence arises when a suit is filed in a civil court
- By a patient or his/her relatives against the doctor for getting compensation from the doctor. If he/she has suffered an injury due to the doctor's negligence.
- By a doctor against the patient or his/her relatives to collect the fees, the payment of which has been refused due to alleged professional negligence by the doctor.
- In either case, the patient has to prove that the doctor has committed professional negligence

Reference: The Essentials of forensic medicine and Toxicology, 33rd edition, page no:35



16 MEDICAL CERTIFICATION OF CAUSE OF DEATH

Introduction

00:00:45

- The certificate provides legal evidence that the person had died, and states the cause of death
- This means that the death can be formally registered
- It is essential that the information on the certificate is accurate.

Importance of Death Certification

00:01:40

- Legal and protective uses
 - Life insurance claims
 - Inheritance claims
 - Hospitals reimbursement etc.
- Administration uses
- Surveillance of specific diseases
 - As indicators of the existence of infection and epidemic disease and the need for immediate control measures.
- Statistical uses
- Data for Mortality statistics
 - In Planning and evaluation of development plans useful in public health and medical research

Definition of Death

00:03:40

- Legal Definition
- Death means the permanent disappearance of all evidence of life at any time, after live-birth has taken place.
- (The Registration of Birth and Death Act, 1959)

Death Certificate or MCCD

00:04:55

Medical Certification → Death Report → Death Certification
 Of cause of Death Form(2) Form (6)

REGISTRATION PRACTICES

00:08:19

Place of occurrence: In the office of registrar of birth & deaths for that area

- Death Information:
 - MCCD (Form 4/4A)
 - Death Report (Form 2)
 - Still birth report (Form 3)
 - Death certificate: (Form 6) (Not to be issued by the doctor)

REPORTING OF THE EVENT

00:09:03

- Birth or Death to be reported for registration within 21 days
- Registration to be done at the time of occurrence

DOCTOR'S RESPONSIBILITY

00:09:37

- Diagnosis of fact of death & Declaration to relatives
- Filling up Forms – 4 & Form 2

Legal obligation

- Every doctor has to know how to certify the cause of death (under RBD act, 1969)

How to fill MCCD?

Refer Diagram 16.1

1. Personal Particulars

A. Name

- Write in full, initials not to be used
- Fathers name / husband name
- For infants not yet named: Write Son / daughter of followed by the name of mother and father
- **Age**
 - For more than 1 year, write age in years
 - For age less than 1 year, write in months and days
 - For less than 1 day, write in hours and minutes.

2. Time and Place of death

- Record the time of death as accurate as possible
- Record, to the best of your knowledge, exactly where the person died. (for example, the name of the hospital or the address)

3. Cause of death statement:

Part I

- The main events that caused death

Part II

- All the conditions which contributed to death

Refer Diagram 16.2

Part II: (cause of death)

- One Cause is to be entered on each line
- First line state the immediate cause of death
- The last statement should be the main disease that led to death underlying cause of death

a. Immediate cause of death

- Disease or injury or complication that precedes death b.

b. Antecedent Cause

- If immediate cause occurred as a consequence of another condition, it should be entered here

c. Underlying cause

- It is the condition that started the sequence of another whichever lead to immediate cause of death

Underlying → Antecedent → Immediate
COD COD COD

Eg. 1:

A diabetic patient dies of septicemia from gangrene foot

Diabetes → Gangrene foot → Septicemia
Duration: (Years) (Months) (Days)

Example-2:

- A patient dies from bronchopneumonia following an intracerebral hemorrhage caused by cerebral metastasis from a primary malignant neoplasm of the left main bronchus.

Disease or condition that Part I led directly to death I (a) Broncho pneumonia (immediate cause of death)

Antecedent cause of death I (b) Intracerebral haemorrhage

Underlying cause of death I (c) Cerebral metastasis from squamous carcinoma of left main bronchus

Contributory cause of death

- While recording a Neoplasm it is better to state the following

1. The histopathological Variety of the neoplasm;

2. Where the neoplasm was;

3. If it was secondary, where the primary neoplasm was.

NOTE:

Single Condition:

- For some deaths, there may be only one condition which led directly to death and no antecedents, for example diabetic ketoacidosis
- If the person died because of injuries from some external cause, the internal cause (such as a fall or a road traffic collision) is the underlying cause of death
- Disease or condition that led directly to death
 - I (a) Ruptured liver
- Underlying cause of death
 - I (b) Pedestrian hit by a car

Immediate cause of death

- Modes of dying, such as "cardiac failure" or "respiratory failure" which are non-specific terms, should not be used.

Part II: (conditions contributing)

- All diseases or conditions, which were not directly related to the disease, though might have unfavourably influenced the morbid process.

Eg:

- A diabetic patient died from bronchopneumonia following an intracerebral hemorrhage cause by cerebral metastases from a primary malignant neoplasm of the left main bronchus.
- Contributory cause of death → Part II Diabetes Mellitus

Interval between onset and death

- Exact period from onset of morbid condition and the date of death is to be mentioned.
- It can be unknown / mins / hours / days / months / years.

Correct Sequence in interval

Duration: I (a) < I (b) < I (c)

Manner of death

- Whether it is natural / suicidal / accidental / homicidal
- If the investigation is pending, it has to be mentioned 120

Name of the practitioner

- The name with rubber stamp mentioning the registration

number of the medical practitioner should be mentioned.

Refer Diagram 16.3

To the relatives

- The bottom portion of the image (detachable portion) of the certificate is to be filled up and handed over to the relative
- This document helps for cremation as well as for future reference.
- It may be noted that this portion, handed over to the relatives does not mention the medical cause of death.

DETACHABLE PART OF FORM NO 4/4 A

(To be detached and handed over to the related of the deceased)
Certified that Shri/Smt/Km S/W/D of Shri R/O
..... Was under treatment from to And he/she
expired on at AM/PM

Doctor
Signature and address of Medical Practitioner/
Medical attendant with Registration No.

LEGAL PROVISIONS

00:31:36

- Registration of Births & Deaths Act, 1969
- Sections 10 (2) & 10 (3)

Section 10:

- (1) The doctor has to notify the deaths to registrar
- (3) The process should not be delayed & it has to be issued without any collection of fees

Section 23: (Penalties)

- (1) Any Person who fails without any reasonable cause to give any information which it is his duty / giving false information should be punishable.
- (3) Any Medical practitioner who neglects or refuses to issue a certificate under section 10 (3) and any person who neglects or refuses to deliver such certificate shall be punishable with fine, which may extend to fifty rupees

NOTE:

- Form 4 to be sent along with form 2 (death report)
- The death certificate should be issued by a registered medical practitioner who:
 - Has been the medical attendant of the deceased during life
 - Has attended the patient within past 14 days prior to his death
 - Is satisfied as to the cause of death

When not to issue?

00:36:26

1. The injured is brought dead
2. A Crime has already been registered by the police
3. The cause of death is unknown.

If you are not the attending Physician or Patient "Brought Dead"

- No filling of form 4 / 4A
- Pronounce death and fill up 'Form-2'
- Refer the dead body to concerned legal agency (police) to take further action (Viz: postmortem examination)
- MCCD can be given after PME by the Autopsy surgeon.

DEATH CERTIFICATE

- To be issued free of charge
- Not to be withheld for pending fees payment
- Carbon Copy of the death certificate to be maintained by doctor.
- Forward it to registering authority

GENERAL RULES

00:38:55

- No abbreviations should be used, eg: "CVA", "MI" or "PE" or medical symbols such as '#' should be avoided.
- Do not refuse/delay
- Do not sign in advance
- Do not sign without examining the dead body personally

Diagram 16.1

FORM NO. 4A

(Sec Rule 7)

MEDICAL CERTIFICATE OF CAUSE OF DEATH

(For non-institutional deaths. Not to be used for still births)

To be sent to Registrar along with Form No. 2 (Death Report)

I hereby certify that the deceased Shri/Smt./Km..... son of/wife of/daughter of resident of was under my treatment fromto and he/she died on' at AM/PM.

NAME OF DECEASED				For use of Statistical Office
Sex	Age at Death			
	Age in completed years	If less than 1 year age in months	If less than one month age in Days	
1. Male 2. Female				
CAUSE OF DEATH				Interval between onset & death approx.
I Immediate cause State the disease, injury or complication which caused death, not the mode of dying such as heart failure, asthenia etc.		(a) Due to (or as a consequences of)		
Antecedent cause Morbid conditions, if any, giving rise to the above Cause, stating underlying condition last		(b) Due to (or as a consequences of)		
II Other significant conditions contributing to the death but not related to the disease or conditions causing II		©		

If deceased was a female, was pregnancy the death associated with? 1. Yes 2. No
If yes, was there a delivery? 1. Yes 2. No

Diagram 16.2

INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

Cause of death		Approximate interval between onset and death
I Disease or condition directly leading to death*	(a) due to (or as a consequence of)
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(b) due to (or as a consequence of)
	(c) due to (or as a consequence of)
	(d) due to (or as a consequence of)
II Other significant conditions contributing to the death, but not related to the disease or condition causing it

*This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury, or complication that caused death.

Diagram 16.3

Examples of properly completed medical certifications

<p>CAUSE OF DEATH (See Instructions and examples) 32. PART 1. Enter the chain of events-Diseases, injuries, or complications-that directly caused the death. DO NOT enter terminal events such as cardiac arrest, respiratory arrest, or ventricular fibrillation without showing the etiology. DO NOT ABBREVIATE. Enter only one cause on a line. Add additional lines if necessary.</p>		
<p>IMMEDIATE CAUSE (Final disease or condition resulting in death)</p>	<p>a. Rupture of myocardium Due to (or as a consequence of):</p>	<p><u>Minutes</u></p>
<p>Sequentially list conditions, if any, leading to the cause listed on line a. Enter the UNDERLYING CAUSE (disease or injury that initiated the events resulting in death) LAST</p>	<p>b.Acute myocardial infarction Due to (or as a consequence of):</p> <p>c.Coronary artery thrombosis Due to (or as a consequence of):</p> <p>d. Atherosclerotic coronary artery disease</p>	<p><u>6 days</u></p> <p><u>5years</u></p> <p><u>7 years</u></p>
<p>PART II. Enter <u>other significant conditions contributing to death</u> but not resulting in the underlying cause given in PART I. Diabetes, Chronic obstructive pulmonary disease, smoking</p>	<p>33. WAS AN AUTOPSY PERFORMED? Yes <input type="checkbox"/> No</p>	
	<p>34. WERE AUTOPSY FINDINGS AVAILABLE TO COMPLETE THE CAUSE OF DEATH? Yes <input type="checkbox"/> No</p>	
<p>35. DID TOBACCO USE CONTRIBUTE TO DEATH? Yes <input type="checkbox"/> Probably <input type="checkbox"/> No <input type="checkbox"/> Unknown</p>	<p>36. IF FEMALE: Not pregnant within past year <input type="checkbox"/> Pregnant at time of death <input type="checkbox"/> Not pregnant, but pregnant within 42 days of death <input type="checkbox"/> Not pregnant, but pregnant 43 days to 1 year before death <input type="checkbox"/> Unknown if pregnant within the past year</p>	<p>37. MANNER OF DEATH Natural <input type="checkbox"/> Homicide <input type="checkbox"/> Accident <input type="checkbox"/> Pending investigation <input type="checkbox"/> Suicide <input type="checkbox"/> Could not be determined</p>



LEARNING OBJECTIVES

UNIT-3- VIOLENT ASPHYXIAL DEATHS

1. Asphyxial deaths – Hanging, strangulation, Suffocation

- Asphyxia
- Classical Signs of Asphyxia
- Hanging
- Strangulation
- Suffocation
- Traumatic Asphyxia
- Burking
- Wedging

2. Asphyxial deaths – Drowning

- Types of drowning
- Fatal period
- Autopsy findings
- Lab investigations



17 ASPHYXIAL DEATHS, HANGING & STRANGULATION

🕒 00:00:38

- **Asphyxia** = A + Phyxia = Absence of pulse/pulselessness
 - It is a condition, where in there is interference of the respiration, resulting in deprivation of oxygen to the tissues i.e hypoxia

4. Rt. Ventricular enlargement

5. Postmortem fluidity of the blood

- All the above 5 features are termed as Quintet of asphyxia

CLASSICAL SIGNS OF ASPHYXIA 🕒 00:01:54

1. **Peripheral cyanosis** [i.e at tip of the nose, nail bed [mc site], ear lobule etc]
 - Occurs when deoxy-hemoglobin is >5gm%
 - If the pt. is severely anemic, total amount of Hb itself is low. Thus, this sign is not seen in anemic pts.



Peripheral cyanosis

2. **Petechial hemorrhages**

- Minute, pin-point shaped hemorrhages which are <2mm in size [If hemorrhages are >2mm, these are k/a Ecchymosis]
- MC seen in eyelids, forehead, conjunctiva, visceral pleura/pericardium, heart, lungs, scalp etc.
- Increased intracapillary pressure & capillary endothelial damage [d/t hypoxia] results in rupture of capillaries & venules resulting in petechial hemorrhages



Petechial hemorrhage



Important Information

- **Tardieu spots/ Bayard's spots** are synonyms for petechial hemorrhages
- **Tardieu spots** are synonym for petechial hemorrhages in the visceral pleura



Visceral congestion

3. **Visceral congestion**

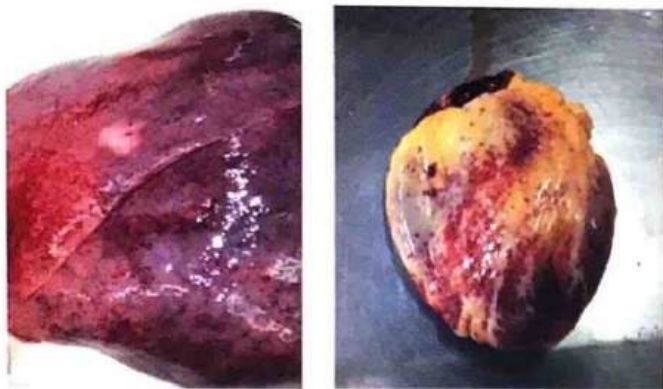
- Congestion of the visceral organs like liver, spleen etc occurs d/t increased capillary permeability



Important Information

- **Asphyxial triad** include
 - Peripheral cyanosis
 - Petechial hemorrhages
 - Visceral congestion
- These are **not** specific signs of asphyxia. Thus, these are k/a **Obsolete signs of asphyxia**





Visceral petechial hemorrhages



Liver congestion

Form of asphyxia**Simplified definitions****Hanging**

- Neck compression/ constriction d/t the suspension of the body [complete or partial suspensions]

Strangulation

- Compression of the neck by any means other than body suspension
- It can be d/t ligature/ hands/ stick/ bend of elbow etc

Suffocation

- Obstruction to the airway by any means other than the neck constriction & body suspension is k/a suffocation

HANGING

- It is MC asphyxial death
- Have neck compression + body suspension
- Ligature encircling the neck may not be always present



- In above image Suspension of the body & constriction of the neck is seen
- Ligature is absent
- Constriction force is weight of the body. Thus, it is hanging

MECHANICAL ASPHYXIAL DEATHS 00:08:30

Include

1. Hanging

- It is a form of asphyxia, caused by the suspension of the body by a ligature which encircles the neck
- Constricting force is weight of the body

2. Strangulation

- It is a form of asphyxial death caused by constriction of air passages at the neck by means of ligature or by any other means other than the suspension of the body

3. Suffocation

- A form of asphyxia, caused by mechanical obstruction to the passage of air into the respiratory tract by means other than constriction of neck/ drowning

4. Drowning

- Interference of respiration d/t entry of water into the airway

Types of hanging**I. Based on position of the knot**

- Typical hanging: knot is placed at the occipital region
- Atypical hanging: knot is placed at any other site other than the occipital region [i.e left of the mandible/ right side/ submental region etc]

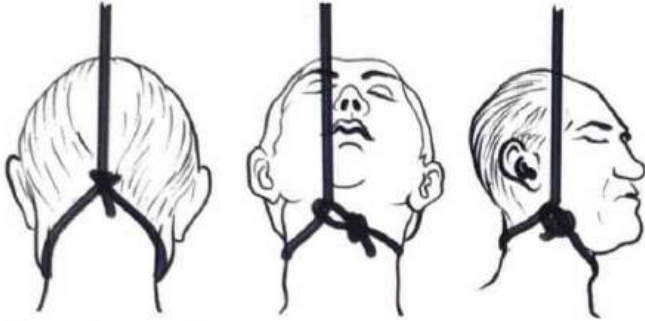
Position of knot



Atypical hanging



Typical hanging



Typical hanging

Atypical hanging



Partial hanging



Partial, Atypical hanging



Complete hanging



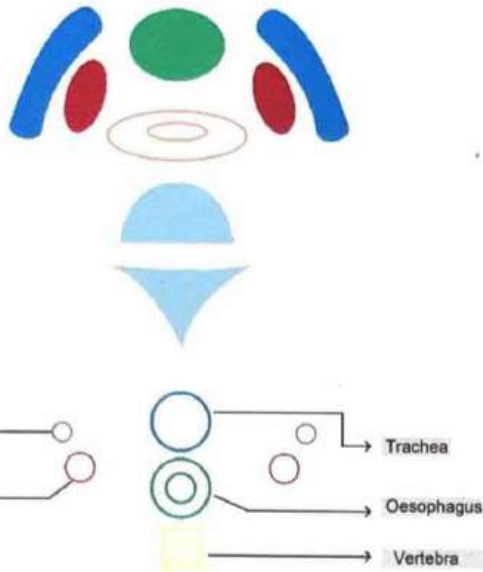
Complete hanging

II. Based on the degree of suspension of the body

- Complete hanging: Entire body is suspended without touching the ground
 - Constricting force is entire weight of the body
- Partial hanging/ Incomplete hanging: Body part touches the ground [Person hangs himself in sitting/ kneeling posture]
 - Constricting force is weight of the head

Pressures required to constrict the structures in the neck

00:18:57



- Any occlusion/ pressure on the carotid sinus results in vagal inhibition of heart & Cardiac arrest

LIGATURE MATERIAL

00:24:52

- Depending on the availability, any material can be taken as a ligature
- Eg: Wire, rope, cable, saree, dhoti, dupatta etc.
- The ligature material should be strong enough to hold the weight of the person
- While examining the ligature material, we have to check if there is any specific pattern
 - This pattern is correlated with the ligature mark
- Soft ligature causes wide/ faint ligature mark
- Narrow wire causes deep ligature mark
 - It is specifically k/a Cheese cutters method

Ligature mark

- Pressure abrasion produced by the ligature material is k/a Ligature mark
- Sometimes, it may be patterned abrasion

Pressure required	Constricted structure	Causes of death
2kg	Jugular vein	Venous congestion/ Apoplexy
5Kg	Carotid artery	Cerebral anemia/ Ischemia
15Kg	Trachea	Asphyxia
25-30Kg	Vertebral artery	

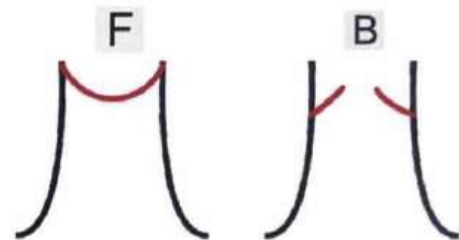
KNOT

00:28:35

- Mainly 2 types of knots are seen

I. Fixed knot

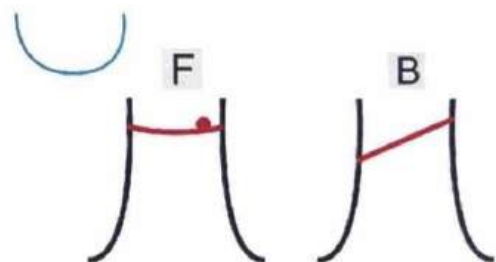
- It produces oblique ligature mark
- Part of the knot isn't touching the skin.
- Thus, incomplete ligature mark is seen



Oblique & incomplete ligature mark seen with fixed knot

II. Slip knot

- Slip knot produces running noose
- It completely encircles the neck & constricts it
- We can see transverse ligature mark
- Even the knot compresses the skin

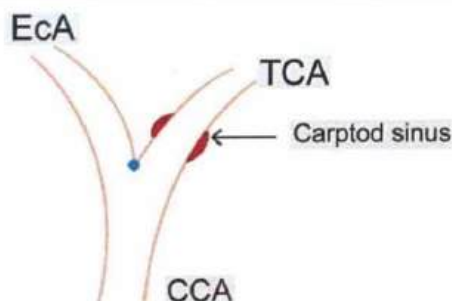


Transverse ligature mark with impression of knot



Important Information

- MCC of death in hanging is **Asphyxia + Venous congestion**
- Fracture of C2 cervical vertebra can also result in death



- If a case of hanging is brought to the autopsy, removal of ligature material is done by cutting it at a site away from the knot [preferably at opposite side of knot]
 - Knot should be preserved to interpret with ligature mark in the neck

→ Depending on the position of the knot, we can find the appearance of the ligature mark

AUTOPSY FINDINGS

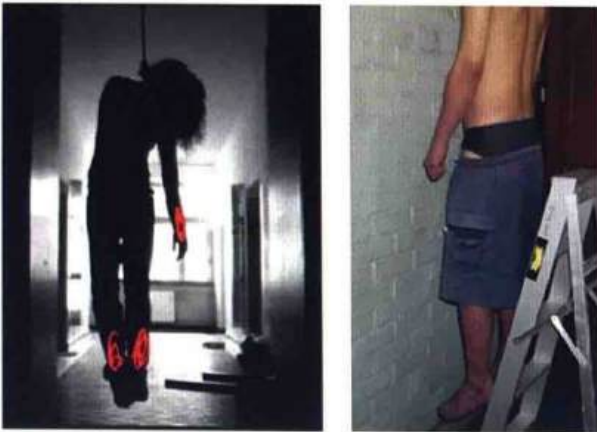
00:33:40

- 1st thing to confirm in hanging case is, whether it is antemortem hanging or not

When a body is completely suspended, following signs are seen

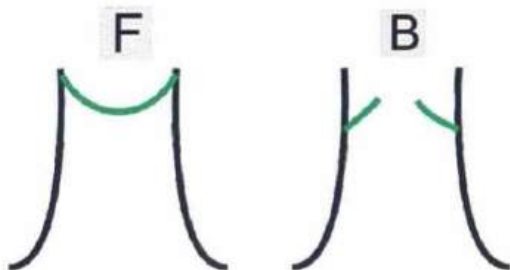
External findings

1. Hypostasis is in glove & stocking distribution [lower part of upper & lower limb]
- Engorgement of penis d/t pooling of blood



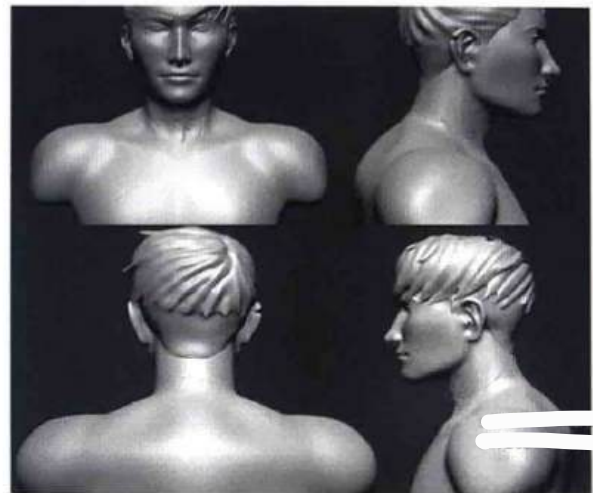
Glove & stocking distribution livor mortis/ hypostasis

2. Face
 - Congested (d/t jugular vein occlusion) or Pale (d/t jugular vein & carotid artery occlusion)
 - Thus, in partial hanging more congested face is seen & death is relatively slower than complete hanging
3. Ligature mark
 - It is Pressure abrasion produced by ligature material. Sometimes, it can be patterned abrasion (if it is showing pattern) as well
 - Appearance of ligature material in the neck
 - In Fixed knot, ligature mark would be oblique, incomplete & above thyroid cartilage



★ Important Information

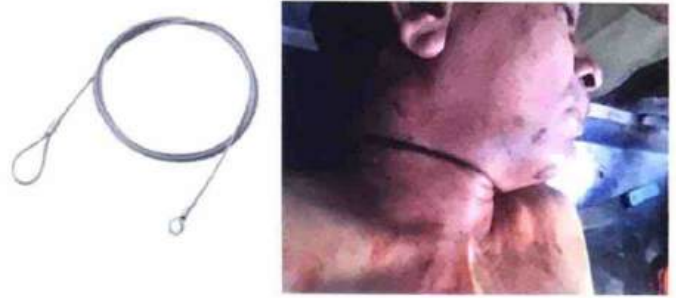
- Transverse ligature mark is seen in
 - Partial hanging
 - Low point of suspension
 - Slip knot with running noose
- In 85% cases, the mark is above thyroid.
- In 10% cases, mark is at the level of thyroid
- In 5% cases, mark is below the level of thyroid, depending on the level of suspension
- Complete ligature mark is seen when there is a running noose
- Ligature mark is usually pale, white & glistening
 - After sometime, it may turn into yellow brown d/t drying of the tissues
 - It gives Parchment like consistency



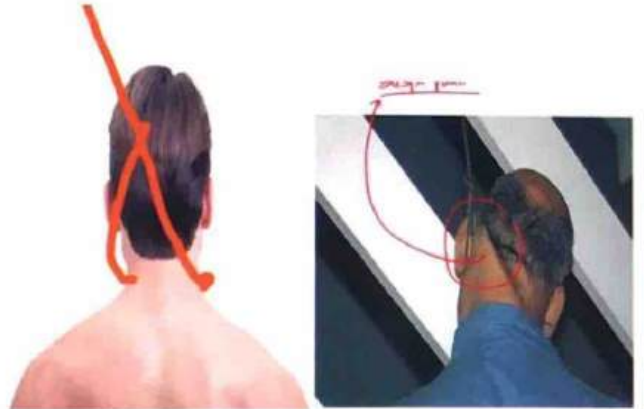
Ligature mark with a belt



Superficial ligature mark produced by soft ligature material



Thin ligature material producing deep groove
[Cheese cutter method]



Suspension peak

- If vertical segment of ligature material is pulling the knot, at that place, knot won't be in contact with the skin.
- This deficient area is k/a suspension peak
- It signifies that the body is suspended
- Discontinuous ligature mark is seen
 - When skirt comes b/w skin & ligature
 - When ligature material is on the hair etc.



Patterned abrasion d/t ligature material

4. Dribbling of saliva

- When a person hangs himself, the ligature material puts pressure on the salivary glands d/t which there is stimulation of salivary glands & increased secretion of saliva
- It results in dribbling of saliva
- It isn't seen in all cases
- But if it is present, it is surest sign of ante mortem hanging
- It is noted at the opposite side to the knot

Ligature material constriction



Stimulates salivary glands



salivary secretion



Dribbling of saliva



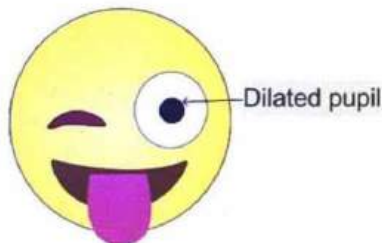
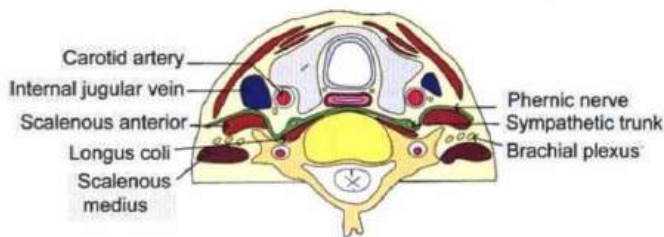
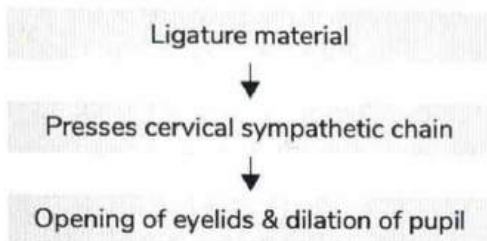
Ligature mark with broad ligature material



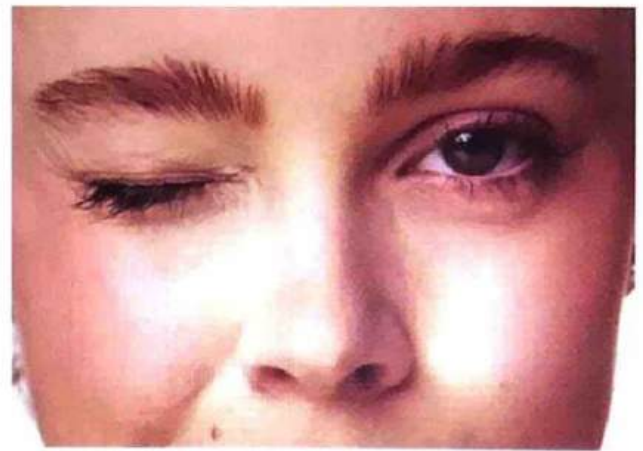
Dribbling of saliva

5. La facies sympathique

- When ligature material/ knot constricts the neck, pressure is applied on to the cervical sympathetic chain resulting in its stimulation
- On stimulated side, we can see
 - Opening of the eyelids
 - Pupillary dilatation
- It is one of the important signs of Antemortem hanging



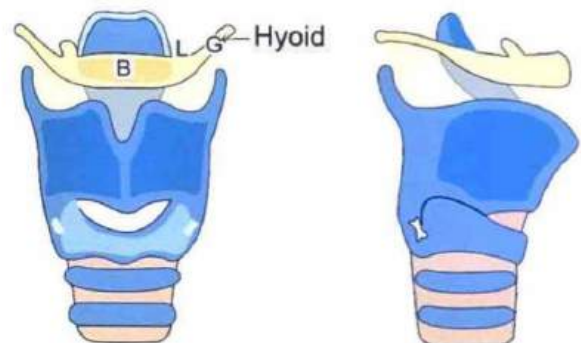
La facies sympathique



Internal findings

00:56:11

1. Skin under the ligature mark is white, glistening [without hemorrhage]
- In strangulation, bruises, hemorrhage are seen under the ligature mark
2. Hyoid bone

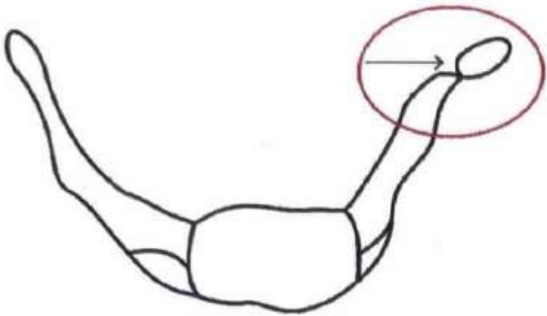


- In 50% of hanging cases, we can see the fracture of superior horn of thyroid cartilage
- In antero-posterior compression seen in hanging, hyoid bone is pushed backward & is compressed b/w the pressure of ligature & hard surface of vertebra
 - It results in fracture of hyoid bone & the fractured

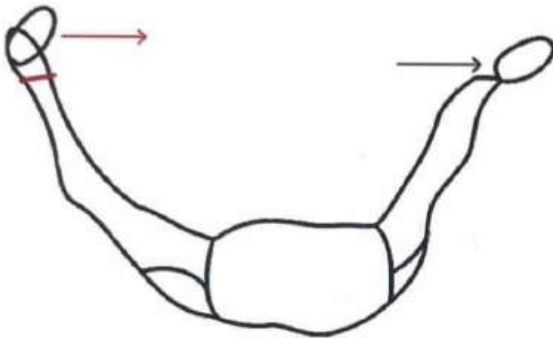
fragments displace outward

- This is k/a Abduction fracture/ outward compression fracture/ antero-posterior compression fracture

Abduction fracture/ Outward compression fracture



- If fractured segment on 1 side is displaced outwards & other side segment is displaced inwards, it is k/a side to side compression fracture
→ It is also seen in cases of hanging



★ Important Information

Difference b/w antemortem & postmortem fractures of hyoid bone

- If hemorrhage/ contusion of the surrounding tissue is seen, it is suggestive of Antemortem fracture.
 - If surrounding soft tissue is normal, it is suggestive of artefact [postmortem fracture]
3. Carotid artery injury
 4. Fracture of vertebra
- MC site of hyoid bone fracture is at junction of the inner 2/3rd & outer 1/3rd
 - Hyoid fracture is seen in 15-20% of the cases
 - It is MC seen in >40 yrs of age
 - Till 40 yrs hyoid bone is cartilaginous.
 - After 40 yrs it gets calcified. Thus, it is easily broken

★ Important Information

Amussat's sign

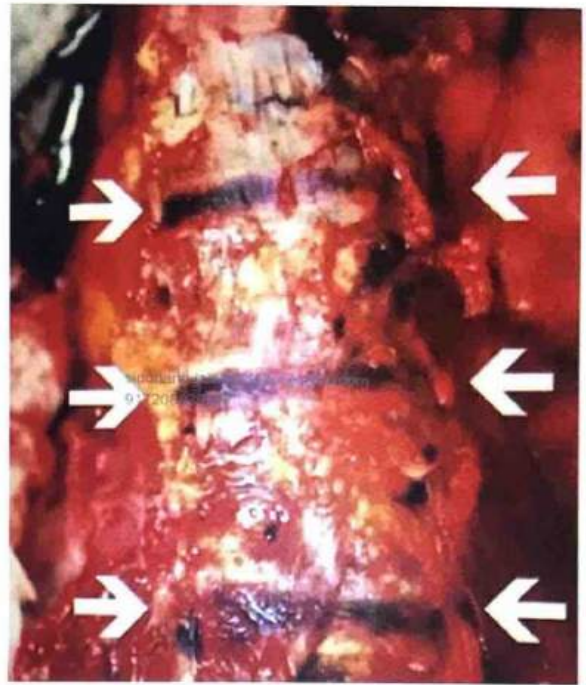
- Cut-section of carotid artery shows transverse intimal tears d/t stretching
 - It is specifically k/a Amussat's sign
 - If hemorrhages are seen surrounding this tear, it is sign of Antemortem hanging
- MC fracture seen is of C2 cervical vertebra [i.e Axis] at Pars interarticularis
 - It is seen particularly when there is a jerk with hyperextension
 - It is specifically k/a Hangman's fracture seen in Judicial hanging
 - Sometimes, fractured C2 vertebra dislocates forward over C3 k/a Spondylolisthesis



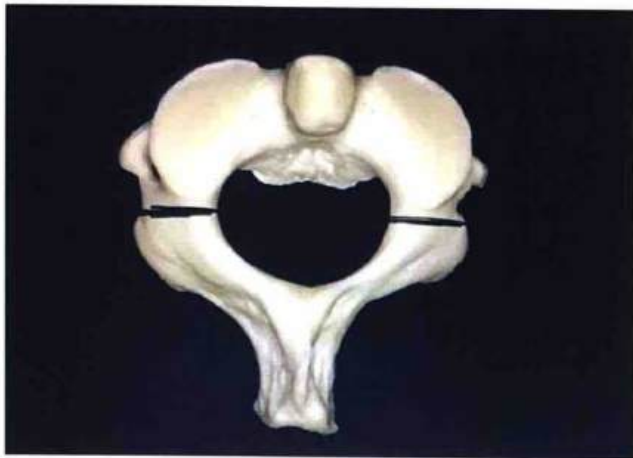
Displacement of Hyoid bone seen during dissection



Intimal tear with hemorrhages [Antemortem hanging]



Stripes of hemorrhages in intervertebral disc [Simon's bleed]

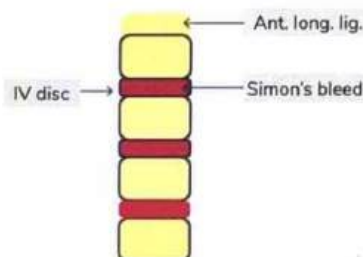


Hangman's fracture

🕒 01:08:10

SIMON'S BLEED/HEMORRHAGE

- Bleeding is seen at anterior surface of the vertebra
- It occurs d/t stretching of the vertebra or convulsions during hanging
- Anterior surface of the vertebral column is lined with anterior longitudinal ligament
- Bleeding seen at Intervertebral disc under the anterior longitudinal ligament is k/a Simon's bleed
- It is basically d/t bleeding from the spinal artery, which is confined to the intervertebral area



- Hemorrhage in bowel wall is also one of the indications for antemortem hanging

🕒 01:11:49

MANNER OF HANGING

1. Suicidal hanging

- It is MC manner of hanging
- It is MC method of committing suicide
- 2nd common method of committing suicide is poisoning
- Hanging is preferred as it causes painless death & its Fatal period is only 3-5 mins

2. Homicidal hanging

- If we find a body with any other fatal injuries, then there is a chance that it is a postmortem suspension/homicide
- The person is made unconscious by giving him drugs & then can be hanged
- Absence of any ligature material on hands of the victim is important feature



Important Information

Lynching

Homicidal hanging by a mob [group of ppl] in a public place without any trail

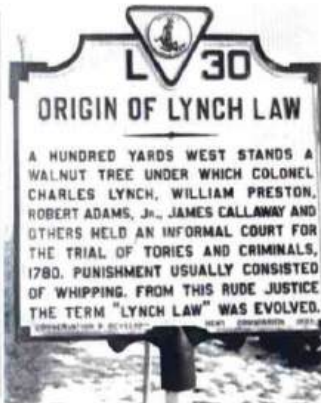


Lynching

- MC seen in males
- These male perverts partially constrict their neck, resulting in partial asphyxia
- It causes partial occlusion of carotid artery resulting in cerebral ischemia/anemia
- D/t this ischemia, the pt. gets erotic hallucinations & achieves orgasm
- After achieving the orgasm, he releases the pressure on the neck & comes back to normal
- This person can be naked/ wear the dress of opposite sex [transvestism]/ may have pornographic material etc.
- In case, if he isn't able to release the pressure; persistent neck compression results in death of the person
- This death is k/a Auto-erotic death/ Auto-erotic asphyxia

Neck Constriction → partial asphyxia → Carotid artery occlusion → Cerebral ischemia
 Release the pressure ← orgasm ← Erotic hallucination

- Term lynching is derived from the person Captain William lynch



- Scene of crime is usually bathroom
- Manner of death is accidental



Transvestism

- It is extra-judicial killing which was 1st brought by Charles lynch



Kotzwar [1st reported case of Auto-erotic asphyxia]

3. Accidental hanging Sexual asphyxia

- Aka Auto-erotic asphyxia/ Hypoxyphilia / Asphyxiophilia/Kotzwarrism

- It is a type of **Masochism** [person harms himself & gets sexual gratification]

4. judicial hanging/ Death penalty

- Lowest court to give death sentence in India is Sessions court
- High court should confirm the death sentence given by sessions court
- 416 Crpc: Postponement of death sentence in a pregnant female/ commutation of death sentence to life imprisonment in a pregnant female
- It is practiced in India

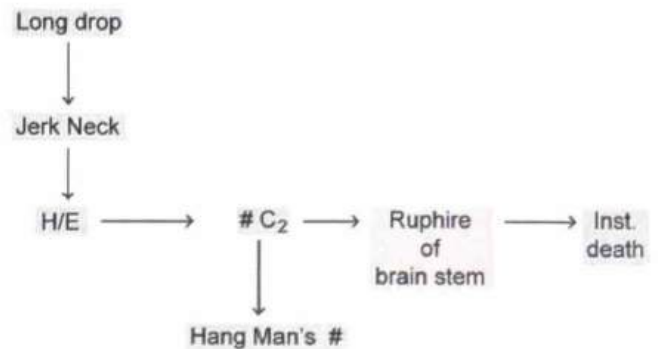


- The person is asked to stand on the above platform. His face is covered with a mask
- Then, they will tie the rope
- Length of the rope isn't constant [1-5meters]. It is decided according to the height & weight of the person [as rope has to sustain the weight of the person]
- Its knot is k/a Hangman's knot
- Ideal site of the knot is Sub-mental/ below the chin
 - It typically causes hyper-extension of the neck resulting in C2 vertebral fracture & death of the person
- In India, knot is commonly placed at below the angle of mandible

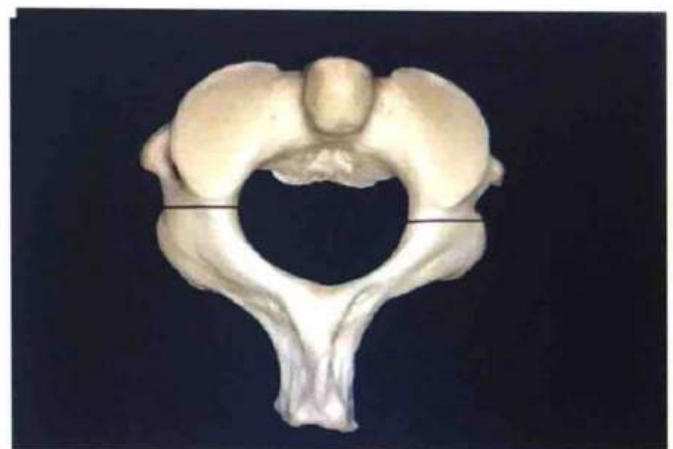


Hyper-extension of the neck resulting in fracture

- Long drop causes sudden jerk to the neck, resulting in hyper-extension of the neck & fracture of C2-cervical vertebra [MC]
- This causes rupture of brain stem & instantaneous death
- This fracture is k/a Hangman's fracture



- In this, if the heart stops immediately. Then the lungs stop in 20 sec
- But, if the lung stops 1st, the heart keeps on beating for 20 mins

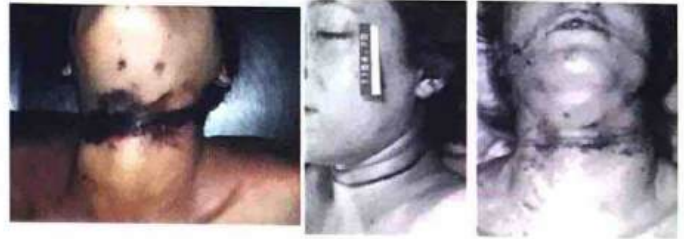


C2 Fracture

Types of fractures

01:32:17

- **Type-1 fracture**
 - Fracture alone is present
- **Type-2 fracture**
 - Have subtypes A & B
- **Type-3 fracture**
 - C2 vertebra slips forward over C3 [d/t facet joint dislocation]
 - It is k/a spondylolisthesis of C2



Contused adjacent areas of ligature mark

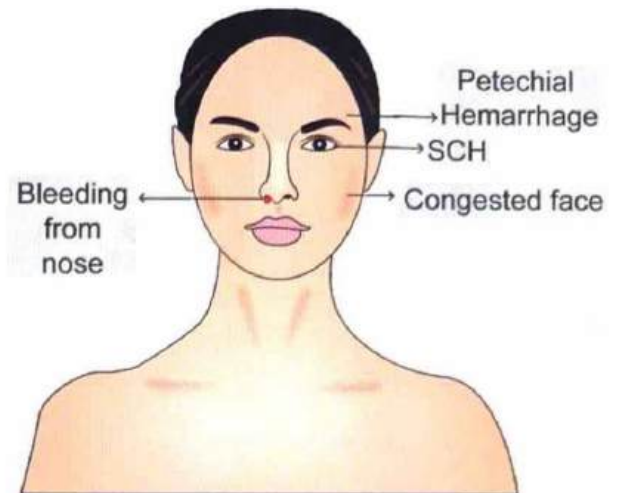
- Face will be intensely congested d/t decreased venous return from the head
- Petechial hemorrhages are seen over face
- Sub-conjunctival hemorrhages are seen
- Bleeding from the nose/ ear can also be noted
- On neck dissection, contusions in the soft tissues of the neck are seen

STRANGULATION

01:32:48



- Neck constriction by any means with no body suspension is k/a strangulation
- **Means**
 - Neck done constriction by
 1. Ligature material is k/a ligature strangulation
 2. Hands/ fingers manually is k/a Throttling / Manual strangulation
 3. Bamboo stick is k/a Bansdola
 4. Bend of elbow/ forearm is k/a Mugging
 5. If neck compression is done from behind, suddenly without any warning is k/a Garroting
 6. Neck compression done by palm is k/a Palmar strangulation



1. LIGATURE STRANGULATION

01:35:44

- ligature mark is transverse, complete & below thyroid cartilage (mostly)
 - Ligature mark of hanging d/t slip knot is situated above thyroid cartilage



- Contusion & hemorrhages are seen around the ligature mark. It is typical to ligature strangulation
 - It occurs d/t the struggle & friction



Skin folds in obese person



Strangulation mark

- Skin folds in obese person/ infants mimics strangulation mark
- These are k/a Pseudo-strangulation marks

2. MANUAL STRANGULATION / THROTTLING

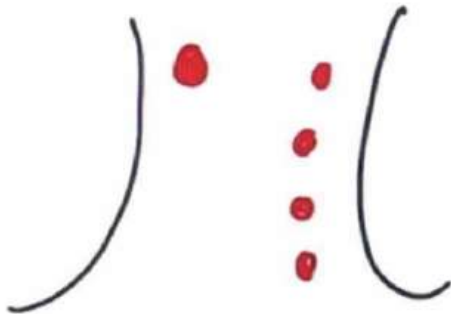
01:40:50



- Constriction of the neck by hands/ fingers manually is k/a Manual strangulation

External findings

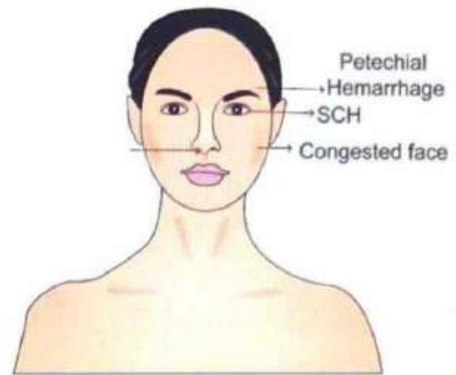
- Crescentic finger nail scratches/ abrasions are seen on the skin
- Round/ Discoid bruises on the neck produced by tip of the fingers of 1 hand is k/a Six penny bruise



- If both the hands are used, multiple bruises are seen on both sides of the neck

Internal findings

- To appreciate internal findings, the neck has to be dissected at least i.e. Bloodless dissection should be done
- Extensive soft tissue contusions are seen [important feature]
- Thyroid cartilage fracture [superior horns], tracheal ring fracture
- Hyoid bone fracture
 - Adduction fracture/ Inward compression fracture is seen in throttling
 - Antero-posterior fracture i.e. outward compression fracture/ Abduction fracture is seen in hanging
- Cricoid cartilage fracture
- Congested face, petechial hemorrhages, sub-conjunctival hemorrhages are seen over the face



Six penny bruises & crescentic nail abrasions



Crescentic nail marks

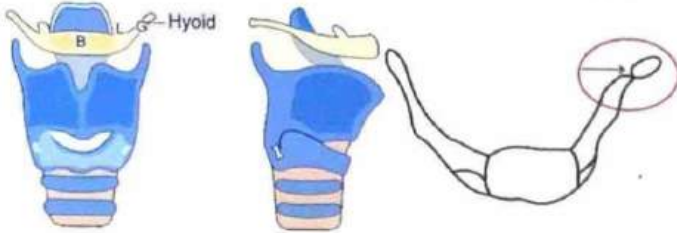


Contusions



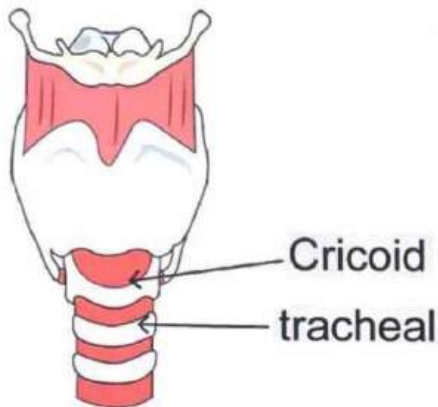
Extensive soft tissue contusion [internal finding]

- Hyoid bone fracture in ligature strangulation is rare, as the ligature applied would be below the level of thyroid



Adduction fracture/ inward compression fracture

- Cricoid cartilage fracture
 - It is rare finding. But if present, it is specific for throttling



- Throttling is always homicidal

? Previous Year's Questions

Q. A person was found dead. Post mortem shows nail scratches in the face, lip laceration in the inner side of the lip. Hypostasis is fixed. Which of the following cannot be the reason?
(FMGE Dec 2020)

- A. Cause of throttling
- B. Post mortem was done with 24 hours
- C. Due to asphyxia
- D. It is Homicide

? Previous Year's Questions

Q. A woman died in her room. Her room was unlocked. Her blood alcohol levels were 350 mg/ml. Image is shown below. On neck dissection, there was contusion present? (AIIMS Nov 2018)



- A. Throttling
- B. Bandedola
- C. Cafe coronary
- D. Alcohol intoxication

3. PALMAR STRANGULATION

01:49:38

- 1 palm occludes both nostrils & the mouth
- Another palm is placed perpendicular to the 1st palm. The base of this palm compresses the neck

Palmar strangulation



4. MUGGING

01:50:39

- Constriction of the neck by bend of the elbow/ forearm



5. BANSDOLA

- Compression of neck by bamboo stick
- One stick is placed behind the neck, another stick is placed in-front of the neck & both are compressed or
- Sticks are placed in V-shaped in front of neck & is compressed from the back



BANSDOLA

6. GARROTING

🕒 01:52:02



- Neck compression is done suddenly without any warning



Important Information

WINDLASS TECHNIQUE

- In garroting, if a lever [stick] is used to increase the constriction, it is k/a windlass technique
- In Spain, it was practiced as a form of Judicial execution. Hence k/a Spanish windlass technique



WINDLASS TECHNIQUE

- Victim is made to sit on the chair
- Iron collar is put around the neck of the victim
- Lever/stick is turned from the back. It increases the neck compression & results in death

SUFFOCATION

🕒 01:54:32

- Obstruction of the airway with no neck compression & no body suspension is k/a Suffocation
- Types

1. SMOTHERING

- Blocking the entry of air by obstructing both mouth and nostrils together by hands/ any other means [pillow etc.] is k/a Smothering
- It can be accidental [MC]/homicidal [suicidal is very rare]
- Accidental smothering is seen with
 - Child playing with plastic bag over the face
 - Person trapped in the mud/ sand
 - Epilepsy pts/ intoxicated ppl.
- Homicidal smothering is common in elderly
- When face is compressed with the hand, we can see
 - Finger nail abrasions over victim's face i.e Peri oral region
 - Contusions of lip
 - Lacerations at frenulum of upper lip. It is typical to smothering



It is not smothering as the nose is open



3. GAGGING

02:02:53

- It is a form of asphyxia d/t obstruction of Pharynx by a GAG material [i.e cloth/ fiber/ paper etc].
- When gag material is pushed into the mouth initially, it eventually enters the airway & cause asphyxia
- It is homicidal
- Eg.
 - Cloth stuffed into the mouth of the victim to keep him shut during kidnapping
 - Initially this cloth may not cause obstruction
 - Later, the secretions of larynx is absorbed by the cloth, it gets swollen & may obstruct the airway completely & cause asphyxia
 - Here, the accused didn't want to kill the victim, he just didn't want the victim to shout
 - The death here was unintentional [but it is homicide]



Homicidal smothering



2. OVERLAYING

02:01:06

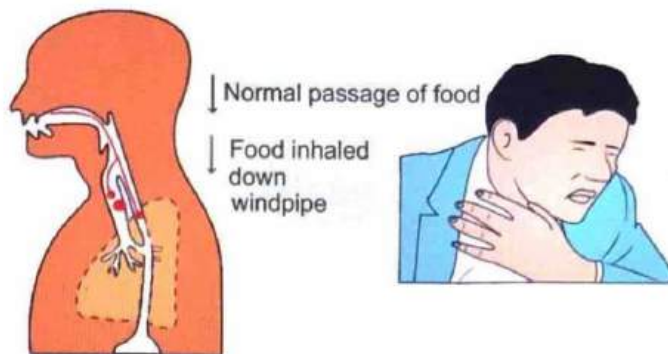
- When larger individual sleeps with a small individual [i.e infant], chances of overlaying is seen
- E.g.
 - When obese lady shares a small cart with a baby; In sleep, obese lady rolls over onto the baby & the baby's face is occluded
 - This results in death of the baby
 - Sometimes, when lady's weight falls on the baby, the baby can even die of **traumatic asphyxia**

4. CHOKING

02:05:51

- Asphyxia d/t obstruction of airway by a foreign body or food bolus
- Obstruction of airway by coin is MC seen in children
- MC seen in children

- When the foreign body enters into the airway, the person initially gets breathlessness, cough. Complete obstruction causes cyanosis resulting in death
- I.e respiratory distress is seen in these victims
- If first-aid is Heimlich maneuver
 - By this, the foreign body can be expelled outside
- If the person isn't able to expel the foreign body outside, it results in death
- **Cause of death**
 - Asphyxia
 - Vagal inhibition
 - Reflex Laryngeal Spasm
- **Autopsy findings**
 - Big, food bolus is seen in trachea, which is obstructing the airway
- Manner of death is accidental



Choking



Food bolus occluding the airway

★ Important Information

Cafe Coronary

- It is usually seen in restaurants. Hence, it is k/a Cafe coronary
- It is a misnomer.
- It is 1st reported by Ronald Haugen
- Obese, Intoxicated person, dies suddenly while eating
- It mimics Myocardial infarction [hence, k/a Cafe coronary]
- Food bolus directly enters the airway & causes death
- No signs of respiratory distress is seen
- Under the influence of alcohol/ drugs the gag reflex/cough reflex is suppressed, and the person will not be able to bring out the foreign body.
- COD: Vagal inhibition of heart

Creche coronary

- MC seen in children b/w 1-3 yrs of age with poor dentition
- These children aren't able to chew the food properly
- The food bolus accidentally enters the airway & causes death



Heimlich maneuver

[Person stands behind the victim, keeping hand in the epigastrium, giving pressure upwards & backwards, and making the foreign body expelled out.]

5. TRAUMATIC ASPHYXIA

🕒 02:13:17

- It is a form of asphyxia due to mechanical fixation of the

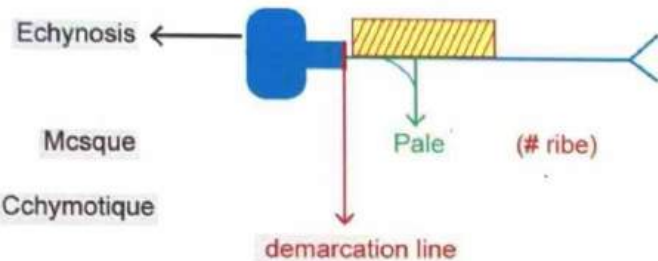
chest by any trauma

- When chest is fixed, there is restriction of the chest movement
- As a result, the person isn't able to breath & suffer from asphyxia
- **Causes**
 - Stampedes [ppl running on chest of the victim]
 - Fall of sand/ brick on chest of the victim
 - House collapse
 - During car repair
 - Heavy weight over chest of the victim
 - Person had buried alive [head above the ground & whole body below the ground]



Important Information

- D/t heavy weight falling on the chest. there is **no venous return** from head to the chest.
- Thus, there will be intense **congestion/ cyanosis/ ecchymosis**, above the level of obstruction k/a **Masque ecchymotique**
- Parts below the level of obstruction will be completely **pale**
- Clear cut demarcation line is seen b/w congested part & pale part
- D/t weight **fracture of ribs** can also be seen



Traumatic asphyxia d/t car falling on the chest



Masque ecchymotique

7. BURKING

02:20:54

- It is combination of Homicidal smothering + Traumatic Asphyxia
- One person sits on the chest of the victim, while another person covers the mouth & nostrils of the victim



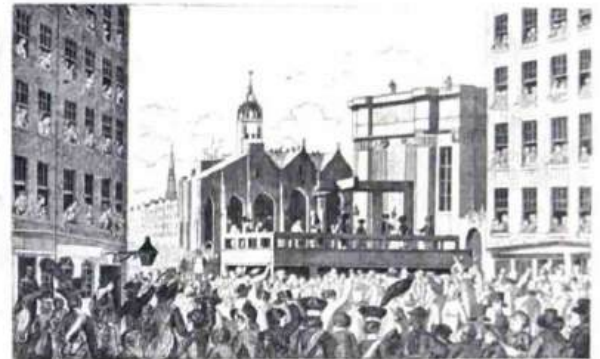
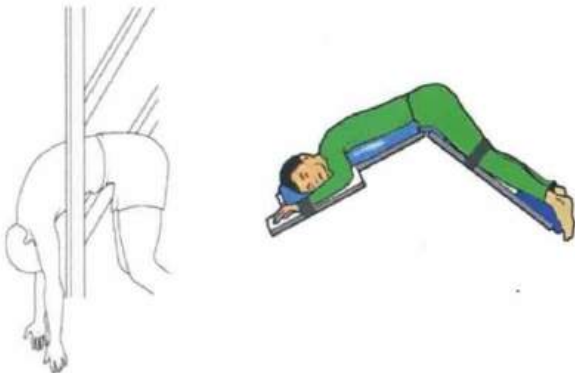
6. POSITIONAL ASPHYXIA

02:18:46

- Asphyxia due to abnormal position of the victim
- Due to abnormal position, there is restriction of respiration & the person dies

Jacks Knife's Position

- One half of the body is on 1 side; other half of the body is on other side
- Abdominal organs & bowel compresses the diaphragm, restricts the lung movements & results in death of the person



REPRESENTATION of the notorious WILLIAM BURKE the murderer, who supplied UP KNIVES with subjects.

Execution of Burke.
From a Contemporary Print.

- William Burke & William Hare killed so many victims [around 16 victims] by this method to supply dead bodies to anatomist Robert Knox

Inverted Crucifixion

- Head is down & legs are up
- Abdominal organs compress the diaphragm, restricts the lung movements & results in death of the person



Hi
This is
Burke

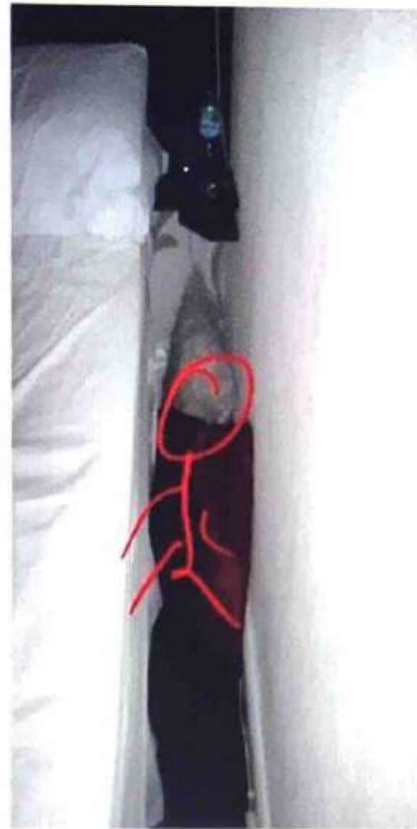
Skeleton of Burke [he had been judicially executed]

- After this an act is implemented by legalizing the donation of dead bodies for research purposes

8. WEDGING

🕒 02:23:46

- The victim is wedged b/w 2 firm structures [wall & corner of bed]
- Children are MC effected
- Eg. Baby might slip in a gap b/w wall & the bed & gets wedged b/w these 2 structures, baby can't breathe & die



Baby might get caught b/w wall & bed & die



18 ASPHYXIAL DEATHS DROWNING

DEFINITION

00:00:13

- As per WHO, Drowning is the process of Respiratory impairment d/t the submersion or immersion of the victim.
- MC mode of drowning deaths is Accidental

PATHOPHYSIOLOGY OF DROWNING

00:01:45

- When a person falls into water, he becomes Panic & Voluntary holds the breath
- Later, d/t Air hunger, Reflex Inspiratory Effort occurs & Water enters rapidly into the airway

Dry drowning

- Rapid entry of water into airway causes Reflex vocal cord spasm
- This results in asphyxia & death
- As water didn't enter the lungs, it is k/a Dry drowning

Wet drowning

- Water enters the lungs
- Depends on the volume of water aspirated
- If volume aspirated is 3-4 ml/kg.Bwt (MC volume aspirated), it enters alveoli & washes away Surfactants. [surfactant keeps the alveoli patent]
- This results in Alveolar collapse
- It causes Ventilation-Perfusion ratio mismatch, which results in cerebral hypoxia & death
- If the volume aspirated is 11ml/kg; following effects are seen depending on the type of water entered [freshwater/salt water]

Fresh water drowning

- Fresh water is hypotonic
- Water enters the lungs, fills the alveoli & enters pulmonary capillaries resulting in Hemo-dilution
- D/t this RBC swells & results in hemolysis
- This hemolysis causes release of intracellular-potassium resulting in hyperkalemia
- Hyponatremia occurs d/t dilution
- This hyperkalemia & hyponatremia results in cardiac arrhythmias & death
- Fatal period for fresh water drowning is 4-5 mins



Previous Year's Questions

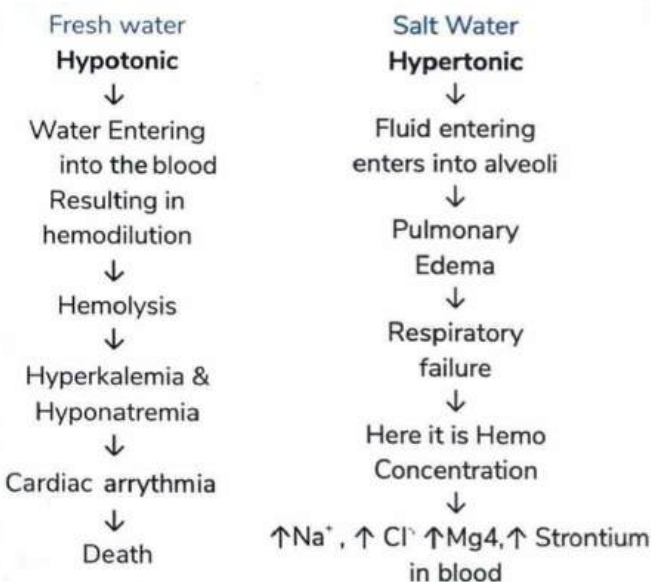
Q. True about freshwater drowning?

(INICET-NOV-2020)

- A. Hemodilution
- B. Hypokalemia
- C. Hyponatremia
- D. Arrhythmia

Salt water drowning

- Salt water enters the lungs & fill the alveoli
- This hypertonic water pulls the fluid from the blood into the alveoli resulting in pulmonary edema
- This causes respiratory failure & hemo-concentration
- Salt water causes shrinking of RBC
- Hemo-concentration results in
 - Increased sodium
 - Increased chloride
 - Increased magnesium
 - Increased strontium
- Fatal period is 8-10 mins



HYDROCUTION

00:13:09

- Aka Immersion Syndrome/Vagal inhibition of Heart
- MC seen with cold water, particularly when its temperature is <5°C of body temp of the victim

- When cold water comes in contact with skin, it Stimulate skin receptors/ causes direct Epigastric blow
- Both of these causes Vagal stimulation, resulting in Bradycardia & Cardiac arrest
- This cardiac arrest is k/a Vagal Inhibition of heart
- Here the water is not entering into lung. So, it is also a type of DRY DROWNING

NEAR DROWNING

00:15:48

- Victim dies after 24hrs of drowning d/t complications
- MC Complications are
 - Pneumonia/ Pulmonary Infections
 - HIE – Hypoxic Ischemia Encephalopathy
 - Electrolyte Imbalances
 - ARDS
- Aka Post Immersion Syndrome



Important Information

FATAL PERIOD

Fresh water drowning → 4-5 minutes

Sea Water drowning → 8-10 minutes

00:16:53

AUTOPSY FINDINGS

00:17:40

Specific findings

- Present only in Antemortem Drowning

Nonspecific

- Present both in Antemortem & Post-mortem drowning

Specific Findings

External findings

1. Cadaveric Spasm

- Presence of grass clenched in the hand



- Alive person when fallen into water, he/she will struggle to come out of it and will grasp the grass/weeds/stem.
- Muscles that are contracted at the time of death, will continue to be in spasm even after death. This is known as cadaveric spasm.
- It is most specific sign of Antemortem drowning

2. Presence of Froth in the nostrils

- Whenever a person falls into water, there is entry of water into the airway,
- This water irritates the mucosa resulting in increased secretion of mucus
- Violent respiratory struggle causes churring effect, which mixes Mucus + surfactant+ water+ air & results in production of Froth.
- In post-mortem drowning as this violent respiratory struggle is missing, froth can't be seen
- Thus, it is a sign of Antemortem drowning
- Properties of Froth
 - Fine
 - Tenacious
 - Lathery
 - Persistent [comes from lungs even after wiping from the mouth & nostrils]



Internal findings

00:23:28

1. Lungs

- Voluminous/bigger
- Inflated

- Spongy/ Crepitant
- Rib markings are seen on Lungs

HPE shows

- Dilatation of alveoli
- Thinning of alveolar walls
- Rupture of alveolar walls
- Compression of pulmonary capillaries
- These findings are specific for drowning & are k/a Emphysema aquosum
 - This occurs when a conscious person is drowned into water



Important Information

Edema Aquosum

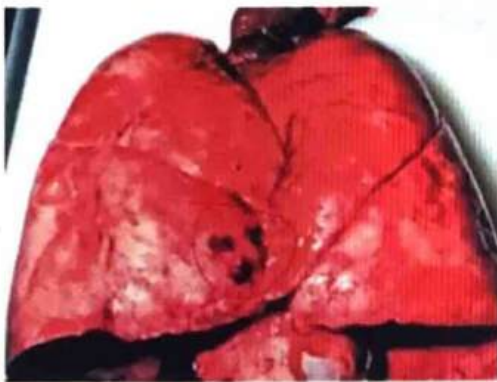
- Occurs when unconscious person is drowned into the water
 - It is passive filling of lungs with water
 - There is no froth, no respiratory effort, no churring effect, no edematous change
- When we cut the airway, we can see the presence of mud/ sand particles along the airway upto the level of secondary bronchioles



Important Information

PALTAUF'S HEMORRHAGE

- Occurs d/t rupture of alveolar capillaries
- Commonly seen in anterior surface of Lower lobes of Lungs



- Water is seen in the stomach & small intestine

Signs in Drowning

1. **Ueno's Sign:** Presence of water & hemorrhages in middle ear

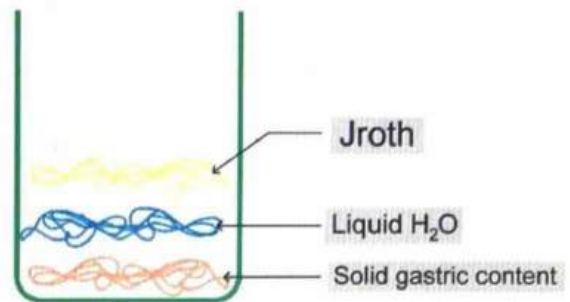
2. **Sveshnikov sign:** Presence of water in Sinuses (Maxillary/Sphenoid sinuses)

3. **Sabinsky's sign:** Small & shrunken spleen d/t drowning

4. **Wyoller's sign**

- When gastric contents are placed in a container, it forms 3 layers
- This is k/a Wyoller's sign
- The 3 layers are
 - Solid Gastric content
 - Liquid water
 - Froth [top layer]

Wyoller's sign



Non-Specific Signs

External findings

1. **Cutis Anserina / Goose flesh**

- Whenever erector pili muscle contracts, the hair stands on the skin
- Cutis anserina occurs d/t Contraction of Erector Pili Muscles.
- It is seen in drowning
- But, it occurs even d/t Rigor Mortis of Erector Pilli Muscle
- Thus, it is non-specific sign



2. **Washer Women's hand**

- It is non-specific sign of drowning
- It involves the skin of palm & feet
- It occurs d/t imbibition of water into layers of the skin
- Characteristic features of washer women's hand are
 - Wrinkled: occur in 3hrs
 - Soddened: occur in half day
 - Bleached: occur in 1 day

- Peeling of skin occurs in 2-3 days
- It helps to calculate Time since death (TSD)

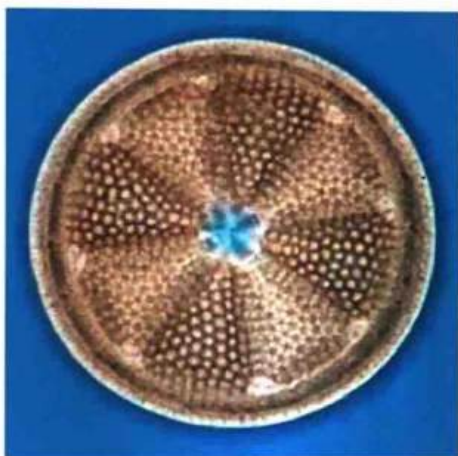


Washer women hand

LAB INVESTIGATIONS TO CONFIRM THE CASE OF DROWNING 🕒 00:36:08

1. Diatom's test

- Diatom is an Unicellular algae
- Varies in species, size, shape depending on their location [present in all water bodies]
- There are 2 important types of diatoms based on the Salinity of water i.e
 - Oligo halophilic
 - Poly halophilic
- Its outer wall is coated with Silica, which is Acid & Alkali resistant
- It resists putrefaction as well



Diatoms

- When a person falls into the water, along with the water, diatoms enter into the airway
- These diatoms reach the alveoli, penetrates the pulmonary Capillaries & enters into the circulation
- If the person is alive & if the heart is beating; these diatoms will be circulated throughout the body

- Thus, diatoms can be seen in bone marrow, brain, spleen, kidney, liver etc
- Presence of diatoms in distant organs is a sign of Antemortem drowning



Important Information

- Best Sample to test diatoms is Bone Marrow of femur/ sternum
- Best visceral organ → Spleen

Test procedure

- Add nitric acid into the bone marrow sample of the victim
- This acid lysis entire bone marrow except the diatoms as they are resistant to acid
- These diatoms are seen under microscope. This is suggestive of Antemortem drowning
- These diatom species should be compared with the diatoms of the respective water body



Important Information

Diatom Test is Not Useful In

- Dry drowning
- Hydrocution

2. GETTLER'S TEST 🕒 00:44:20

- It is based on the chloride concentration in the blood samples of heart chambers [right side & left side]
- Normally, chloride concentration in both right side chambers & left side chambers should be equal
- In fresh water drowning
 - Chloride concentration in right chambers > chloride concentration in left chambers d/t hemodilution
- In salt water drowning,
 - Chloride concentration in left chambers > chloride concentration in right chambers d/t hemoconcentration
- If there is difference of >25mg%, it is significant



How to remember

- Fresh water drowning: Right side chloride is more
- Salt water drowning: Left side chloride is more

Gettler's test is not useful in

- Dry drowning
- Hydrocution
- Patent Foramen Ovale [anomalous connection b/w left & right side]
- Serum magnesium concentration (Moritz test)
- Serum strontium concentration
 - Both Mg & strontium are increased in salt water drowning
- Among this 2-serum strontium is the best parameter for finding sea water drowning.
- In Autopsy, there is no single pathognomonic finding for the diagnosis of drowning.
- It is diagnosis of exclusion



Previous Year's Questions

Q. Gettler's test is positive in? (FMGE-May-2018)

- A. Hanging
- B. Poisoning
- C. Strangulation
- D. Drowning



CLINICAL QUESTIONS



1. After 5 days, the search team recovered the body of the 10-year-old boy who had gone missing while swimming in the lake. The skin of the boy showed signs of cutis anserina and the hands were seen clenched with weed and gravel in it. Which of the following findings would also be seen in the case of antemortem drowning?

- A. Water in the small intestine
- B. Emphysema aquosum
- C. Hemorrhage in the middle ear
- D. All of the above

Answer: D

Solution

SIGNS OF ANTEMORTEM DROWNING

External findings:

- Cadaveric spasm holding grass, gravel and sand in hand
- Fine, white lathery froth in mouth & nose.

Internal findings

- Presence of froth mixed with sand particles in the trachea & bronchi (particularly in the lower airways) Mud in the upper airway alone may be seen in post-mortem drowning as well.
- Presence of water in stomach & small intestine
- Presence of water and haemorrhage in middle ear

Non-specific signs:

1. Cutis anserina
2. Washerwoman's hands

Reference:

Review of forensic medicine & toxicology, Gautum biswas, 3rd edition, Page No: 182

2. The usual boat ride off the coast of Chennai turned tragic when the boat capsized with all 7 tourists and the boatman on board. 5 of them knew swimming and managed to stay afloat. They were rescued by the coast guards within 30 mins. The 2 others were separated from the rest by the strong current. Their bodies were recovered and sent for examination. Among the findings, the forensic doctor has documented the presence of Emphysema Aquosum. Which one of the following is that finding associated with?

- A. Dry drowning
- B. Wet drowning
- C. Immersion syndrome
- D. Secondary drowning

Answer: B

Solution

- Emphysema aquosum is a sign of **wet drowning**.
- Drowning fluid actually penetrates alveolar walls to enter the tissues and the blood vessels. This has been described as emphysema aquosum.

Cause of death in wet drowning: Disruption of pulmonary surfactant

Dry drowning: Water does not enter the lungs, but death results from:

- Immediate sustained laryngeal spasm
- Cardiac arrest due to vagal inhibition

Reference:

The essentials of Forensic medicine and toxicology, Dr. KS Narayana Reddy; 33rd edition, Page No:369

3. A 55-year-old man who had gone camping in Manali on New year's eve was found dead in a lake the next morning. He had been part of the celebrations the previous night and was seen drinking and smoking Hooka with his group of friends. Autopsy reports confirm that he has died of drowning in cold water. Among the following, what causes death when drowning in cold water?

- A. Vagal inhibition of heart
- B. Asphyxia
- C. Loss of consciousness
- D. Ventricular fibrillation

Answer: A

Solution

Immersion syndrome (Hydrocution/submersion inhibition/cold water drowning):

- It refers to syncope resulting from cardiac dysrhythmias on sudden contact with water that is **atleast 5°C lower than body temperature**
- Type of **atypical drowning**

Mechanism:

- Cold water stimulating the nerve endings of the surface of the body
- Cold water striking the epigastrium
- Cold water entering ear drums, nasal passages.

- Sudden dyspnoea and **vagal inhibition** → asystolic cardiac arrest (diving reflex) heart stops immediately. or ventricular fibrillation secondary to QT prolongation after a massive release of catecholamine on contact with cold water.
- The resultant loss of consciousness leads to secondary drowning.

#Alcohol increases such effects.

Reference:

The essentials of Forensic medicine and toxicology, Dr. KS Narayana Reddy; 33rd edition, Page No:363

6. A woman died in her room. Her room was unlocked. Her alcohol levels were 150 mg%. Image is shown below. On neck dissection, there was contusion present.



- A. Throttling
- B. Smothering
- C. Cafe coronary
- D. Alcohol intoxication

Answer: A

Solution

In the given scenario:

A woman died in her room.
The room was unlocked
Her alcohol levels were 150 mg%.

Suicide less likely

- mg%: indicate the mass (in milligrams) of that chemical in 100 millilitres of blood.
- Her alcohol levels before death must be more than 150 mg% (it is a post mortem reading which is invariably less than antemortem level)
- She is under Alcohol intoxication but the level is not sufficient to cause death.
- More over contusion present over neck cannot be explained by Alcohol intoxication, so excluded.
- However, this much blood alcohol concentration is sufficient to induce delirious to stupor, in which condition she can easily be throttled or strangled manually without any obvious sign of struggle.

On neck dissection, there was contusion present which can also be seen in the given picture

Suggestive of throttling or manual strangulation.

#Café coronary

- Sudden and unexpected death occurring during a meal due to accidental occlusion of the airway by food.
- No signs of airway obstruction are given in the question moreover contusion present over neck which cannot be explained by Café coronary, so excluded.

#Smothering: death from mechanical occlusion of the mouth and nose, excluded

Reference:

The essentials of forensic medicine and toxicology, KSN Reddy, 33rd edition, Page No: 329



LEARNING OBJECTIVES

UNIT-4- FORENSIC THANATOLOGY & FORENSIC IDENTITY

1. Post-mortem techniques

- Why to learn this chapter?
- Autopsy and its types
- 1st cavity to open
- Different types of Incisions
- Techniques of Organ Removal
- Individual Organ Dissection
- Exhumation

2. Thanatology

- Deaths & its types
- Suspended Animation
- Post - Mortem Changes
- Late changes after Death
- Post-Mortem Luminescence
- Modified forms of Putrefaction
- Embalming

3. Human identification-1

- Corpus Delicti
- Race Determination
- Age Estimation
- Age Estimation from Ossification of long bones
- Age Estimation from Skull
- Age Estimation from Dentition
- Age Estimation from Other methods
- Sex Determination
- Primary and Secondary Sexual Characters
- Chromatin Study
- Chromosomal Study
- Examination of Skeletal Remains
- Sex Determination: Video Discussion
- Ashley's Rule of 149
- Chilitic Line
- Krogman's Accuracy

4. Human identification-2

- Medicolegal Importance of Age

- Dental Charting
- Universal Method (Cunningham's Method)
- Palmer's Notation (Zigmondy's System)
- Haderup's System
- FDI System: Federation Dentaire Internationale
- Modified FDI System
- Stature (Height)

5. Human identification-3

- Finger-prints types & patterns
- Matching of Fingerprints
- Importance and Alteration of Fingerprints
- Lip Printing
- Rugoscopy
- Podogram
- Frontal Sinus Pattern
- Tattoo Marks
- Superimposition



19

POSTMORTEM TECHNIQUES

- Every registered medical practitioner is eligible to conduct autopsy

AUTOPSY / NECROPSY [STUDY OF DEAD BODY]/ POSTMORTEM EXAMINATION

🕒 00:01:13

- 1st autopsy was done in 1302 at Italy by Varignana
- 1st medicolegal autopsy in India was done at Chennai by Edward Bulkley
 - Done on a case of Arsenic poisoning

TYPES OF AUTOPSIES

1. Medico legal autopsy

- MC type of autopsy in India
- Done in unnatural deaths [Medico-legal cases]
- Requisition is given by investigating officer (I.O)/ Inquest officer
- Consent from the relatives is not needed
- Body will be handed over to the I.O after completion of the autopsy

2. Clinical / Pathological autopsy

- Done in natural deaths to know the pathology [for academic interests]
- Investigating process isn't necessary
- Relative's consent is mandatory
- Body will be handed over to the relatives after completion of the autopsy

3. Virtual autopsy / Virtopsy

- Whole body imaging is done
- Any structural abnormality [fractures, injuries etc] can be identified through this imaging.
- Thus, cause of death is found with minimal dissection

4. Obscure autopsy

- Obscure = Not sure
- Gross findings are minimal / inconclusive [couldn't determine the cause of death]
- Thus, additional tests are done to determine the cause of death i.e.
 - Histopathological examination [HPE]

- Microbiological examination
- Chemical/ Toxicological examination etc
- Eg for which additional investigations are required are
 - Epilepsy
 - Status asthmaticus
 - Hypokalemia etc

5. Negative autopsy

- Autopsy fails to reveal the cause of death [i.e Inconclusive even after all the investigations]

- Gross findings + Additional investigations are **negative**

6. Psychological autopsy

- Done in suspected **suicidal deaths**
- Done by **interviewing** victim's parents/ friends/ relatives
- Confirmation of suicide is done by assessing mental status of the victim before committing suicide

7. Verbal autopsy

- If appropriate medical records aren't available, information about the patient's last symptoms/ illness is taken from the pt's relatives by conducting interviews
- Cause of death can be determined by this
- It is basically for statistical/ research purposes



Important Information

- MC type of autopsy in India is **Medico-legal autopsy** [as unnatural deaths are more in India]

1ST BODY CAVITY TO BE OPENED DURING AUTOPSY

🕒 00:13:26

- Depends on the case & the person conducting autopsy
- Commonly Thoracic cavity is preferred

I. Poisoning

- Cranial cavity is opened 1st, where smell a/w the poison can be perceived
- Cyanide poisoning gives Oil of bitter almond smell

II. Newborn

- Abdominal cavity is opened 1st
- The purpose of conducting an autopsy in newborn is to know whether the baby is live born or not [i.e respired/

not]

- When the baby starts respiring, expanded lungs pushes the diaphragm down
- Thus, abdominal cavity is opened 1st to check the level of diaphragm
 - If the diaphragm is at lower level, that means baby had respired
 - If the diaphragm is at higher level, that means baby hadn't respired

III. Air embolism

- Open the pericardium & fill the cavity with water.
- Then puncture the ventricle, a case of air embolism shows air bubbles coming out
- Pyrogallol test
 - Ventricle is aspirated with a syringe containing Pyrogallol solution
 - If air embolism is present, it is sucked into the syringe & the color of the solution changes into brown color [+ve pyrogallol test]

IV. Asphyxial death

- Eg. of Asphyxial deaths are Hanging, strangulation, mugging, garroting, bansdola etc
- Most important asphyxial death is throttling
- In throttling, small contusions are seen over the soft tissues of the neck [d/t pressure]
- To demonstrate these contusions & minor injuries, bloodless dissection is done [i.e neck should be opened last]
- To achieve bloodless field, following order of dissection is followed
 - Cranial cavity → Thorax & Abdominal cavity → Neck
- If we dissect the cranial, thoracic & abdominal cavities, all the blood from the body is drained & blood less dissection is achieved while opening the neck

V. Pneumothorax

- Presence of air in the pleural cavity is k/a Pneumothorax
- If thoracic cavity is dissected 1st, all the air in the pleural cavity is dissipated & pneumothorax can't be demonstrated
- Thus, following order should be maintained to demonstrate pneumothorax
 - Open chest cavity --> open skin flap & fill it with water --> puncture the pleura under water --> any air in the pleural cavity escapes as an air bubble

- It confirms the case of Pneumothorax



Previous Year's Questions

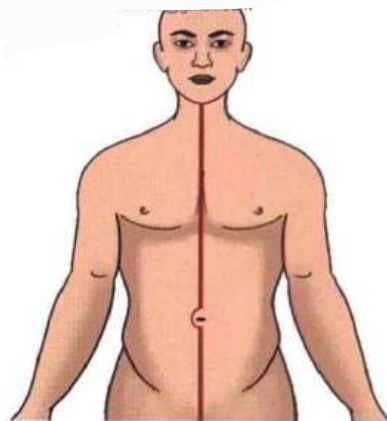
- Q. In autopsy, the doctor tied the bronchus and checked the floating and sinking of the lung. The test is identified as? (FMGE - Aug - 2020)
- A. Getter's test
 - B. Diatom test
 - C. Hydrostatic test
 - D. Ploquet's test

TYPES OF SKIN INCISIONS

00:23:50

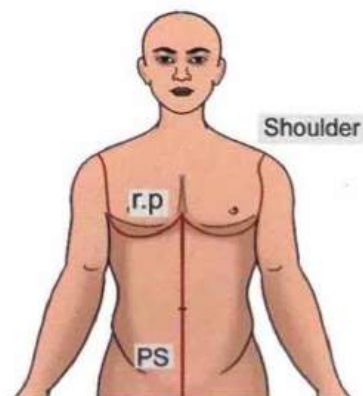
I. 'I' Incision

- Incision starts from the chin, in midline upto pubic symphysis
- It is MC type of incision
- From neck till pelvis, all the organs are opened



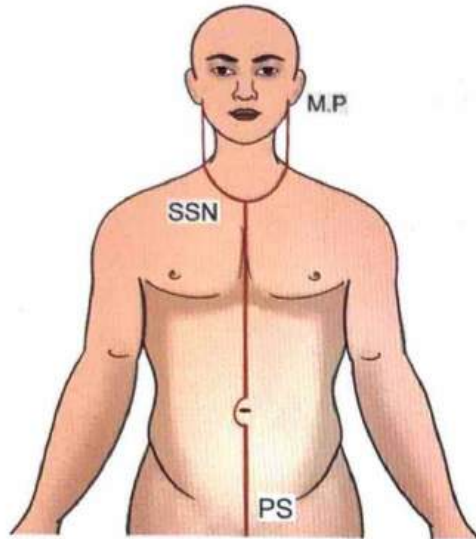
II. 'Y' Incision

- Incision starts from the shoulders [acromion process], comes below the breast, meets at the xiphisternum. From xiphisternum, it comes to pubic symphysis in the midline
- It is cosmetically better incision for females [as incision comes below the breast & isn't obvious]



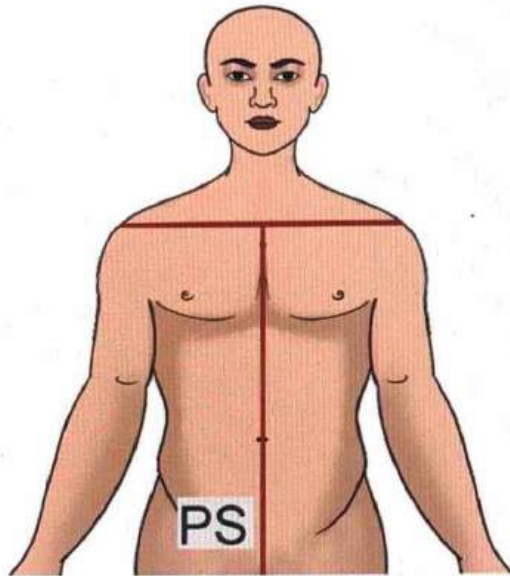
III. Modified 'Y' Incision

- Incision starts from the mastoid process, meets in the suprasternal notch. From suprasternal notch, it comes down to the pubic symphysis in midline
- It helps in examining the neck in detail
- Thus, useful in Asphyxial deaths



IV. 'T' Incision

- One transverse incision from shoulder to shoulder & one vertical incision till pubic symphysis in midline is made [looks like 'T']



V. 'X' Incision

- This incision is made in posterior aspect of the body
- Incision is made from shoulders to opposite sided iliac crests [both sides] giving the shape of 'X'
- Used to find deeper bruises/injuries

- Hence, it is preferred in custodial deaths.

TECHNIQUES OF ORGAN REMOVAL 00:28:30

Refer Table 19.1



Important Information

- Usually in COVID pts. we cant do any kind of autopsy.
- But, if autopsy is absolutely necessary, then Rokitansky technique is preferred, as it is in-situ dissection [no much contamination occurs]



Previous Year's Questions

Q. In autopsy of suspected poisoning, which organ along with stomach part of intestine and liver is preserved? (FMGE - Dec - 2019)

- A. Kidney
- B. Lungs
- C. Brain
- D. Heart

INDIVIDUAL ORGAN DISSECTION 00:34:50

I. Brain

- Ideally, brain has to be dissected after fixation with formalin [10%] for a week
- Sometimes, fresh dissection can also be done
- Among fresh dissection methods, cranial cutting method [multiple cranial slices are made & parenchyma of the brain is studied] is better
- Any injury/ tumor/ abrasion of the brain can be studied easily

II. Heart

- Most commonly used & easy method to dissect heart is Inflow outflow method
- I.e Dissection follows the direction of blood flow in the heart
 - RA → RV → LA → LV [after opening each chamber, examine that chamber]

III. Spinal Cord

- Dissection of spinal cord is cumbersome. Hence, not routinely done
- But, if we suspect any kind of spinal tumors/ injuries, in these cases dissection is done by
 - Anterior dissection method: Open spinal cord from

anterior side

- o Posterior dissection method: Open spinal cord from posterior side

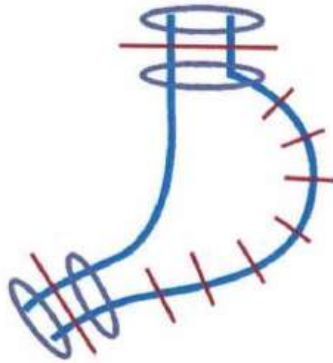


Important Information

- In general, spinal cord is **never opened**
- **Best spinal cord dissection is Posterior dissection method**

IV. Stomach

- Gastric contents should be examined
- Thus, 2 ligatures are put on each end of the stomach [i.e both cardiac & pylorus ends] & make a cut in the middle of ligatures so that gastric contents doesn't escape
- This is k/a double ligation method



- Stomach is opened along the greater curvature
- Particularly in cases of acid intake, maximum damage is seen along the lesser curvature. To examine it, we should open along the greater curvature
- Area where maximum damage takes place in acid intake is k/a Magenstrasse



Previous Year's Questions

Q. In corrosive acid case, stomach is opened along?
(FMGE - Jun - 2019)

- A. Lesser curvature
- B. Greater curvature
- C. Vertical
- D. Pylorus

V. Liver

- Multiple parallel cuts are made along the liver & examine it

VI. Small intestine

- Small intestine is opened along the mesenteric border &

examine inside

VII. Large Intestine

- Open along the anterior tenia

EXHUMATION

00:41:17

- Lawful digging of the already buried body is k/a Exhumation
- Usually required in insurance claims, inheritance claims, in murder cases which are featured as suicide
- Exhumation means only digging the body. 2nd autopsy isn't included in the term Exhumation.
- But, usually in clinical practice, it is combined with autopsy
- Authorization should be from the Magistrate
- A/w (176 (3) CrPC)
- Usually started in early morning. Thus, exhumation is conducted in bright day light
- In India, there is no time limit for exhumation
- Done in the presence of Magistrate, Police & the Doctor
- Identify the site of the body with the help of victim's relatives & slowly start digging it
- About 500 gms of soil samples should be preserved [from all the sides]
- Control soil sample should be taken away from the site



Important Information

Post mortem imbibition

- Any metallic poison present in the soil, can enter into the tissues of the body
- MC metal a/w PM imbibition is **Arsenic**



- Note down the position of the body
- Take all the samples & send it to Forensic science lab
- Send tissue samples for Toxicology
- Preserve the bones & send it for Chemical analysis

Table 19.1

	Organ by organ / Virchow's method	En masse / Lettule's method	En block, / Ghon's method	In situ / Rokitansky technique
Features	<ul style="list-style-type: none"> • Organs are removed one by one • MC method 	<ul style="list-style-type: none"> • Organs are removed at once (cervical, thoracic, abdominal, pelvic) as a single mass 	<ul style="list-style-type: none"> • Organs of targetted region are removed as a block [Cervical/ thoracic/ abdominal/ pelvic blocks] 	<ul style="list-style-type: none"> • Dissection of organs is done inside the body
Merits	Done Faster	<ul style="list-style-type: none"> • Done quickly • Excellent method to study Interorgan relations 	Good method to study Interorgan relations within the block	Ideal for infectious disease [especially in cold conditions] Eg:HIV, Hepatitis etc
Demerits	Interorgan relations can't be studied	Gives large mass, which is difficult to handle		Difficult to carryout in adults



CLINICAL QUESTIONS



28. After the death of 42 yr old HIV +ve man, his body has been sent for post-mortem investigations. What is the best method of organ removal in autopsy of this case?

- A.Letulle's method
- B.Ghon's method
- C.Rokinansky method**
- D.Virchow method

Solution:

Autopsy Techniques		Advantage	Disadvantage
Letulle's	Thoracic, cervical, abdominal, and pelvic organs are removed "en masse," as one big organ block.	<ul style="list-style-type: none"> • The best technique to see relations amongst organs. • Preferred in infants so that congenital abnormalities in different organs can be seen in relation to each other • Rapid technique 	Difficult to handle large mass.
Ghon's	Cervical, thoracic abdominal and pelvic organs are removed in separate blocks (en block)	This method can also be used in Infants	
Virchow's	Organs are removed one by one	Most commonly used technique (easier to perform)	Anatomical relations of organs are not preserved
Rokitansky	In situ dissection (inside the body itself)	Good for <ul style="list-style-type: none"> • infected bodies like HIV, Hepatitis B (prevents spreading of infection) • Radiation hazards • Fetal brain dissection 	•

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no. 109

29. The forensic doctor is about to begin the autopsy of the 50-year-old farmer who had allegedly committed suicide by consuming an organophosphate. The doctor prefers an organ for the detection of the poison as the sample can be collected with ease, a high concentration of toxins can be detected in that tissue, and also because of the availability of a large database of drug concentrations. Which organ is the doctor about to examine?

- A. Stomach
- B. Spleen
- C. Kidney
- D. Liver

Solution:

- Although, spleen and kidneys are also routinely preserved along with liver.

Liver is most important since

1. large amount of tissue is available
2. ease of sample collection, high concentration of toxins
3. availability of large database of liver drug concentrations

- A 100 g of tissue is sufficient for most analysis.
- The **right lobe is preferred** since chances of postmortem diffusion of toxins from bowel contents and mesenteric circulation is less.

Reference: Review of forensic medicine and toxicology by Gautam Biswas, 3rd edition, pg 114.

30. When post-mortem examinations of radioactive cadavers are performed, no special precautions are necessary provided that the radioactivity remaining in the cadaver does not exceed:

- A. 05 mCi of I-131
- B. 11 mCi of I-131
- C. 14mCi of I-131
- D. 31 mCi of I-131

Solution:

- 05 mCi of I-131

PRECAUTIONARY MEASURES IN HANDLING RADIOACTIVE CADAVERS

- The precautions in handling radioactive cadavers depend on the nature and quantity of the radionuclide present and on the type of handling intended (e.g. autopsy or embalming prior to burial).

Post-mortem Examinations

- When post-mortem examinations are performed at places other than treatment centres, no special precautions are necessary provided that the activities remaining in the cadaver who do not exceed 05 mCi of I-131.

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no.659



20 THANATOLOGY

THANATOLOGY

🕒 00:00:18

- Study of Death in all aspects is k/a Thanatology

DEATH

- Irreversible Cessation of Circulation, Respiration & Brain function is k/a death
- Defined under 46 IPC

Somatic / Clinical Death

- When a pt. is dead & brought to you in unconscious state.
- Check for vital signs i.e.
 - Circulation [carotid pulse]
 - Respiration [beath sounds]
 - Brain functions [pupillary response]
- If there is absent carotid pulse, absent breath sounds, fixed dilated pupils; then declare the person as dead
- This is called as somatic / Clinical death (Doesn't mean that cells in the body are dead. It is only the stoppage of clinical signs)

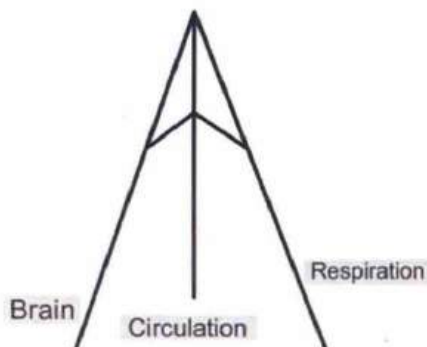
Molecular Death / Cellular Death

- Every cell in the body dies after some time
- This stage is called as molecular death / cellular death
- There is a gap b/w somatic & molecular death which is k/a Supra – vital period [Pt. is clinically dead, but the cells are viable]
 - It is golden Period for Cadaveric organ harvesting
- Zasko's Phenomenon: Tap on quadriceps muscle results in Knee Jerk.
- Application of drugs on pupil results in Pupillary response

🕒 00:05:03

BISHOP'S TRIPOD OF LIFE

- Life is like a tripod, as it stands on 3 important limbs. They are
1. Respiration
 2. Circulation
 3. Brain function



- Even if one of these functions is stopped, the person cannot live, even if other 2 functions are normal (all the 3 limbs are imp for a person to live)
- This is called *atria mortis* / *gate way of death*
 - If respiration stops, the person goes into asphyxia
 - If circulation stops, the person goes into syncope
 - If brain function stops, the person goes into Coma.

APPARENT DEATH

🕒 00:09:01

- The person looks like dead, but he is not dead
- This is k/a Suspended Animation (SA)
- It is temporary stoppage of the life signs
- The BMR is so low that the clinical signs are not detectable.
- If CPR is given to this person, he can come back to life

Condition in which suspended animation is seen

- I – Iatrogenic / Induced
- N – New borns (MCC)
- E – Electrocutation
- W – Wasting diseases like Cholera, T.B, cachexia
- H – Heat stroke / Hypothermia
- D – Drowning
- T – Typhoid (enteric fever)
- V – Voluntary practice
 - A person can voluntarily induce S.A
 - Eg. Yoga practitioners



How to remember

- In NEW HD T.V

- Premature certification of death [i.e the person is declared dead while he is in suspended animation] is punishable

POST-MORTEM (PM) CHANGES

🕒 00:12:08

Refer Table 20.1

EYE CHANGES

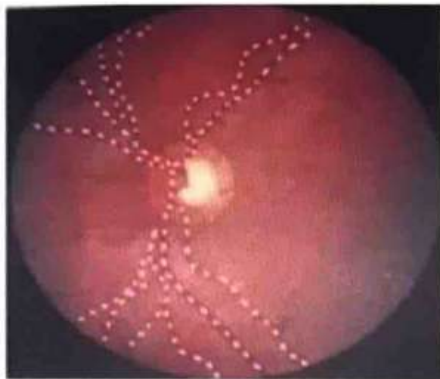
🕒 00:15:06

1. Retina
 - Retina is checked with an ophthalmoscope

- Fragmentation/Segmentation of retinal vessels is seen



- It occurs d/t stoppage of blood circulation after death
- It looks like a railway track. Thus, it is also k/a Tram track appearance/ Kevorkian sign
- It is seen within few minutes after death
- It is earliest eye sign seen after death
- Helps us to find out Time since death (T.S.D)



2. Loss of I.O.P (Intra Ocular Pressure)

- Normal I.O.P = 20 mm of Hg
- Within half/ 2hrs after death, I.O.P decreases gradually from 20 mm of Hg to 0 mm of Hg
- Helpful in detecting T.S.D

3. Cornea

- Normally, cornea is transparent
- After death → Cornea becomes hazy in 1 hour
- Hazy cornea becomes opaque cornea within 6 hrs.



Hazy cornea

4. Tache Noire Sclerotique

- After death, if the eyelids are open; dust present in the atmosphere will get deposited in sclera, resulting in 2 brownish Δ lar shaped opacities on either side of the cornea k/a Tache Noire Sclerotique

- Appear in 3-6 hrs after death
- Helpful in detecting T.S.D



TACHE NOIRE SCLEROTICA

5. Vitreous humor

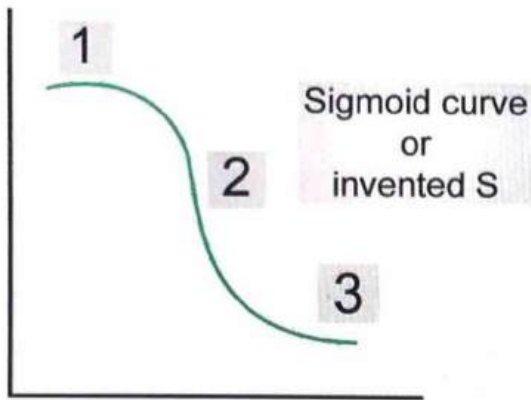
- It is the most important medium in eye, which resists putrefaction
- It is the best medium for estimating T.S.D
- As it is enclosed within eyeball; bacteria cannot have access to it easily
- So, even in advanced decomposed body, this medium is very helpful
- Best parameter is vitreous potassium levels
- It has Linear Correlation with T.S.D
- 2 formulae for finding T.S.D
 - Sturmer's Formula
 - Madea's Formula

ALGOR MORTIS

00:24:39

- Also called as PM cooling of the body/ P.M chill
- It is decrease in Body Core Temperature (BCT) after death
- Site for recording BCT
 - Rectum (Common site)
 - Sub-hepatic space (Ideal site)
- Instrument used to record BCT
 - Thanatometer / Chemical thermometer
 - It is 25 cms long
 - Calculated b/w 0°C – 50°C [serially]

Pattern of decreasing BCT



- It starts in 15 mins after death
- **Occurs in 3 phases**
 - 1st phase: Gradual decrease in BCT
 - 2nd phase: Rapid decrease in BCT
 - 3rd phase: Gradual decrease in BCT
- Shape of Algor mortis curve is Sigmoid
- Rate of fall of temperature is $0.4^{\circ}\text{C} - 0.7^{\circ}\text{C/hr}$
 - i.e Summer: 0.4°C/hr ; Winter: 0.7°C/hr
 - Average is 0.5°C/hr
- By knowing the rate of fall, we can calculate T.S.D

$$\text{TSD} = \frac{\text{NBT} - \text{BCT (RT)}}{\text{Rate of fall of Temp.}}$$

- N.B.T = Normal body temp
- BCT = Body core temp
- R.T = Rectal temp
- ROF = Rate of fall of temp

PM CALORICITY (CALOR = HEAT) ⌚ 00:30:31

- Normally, the body becomes cold within 15mins after death [Algor mortis]
- But, if the body remains warm for 1-2 hrs even after death, it is k/a PM caloricity.
- Whenever there is increased B.C.T at the time of death, PM caloricity is seen.
- Increased BCT at death is seen in
 - Conditions with increased Muscle contraction i.e
 - Tetanus
 - Strychnos Nux vomica poisoning
 - Exercises etc
 - Defective thermoregulation in the body
 - Heat stroke
 - Pontine hemorrhage [have pyrexia, paralysis, pin point pupils]
 - Septicemia

LIVOR MORTIS ⌚ 00:34:05

- Aka Post mortem staining / PM hypostasis (blood pools

down) / Cadaveric lividity / PM lividity / Suggillation / Vibices

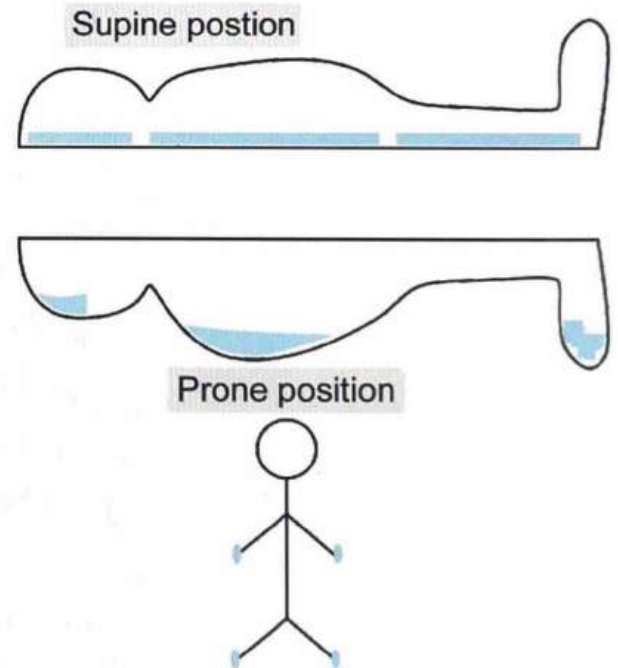
Mechanism of livor mortis

- After death, blood in the body pools down in the vessels of (capillaries & venules) dependent parts, resulting in staining

Distribution of hypostasis/ Livor mortis

Position	Dependent parts/ Hypostasis is seen in
----------	--

- | | |
|------------------------|---|
| • Supine position | • Back of head (not in contact with ground), back of chest, abdomen, legs are dependent parts |
| • Prone Position | • Front of face, front of chest, front of abdomen, front of legs |
| • Vertically suspended | • Lower part of forearm & lower part of legs
• i.e Glove and stocking distribution
• Seen in hanging cases. |
- Depending on the distribution of hypostasis we can find the position of the body



Vertically suspended position [Glove & stocking distribution]

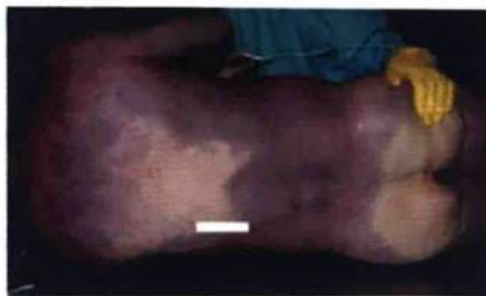
- If the body is continuously changing its position, we can't find any fixed dependant part. Hence, hypostasis is absent
- Eg. If the body is in river with continuously flowing water
 - D/t fast flowing of water in river, body will be rolling & there is no fixed dependent part.
- L.M is absent, at the places in the body, which are in tight contact with the ground (i.e pressure points) k/a contact pallor.
- In Supine position, pressure points are at back of head, shoulder blades, gluteal region, back of foot. Thus, in these parts Livor mortis is absent
- Even if the pt. has tight collar/ wear tight belt, it forms Contact pallor



Previous Year's Questions

Q. Which of the following is present in the image below?

(AIIMS - May - 2019)



- A. Rigor mortis
- B. Algor mortis
- C. Suggillation
- D. Marbling

STAINING

- Color of hypostasis gives clue regarding cause of death

Refer Table 20.2

🕒 00:41:27

- Based on the color of hypostasis, we can find cause of death (COD)

Timings

🕒 00:40:13

- Onset is 30 mins after death & starts as a small patch
- Visible prominently in 2 hrs
- Max hypostasis seen in 6-12 hrs [all patches merge

together]

• Fixation of hypostasis

- Hypostasis will be fixed at that particular body part. After this, even if we move the body, hypostasis will not change
- Time limit for fixation is 8hrs after death
- When we apply pressure on livor mortis area, if it blanches (become pale), hypostasis is not fixed yet
- If it isn't blanching even after applying pressure, it is fixed

• Medico-legal importance

- By looking at hypostasis we can know
 - T.S.D (Time Since Death)
 - Position of the body
 - Cause of death (Depending on color of hypostasis)

Muscle changes after death

- Immediately after death, the muscles are flaccid
 - It is k/a Primary flaccidity
- If we check the tone of muscles, after sometime it becomes rigid/stiff
 - It is k/a Rigor mortis
- After few days, it become stiff again
 - It is k/a Secondary flaccidity
- It depends on ATP levels

Refer Flow Chart 20.1

RIGOR MORTIS

🕒 00:52:33



- Aka cadaveric rigidity/ Cadaveric stiffening
- Gives muscle status after death of a person
- Decrease in ATP causes stiffening of the muscle.
- Rigor mortis is generalized i.e seen in both voluntary & involuntary muscles.
- 1st seen in involuntary muscles

CONDITIONS THAT STIMULATE (LOOK LIKE) R.M.

01:04:50

1. Cadaveric Spasm

- Aka instantaneous rigor i.e Occurs immediately after death
- Commonly seen in cases of drowning deaths
- It is spasm of group of voluntary muscles which are used at the time of death
 - Grass clenched in the hands, in drowning
 - Weapon [gun] in hand, in suicides
- It is purely Antemortem Origin
- It cannot be produced artificially
- Primary relaxation phase is absent
- Manner of death can be known



Cadaveric Spasm



Previous Year's Questions

Q. True about pugilistic attitude?

(AIIMS - May - 2018)

- A. Indicate only antemortem burn
- B. Indicate only postmortem burn
- C. Cannot differentiate between antemortem & Postmortem burn
- D. Indicate defense by victim during antemortem death



Previous Year's Questions

Q. In the case of RTA. the dead body showed spasm of a group of muscles immediately after death. In which of the following conditions primary relaxation is not seen? (FMGE - DEC 2020)

- A. Heat stiffening
- B. Cold stiffening
- C. Cadaveric spasm
- D. Rigor mortis

2. Heat stiffening

- Whenever the muscle is exposed to heat, there is muscle protein coagulation
- D/t this the muscles become Stiff
- Heat stiffening is also called as Boxer's Attitude / Pugilistic attitude / Défense Attitude [all the joints will be flexed]

3. Cold stiffening

- When we freeze the body, all the body fluids become ice crystals
- D/t this Joints cannot move & becomes stiff k/a Cold stiffening

4. Gas stiffening

- Occurs d/t intense accumulation of gas
- Seen with decomposition
- During decomposition, there is excess gas production
- These gases get accumulated in the body, resulting in stiffness of the body



Gas stiffening

LATE CHANGES

01:11:43

- Body gets decomposed
- Occurs by 2 processes
 - I. Autolysis: Body is lysed by own enzymes
 - II. Putrefaction: Body is lysed by enzymes of external bacteria

Autolysis

- Due to lysosomal enzymes
- Externally 1st sign is clouding of cornea
- Eg. Maceration (Type of aseptic autolysis)

Putrefaction

- Due to bacteria
- Most imp bacteria involved is clostridium welchii, with the help of enzyme Lecithinase
- So clostridium welchii is known as chief destructive agent of putrefaction.
- Occurs in 3 stages
 - Color change
 - Gas production
 - Liquefaction of tissues.

Colour change

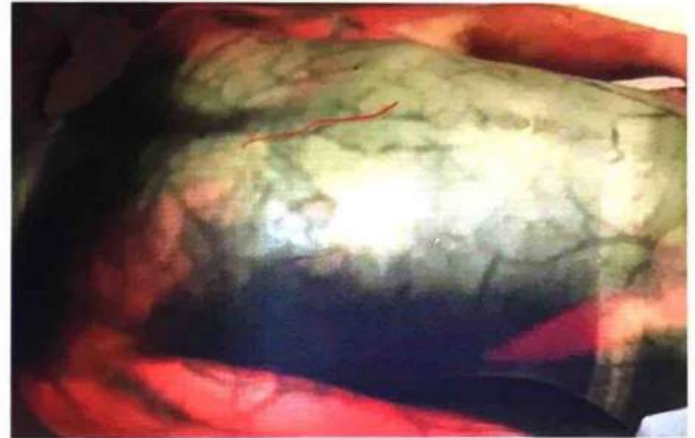
- 1st internal site / Overall Site: Reddish / Brownish discoloration at Aortic Lumen (intima)
- 1st site Externally is greenish discoloration at Right iliac fossa
 - R.I.F. have caecum which contain lot of bacteria & is very close to the skin (superficial)
 - Loads of bacteria forms H₂S which combines with Hb & form sulf-Hb
 - This is green in colour. Thus, we find greenish discoloration in R.I.F.
 - This is 1st external sign of putrefaction/ decomposition
- In Summer, it occurs in 12-18 hrs after death
- In Winter, it occurs in 24-36 hrs after death
- It is used to find TSD



Marbling

- Bacteria like clostridium multiply along the blood vessels

- & produces H₂S gas
- H₂S combines with Hb & forms sulf-hemoglobin
- This sulf-Hb stains vessel walls giving greenish, linear branching pattern on the skin [Corresponding to vascular channels]
- This is k/a Marbling
- Appearance of marbling = 36-72 hrs after death
- It helps to determine T.S.D



Marbling

Differences b/w marbling & filigree burns

Marbling	Arborescent burns/ Filigree burns
<ul style="list-style-type: none">• Occurs d/t putrefaction• Greenish• Follows vessel wall	<ul style="list-style-type: none">• Occurs d/t lightning• Erythematous/ pinkish• Doesn't follow vessel wall



Previous Year's Questions

Q. Identify the Phenomenon?

(INICET - NOV - 2020)

- A. Filigree Burn
- B. Marbling
- C. Hypostasis
- D. Poisoning

Gas production

- Predominant gas produced in decomposition is H₂S
- This gas gets accumulated in the body resulting in stiffening k/a gas stiffening
- Gas in skin at dermo - epidermal Junction results in Blister Formation

	Post mortem Blister	Burns blister (Ante – mortem)
Content	Air (Gas bubble)	Inflammatory fluid (↑ protein & Cl)
Base	Pale	Redness around blister is seen with Erythemic base



Gas stiffening



Postmortem blister

PM Purge

- It is bleeding from the nostrils
- Due to excess accumulation of gas, blood vessels/ capillaries rupture, resulting in oozing of blood from nostrils
- Sometimes, PM delivery also occurs due to ↑ in pressure in abdomen
- PM prolapse of uterus / rectum can occur d/t gas accumulation

LIQUEFACTION OF TISSUES

🕒 01:23:33

- Takes 5-10 days
- Loosening of hair/ nails, occur in 3-5 days
- Skin around the hands & legs peel off i.e Degloving /

Destocking pattern is seen. It Occurs in 5-10 days

ORDER OF ORGANS IN PUTREFACTION

🕒 01:25:58

1. Larynx / Trachea – 1st site (Earliest organ to putrefy)
 2. Stomach
 3. Intestine
 4. Spleen
 5. Liver / Lung
 6. Brain
 7. Heart
 8. Prostate / Uterus (non-gravid uterus decompose early)
 9. Skin
 10. Tendon
 11. Bone / Tooth: Last organ to decompose
- Mnemonic: SiSter Lilly's Brittle Heart

? Previous Year's Questions

- Q. Which of the following is the first organ to putrefy? (NEET - Jan - 2018)
- A. Brain
 - B. Heart
 - C. Prostate
 - D. Kidney

POST – MORTEM LUMINESCENCE

🕒 01:29:02

- Glowing of the body after death
- Occurs d/t
 1. Bacteria: Photobacterium
 2. Fungus: Armillaria

CASPER'S DICTUM

- It is about rate of putrefaction in different medium
- Rate of putrefaction is compared b/w 3 imp medium

Air [fastest putrefaction]	Water	Earth [slowest putrefaction]
----------------------------	-------	------------------------------

If a body takes 1 week in air for putrefaction,

It takes 2 weeks for same amount of putrefaction

Takes 8 weeks

- Its ratio of putrefaction in air: water: earth

MODIFIED FORMS OF PUTREFACTION

🕒 01:32:00

1. ADIPOCERE [WAX LIKE SUBSTANCE]

- Aka Grave wax/ Saponification
- Fat in the body gets converted into fatty acids; combines with Ca^{+2} in body & forms insoluble wax like substance i.e adipocere (SOAP)
- When adipocere is formed, it is preserved for longer time
- It is Hydrolysis and hydrogenation of fat
- Factors required for conversion are
 - Warm, moist climate
 - Clostridium welchii (lecithinase)
 - Intrinsic lipases (lipases within the body)
- Most predominant fatty acid is Palmitic acid
- Acidic medium Inhibits the multiplication of bacteria (Further putrefaction is inhibited)
- Hence the body is preserved
- Smell of adipocere: Ammoniacal
- Appearance
 - Fresh: greasy; Looks like rancid butter Later
 - Old adipocere: grey/white, brittle



Old adipocere

- Adipocere is formed in 3 days to 3 months

Medico – legal importance of adipocere

- Identification (as the body is preserved)
- Place of disposal (climate of that place)
- Time since death can be determined

2. MUMMIFICATION

🕒 01:35:59



- When the body is exposed to dry / hot climate, drying & dehydration of the body occurs resulting in mummification
- Body size is shrunken
- There is loss of weight [$>70\%$ weight is lost]
- No specific smell / Odourless
- Time: 3months – 12 months
- Mummification is also seen in intrauterine death of fetus, when there is intact membranes & deficient blood supply
- Arsenic & Antimony favour mummification

Natron

- Body is covered with salt for nearly 41 days
- This salt absorbs all the moisture content from the body & gets dehydrated
- Then, the chemicals are added



Important Information

Basic principle in mummification is Dehydration

Medicolegal importance of mummification

- Place of disposal can be known (hot & dry climate)
- Time taken → 3 months – 12 months

EMBALMING / THANATOPRAXIA

🕒 01:39:30

- Artificial method of preserving the body by injecting anti-septic's & preservatives
- Exhumation is lawful digging of the body
- Ideal Time for embalming: < 6 hrs after death (Very effective)

Components of embalming fluid

1. Preservative
 - It is mixture of formaldehyde, formalin, Glutaraldehyde, methanol (sometimes)

2. Germicide (Antiseptic): Phenol
3. Wetting agent (moisturing agent to prevent drying of body): Glycerol
4. Buffer: Sodium citrate / sodium carbonate / sodium borate
5. Dye: Eosin
- All these are injected with a diluent vehicle i.e water [10litres]



Important Information

- Ethanol is not a component of embalming fluid

Types of embalming

1. Arterial embalming (Best): Inject fluid into capillaries
2. Cavity embalming: injecting the fluid into cavity
3. Surface embalming
4. Hypodermic embalming: Injecting the fluid into skin

Method of injecting this solution into body

- How to inject: By Electric motor
- Best method is Discontinuous injection & discontinues Drainage
- High Pressure / Low Volume Injection for better perfusion
- Best vessel is Femoral artery
- Colour
 - Normally brown in colour
 - Greenish discoloration is seen in jaundiced patients
→ Formalin + Bilirubin forms Biliverdin which is green colour
- Embalming can never be done prior to autopsy in poisoning cases
 - Poison cannot be detected after embalming. It destroys evidences. Thus, it amounts to disappearance of evidence
 - It is Punishable under 201 I.P.C
- So, embalming should be done only after receiving the death certificate.



Previous Year's Questions

- Q. First PM change in a dead body? (FMGE - May - 2018)
- A. Maggot formation
 - B. Putrefaction
 - C. Greenish discoloration of right iliac fossa
 - D. Mummification



Previous Year's Questions

- Q. Which of the following is not used as a preservative in chemical analysis? (NEET-Jan-2019)
- A. Glycerine
 - B. Formalin
 - C. Rectified spirit
 - D. Salt solution

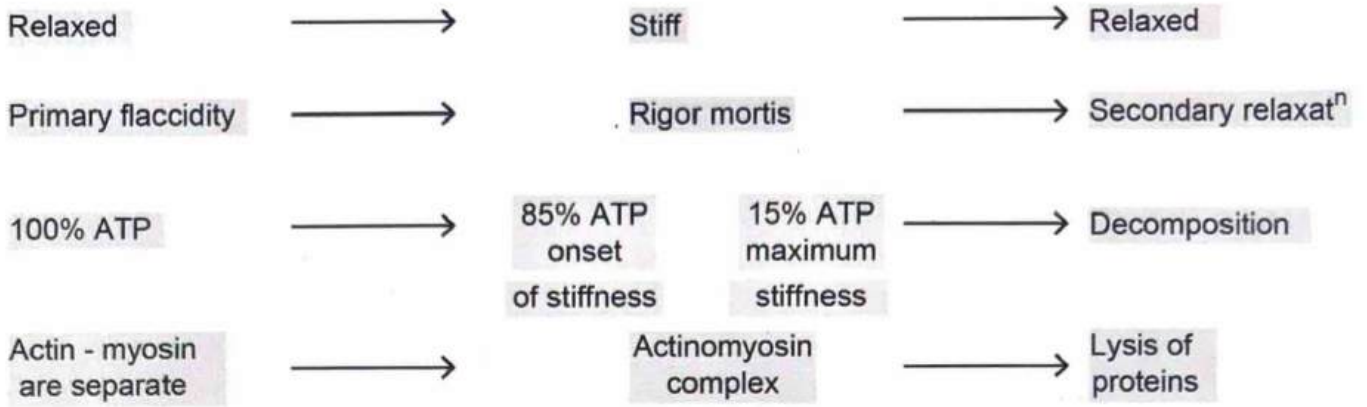
Table 20.1

Immediate changes	Early changes	Late changes
<ul style="list-style-type: none"> • Seen within few minutes 	<ul style="list-style-type: none"> • Seen within hours to days 	<ul style="list-style-type: none"> • Seen in days to months
<p>Includes</p> <ul style="list-style-type: none"> • Loss of Vol. Movement & Unresponsiveness) • Cessation of respiration • Cessation of circulation 	<p>Includes</p> <ul style="list-style-type: none"> • Skin Changes [loss of elasticity] • Eye changes • Algor mortis • Livor mortis • Rigor mortis 	<p>Includes</p> <ul style="list-style-type: none"> • Decomposition <ul style="list-style-type: none"> ○ Autolysis [self- destruction using lysosomal enzymes, without bacterial involvement] ○ Putrefaction [with help of bacteria]

Table 20.2

Color of Livor mortis	Cause of death
<ul style="list-style-type: none"> • Normal 	<ul style="list-style-type: none"> • Bluish / purple due to de-oxy haemoglobin
<ul style="list-style-type: none"> • Cherry red hypostasis 	<ul style="list-style-type: none"> • Due to excess free O₂ in the blood • Co poisoning
<ul style="list-style-type: none"> • Brick red hypostasis 	<ul style="list-style-type: none"> • Due to excess free O₂ in the blood • Cyanide poisoning
<ul style="list-style-type: none"> • Bluish - Green hypostasis 	<ul style="list-style-type: none"> • Due to excess sulf-Hb • H₂S poisoning
<ul style="list-style-type: none"> • Brown colour hypostasis 	<ul style="list-style-type: none"> • Due to excess Meth-hemoglobin • Mnemonic: PAN <ul style="list-style-type: none"> ○ Phosphorous, Kclo₃ ○ Aniline poisoning [sometimes blue] ○ Nitrites poisoning
<ul style="list-style-type: none"> • Black 	<ul style="list-style-type: none"> • Opium poisoning
<ul style="list-style-type: none"> • Purple 	<ul style="list-style-type: none"> • Methanol

Flow Chart 20.1





CLINICAL QUESTIONS



Q. While reporting to the police who are investigating the death of the 30-year-old actress, the forensic team was enquired about the possible time frame of the murder. The forensic team has an approximate time of death which they determine from various observations. In the eyes, 'trucking' or segmentation of retinal blood vessels is one of the first observable signs. This sign presents as a break in the continual column of blood on ophthalmoscopic examination of the eyes, and usually occurs within half an hour and may sometimes take as long as 2 hours after death. The skin loses its elasticity and luster within the first few hours after death and appears pale. Histological examination of the skin, however, shows no morphological changes within 6 hours post-mortem. All of the following can also be studied by the team to narrow the time frame of death, except?

- A. Cadaveric spasm
- B. Algor mortis
- C. Rigor mortis
- D. Livor mortis

Answer: A

Solution

Cadaveric spasm	Manner of death, last act of the person
Algor mortis	Time since death
Rigor mortis	Time since death, Position of the body
Livor mortis	Time since death, Position of the body, Cause of death

Reference: The Essentials of Forensic medicine and Toxicology, Dr. K.S. Narayana reddy and Dr. O.P. Murty, 33rd edition, Page no.162

Q. A group of National Geographic documentators was scouring the marshes for a good location to shoot the next episode of "Man in the Wild" when they accidentally discovered the remains of a corpse among the vegetation. They immediately informed the concerned authorities and the body was collected by the forensic team for further investigation. There was a thick layer of adipocere formation which the team knew would have preserved certain features and injuries that would aid in the determination of identity and in the cause of death of the body. Which among the following statements is not true of adipocere formation?

- A. It's a modification of putrefaction
- B. Its developed in the presence of moist air

- C. It occurs in dead bodies lying in water
- D. Body has rotten & foul smell

Answer: D

Solution

- Adipocere has rancid butter/ ammoniacal smell
- Mummification is odourless
- Decomposition is foul smelling

Factors Influencing Adipocere Formation :

A warm, moist and anaerobic environment favours adipocere formation.

- **Environmental temperature:** Heat accelerates, and cold retards adipocere formation in a body.
- **Moisture:** Moisture is essential for chemical reactions to occur. It occurs rapidly in bodies submerged in water than in damp soil.
- **Bacterial infection:** Early activity by anaerobes such as *Clostridium perfringens* assist in the reaction, as the bacteria produce lecithinase which facilitates hydrolysis and hydrogenation.
- **Built:** In obese people and mature new-born, it is formed quickly.
- **Age:** Fetus < 7 months do not show adipocere formation.
- **Air current:** It retards adipocere formation by evaporation of the body fluid, and by reducing the body temperature.
- **Running water:** Retard adipocere formation as electrolytes are washed away from the surface of the body which is necessary for the change.
- **Time Required for Adipocere Formation :**
- The rate of adipocere formation is extremely variable.
- In temperate countries, the shortest time for its formation is about three weeks in summer.
- it may occur as early as in 3 days in very hot and humid climate.
- Completion requires at least **three weeks to three months**

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no.171



21 HUMAN IDENTIFICATION (PART - 1)

00:00:13

- Identification is determination of individuality of a person

PARAMETERS FOR IDENTIFICATION OF PERSON

00:01:30

1. Partial / Incomplete identification/ Presumptive identification

- Race
- Age
- Sex
- Stature/ height

2. Complete / Definitive identification parameters

- Finger printing / Dactylography: Most reliable method of identification
- DNA Finger printing: It will not differentiate b/w monozygous twins
- Lip printing
- Palato-prints

CORPUS DELICTI

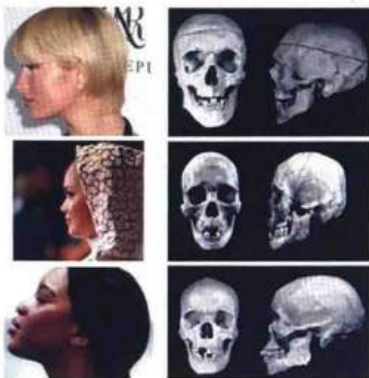
00:04:07

- Also termed as body of offence / essence of crime.

1. RACE

00:04:54

- 3 main Races are
 - **Negroid:** Include Africans / Aryans
 - **Caucasoid:** Include Europeans / Chinese
 - **Mongoloid:** Include Japanese
- Indians come in b/w Caucasoid & Negroid features

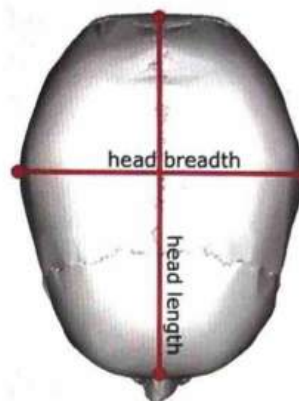


Determination of Race by

- Eyes, Hair Complexion/ Texture, Skin
- Bones: Skull (Best), Long Bones
- Teeth

Bones

- Best bone for race determination is skull



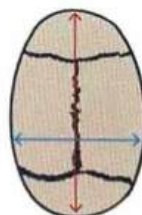
- Max. transverse length & max. longitudinal length of the skull is measured.



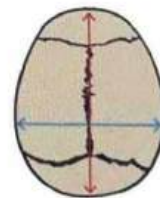
Important Information

$$\text{Cephalic index: Ratio} = \frac{\text{Max Breadth}}{\text{Max length}} \times 100 = \frac{B}{L} \times 100$$

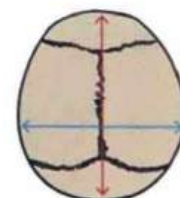
- 70-74.9 is Dolichocephalic, seen in Negroids
- 75-79.9 is Mesaticephalic, seen in Caucasoid
- 80-85 is Brachycephalic, seen in Mongoloid
 - Indian Skull is in mesaticephalic category i.e. Caucasoid with few Negroid features.



Dolichocephalic <75%



Mesocephalic 75-80%



Brachycephalic >80%





Previous Year's Questions

Q. Pure Aryans have which type of skull ?

(FMGE May 2018)

- A. Brachycephalic
- B. Mesocephalic
- C. Dolichocephalic
- D. All of the above

	Negroid	Caucasoid	Mongoloid
Orbit	Square	Triangular	Round
Palate	Rectangular	Triangular	Round

Other indices for race determination

🕒 00:13:41

1. Brachial index = $\frac{\text{Length of radius (R)}}{\text{Length of Humerus (H)}} \times 100$
2. Crural (Crus) Index = $\frac{\text{Length of tibia (T)}}{\text{Length of femur (F)}} \times 100$
3. Intermembral Index = $\frac{\text{Length of (H+R)}}{\text{Length of (F+T)}} \times 100$

Teeth

🕒 00:15:46

- **Caucasian**
 - Have Carabelli's cusp i.e, have additional Cusp in molar.

Caucasian



Distal



Carabelli cusp

Mesial

- **Mongoloids**

- Have "SET"
- S - Shovel Shaped incisor



→ E - Enamel pearl seen with premolar



→ T- Taurodontism i.e Bull tooth with wide pulp cavity [tooth itself is big].

Mongoloid



Negroid



Additional cusps in molars

2. AGE DETERMINATION [Parameters]

🕒 00:18:41

- Ossification of long bones
- Skull Sutures
- Dentition

In fetus,

- Rule of Hasse, is used to determine gestational age of the fetus.
- Crown to heel length (CHL) is used to determine gestational age of the fetus.
 - 1st 5 months = $\sqrt{\text{CHL}} = \text{GA}$ (Rule of Hasse)
 - 2nd 5 months = $\text{CHL}/5 = \text{GA}$ (Morrison's rule)
- CRL = Crown to rump length
 - $\text{CRL} = \text{CHL} \times \frac{2}{3}$; $\text{CHL} = \text{CRL} \times \frac{3}{2}$

Fetal Examination

🕒 00:22:19

- As per, rule of Hasse, fetal length in each month of gestational age are

X Ray Elbow

- Elbow joint includes lower end of Humerus, upper end of ulna & upper end of radius
- We have 6 centers
- Sequence of appearance of ossification center in elbow joint
 - C - Capitulum: 1 yr
 - R - Radial Head: 5 yrs
 - I - Inner/Medial Epicondyle: 6 yrs
 - T - Trochlear: 9 yrs
 - O - Olecranon (Tip): 9 yrs
 - E - External/Lateral Epicondyle: 11 yrs



How to remember

• CRITOE

- Lateral epicondyle, capitulum, trochlea fuse to form conjoint epiphysis & then fuse with humerus
- Medial epicondyle directly fuses with the main bone [humerus].
- Complete fusion of elbow joint occurs by 16 yrs



- In females, the ossification centers fuses, 1 year earlier than males, due to hormonal changes.

Complete fusion of upper limb joints

- Shoulder joint: 18 years
- Elbow joint: 16 years
- Wrist joint: 18 years

For lower limb joints fusion occurs by

- Hip joint: 17 years
- Knee joint: 18 years
- Ankle joint: 17 years

🕒 00:41:20



Previous Year's Questions

- Q. A 14 year old female was claimed to be kidnapped on interrogation she claims that she is not a minor and left home with the person on her own well count ordered for her age estimation. Given below are the X-ray of pelvis. Wrist and bilateral elbow. What is her most probable age based as these?

(AIIMS May 2018)



- A. 14 years
 - B. 16 - 17 years
 - C. 17 - 19 years
 - D. 21 - 22 years
- D. Indicated defense by victim antemortem death



Previous Year's Questions

- Q. X-ray showing fusion of sternal body body segments and fusion of medial end of clavicle. The approximate age is? (INICET Nov 2020)

- A. More than 15 years
- B. More than 18 years
- C. More than 22 years
- D. More than 25 years

AGE ESTIMATION FROM SKULL

🕒 00:42:26

- Done from fontanelles & sutures

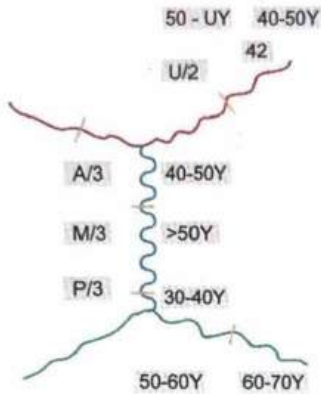
Skull fontanelles

- Lambda / Posterior fontanelle closure occurs by 3 months
- Metopic suture fuses by 9 months
- Bregma/Anterior fontanelle closure occurs by 18 months/2 years

Sutures

- Sagittal suture is divided into 3 parts

- Posterior 1/3: fuses by 30 to 40 years
- Anterior 1/3: fuses by 40 to 50 years
- Middle 1/3: fuses in > 50 years
- Coronal suture is divided into 2 parts
 - Upper half: fuses by 50-60 years
 - Lower half: fuses by 40-50 years
- Lambdoid suture is divided into 2 parts
 - Upper half: fuses by 50-60 years
 - Lower half: fuses by 60-70 years



Important Information

- Spheno-occipital closure i.e Junction between basiocciput & basisphenoid closes / fuses by 18 to 21 years

AGE ESTIMATION FROM DENTITION

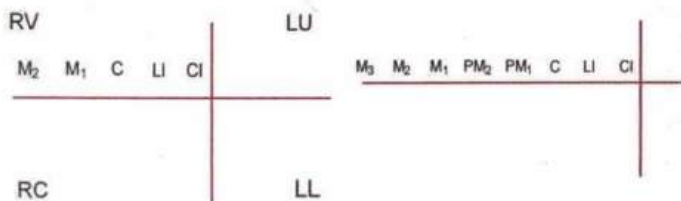
Include

🕒 00:47:10

- Primary/temporary dentition
- Secondary/permanent dentition

Primary Teeth	Secondary Teeth
---------------	-----------------

- | | |
|--|--|
| <ul style="list-style-type: none"> ● Temporary Teeth <ul style="list-style-type: none"> ○ Aka Milk / deciduous teeth ○ Have 20 temporary teeth | <ul style="list-style-type: none"> ● Permanent teeth ● Have 32 permanent teeth |
|--|--|



- | | |
|---|---|
| <ul style="list-style-type: none"> ● There are 5 teeth in each quadrant ● Thus, total teeth= 5x4= 20 temporary teeth. | <ul style="list-style-type: none"> ● There are 8 teeth in each quadrant ● Thus, total teeth= 8x4=32 permanent teeth |
|---|---|

Sequence of eruption of temporary teeth

- Central incisor [I] → Lateral incisor → Molar-1[M1] Canine [C] → Molar-2 [M2]
- Age of appearance [Rule of half dozen]
 - I - I: 6 months
 - M - M₁: 12 months
 - C - C: 18 months
 - M - M₂: 24 months



How to remember

- IM CM

- 1st temporary tooth to erupt is lower central incisor
- Then Upper central incisor upper lateral incisor lower lateral incisor appears in sequence

Permanent teeth eruption in sequence

🕒 00:53:40

Permanent teeth	Average Age of eruption
M - Molar ₁	6 years
I - Central Incisor	7 years
I - Lateral Incisor	8 years
P - PreMolar ₁	9 years
P - PreMolar ₂	10 years
C - Canine	11 years
M - Molar ₂	12 to 14 years
M - Molar ₃	17 to 25 years (wisdom tooth)



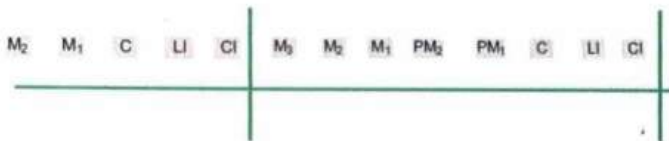
How to remember

- Mama Is In Pain. Papa Can Make Medicine

- Temporary dentition is complete by 2 years [complete teeth=20]
- By 6 years, permanent dentition starts, 4 molars are added [complete teeth=24]
- B/w 6-11 yrs, there is gradual replacement of temporary

teeth by permanent teeth

- o This is k/a Period of mixed dentition [have both temporary & permanent teeth]



Important Information

Successional teeth

- Set of permanent teeth which replaces and comes in place of temporary teeth is called **Successional teeth**
- These are 20 teeth

Superadded teeth

- Set of permanent teeth that comes by itself without replacing temporary teeth [i.e added itself] is k/a **superadded teeth**.
- These are 12 teeth
- Include all permanent molars M_1, M_2, M_3

- Total number of teeth in 6 to 11 years = 24 teeth
- No. of permanent teeth between 6 to 11 years [mixed dentition period] = $(Age - 5) \times 4$



Previous Year's Questions

Q. Total number of teeth at the age of 12 years?
(FMGE May 2018)

- A. 12
- B. 20
- C. 28
- D. 30

Age estimation by other methods

01:02:40

1. Boyde's method

- Most reliable method used in neonatal period
- Principle: Enamel grows at a rate of $4 \mu / \text{day}$
- Under electron microscope, it appears as incremental lines/ Haustrations/ Striae of retzius
- As the child grows, these lines keep on added
- Darkest line is k/a neonatal line, which appears by $2^{\text{nd}}/3^{\text{rd}}$ day of life
 - o Neonatal line is an indicator of live birth.

- Age is determined by counting the number of incremental lines

2. Stack's formula

- Age is determined by the weight & height of the tooth.
- More reliable in infants

3. Gustafson's Method (Obsolete)

- Based on secondary changes in the teeth (particularly after > 21 yrs)
- Anterior teeth are more reliable
- Incisors are more reliable & Molars are not reliable
- Include
 - o S – Secondary dentin (2^{nd} most reliable)
 - o C – Cementum apposition
 - o R – Root resorption
 - o I – Attrition
 - o P – Parodontosis [changes around the gums]
 - o T – Transparency of root (Most reliable parameter)



How to remember

- SCRIPT

4. Dalitz Formula

- Include
 - o A – Attrition
 - o P – Parodontosis
 - o S – Secondary dentin
 - o T – Transparency of root



How to remember

- APSRTC

5. Lamendin's method (Better Method)

- Include 2 Criteria
 - o Parodontosis
 - o Transparency of root
- Advantages
 - o Single tooth examination is sufficient
 - o There is no influence of age on this method.

3. SEX DETERMINATION

01:10:54

- Sex of a living person can be determined by gonadal biopsy
- a. By primary sexual characters / By secondary sexual characters
- Concealed Sex

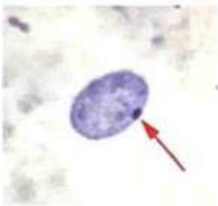
- Hiding the real sex / Gender by cross dressing
- Motive is present [MC done by criminals]
- In such cases, Undressing should be done to find out the real gender

b. Chromatin study

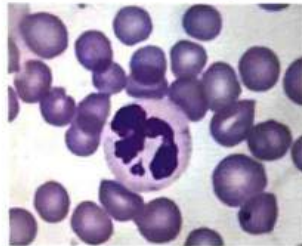
Barr Body	Davidson Body
-----------	---------------

- | | |
|---|--|
| <ul style="list-style-type: none"> • Inactivated X chromosome, seen as condensed mass inside the nucleus | <ul style="list-style-type: none"> • Seen as drumstick body (additional lobe), attached to the lobes of nucleus |
|---|--|

Barr body



Davidson body



Cell	Seen in Somatic Cells	• Seen in Neutrophils
Sample	Buccal Smear, hair follicle	• Blood smear
Significance For identification of sex	<ul style="list-style-type: none"> • Females: 20-80% count. • Males: 0-4 % 	<ul style="list-style-type: none"> • Females = 0-6% • Male = Absent



Important Information

- Davidson Body is seen only in females
- Thus, it is more reliable than barr body to determine sex

c. Chromosomal studies

- **By Staining of X chromosome**
 - When acriflavine reagent is added, It stains X chromosomes in bright yellow color

- This is k/a Feulgen reaction
- **Staining of Y chromosome**
 - When QDH i.e. Quinacrine dihydrochloride reagent is added, Y chromosome is demonstrated as Fluorescent bodies

d. Examination of Skeletal remains

🕒 01:18:47

- It is useful to determine sex, when cluster of bones are present



General Characters	Male skeleton	Female skeleton	Exception
1. Muscle markings / ridges	More prominent	Less prominent	Frontal & parietal eminence of skull, preauricular sulcus in pelvis are more prominent in females
2. Angles	Acute & Less obtuse	More obtuse	-
3. Shapes	Square	Round	Obturator foramen is oval in males, triangular in females
4. Indices	Lesser in value	More	Corporo-basal index, Chilitic line index are more in males & less in females
<ul style="list-style-type: none"> • Sciatic notch • Ischiopubic (Washburn index) • Sacral index • Sternal index 			



Important Information

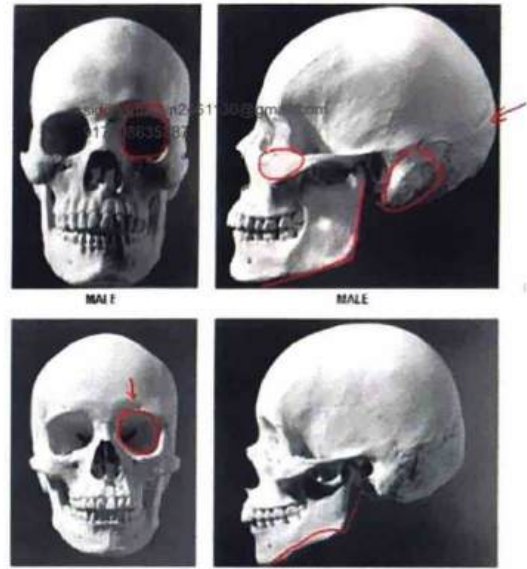
- All indices are useful in age determination except **Cephalic index**
- Cephalic index is only useful for race determination

Sex Determination from Skull

Features	Male	Female
1. Architecture	Rugged	Smooth
2. Frontal Eminence	Small	Large
3. Parietal Eminence	Small	Large
4. Orbits	Square with smooth margin	Round with sharp margin
5. Fore Head	Steeper	Vertical
6. Glabella	More pronounced	Less Pronounced
7. Fronto Nasal Junction	Distinct & angulated	Smooth
8. Supra Orbital Ridges	Prominent	Less prominent
9. Mastoid Process	Large & Blunt	Small & Pointed
10. Occipital Protuberance	Well marked	Less marked
11. Palate	Large, Broader & U shaped	Smaller & Parabola
12. Zygomatic Arch	More Prominent	Less Prominent

Sex Determination from Mandible

Feature	Male	Female
Appearance	Large, Prominent muscle markings	Small, not prominent muscle markings
Chin	Square shape	Rounded
Angle of body of mandible with ramus	Less obtuse (< 125 degree)	More obtuse (> 125 degree)



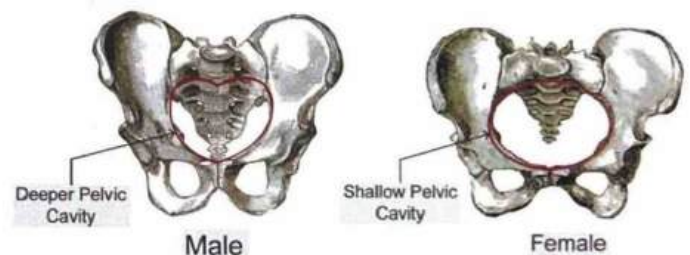
- Forehead of skull is Sloping in case of males and vertical in case of females
- Spheno-occipital junction closes by 18-21 years

Pelvis

- It is best bone for sex determination.

🕒 01:29:42

Refer Table 21.1



- Pelvic side walls are converging in males

Chilotic line index

- It is the line extending from posterior part from auricular surface of pelvis up to level of ilio-pubic eminence.
- Sacral part of chilotic line is bigger in males
- Pelvic part of chilotic line is bigger in females
- Accuracy of pelvic bone is 95%; accuracy of skull is 90%



Sacrum

Male

Female



SEX DETERMINATION ACCURACY WITH BONES

- Pelvis: 95%** - Gives max accuracy (Best)
 - Single Best parameter in pelvis is Greater sciatic notch
- Skull: 90%**
- Long bones: 80%**
 - To increase the accuracy, combine pelvis with skull or long bones
 - It gives 98% of accuracy
 - This is k/a Krogman's accuracy.
 - It is accuracy of sex determination from the bones
- 100% accuracy with complete Skeleton.
- Best long bone for sex determination: Femur i.e Femoral Head Diameter



Important Information

- Best parameter to determine sex from pelvis is greater sciatic notch.

RULE OF ASHLEY

🕒 01:41:03



- It is based on the sternal length
- Used for Sex determination
- Measurement of sternal length
 - > 149 mm is suggestive of Male
 - < 149 mm is suggestive of Female

CHILOTIC LINE INDEX

🕒 01:42:13

- It is the line extending from posterior end of auricular surface of pelvis upto the ilio-pubic eminence
- Chilotic line has 2 parts
 1. **Pelvic part:** More prominent in females
 2. **Sacral part:** More prominent in males

Table 21.1

Features	Male	Female
Pelvic Inlet	Heart Shaped	Circular
Pelvic Cavity	Funnel Shaped	Flat
Pre-Auricular sulcus	Narrow, Shallow, Not frequent	Broad, Deep; More frequent Evidence of pregnancy
Sub-pubic angle	V-shaped, acute	U-shaped, obtuse
Greater Sciatic Notch (75%): Best parameter	Narrower & Deeper	Wider & Shallower
		
Obturator Foramen	Large & Oval	Small & triangular
Ischial Tuberosity	Inverted	Everted
Sacrum	Long, uniformly curved	Small
Body of Pubis	Triangular	Square
Sciatic Notch index	4-5	5-6
Ischio-pubic index	< 90	> 95



CLINICAL QUESTIONS



1. An autopsy was performed on the 15-year-old boy who had succumbed to injuries sustained in a road traffic accident. The doctor also examined the skull and the brain for signs of damage. He noticed that the base of his sphenoid was not yet fused with the occiput. By which age is the fusion of the bones expected to happen?
- A. 20 years
 - B. 30 years
 - C. 40 years
 - D. 50 years

Answer: A

Solution

AGE ESTIMATION FROM SKULL

Closure of posterior frontanalle (Λ): Birth to 6 months

- Closure of Anterior frontanelle (Bregma°): 1½–2 years^o
- Closure of Metopic suture: 2–4 years
- Two halves of mandible fuse together: 1–2 years
- Basis-occiput and basisphenoid: 18–20 years^o
- Lambdoid suture 45–50 years
- Parieto-temporal 60–70 years

Saggital suture	Coronal suture
Posterior one third: 30 – 40 years	Upper half: 40- 50 years
Anterior one third: 40 – 50 years	Lower half : 50 – 60 years
Middle one third: 50 – 60 years	

CERTAIN FACTS REGARDING SKULL SUTURAL CLOSURE

- Sagittal suture is **most reliable**^o for age estimation, followed by lambdoid and then coronal sutures.
- Closure of skull sutures begins on the inner side (endocranially), 5–10 years earlier than on the outer side (ecto-cranially).
- **Metopic suture**^o: Suture in between frontal bones.

Reference:

The essentials of Forensic medicine and toxicology, Dr. KS Narayana Reddy; 33rd edition, pg. no: 82

2. The forensic pathologist is performing an autopsy on a 3-month-old girl baby. She was apparently a healthy infant who was fed, put to bed, but found lifeless early in the morning. During the examination, he noticed that one of the carpal bones was ossified. This bone is also the first bone to ossify. Which carpal has the doctor identified?

- A. Scaphoid
- B. Lunate
- C. Capitate
- D. Pisiform

Answer: A

Solution

Ossification of Carpal Bones

Capitate	2 months - 1 year
Hamate	3 months - 2 years
Triquetral	3 years
Lunate	4 years
Scaphoid	5 years
Trapezium	5 years
Trapezoid	6 years
Pisiform	9-12 years

- Radiograph of 2 yr and 10 months/Female as only Capitate and Hamate are visible

Reference:

The essentials of Forensic medicine and toxicology, Dr. KS Narayana Reddy; 33rd edition, pg. no: 74



22 HUMAN IDENTIFICATION (PART- 2)

MEDICOLEGAL IMPORTANCE OF AGE

00:00:48

- 1yr
 - killing of an infant <1yr amounts to Infanticide
 - It is Punishable under 302 IPC, i.e. same as murder
- 7yrs
 - Any crime done by a person who is < 7 yrs, is not liable
 - It is defined under 82 IPC.
- 7-12 yrs
 - Any crime done by a person who is 7-12 yrs of age, the liability depends on maturity of the person.
 - Court will decide the psychiatric maturity after evaluation
 - If the person has attained sufficient maturity, he is liable
- 12 yrs
 - A person < 12 yrs of age, need not take the oath under the court of law
 - Consent for physical examination/ investigations can be given after 12yrs of age
 - Consent given by a person who is < 12 yrs of age is invalid.
 - It is given under 90 IPC.
 - Consent has to be taken from the parent/ the guardian. It is given under 89 IPC
- 14 yrs
 - A child <14 yrs cannot get employed in a factory
 - Child b/w 14-15 yrs can get employed in non-hazardous environment, after getting fitness certificate, but only for a fixed number of working hours.
- 16 yrs
 - Taking away a boy <16 yrs from legal guardianship amounts to kidnapping
 - It is punishable under 363 IPC.
- 18 yrs
 - Taking away a girl <18 yrs from her legal guardianship amounts to kidnapping
 - It is punishable under 361 IPC.



Important Information

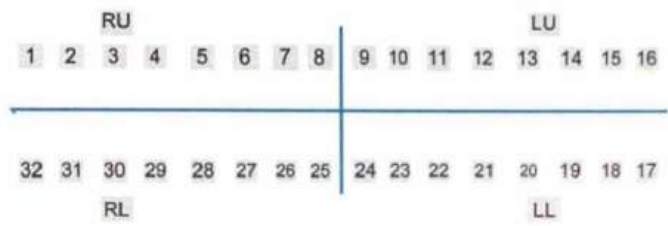
- 18 yrs of age is considered as the age of
 - Majority
 - Voting
 - License
 - Marriage age for girls
- Person >18 yrs: Can give consent for
 - Organ donation
 - Sexual intercourse [intercourse with a girl <18yrs, even with her consent is considered as rape]
 - Surgery
- Child <18 yrs is k/a Juvenile
 - Any crime done by a juvenile is considered as juvenile in conflict with law.
 - These cases are handled by Juvenile Justice Board
 - No Juvenile will be given life imprisonment / death sentence
 - These Juvenile can be advised to go for counselling / community service/ pay fine / release on probation or put in special homes but only for a maximum of 3 years.
- 21 yrs
 - If a person is under courtship, then he / she can be considered as a major only after 21 years of age
 - Marriage age for boys
 - Procuring a female < 21 years from foreign countries is punishable.

DENTAL CHARTING

1. Universal (Cunningham's) method

00:12:10

- Continuous adding of numbers from 1 – 32 for Permanent dentition.



UNIVERSAL METHOD

								PERMANENT DENTITION							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
								TEMPORARY DENTITION							
A B C D E				F G H I J											
T S R Q P				O N M L K											

- Temporary dentition can be denoted in alphabets (A-J → Upper Jaw, K-T → Lower Jaw)

2. Palmer's notation (Zigmond's system) ⌚ 00:14:07

- Addition of numbers from 1 – 8 in each quadrant of Permanent dentition.

8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

- Canine is of number 3. Its quadrant is specified by adding following symbols

$\begin{array}{|c|} \hline 3 \\ \hline \end{array} \begin{array}{|c|} \hline 3 \\ \hline \end{array}$
 $\begin{array}{|c|} \hline 3 \\ \hline \end{array} \begin{array}{|c|} \hline 3 \\ \hline \end{array}$

- L → Left upper quadrant
- J → Right upper quadrant
- ┌ → Left lower quadrant
- └ → Right lower quadrant

3. Haderup's system ⌚ 00:17:17

- '+' symbol is used for all the teeth of upper jaw
- '-' symbol is used for all the teeth of Lower jaw
- Right side teeth: +/- symbol is mentioned to the right side of the tooth number
- Left side teeth: +/- symbol is mentioned to the left side of the tooth.

B + 7 + 6 + 5 + 4 + 3 + 2 + 1 +	+ 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8
B - 7 - 6 - 5 - 4 - 3 - 2 - 1 -	- 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8

4. FDI system ⌚ 00:20:21

(Federation Dentaire Internationale)

- Most widely used & is universally accepted
- Aka Two Digit system i.e to represent one tooth, we use 2 digits
- For permanent tooth prefix added is [1,2,3,4]
- For temporary tooth, prefix added is [5,6,7,8]

PREFIX (CLOCKWISE)

1	2
4	3

FDI SYSTEM

PERMANENT TEETH

18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

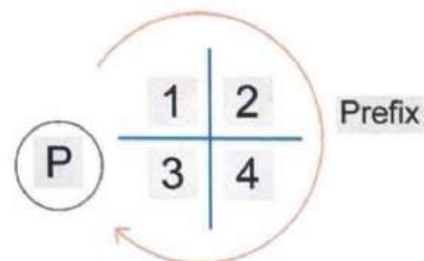
PREFIX (CLOCKWISE)

TEMPORARY TEETH

1	2	55	54	53	52	51	61	62	63	64	65
4	3	85	84	83	82	81	71	72	73	74	75

• For Permanent dentition

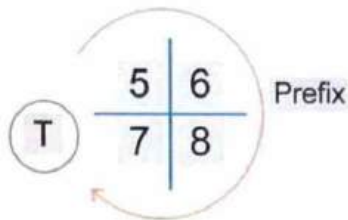
- 11–18 → Rt. Upper quadrant
- 21–28 → Lt. Upper quadrant
- 31–38 → Lt. Lower quadrant
- 41–48 → Rt. Lower quadrant



• For Temporary dentition [only 5 teeth in each quadrant]

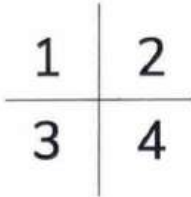
- 51 - 55 → Rt. Upper quadrant
- 61–65 → Lt. Upper quadrant
- 71–75 → Lt. Lower quadrant
- 81–85 → Rt. Lower quadrant

Palmer notation															
Permanent Teeth															
Upper right								Upper left							
8 _J	7 _J	6 _J	5 _J	4 _J	3 _J	2 _J	1 _J	L ₁	L ₂	L ₃	L ₄	L ₅	L ₆	L ₇	L ₈
8 _└	7 _└	6 _└	5 _└	4 _└	3 _└	2 _└	1 _└	┌ ₁	┌ ₂	┌ ₃	┌ ₄	┌ ₅	┌ ₆	┌ ₇	┌ ₈
lower right								lower left							
Deciduous teeth (baby teeth)															
Upper right								Upper left							
		E _J	D _J	C _J	B _J	A _J		L _A	L _B	L _C	L _D	L _E			
		E _└	D _└	C _└	B _└	A _└		┌ _A	┌ _B	┌ _C	┌ _D	┌ _E			
lower right								lower left							



5. Modified FDI system

00:25:01



- 1,2,3,4 goes in zig-zag form

STATURE

00:25:42

- It is height of the person
- It can be best determined by using long bones
- Among long bones femur is best bone to determine stature

Methods

- Regression formula
 - Karl Pearson formula
 - Trotter Glasser formula
- Multiplication factor
- Percentile formula

Percentile formula

- Every bone contributes to significant percent of stature
 - **Femur**: Contributes 27% of entire stature
 - **Tibia**: Contributes 22% of entire stature
 - **Humerus**: Contributes 20% of entire stature
 - **Intact Vertebral column**: Contributes 35% of entire stature
 - **Height of Skull**: Contributes 1/8th of stature
- Osteometric board is used to determine the length of the bone
- It is k/a Hepburn's osteometric board

Fixed end

Adjustable end



Hepburn osteometric board

Stature from bone fragments is calculated by 00:30:42

1. Steele & Mckern Method
2. Bidmos Method

Bertillon system

00:31:40

- We can identify the person based on
 - Anthropometry [body measurements]
 - Descriptive data [skin complexion, colour of hair, iris colour etc].
 - Body marks [Identification marks]
 - Photos [4 photographs]



CLINICAL QUESTIONS



1. The forensic doctor allotted to the case has attended a course that has certified him to identify a person based on characteristic arrangements of lines of a particular body part. He has made a thorough search and found some prints on a bottle and a whisky glass found at the crime scene. He documented the same as "Figura linearum labiorum rubroum". Which one of the following is the doctor examining?
- A. Nose print
 - B. Lip print
 - C. Ear print
 - D. Palate rugae

Answer: B

Solution

Figura linearum labiorum rubroum refers to **lip ridges**.

Suzuki has divided lip prints into five main types:

Type I represents grooves running vertically over the lips.

Type II represents the branched grooves

Type III represents the intersected grooves.

Type IV represents the reticular pattern, much like a wire mesh.

Type V represents all other patterns. These are irregular non-classified patterns.

Reference:

Review of forensic medicine and toxicology by Gautam Biswas, 3rd edition, Page No:89.

2. The body of a young man has washed ashore on a beach in Chennai. The police have circulated the pictures of the victim to cross-check with missing reports across the state. The forensic team was handed the body to determine the cause of death. The forensic team studied the palatal rugae as its design and structure are unchanged on exposure to chemicals, heat, disease, or trauma. All of the following statements regarding Rugoscopy are true, except?
- A. Palatal rugae are used as a method of identification
 - B. Palato-prints do not change during growth
 - C. Primary rugae are less than 3mm
 - D. Secondary rugae are 3-5mm

Answer: C

Solution

View of the hard palate showing palatal rugae. Torus palatinus, a bony protrusion on the palate is also visible.

- Primary rugae are 5-10mm or more.
- Secondary rugae are 3-5mm.
- Fragmented rugae are less than 3mm.
- Palatal rugae are unique to each person.
- Harrison Allen, in 1889, suggested the use of palatal rugae for identity verification.

Reference:

The Essentials of Forensic medicine and Toxicology, Dr.K.S.N Reddy and Dr.O.P.Murty, 33rd edition, Page no : 88

3. A 28-year-old woman has been rescued from the bungalow of a businessman. She is a native of Thailand and had been allured with the promise of a job by a few men, who the police are on the lookout for. The forensic team has begun the physical examination of the victim. They found concentric teeth marks on the right forearm. What is the first procedure to be done with the finding?
- A. 2 swab technique for saliva collection
B. Keep scale for measuring below the mark and take photographs
C. Prepare cast using vinyl poly-siloxane
D. Skin is removed and preserved

Answer: B

Solution

Bite marks can be matched for identification purpose with dental profile of an accused.

Common sites:-

- sexual assault cases
- child abuse
- fruits and vegetables from crime scene.

Things to be done after finding bite marks

1. Measurements and Photography
2. Swab from bite marks (we can find the blood group antigen in saliva)
3. Casting
4. Remove the skin with bite mark and preserve it with formalin

Reference:

Reddy 34th ed . pg no. 95

4. Arrange the following tooth in the order of age of eruption of temporary teeth
1. Upper lateral incisor
 2. Lower lateral incisor
 3. Lower medial incisor
 4. Upper medial incisor

- A. 1→2→4→3
- B. 3→2→1→4
- C. 3→4→1→2
- D. 2→3→4→1

Answer: C

Solution

Eruption sequence of Temporary Dentition

Lower medial incisor 6 to 8 months

Upper medial incisor 7 to 9 months

Upper lateral incisor 7 to 9 months

Lower lateral incisor 10 to 12
months

First molar 12 to 14 months

Canine 17 to 18 months

Second molar 20 to 30 months

Reference:

The essentials of forensic medicine and toxicology, KSN Reddy, 33rd edition, p. no: 69 – 71



23 HUMAN IDENTIFICATION (PART - 3)

DEFINITIVE / COMPLETE IDENTIFICATION DACTYLOGRAPHY / FINGER PRINTING

00:00:19

- It is most reliable technique
- Finger prints are impressions produced by dermal ridges on a surface
- Study of fingerprints is k/a Dactylography
- Skin contact on a surface results in impressions of papillary ridges, which is k/a Finger printing

Refer Picture 23.1

History

1. World's 1st finger print bureau is present at Kolkata (1897)
2. William Herschel was 1st person who used this method
3. Francis Galton was 1st person who classified the fingerprints

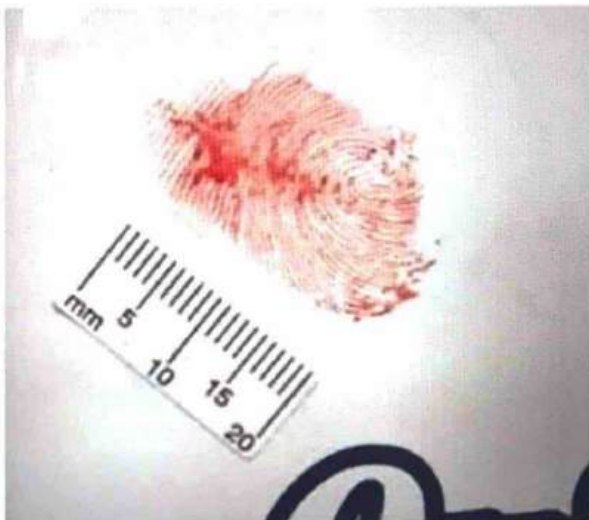
Development of Finger Prints

- Finger prints appear by 12 weeks of IUL
- These are completely formed by 24 weeks of IUL [Intra Uterine Life]

Types of fingerprints

00:03:57

- i. Visible Finger prints



- ii. Plastic Finger prints: Impression of finger print can be seen on molten surface



- iii. Latent Finger prints: It is invisible. Need to develop it, to make it visible



Patterns of fingerprints

00:06:00

- Based on arrangement of ridges

 1. Loop: Most common
 - Ridge start from one side, reaches top & returns to the same side
 2. Arch
 - Ridge start from one side, reaches top & goes to opposite side

3. Whorls

- Concentric circles are seen

4. Composite – least common

- Shows mixed arrangement



MR. GALTON'S TYPES OF FINGER-PRINTS.

Matching / Comparison of finger prints

00:10:17

Done in 3 different levels

- **Level I:** Comparison of patterns (it is not unique)
- **Level II:** We need to find characteristics of the ridge
 - When we follow each ridge, the ridge may show different appearances
 - Ridge ends abruptly k/a Termination
 - Ridge may go & divide into 2 k/a Bifurcation
 - If the ridge divides into 3, it is k/a Trifurcation
 - Ridge may go & form an island/lake
 - 2 ridges may cross-over
 - Ridges can bridge etc
 - These patterns are k/a Minutiae
 - Study of Minutiae is k/a Ridgeoscopy

	Termination
	Bifurcation
	Lake
	Independent ridge
	Point or island
	Spur
	Crossover

- At least 12 Points of such comparison need to be noted
- It is not Constant and varies from state to state



Important Information

- Most common to least common patterns of finger prints encountered in descending order
- Loop [MC] > Whorls > Arch > Composite [least common]

Extra edge

- Core: The point where the ridge recurs is k/a Core
- Delta: The central point where the three ridges converge is k/a Delta



	No. of Cores	No. of Deltas
Arch	0	0
Loop	1	1
Whorls	0	2



• **Level III**

- Take a part of ridge & study opening of sweat glands/ pores
- Pores may vary in location, size, numbers, shape, edges, character along the particular ridge in different individuals
→ This study is k/a Edgescopy



- Study of pores alone is k/a Poroscopy
- It is Invented by Edmond Locard. Hence, it is k/a Locard's poroscopy

Alteration of finger prints is seen in

00:18:35

Intentional alteration	Disease/Conditions
<ul style="list-style-type: none"> • Abrading the skin with rough surface • Burns • Damage d/t Corrosives • Excision / Grafting 	<ul style="list-style-type: none"> • Leprosy/ Hansen's disease • Electrocutation • Radiation

? Previous Year's Questions

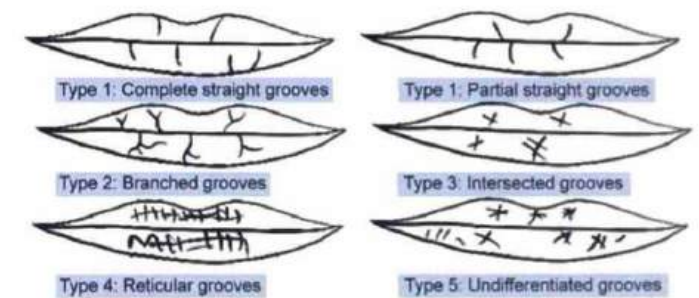
- Q. Identical twins can be differentiated by? (NEET Jan 2018)
- A. Finger print
 - B. DNA finger printing
 - C. Blood grouping
 - D. Age

CHELIOSCOPY / LIP PRINTING

00:19:53



- Study of impressions produced by pattern seen on lips is k/a Lip printing/ Chelioscopy
- Classified by Suzuki into 5 types



- Type 1': Partial straight groove

? Previous Year's Questions

- Q. Locard's principle is famous for? (NEET Jan 2018)
- A. Theory of exchange
 - B. Fingerprint study
 - C. Formula for estimation of stature
 - D. System of person identification using the body measurement

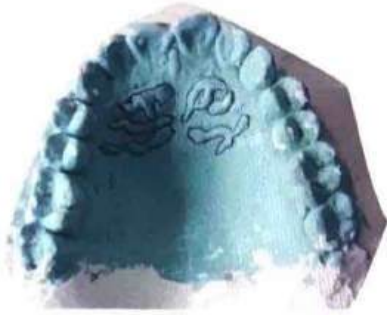
★ Important Information

- Why Finger Prints are Superior? 00:16:58
Finger prints [FP] are
- Not inherited
 - Different even in monozygotic twins [have same DNA pattern]
 - Even if epidermis is lost, FP can be obtained from dermis

RUGOSCOPY/PALATOSCOPY

00:22:00

- Study of arrangement of rugae in hard palate (at anterior 2/3rd of palate)
- **Types of rugae**
 1. Primary rugae: 5-10 mm in length
 2. Secondary rugae: 3-5 mm in length
 3. Tertiary rugae: 0-3 mm in length
- Matching of all the types of rugae is done to identify the person



PODOGRAM

00:23:32

- Study of footprints
- It is mainly used in maternity hospitals to prevent the exchange of newborns



- Identification can also be done based on frontal sinus pattern

TATTOO MARK

00:24:21

- It is the design produced by dye injection into the skin
- These are primarily used as mark of identification
- If the dye is deposited superficially, it might fade away
- If it is deposited deeper [dermis], it is taken up by phagocytes
- Dye is taken up by Regional lymph nodes as well
 - Even though if the tattoo mark is faded/ removed/

amputated, its regional lymphnode shows the deposition of dye/pigment

- **Dyes (pigments) commonly used are**

1. I - Indigo
2. I - Indian ink
3. P - Prussian blue
4. C - Cadmium
5. C - Carbon
6. C - Cobalt

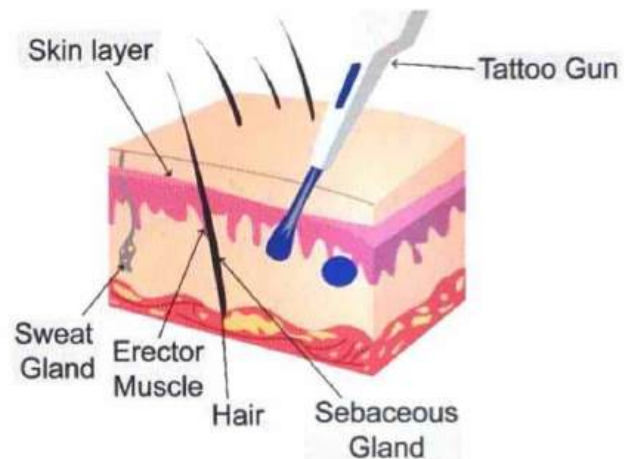


How to remember

- IPC

MEDICO LEGAL IMPORTANCE

1. Person identification
 2. Religion identification
 3. Place identification
 4. Political interest identification
 5. IV Drug abuse identification [Multiple puncture marks of needle is seen. To conceal these needle marks they may put tattoo]
- Old tattoo marks can be visualised by UV / INFRA RED light



SUPER IMPOSITION

00:30:37



- In this, we match photograph of the missing person & photograph of the skull & superimpose it
- We should see if the anatomical landmarks are matching or not

Types of super imposition

1. Photo superimposition
2. Video superimposition

Skull-Photograph superimposition



1. (a) Skull



1. (b) Photograph



1. (c) Wiped image



1. (d) Mixed image

- Step 3: If all Anatomical landmarks are matched, then we can say that the skull may belong to the missing person
- If anatomical landmarks are not matching, then we can exclude that the skull doesn't belong to the missing person
- It is a test of exclusion i.e have more of negative value

SHEENA BORA - Murder case



Site from where burnt bones of Sheena bora are recovered



Through superimposition technique, they matched that the skull belongs to Sheena bora

- Step 1: Skull & antemortem photos of missing person are needed
- Step 2: Enlarged the photo & positioned (Super imposed) it

Digital superimposition of Sheena Bora's photo, skull a match: expert



PTI

MUMBAI JANUARY 04, 2020 06:33 IST
 UPDATED: JANUARY 04, 2020 06:33 IST

SHARE ARTICLE PRINT A | A | A



Digital superimposition of the photograph of Sheena Bora and the skull recovered by the prosecution was a match, a forensic expert told a court on Friday while deposing in the ongoing trial against former media barons Peter Mukerjea and Indrani Mukerjea.

Mr. Mukerjea, Ms. Mukerjea and her first husband Sanjeev Khanna are accused of killing Ms. Mukerjea's daughter Sheena in April 2012. The trio was arrested in August 2015 when the alleged killing came to light after Ms. Mukerjea's driver Shyamwar Rai was arrested in another case.



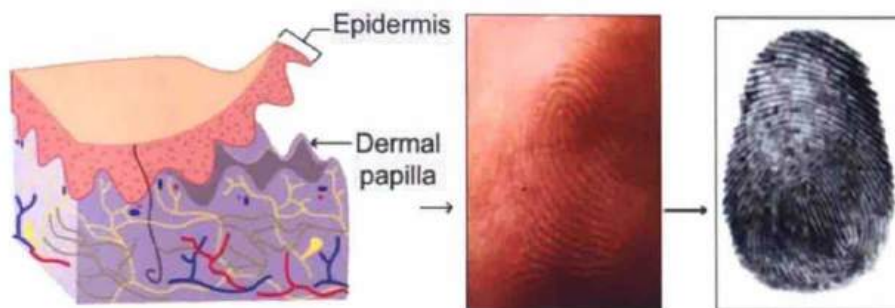
Previous Year's Questions

Q. Superimposition technique is used for?

(AIIMS May 2018)

- A. skull
- B. Pelvis
- C. Femur
- D. Ribs

Picture 23.1





LEARNING OBJECTIVES

UNIT-5 – SEXUAL JURISPRUDENCE

1. Sexual offences

- Case report
- Role of a Doctor
- Classification
- Rape
- Medical Examination
- Adultery
- Incest
- Unnatural Sexual Offence
- Pederasty
- Lesbianism
- Bestiality
- Sexual Perversions

2. Impotency, virginity, pregnancy & abortion

- Definitions
- Causes of Impotency
- Impotence Quad Hanc
- Nullity and Divorce
- Fecundation ab extra
- Assisted Reproduction
- Surrogate Motherhood
- Virginity
- Pregnancy
- Abortion
- Voluntary Miscarriage
- MTP Act

3. Infant deaths

- Sections associated
- Dead Born and Still Born
- Live Born
- Tests for Live Born

4. Trace evidences

- Seminal Stains
- Physical Examination
- Chemical Tests
- Enzymatic Tests

- Microscopy Examination
- Trichology
- Blood Stains

5. Battered baby syndrome

- Predisposing Factors
- Classical Features
- Injuries
- Munchausen's Syndrome by Proxy
- Sudden Infant death Syndrome



24 SEXUAL OFFENCES

Case report

- On September 21, 2017, an unnamed deaf-mute 13 year old girl was allegedly raped by an employee of an observation home for children in, Mumbai.
- A team was appointed for investigating this case including the medical procedure followed immediately after the crime was discovered.
- Following an order by the superintendent of the observation home, the honorary doctor examined the victim and recorded the clinical findings in four lines.
- This medical record was inconclusive simply because it was incomplete.
- There was no history taken
- Other than sealing the clothes she was wearing, no forensic specimens were taken, nor were any investigations ordered.
- No re-examination of the victim done for developing signs of injuries and infection after an interval of a few days.
- Lastly and most importantly, the assailant who was on the premises at the time was not examined by the doctor.
- In conviction rates of sexual offences, a high value is placed on a thorough and complete report of the medical examination of the victim.
- Medical evidence is the most important component of evidentiary material that is considered in a prosecution for rape.

ROLE OF A DOCTOR

🕒 00:02:52

- Treat the injuries of the victim
- Give psychological support
- Examine whether the history correlates with the findings or not
- Preserve all the forensic evidences

CLASSIFICATION OF SEXUAL OFFENCES

🕒 00:04:00

- It is based on type of penetration
- 1. Natural sexual offences
- 2. Unnatural sexual offences
- 3. Sexual perversions/ Paraphilia

Natural sexual offences

- Peno-vaginal penetration
- Rape
- Incest
- Adultery

Unnatural sexual offences

- It is against the order of the nature
- Penis inserted into
 - Anus
 - Mouth
 - Animal
- Sodomy
- Bestiality
- Lesbianism
- Buccal coitus

Sexual Perversions

- Sexual gratification is achieved not by intercourse, but by any other methods

- According to 375 IPC, both Natural & Unnatural sexual offences are considered as rape

Rape

🕒 00:07:00

- Defined under section 375 IPC
- Rape is always a legal definition (not a medical definition)
- A man is said to commit rape when
 1. There is Penetration of penis into the vagina/ anus/ urethra/ mouth
 2. Insertion of object / any body part into the vagina/ anus/ urethra
 3. Application of mouth into the vagina/ anus/ urethra
 4. Manipulation of any part of the victim's body to cause penetration into vagina/ anus/ urethra

If all the above acts are done

1. Against her will
 2. Without her consent
 3. Consent given d/t fear of death / hurt
 4. Consent given d/t impersonation [consent is given by thinking that he is her husband]
 5. Consent d/t insanity, intoxication, influence of any drug [section 90 IPC]
 6. Consent given by female aged < 18 years of age.
 7. Girl who is unable to communicate
- In all the above situations, a man is said to have

committed a rape on a women

Important Points

1. There was no penile penetration was it rape? -

- Slightest touch of glans penis on the vagina (labia majora) is considered as rape [no need for erection/penetration]

2. Who is the Victim?

- Females are the victims

Who is the accused?

- Only males can be punished as per Indian law except in Gang rape
 - In gang rape, female [who helped] can also be prosecuted
 - 375 IPC → A man is said to commit rape on a woman
- #### 3. Minimum age for giving consent in sexual intercourse is 18 yrs (Irrespective of marital status)
- #### 4. Statutory Rape
- Sex with a girl < 18 yrs (with or without consent) amounts to Statutory rape



Important Information

- If a boy < 18 yrs is raped, punishment is given under POCSO Act
- Any person [boy/girl] < 18 yrs is considered as a child
- Any sexual assault on a child is dealt under POSCO act

- #### 5. Medical interventions shall not constitute as rape [as it is done with consent for the benefit of the pt.]



Important Information

- 375 IPC → Definition of Rape
- 376 IPC → Punishment for rape

Refer Table 24.1

- 376 (A) I.P.C
 - Punishment for Rape if she dies / becomes comatose / enters into persistent vegetative state
 - Maximum Punishment can be Death Sentence
- 376 (AB) I.P.C
 - Punishment for Rape of a girl < 12 yrs of age

- Maximum Punishment can be Death Sentence
- 376 (B) IPC
 - Punishment for forceful sex by husband on his wife during separation
 - There is no section which deals with marital rape in India.
- 376 (C) IPC
 - Punishment for sex by a person in authority
 - Person who is in authority, Induces / Seduces a woman by giving favors to have sex
- 376 (D) IPC
 - Punishment for Gang Rape [i.e More than one person involved]
 - Female can also be prosecuted (if she is a part of gang rape)
- 376 DA IPC
 - Punishment for Gang Rape of a girl < 16 yrs of age.
- 376 DB IPC
 - Punishment for Gang rape of a girl < 12 yrs of age
- 376 E IPC
 - Punishment for Rape by a repeat offender [more punishment can be given]

BURDEN OF PROOF

🕒 00:29:55

- It lies with the accused (i.e accused has to prove that he did not rape the victim)

Presumption of consent

- Given under 114 IEA
- It is presumption of absence of consent.
 - If the victim in the court of law says that she did not give consent for the particular act, it is presumed that she did not give the consent

In Camera Trial

- Closed Court room proceedings, where public / press are not allowed
- It is given under 327 (2) CrPC

IDENTITY OF THE RAPE VICTIM

🕒 00:32:26

- Never reveal identity of the rape victim
- Disclosure of identity of the rape victim is punishable under 228 A IPC [2yrs imprisonment]

357C CrPC

- Refusing to treat rape victim is ethically & legally wrong
- All hospitals [govt + private] should give first aid treatment to victims of rape / Vitriolage immediately free of cost.
- After giving Rx, It is duty of the doctor to intimate the Police
- Violating 357 C CrPC is Punishable under 166 (B) IPC

MEDICAL EXAMINATION IN RAPE CASES

🕒 00:35:49

Rape accused

- 53 (A) CrPC: Examine the rape accused with reasonable force under the police request (Police not below the rank of Sub inspector)
- 54 CrPC: Examination of accused, under his own request
- Examination includes
 - Lugol's iodine test: Demonstrate vaginal epithelial cells
 - Swab from penis is taken & exposed to iodine vapor
 - If swab turns to brown colour, it is positive
 - It can be Positive upto 4 days
 - It follows Locard's principle of exchange

Rape Victim

164 (A) CrPC: Victim cannot be examined without her consent

Examination of victim includes

- Toluidine blue test (TBT): It detects recent micro injuries

ADULTERY

00:43:16

- A male having sex with wife of another male without his knowledge
- It is not punishable
- Can be a ground for divorce

INCEST

00:44:53

- Sexual intercourse between blood relations
- Not punishable in India
- **Types**
 1. Oedipus complex: Sexual relation b/w mother & son
 2. Electra complex: Sexual relation b/w father & daughter
 3. Pharaon complex: Sexual relation b/w brother & sister

UNNATURAL SEXUAL OFFENCES

00:46:50

1. Sodomy / Greek-Love / Buggery

- It is penile – anal intercourse
- Can be b/w male & male or male & female
- Passive agent & active agent are included.

Passive agent

Active agent

Elderly person

Adult

Gerontophilia

Child

Adult

Pederasty



Important Information

Locard's principle of exchange

- Whenever there is contact b/w the two surfaces there is an **exchange of materials between the two surfaces**
- i.e when there is a contact b/w male genitalia & female genitalia. transfer of female vaginal cells occurs from female genitalia on to the male genitalia



Previous Year's Questions

Q. A 14 year-old rape victim was brought to the hospital with 22 weeks pregnancy. All of the following are correct statement regarding the case. Except?

(AIIMS-NOV-2017)

- Vaginal swab need to be taken
- The fetus can be aborted after her consent
- Examination can be done by a male doctor with a female
- Urine pregnancy test is not necessary



Important Information

Pederasty

00:49:02

- Adult Male (active agent) having habitual sodomy with a male child (passive agent)
- This adult male (Active Agent) is k/a **Pedarast**
- The male child (Passive Agent) is k/a **Catamite**

Medical Examination

- Findings during medical examination differ depending upon whether passive agent is habitual / nonhabitual person

Non habitual passive victim

1. Pain / tenderness is present
2. Presence of semen of accused
3. Presence of Injuries
 - Abrasion
 - Contusion
 - Laceration
 } in Perianal region
4. Anal Fissures
 - MC seen in posterior quadrant
5. Tyre Sign
 - Seen in forceful sodomy

- Obliteration of normal skin folds in the perianal region d/t presence of hematoma

Habitual passive victim

- Pain / tenderness is typically absent
- Shaving of the perianal hair is seen
- Perianal skin is thickened / keratinized
- Anal Sphincter will be abnormally lax / patulous / loose
- Lateral traction test
 - Apply traction laterally on the gluteus region
 - On traction, anal sphincter relaxes in these victims (normally it contracts)

Is sodomy punishable or not ??

- Consensual sexual activity b/w 2 adults is not punishable
 - If done without consent, it is punishable
 - If done with minor (not adult), it is punishable

1. Lesbianism or Tribadism

🕒 00:58:02

- Homosexuality b/w two females
- Active partner is k/a Butch / Dyke
- Passive partner is k/a femme

2. Buccal Coitus (Oral Sex)

- Aka Sin of Gomorrah
- Fellatio: Oral stimulation of penis
- Cunnilingus: Oral Stimulation of vagina

3. Bestiality

🕒 01:00:00

- Always Punishable
- Sex with lower animals (Dogs, Sheep, cat, horse etc)

SEXUAL PERVERSIONS

🕒 01:00:35

- No Penetration is seen; but the person achieves sexual gratification by any other methods (not by inter course)

1. Sadism

- Person achieves sexual gratification by inflicting pain to the partner
- Aka Algolagnia

2. Masochism

- Person achieves sexual gratification by suffering pain

3. Frotteurism

- Person achieves sexual gratification by touching the private parts of a female [in crowd place]
- Punishable under 290 IPC

4. Fetishism

- Person achieves sexual gratification with inanimate objects which are closely associated with females [inner wears etc]

5. Transvestism/Eonism

- Person achieves sexual gratification by wearing the dress of opposite sex
- It is a variant of fetishism

6. Exhibitionism

- Person achieves sexual gratification by showing his private parts in public place
- Punishable under 294 IPC
 - **Flashing:** Person Suddenly shows genitalia
 - **Mooning:** Person Shows gluteal region & gets sexual gratification
 - **Streaking:** Person Running Naked

7. Voyeurism or Scotophilia or Peeping tom

- Person achieves sexual gratification by watching the private acts of a female [removing/ wearing the dress, bathing etc]
- Punishable under 354 (C) IPC (gives definition and punishment for voyeurism)

8. Triolism

- Sexual activity with 3 people

9. Necrophilia

- Having sex with the dead body
- Punishable under 297 IPC

10. Necrophagia

- Eating the dead body
- It is not a perversion. It is cannibalism
- Punishable under 297 IPC [i.e under indignity towards human body]

11. Coprophilia

- Person achieves sexual gratification by the sight / smell of feces

12. Klismaphilia

- Person achieves sexual gratification by taking enema to himself

13. Urophilia

- Person achieves sexual gratification by the sight or smell of urine

14. Lust murder

- Person Kills the victim itself for sexual gratification
- Accused normally will be a psychopath

15. Bobbit Syndrome

- Male genitalia amputation by the female partner

16. Ipsation or Masturbation or Onanism

- Self-stimulation
- Punishable if done in public place resulting nuisance to public

17. Partialism

- Affinity towards a specific body part



Previous Year's Questions

Q. A man continues to call females. Achieves sexual gratification by talking obscenity & sharing obscene picture. The condition is? (AIIMS - AUG-2020)

- A. Scatologia
- A. Stalking
- B. Scopophilia
- C. Voyeurism

Table 24.1

376 (1)	376 (2)	376 (3)
Minimum Punishment for committing Rape is 10 yrs to life imprisonment	Punishment for rape under special situations <ol style="list-style-type: none">1. Custodial Rape (Police, Public Servant, Armed Forces)2. Rape by a relative, guardian.3. Rape on pregnant female4. Rape on an insane person Punishment is 10yrs to Life imprisonment (imprisonment till natural life)	Punishment for Rape of a girl < 16 yrs of age. Punishment is 20years to life imprisonment (imprisonment till natural life)



CLINICAL QUESTIONS



Q. An investigation of a missing 25-year-old woman has led the police and the investigating agency to an abandoned bungalow near the edge of the woods. The woman has been rescued alive but had allegedly been sexually and physically assaulted. During the questioning, the police got a lead to excavate the area around the farm shed. They have recovered the bodies of 2 young women, which was showing signs of early putrefaction. The police have decided to slap multiple charges against the owner of the bungalow including sexual sadism. What offense is termed as such?

- A. Sexual gratification form acts of physical cruelty
- B. Having intercourse with an animal
- C. Anal intercourse
- D. Sexual intercourse with dead bodies

Answer: A

Solution

Paraphilias: Deviant sexual preferences.

- Interfere with dyadic, mutually satisfying sexual behaviour (e.g. Transvestite who is disinterested in sexual relations with partners because he is really only aroused by wearing women's clothing)
- They involve coercive sexual activity (e.g., paedophilia, sexual sadism).

Sadism:

- Sexual preference disorder that focuses on the infliction of suffering, pain, or humiliation to achieve sexual gratification.
- more commonly in male.
- To obtain sexual gratification the sadist may bite, beat, whip, produce cuts, cigarette burns, etc., or ill-treat or torture his sexual partner in many other cruel ways.
- Many are sociopathic, some schizoid and others inadequate personalities.

Necrophilia: Porrifolia whereby the perpetrator gets sexual pleasure in having sex with the dead.

Bestiality/zooerasty: any sexual act with an animal,

Zoophilia/preferential bestiality: a clear preference for engaging in sex with animals.

In some jurisdictions, bestiality, or animal molestation and cruelty, are crimes all on their own. In others, bestiality may be treated as a property crime, and the offender charged only with trespassing.

Reference: The Essentials of Forensic Medicine and Toxicology by K S N Reddy. 33RD Page No: 431

Q. A 52-year-old man who had been diagnosed with Young Onset Parkinson's disease reported back for a follow-up visit. He informed the doctor that he had taken the medication regularly and has experienced an improvement in his symptoms. His tremors and rigidity had noticeably decreased but one complaint he had was that his sexual desire had increased. What is an excessive sexual desire in men termed as?

- A. Nymphomania
- B. Satyriasis
- C. Frigidity
- D. Fetishism

Answer: B

Solution

Males		Females	
Impotence	Inability to achieve & maintain penile erection	Frigidity ^o	Decreased sexual arousal or sexual coldness
Sterility	Inability to procreate children	Sterility	Inability to procreate children
Satyriasis ^o	Excessive sexual desire in males	Nymphomania ^o	Excessive sexual desire in females

Reference: The essentials of forensic medicine and toxicology; Dr. K S N Reddy, 33rd edition; Page no: 382



25 IMPOTENCY, VIRGINITY PREGNANCY & ABORTION

IMPOTENCY/STERILITY

🕒 00:00:45

- In a sexual intercourse, male is an active agent & female is a passive agent
- Inability of a man to achieve/ initiate/ maintain penile erection is k/a Impotency.

FRIGIDITY

- If a female is unable to initiate/ maintain sexual arousal, it is k/a Frigidity
- It is corresponding term for impotency in females
- Common cause of frigidity is Vaginismus

Vaginismus

- The condition where the female is achieving abnormal, spasmic, painful involuntary contractions around the vaginal cavity & the pelvic floor; sometimes even the adductors of the thigh
- Due to this, the female will not able to achieve penetration at all.

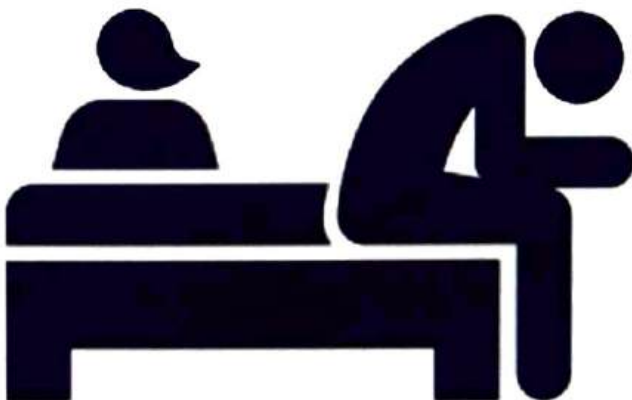
STERILITY

🕒 00:04:20

- Inability to beget(male) or to conceive a child (female) is k/a Sterility
- A person maybe potent but maybe sterile, another person maybe impotent but fertile i.e any combination is possible.
- Sometimes a person may have excess sexual desire
 - If it is among males, it is k/a Satyriasis
 - If it is among females, it is k/a Nymphomania.

CAUSES OF IMPOTENCY

🕒 00:05:54



- Better term for impotency is Erectile dysfunction
- **Psychological**
 - MC functional cause of impotency is psychological [i.e d/t anxiety, depression, emotional stress & fear]
 - Honey moon impotency [Pt. is impotent during honeymoon period d/t anxiety]
- **Vasculogenic**
 - It is MC organic cause of impotency
 - There is decreased blood flow to the penis
- **Neurological** [Multiple sclerosis etc]
- **Congenital deformities**
- **Acquired diseases**
 - D/t hydrocele the person may not be able to perform proper penile penetration or
 - D/t castration i.e removal of testis

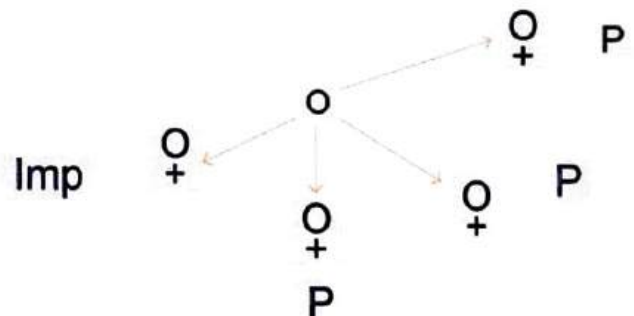


Important Information

- If the testes are removed before puberty, then the person becomes impotent
- If the testes are removed after puberty, then the person becomes sterile [he can be potent]

Impotence Quoad Hunc

- The man is impotent towards one particular women



- Probably it is psychological.

Impotence Quoad Hunc

- If the female is impotent to one particular man, it is k/a Impotence Quoad Hunc

- It is psychological.

NULLITY & DIVORCE

🕒 00:11:03

- Conditions for valid marriage is given under Section-5 of Hindu Marriage Act [HMA]

Nullity of marriage

- Marriage happened is null & void
- The process of declaring the marriage as null and void is k/a Annulment

Divorce

- Legal separation of already married couple is k/a Divorce
- When a person is granted divorce, the partner has to give financial compensation for the livelihood of his spouse

Nullity of marriage

- It includes Void & Voidable marriage

Refer Table 25.1

Divorce

🕒 00:20:23

- It is legal separation of lawful marriage.
- The partner must give financial compensation to the spouse.
- **Conditions**
 - **D- Desertion:** Abandoned the partner for 2 years
 - **Incurable insanity:** If one of the partners is suffering from incurable insanity
 - **V- Venereal disease:** HIV
 - **O- Offence:** If the husband had convicted for rape, bestiality
 - **R- Renunciation:** If the partner wants to live life like saint/ any religious change
 - **C- Cruelty:** Mental/ physical cruelty
 - Abstinence of sex is form of mental cruelty. It can be ground for divorce
 - **E- Extra marital affair:** Adultery
 - Adultery is decriminalized, but can be ground for divorce.



How to remember

• DIVORCE

- Nullity & voidable marriage is given under Section 11 & 12 Hindu Marriage Act
- Divorce is given under Section 13 HMA

FECUNDATION AB EXTRA

🕒 00:27:30

- It is Conception of a female without penile penetration
- It can occur d/t deposition of semen at vulval outlet/ upper part of the thigh itself
- The sperm swims & reaches vagina, uterus, fallopian tubes & fertilize the ova
- It is very rare condition
- It can be ground for making marriage null & void

ARTIFICIAL INSEMINATION

🕒 00:29:47

I. Assisted reproduction

- It is assisting reproduction by any means i.e medical/ technical

II. Assisted reproduction techniques

- It is artificial usage of techniques for assisting & facilitating the reproduction
- It includes only techniques i.e insemination, invitro fertilization & other techniques.
- It includes
 - Artificial insemination of semen into female genital tract. It includes
 1. Intra uterine insemination
 2. Invitro fertilization
 - Fertilization of egg & sperm occurs outside the body & then the embryo is transferred & implanted into the uterus/ fallopian tube
 - Transfer can be Gamete Intrafallopian Transfer (GIFT) or Zygote intra fallopian transfer (ZIFT)
 - Intracytoplasmic sperm injection [ICSI]: Injecting the sperm into the egg artificially. Done when sperm count is low

- Artificial insemination of semen into female genital tract. It includes

1. Intra uterine insemination

2. Invitro fertilization

- Fertilization of egg & sperm occurs outside the body & then the embryo is transferred & implanted into the uterus/ fallopian tube
- Transfer can be Gamete Intrafallopian Transfer (GIFT) or Zygote intra fallopian transfer (ZIFT)
- Intracytoplasmic sperm injection [ICSI]: Injecting the sperm into the egg artificially. Done when sperm count is low

III. Surrogacy [other female bears the child of a couple]

Indications of artificial insemination

🕒 00:32:43

• Husband prospective

- Husband couldn't be able to deposit the semen
- Have Erectile dysfunction
- Congenital defects like Epispadias/ Hypospadias, penil deformity etc
- Oligospermia: mild decrease in sperm count

• Female perspective

- Mild Cervical stenosis
- Cervicitis
- Presence of Anti-sperm antibodies
- Vaginismus [painful spasmodic contractions]
 - In this condition, the female is inseminated under anesthesia

- In all these conditions we can use the semen of the husband itself

- Because he is not able to deposit it, but the quality of the semen is good

- We can use semen of donor k/a Artificial Insemination Donor [AID] in

- Azoospermia [the sperm count is too less]
- RH incompatibility b/w both partners
- Risk of genetic disease
- Case of single women (widow, unmarried, divorced)


Consent

- If we are using the semen of the husband, we need to get the consent of both husband and wife
 - We can't do this without the consent of the husband
- In AID, we should get consent of the recipient couple & the donor couple [both husband & wife]

Legitimacy Status

- When a child is born out of artificial insemination procedure from the semen of the husband, then the child is legitimate.
- When a child is born out of artificial insemination donor (not from husband), then the child is illegitimate unless adopted legally.

Criteria of a Donor

 00:38:49

- Donor has to be from the same race and region
- The donor has to be married & has to have a wife & a child (at least one)
- He should be <40 years of age
- He should be physically and mentally healthy person
- No RH incompatibility
- There should be no risk for genetic disease.

Medicolegal Issues

- Maintain absolute confidentiality
 - Identity details of the donor is never revealed to the recipient and vice versa.
- Nullity and divorce
 - If artificial insemination is done d/t the impotency of the husband, it is a ground for nullity
 - If the women is getting this procedure done, without the consent of her husband; then he can file for divorce
- Adultery
 - It is Extra-marital affair
 - It is sexual intercourse b/w married women and a man who is not her husband
 - Artificial insemination is not considered adultery as there is no component of physical union.
- Incest
 - Sexual relationship b/w blood related individuals
 - There is remote chance that the donor happens to give semen & got a child
 - This donor already has a child
 - In future, if these 2 children have intercourse, it is k/a incest.
- Legitimacy

- In case of a single woman, the child born out of this procedure is legitimate

SURROGATE MOTHERHOOD

 00:45:19

- A female is leasing her uterus for child bearing, for another couple
- India has good expertise and is cheap for this technique
- A surrogate mother is one, who by contract agrees to bear the child for someone else.

Types of surrogacies

1. Commercial surrogacy

- Women bears a child for money; she gets paid for it.

2. Altruistic/ Non-commercial surrogacy

- Women is bearing a child out of love and affection (usually a close relative)
- Hospital expense alone will be borne by the couple

Surrogacy regulation bill

1. Features related to Intending couple (couple who want to have a kid)

- Intending couple should be Indians [NRI aren't permitted]
- No child selection is permitted
- Couple should be suffering from incurable infertility.
- Married more than 5 years
- Essential certificate must be provided from the appropriate authority

2. Features related to Surrogate mother

- The women should be close relative.
- No commercial surrogacy is permitted [only altruistic surrogacy is permitted]
- She should be < 35 years of age
- She must be married & at least have one living child.



Important Information

- The surrogate mother can be a surrogate mother only once in a lifetime.
- According to ICMR guidelines the female can surrogate thrice

3. Features related to child

- This child is absolutely legitimate
- Abandoning this child is absolutely punishable
- It is a comprehensive bill, protecting the rights of the child, surrogate mother
- The intending couple has to put insurance for the surrogate mother in case of any complications d/t pregnancy.

One of the following is done, depending on the condition

- Husband having normal sperm is fertilized with normal ova of wife outside the uterus and implanted into the uterus of the surrogate mother
- If Husband's semen is not of good quality, then we can take sperm of the donor and use for surrogacy
- If Husband's semen is not of good quality & ova is also not good; then we use donor semen and ova of surrogate mother

VIRGINITY

00:56:15

Apta vira

- Girl is fit for sexual intercourse/ procreation
 - When the girl is so young & is not fit for intercourse, they take sola pith & insert into the vaginal cavity
 - It absorbs moisture, gets enlarged and it dilates the vaginal cavity
 - This makes the girl fit for intercourse
 - This is usually done by commercial sex workers

Virgin

- Any female who has not experienced sexual intercourse is k/a virgin

Defloration

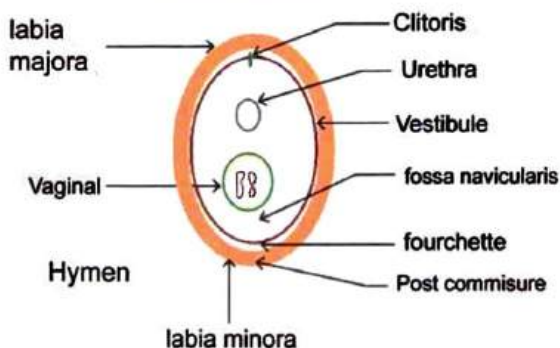
- The loss of virginity is k/a Defloration i.e having sex for the first time

Signs of Virginity

00:59:32

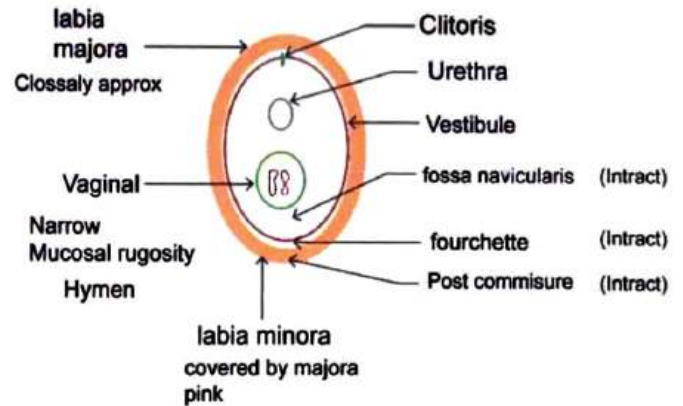
Anatomy

- Posteriorly labia majora fuse and it forms posterior commissure
- Inside Labia majora, we have another fold k/a labia minora
- Anteriorly labia minora fold & enclose the clitoris
- Posteriorly labia minora is fused to form fourchette
- Space b/w 2 labia minora is k/a vestibule
- Anteriorly, urethral opening & posteriorly, vaginal opening are seen
- Vaginal cavity opening is surrounded by thin film of mucus membrane k/a hymen
- There is small depression b/w vaginal cavity and fourchette k/a Fossa navicularis



In a Virgin female

- Labia majora is closely approximated. Thus, labia minora is covered by labia majora & is pink normally
- Vaginal cavity will be narrow [very close to each other] vaginal mucosal rugosities are seen
- Due to repeated sexual intercourse vaginal mucosal rugosity might disappear and vaginal cavity gets dilated.
- The disappearance of vaginal rugosity states that the woman is exposed to sexual intercourse for long time
- In a virgin female, the fossa navicularis, fourchette, posterior commissure is intact



In a deflorated female

- The labia majora is exposed
- Labia minora is not covered by labia majora and will be pigmented
- Vaginal cavity is dilated
- Mucosal rugosity will not be there
- Hymen is torn postero-laterally
- Fossa navicularis (will be disappeared), fourchette, posterior commissure will be torn.

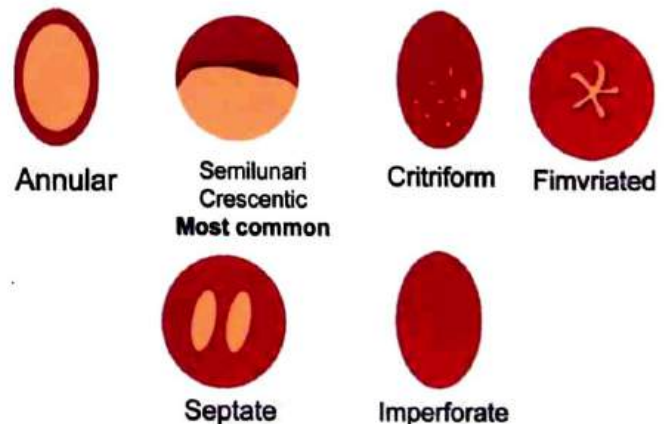
HYMEN

01:07:33

- It is a thin fold of mucus membrane surrounding the vaginal orifice

Types of hymen

Refer Table 25.2



- Hymenal opening is subjective

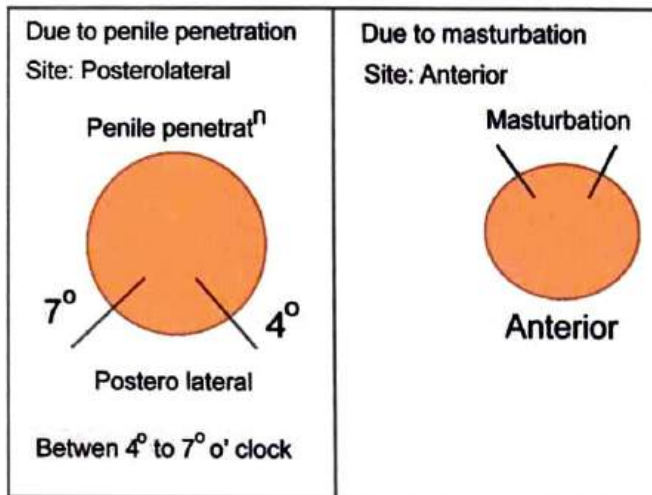
Causes of Hymenal Rupture

🕒 01:11:23

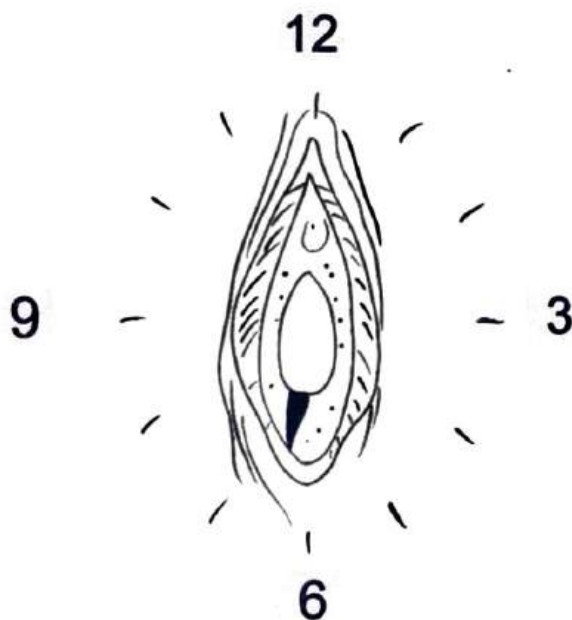
- MCC of hymenal rupture is sexual intercourse
- Masturbation (foreign body penetration if not penile penetration)
- Accidental [Straddling injuries]
- Surgery
- Foreign body insertion (sola pith)

Hymenal tear occurring due to sexual intercourse

- If there is any sexual intercourse i.e., in any penile penetration; the tear will be located at the posterolateral region.
- In digital insertion, tear will be anterior



HYMEN TEAR D/T DIGITAL INSERION



PENILE PENETRATION

Exceptions

1. False virginity

- Female having intact hymen despite of having sexual intercourse.
- All the other signs are like deflorated female
- I.e Fossa navicularis is disappeared; fourchette, posterior commissure are torn, labia minora is opened, only hymen is intact.
- Hymen might be too thick or too loose or might be too elastic. So, it might not rupture.

2. In case of sexual assault of a child

- Since the hymen is deep seated it is not possible to be torn
- So, even after penile penetration it won't be torn

3. Fimbriate type is commonly mistaken for hymenal tear

Fimbriate type	Hymen Tear
<ul style="list-style-type: none"> • Notches are Asymmetrical • Notches are covered by mucosa • Notches do not extend up to the wall 	<ul style="list-style-type: none"> • Notches are not so asymmetrical • Not so covered by mucosa • They extend upto the wall

Glaister keen rod

- Globe like structure which has bulb at the tip
- It is inserted into the vaginal cavity
- When it is gently pulled out, the margin of the hymen is on the globe, which is illuminated
- Thus, we can examine the hymen.

PREGNANCY

🕒 01:19:11



Signs of pregnancy

- It has presumptive signs, probable signs & positive signs/ confirmatory signs of pregnancy

- The most confirmative is the positive signs of pregnancy.

Presumptive signs [these are seen in other conditions as well]

- Amenorrhea
- Morning sickness
- Abdominal enlargement
- Urinary frequency
- Breast changes
- Pigmentation
- Quickening: Subjective

Probable signs

- Goodell's sign: Softening of the cervix
- Hegar sign: We can feel isthmus of the cervix
- Braxton-hick's contraction: Intermittent uterine contraction
- Ballotement
- Positive Hcg test [can be positive in placental tumours or any other tumours].

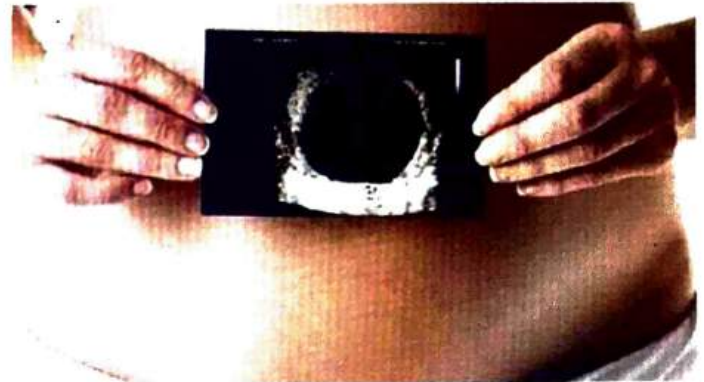
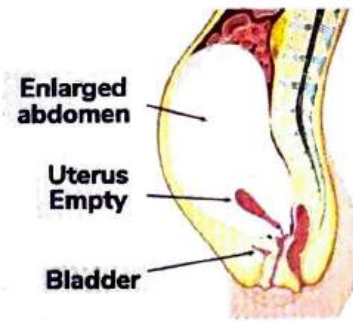
Positive signs [seen only in pregnancy]

- Palpation of fetal movements and fetal parts
- Auscultation of fetal heart sounds
- **Radiograph**
 - Series of small dots linearly arranged is suggestive of fetal vertebra
 - Crescentic shadow is suggestive of fetus skull
 - Series of curved parallel line are suggestive of ribs
 - Linear shadows are suggestive of long bones
- Ultrasonography is commonly done
 - Yolk sac, fetal pole, heart rate etc can be seen without radiation exposure

🕒 01:24:00

Phantom pregnancy/ Spurious pregnancy / False pregnancy / Pseudocyesis

- Commonly seen in childless female, who is nearing menopause & desperately wanting to have a child
- Suddenly she develops abdominal distention, amenorrhea, breast enlargement & gets morning sickness & will go to the extent of quickening.
- She believes that she's pregnant
- But, on examination positive signs of pregnancy are absent; only subjective signs are present.
- So, for confirming the diagnosis, ultrasonography is done; which shows empty uterus [she's not pregnant].
- The abdominal distention is due to hormonal disturbances.
- Sometimes rarely it will advance till full-term & can develop false labour pain as well.
- We can send her for psychological counselling.



USG showing empty uterus

TWIN PREGNANCIES

🕒 01:29:05

Superfecundation

- It is a condition where there is fertilization of 2 ova in the same menstrual /ovulatory cycle by 2 different acts of coitus
- Superfecundation can be done by same man or different man
- If it is done by same person, it is Mono-paternal
- If done by 2 different persons, it is Bi-paternal [homo/hetero]
- If it is bi-paternal, one baby is legitimate and other is not
- If 2 fetus developing inside the uterus can grow and both can be delivered, then both will be of equal development
- In another scenario, one baby is growing to a greater extent & other baby dies
 - D/t pressure of growing fetus, the dead fetus is compressed on to the wall of the uterus
 - The compressed fetus can get mummified. This condition is k/a Fetus papyraceus /Fetus compressus

Superfetation

🕒 01:33:15

- One fetus over the other fetus.
- It does happen when the fertilization of 2 ova occurs in different ovulatory cycle.
- Ideally, when one ova is fertilized by one sperm, another ova is not released for fertilization
- But, in rare circumstance; another ova is released and

- fertilized by another sperm in next cycle.
- In such scenario if we look at the uterus one fetus is of higher development & another one is of lower development.



Superfecundation [Bi-paternal]



Superfetation

LEGITIMACY

🕒 01:35:55

- State of a child, being born during the continuation of lawful marriage or within 280 days of separation [death/ divorce; provided that the female isn't married to another person]



Important Information

Posthumous conception

- People preserve semen for further insemination
- Women uses preserved semen of her dead husband & have a child
- In this case, even if the child is delivered after 280 days of separation, the child is considered legitimate

Affiliation case

- It is a case of disputed paternity, wherein the female is alleging a man as father of her child
- It should be filed under the court for fixing the paternity

Suppositious child / Fictious child / Substituted child

🕒 01:40:40

- The child was supposed to be her child but actually isn't her child
- The female may feign pregnancy & after sometime she will bring the child & claims the child as her own child.
- Actually, she might not delivered a child or delivered a dead fetus, & might have kidnapped the child from maternity hospital & substituted the child.
- It is basically done for blackmailing or compensation.

Post-humous child

🕒 01:43:17

- Child born after the death of biological parents [usually father] is k/a Post-humous child
- If the father is dead and the child is born after that, sometimes the family might not accept the child
- It becomes question of disputable paternity.
- The women have to go to the court for fixing the paternity

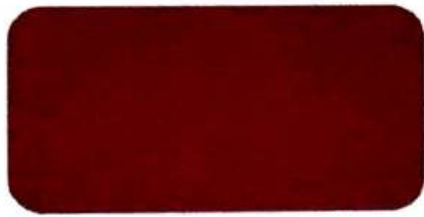
LOCHIA

🕒 01:44:30

- Vaginal secretion after the delivery
- It is a sign of recent delivery.

Types of Lochia

- 3 different types of lochia are
 - Lochia rubra in 1-3 days
 - Lochia serosa in 4-10 days
 - Lochia alba in 11-14 days



[The sequence is important]

- Medical definition: Expulsion up to the period of viability
- Legal definition: Expulsion of the products of conception anytime before the full term

Classification Natural Abortion Induced Abortion

Natural Abortion	Induced Abortion
1. Spontaneous abortion <ul style="list-style-type: none"> • Occurs d/t <ul style="list-style-type: none"> ○ Chromosomal abnormalities [MCC & occurs in 1st trimester itself] ○ Anatomical defects ○ Endocrinal imbalances. 	1. Justifiable / lawful / legal- abortion done as per the provisions of MTP 2. Unlawful <ul style="list-style-type: none"> • Criminal abortion • If the abortion is done by an unqualified person • Even if the abortion is done by the qualified person beyond the permitted duration • If the indication is not mentioned in MTP
2. Accidental	



Important Information

- Order of Lochia is Lochia rubra > Lochia serosa > Lochia alba
- Mnemonic: Republic of south Africa: RSA

- 416 CrPC
 - It is about the commutation of death sentence in a pregnant woman into life imprisonment.

ABORTION

🕒 01:47:33

Definition

- Premature expulsion of the products of conception
- Normal average duration of pregnancy is 280 days/ 40weeks



Methods adopted for criminal abortion

🕒 01:50:55

1. Abortifacient drugs

- Ecbolic**
 - If the drug causes increased uterine contractions, it is k/a ecbolic.
 - Ex: Quinine, Ergot, Oestrogen.
- Emmenagogue**
 - It causes increased menstrual blood flow and cause expulsion.
 - Ex:
 - Borax
 - Oestrogen
 - Savin
 - Sanguinarine



How to remember

- BOSS

III. GIT irritants

- They cause reflex uterine contraction & expulsion
- Eg: Castor, croton.

IV. GUT irritant

- Cantharides, Turpentine etc

V. Heavy metals

- Lead, Mercury

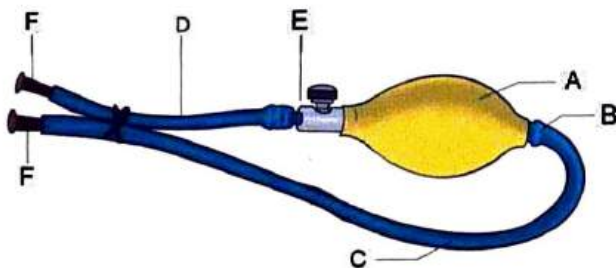
2. Violence

General violence

- Violent exercises like running, jumping, lifting heavy weight can cause expulsion
- Any intentional trauma to abdomen
- Cupping
 - Wik is lighted & covered with a cup
 - This wik creates vacuum by consuming all the oxygen
 - When the cup is violently removed, it causes separation of the membranes & expulsion of fetus.

Local violence

- Syringing
 - Injecting air or soap water into the uterus
 - Higginson's syringe is commonly used
- Rupture of the membranes by using any pointed things
- Abortion stick
 - Stick end is covered with cotton or cloth smear & put the cloth in the juice of castor / Calotropis
 - When this is inserted into genital cavity, it leads to irritation and expulsion of the fetus.
- Dilatation of cervix
 - By drugs
 - Slippery elm bark



Causes of death in criminal abortion

01:57:40

- Haemorrhage d/t injury to the uterus/ rupture of the uterus
- Vasovagal shock i.e vasovagal inhibition of heart
- Amniotic embolism
- Air embolism
- Fat embolism
- Sepsis [causes delayed death]

Voluntary miscarriage / criminal abortion

01:58:58

- 312 IPC
 - Punishment for conducting criminal abortion with the consent of the pregnant female
 - The person conducting the abortion and the female both will be punishable
- 313 IPC
 - Punishment for conducting criminal abortion without the consent of female
 - The person who forced her will be punishable
- 314 IPC
 - Punishment for any kind of criminal abortion resulting in death of the female.

MTP ACT 1971

02:01:40

- MTP amendment act is enacted in 2021

Indications for MTP

- **Therapeutic**
 - If continuation of pregnancy causes serious risk to physical and mental health of the mother.
- **Eugenic**
 - If there is any risk of child being born with severe fetal/ congenital anomalies
 - If the mother was exposed to teratogenic radiation/ TORCH infections etc
- **Humanitarian**
 - If the pregnancy is d/t the result of rape
- **Socio-economic cause**
 - If the pregnancy is d/t failure of contraception of both husband/ wife [of women only acc. to 1971 act]

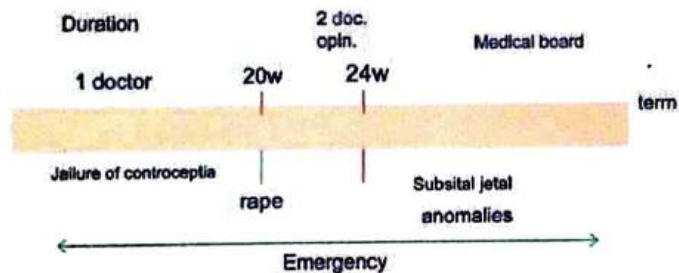
Duration

02:04:44

- If gestational age is < 20 weeks, 1 doctor is enough for conducting MTP
- If gestational age is b/w 20-24 weeks, opinion of 2 doctors is needed
- If termination is d/t the failure of contraception, the MTP can be done only till 20 weeks
- In cases of rape/ vulnerable female, MTP can be upto 24 weeks of gestation
- After 24 weeks of gestation, if we want to do MTP; we need to get approval from the medical board
 - This is permitted only in case of substantial fetal

anomaly

- In emergency situations, to save the life of the mother, MTP can be done at any time, irrespective of duration of gestation



Consent

- Minimum age for giving consent is 18yrs
- If the girl is < 18 years, Consent should be taken from legal guardian
 - This should be informed to the police as it is statutory rape
 - We need to preserve the products of conception
- Consent from the pregnant women is mandatory
- Husbands consent is not necessary
- If the confidentiality is breached, it is punishable
- Records has to be maintained upto 5 years

Place

- MTP can be done in Govt institutions/ places authorized by the govt.

Eligibility criteria of conducting MTP

- The person doing MTP should have
 - Diploma/ degree in OBG/
 - Done 6 months internship in OBG/
 - 1 Year experience in obg. Department/
 - If assisted 25 cases of MTP, out of which 5 cases are done independently

Table 25.1

Void	Voidable
<ul style="list-style-type: none"> • It is void ab initio i.e, right from the beginning, the marriage doesn't exist at all. • The conditions where void is applicable are <ul style="list-style-type: none"> ○ Bigamy: If the person is already married & have another living spouse ○ If the marriage is b/w prohibited relationships <ul style="list-style-type: none"> → E.g. father marrying his daughter/ → Mother marrying her son → i.e. all immoral relationships. 	<ul style="list-style-type: none"> • Here, the party has to apply to the court along with evidences, the court will declare whether the marriage is null & void or not • Conditions where voidable is applicable are <ul style="list-style-type: none"> ○ Impotency <ul style="list-style-type: none"> → At the time of marriage or before marriage, if a man is impotent, it is a ground for nullity. ○ Insanity <ul style="list-style-type: none"> → Consent given by insane person is invalid ○ Invalid consent <ul style="list-style-type: none"> → If one of the people is underage → Marriage is done by force/ fraud → Consent given under any intoxication [Sec 90 IPC] ○ Impersonation <ul style="list-style-type: none"> → E.g.: the person thinks she is getting married to Raju but, he is actually raja ○ Impregnation <ul style="list-style-type: none"> → if the women is already pregnant by someone else [not by the person with whom she's getting married to] → If she's concealing this and getting married, then its ground for nullity

Table 25.2

Type of hymen	Description
1. Annular hymen	<ul style="list-style-type: none"> • Have circular opening
2. Semilunar hymen	<ul style="list-style-type: none"> • Most common type. • Divided into Anterior / posterior semi-lunar, depending on the side of opening
3. Septate	<ul style="list-style-type: none"> • Septum is present
4. Cribriform	<ul style="list-style-type: none"> • Have multiple sieve-like openings
5. Fimbriate	<ul style="list-style-type: none"> • Have multiple notches in the hymen opening • Notches are asymmetrical & doesn't extend up to the wall. • It is covered by mucus membrane • It is often mistaken for hymenal tear but it is normal hymen
6. Imperforate	<ul style="list-style-type: none"> • It is completely closed • Present in new-born/ adolescent <ul style="list-style-type: none"> ○ She will have cyclical abdominal pain & primary amenorrhea ○ Blood gets accumulated inside the cavity resulting in hematocolpos causing urinary retention. ○ Treatment: Hymenotomy, cruciate incision is made leading to drainage of the blood



26

INFANT DEATHS

DEFINITIONS

00:00:35

Infantile period

- Time period from birth till 1 year of age is k/a Infantile period

Fetal period

- Time period from conception up to the birth is k/a fetal period

Feticide

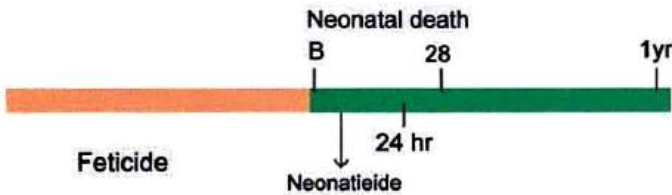
- Killing of the fetus any time before the term is k/a Feticide

Infanticide

- Killing of an infant <1 year of age is k/a Infanticide

Neonaticide

- Neonatal period is a period < 28 days after birth
- If the baby dies within 28 days after birth, this is k/a Neonatal death
- If the baby is killed within 24hrs after birth, it is k/a Neonaticide



Filicide

- Killing of fetus by parents is k/a Filicide

SECTIONS

00:02:54

- Infanticide is punishable under 302 IPC
 - Accused will be punished under same law as for the murder
 - There is no discrimination b/w killing an adult & killing an infant

315 IPC

- Gives punishment for any person who does an act, with an intent to prevent the child from being born alive or to cause it die after birth
- **E.g:** If the victim's husband gives her poison with an intent to kill the baby/ to prevent the baby from being born alive; this person will be punishable under 315 IPC

316 IPC

- Gives punishment for any act, causing death of a quick unborn child amounting to culpable homicide
- The child isn't born yet. Thus, 302 IPC isn't applicable here
- **E.g.:** Accused stabs the pregnant women in abdomen to kill her. Fetus is dead but the mother is saved.
 - Here, accused is targeting the mother, but not the child

DEFINITIONS

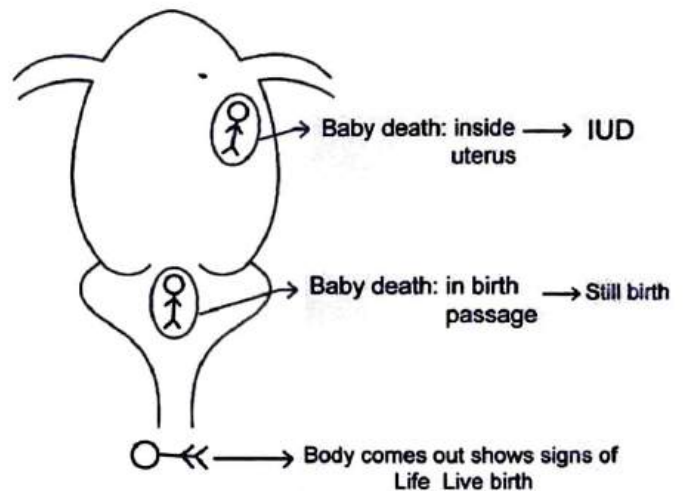
00:08:25

Dead born

- Child dies inside the uterus itself

Still born

- Child is born after 28 weeks [i.e. after the period of viability], but didn't breathe or show any signs of life after completely born



DEAD BORN

00:10:26

Signs of intra-uterine death of fetus are

- Just born fetus showing
 - Rigor Mortis/
 - Maceration/
 - Mummification/
 - Putrefaction

Refer Table 26.1

MACERATION

00:14:48

- Aka Aseptic autolysis
 - Aseptic = occurs without bacteria
 - Autolysis = self-lysis
- Conditions required are Intact sac & excess amniotic fluid

Features of Maceration

External signs

00:15:30

1. Skin slippage/ Reddening of the skin → Earliest sign, seen as early as 12 hrs
 - When pressure is applied on the skin, the epidermis peels off. This is k/a skin slippage
2. Skin blebs → seen in 24 hrs
3. Softening of the joints/ Flaccid baby → seen in 2days/ 48hrs
 - Sweetish disagreeable odour is perceived
4. Hypermobility joints
5. Subcutaneous edema >5mm → seen from 5th day onwards
6. Abdominal distension etc

Classification of changes occurring d/t Maceration

Classification	Features
1. Mild	• Only skin slippage is present
2. Moderate	• Skin slippage + softening of the organs is present
3. Severe	• Skin slippage + Softening of the organs + Hypermobility joints are present



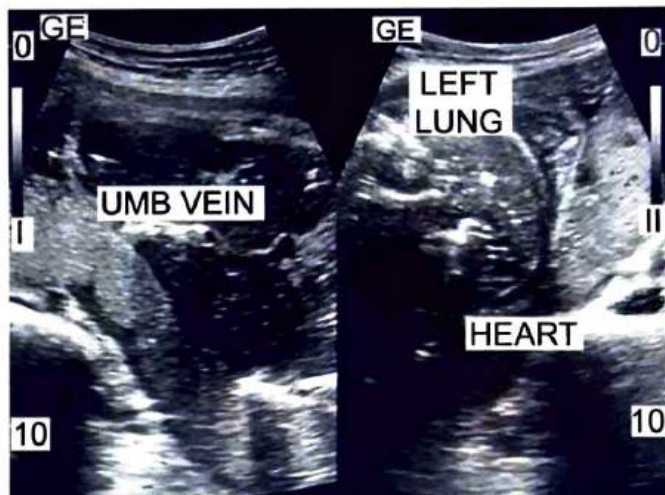
Skin slippage & Peeling of the skin

RADIOLOGICAL SIGNS OF MACERATION

00:19:32

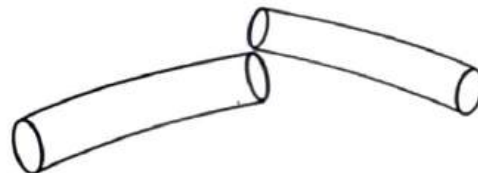
1. Robert Sign

- Presence of gas shadow in the great vessels like aorta, pulmonary vessels, heart chambers, umbilical artery etc
- It is earliest radiological sign, seen as early as 12 hours.



2. Spalding sign

- Loss of alignment & overriding of cranial vault bones
- Reason
 - Brain gets liquified d/t maceration & shrinkage of the cerebrum occurs
 - As the skull vault bones are not fused, when brain gets liquified, vault bones lose their support & override each other
- It occurs in 4-7 days after death





Spalding sign

3. Hyperflexion of spine

- Normally, baby will be in universal flexion
- D/t maceration, joints become hypermobile resulting in hyperflexion of the spine
- Shadow looks like a ball. Thus, it is k/a Ball's Sign
- It is basically d/t collapse of the vertebral column itself



4. Overcrowding of ribs

- D/t maceration, there will be softening of the organs & collapse of the lungs, which results in crowding of the ribs



5. Deuel's halo sign

- Halo is seen around the head of the fetus
- It is d/t edema, resulting in separation of subcutaneous fat from the vault bones



LIVE BORN

00:24:55

- It is given under Registration of Birth & Death Act [RBD]
- Live born is complete expulsion of the products of conception, any time during the pregnancy & the child is breathing / showing any signs of life

Viability

- Ability of the fetus to live separate existence/ life apart from its mother, by virtue of its development
- I.e the baby should have been mature enough to lead a separate life outside the mother
- Period of viability in India = 210 days/ 28 weeks
- There is no law/ legal section mentioning the period of viability in India
- It is based on the survival capacity & available health care services
- If neonatal services are so good, even the child >180 days can also survive
- Any child born <210 days is nonviable & the chances of survival is very less

In 2017, Delhi the following incident happened

- A woman had delivered twins [boy & a girl] prematurely at 23 weeks of gestation. Hospital authorities declared babies as dead & hand overed bodies to the parents. While going back, boy baby started crying & was moving the limbs. He was admitted in other hospital & the boy baby had survived for around 10-15 days
- Now the question is, if the baby isn't viable [<28 weeks],

we should resuscitate the baby or not

- In Dec-2017, Indian medical association on consultation with Indian academic pediatrics, gave the following guidelines regarding resuscitation & viability itself
 - If the baby is < 28 weeks, the baby isn't viable
 - But, if the baby is <24 weeks, the chances of survival is so less
 - Thus, if the baby is b/w 24-28 weeks, resuscitation is done depending on the merits & demerits of the case
 - If the baby is b/w 20-24 weeks, resuscitation isn't necessary. We just have to give care & the comfort

• Possible evidences of live born are

1. Cry of the baby

★ Important Information

- **Vagitus uterinus:** Cry of the baby inside the uterus
- **Vagitus vaginalis:** Cry of the baby inside the vagina

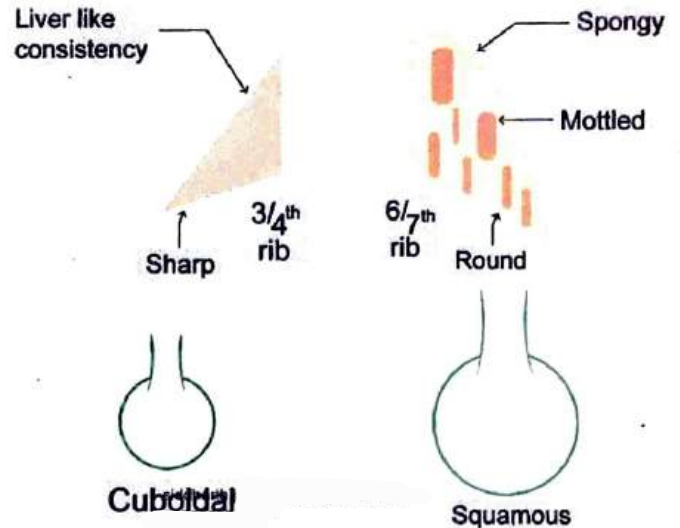
2. Movements of the baby

- Definitive evidence of live born is respiration

Examination

🕒 00:31:35

Features	If the baby hadn't respired	If the baby had respired
Shape of the chest	• Flat	• Expanded
Level of diaphragm	• 3 rd / 4 th rib	• 6 th / 7 th rib
Size of lungs	• Smaller	• Bigger
Margins of the lung	• Sharp	• Rounded d/t expansion of the lungs
Consistency of the lungs	• liver like consistency [solid]	• Spongy/ crepitant
Appearance of lungs	• Uniformly colored lung	• Mottled areas are present, as certain areas are aerated; certain areas aren't aerated
Epithelium of alveoli	• Cuboidal	• Squamous



★ Important Information

- Abdominal cavity is opened 1st during the autopsy of a newborn to check the level of the diaphragm
- If the diaphragm is at lower level [at 6th / 7th rib], it means that the baby had respired
- If the diaphragm is at higher level [at 3rd / 4th rib], it means that the baby hadn't respired

Tests for live born

🕒 00:35:50

1. Fodere's test/ Static test

- It is based on the weight of the lung
- Check the weight of both the lungs
 - If the baby hadn't respired, wt. is 30 gms
 - If the baby had respired, wt is 60 gms (weight ↑ d/t ↑ vascularity)

2. Ploucquet's test

- Check the ratio b/w $\frac{\text{Weight of the lung}}{\text{Weight of the baby}}$
- Initial ratio is 1:70
- On respiration, ratio changes to 1:35

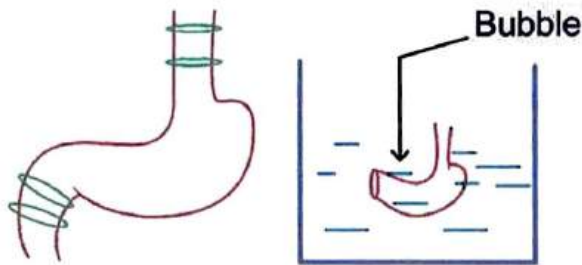
3. Wreden's test

- Examine the middle ear of the baby
 - If gelatinous tissue is present, that means baby hadn't respired
 - If there is clearing of gelatinous tissue & air is present,

that means baby had respired

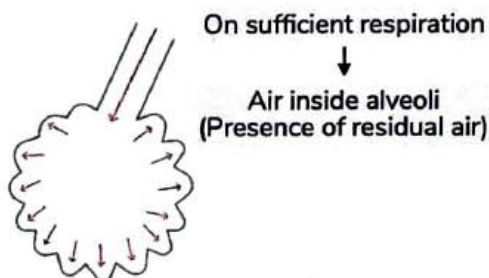
4. Breslau's Second life test

- Aka stomach bowel test
- When the baby breaths, some air is swallowed by the baby i.e there is presence of air inside the stomach
- Double ligate the stomach, cut it & take it out
- Immerse this stomach under the water & open it
 - If air is present inside the gastric cavity, then we can see the air bubbles coming out
 - This indicates that the baby must have respired



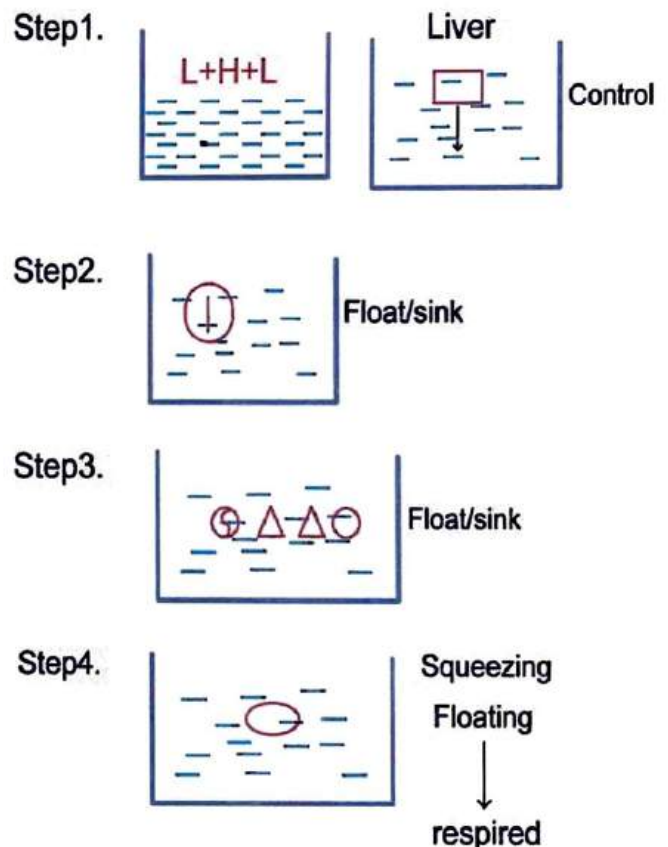
5. Hydrostatic test/ Raygat's test/ Breslau's 1st life test/ Lung floatation test

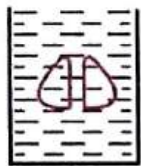
- If the baby had respired, the alveoli would be expanded/ dilated
- Specific gravity of the lung, when the baby hadn't respired is 1.040
- When the baby respire, specific gravity of the lung changes to 0.940
- Thus, as the lungs are expanded, alveoli are dilated & the specific gravity decreases
- Alveoli are dilated d/t presence of residual air
- Thus, this test is done to check the residual air of the lung [not the tidal volume]
- Specific gravity of water = 1
 - Anything with specific gravity >1 is put in the water, it sinks in the water
 - Anything with specific gravity <1 is put in the water, it floats on the water
- When lungs are expanded, specific gravity becomes <1. Thus, they float when they are placed in the water



Steps of the experiment

1. Take a container with water & place the lung block [heart + 2 lungs] into the water
 - If it is floating, there is air inside the lungs. This indicates that
 - The baby had respired or
 - Air can be d/t putrefaction
 - To differentiate this, take another container & place liver in it. It is used as a control
 - In normal conditions, as liver is a solid organ, it sinks
 - But, if there is presence of air in liver d/t putrefaction, it floats
2. Take the container with water & place the lungs in it & check whether the lungs are floating/ sinking. If the lungs are floating, go to next step
3. Take another container of water, cut lung into multiple pieces & place it in water. Now, check whether lung pieces are floating/ sinking.
 - If the lung pieces are floating, move on to the next step
4. Take a piece of the lung, squeeze it & put it in water.
 - Even after squeezing, if the lung pieces are floating, that means that the baby had respired





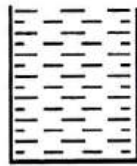
If floats

Squeeze

It

We squeeze to
Check for
Residual air

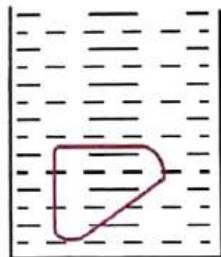
If still floats



Test is 't'

i.e baby has
Respired
Properly

TEST



Liver pieces
in water

Sink's-Normal

Floats-d/t Putrefaction

If sinks proceed & test

Control

Errors/Fallacies of this test

00:51:37

False positive

- Baby had not respired; but still, lungs pieces float
- Occurs d/t
 - Putrefaction
 - Artificial ventilation

False negative

- Baby had respired; but still, the lung pieces are sinking float
- Occurs d/t
 - Feeble respiration
 - Congenital pneumonia [alveoli are filled with inflammatory fluid]
 - Atelectasis

Hydrostatic test is not necessary in

00:53:37

- When the baby is definitely dead born
 - E.g.
 - Monster i.e. the baby born with congenital anomalies, anencephaly etc. with which survival is impossible
 - Maceration [sign of IUD]
 - Mummification
 - Gestation period is ≤ 180 days
- When the baby is definitely live born
 - E.g.
 - Presence of milk in the gastric cavity
 - Umbilical cord is separated & is healed with a scar [normally, it takes 1-2 weeks for umbilical cord to heal]



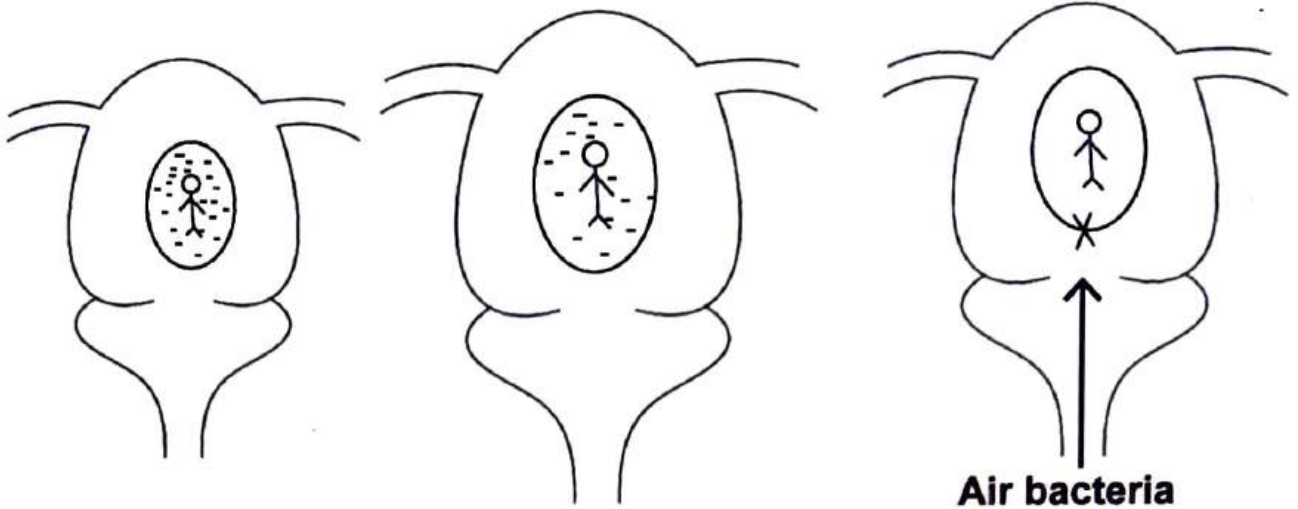
Important Information

- In Breslau's 1st life test, we are checking the residual air
- Squeezing of the lung is done to exclude the tidal air
- Thus, even after squeezing, if the air is present in the lungs, it is residual air & it makes the lungs to float on water

Table 26.1

	Maceration	Mummification	Putrefaction
Required conditions	<ul style="list-style-type: none"> • Intact sac, • Presence of adequate amniotic fluid, • Dead baby is inside the uterus 	<ul style="list-style-type: none"> • Intact sac • Dead baby is inside the uterus • Scanty amniotic fluid • Decreased blood supply <ul style="list-style-type: none"> ○ Scanty amniotic fluid & decreased blood supply results in dehydration k/a Mummification 	<ul style="list-style-type: none"> • Amniotic sac is ruptured • Outside bacteria enters uterine cavity & results in putrefaction

Image





CLINICAL QUESTIONS



Q. The forensic pathologist has to perform Raygat's test on the baby's body. For that, he dissects out the fetal lungs & puts them into the water, and observes while keeping the liver as a control. What is the characteristic of the lung that the doctor is studying?

- A. Weight of lung
- B. Specific gravity of lung
- C. Consistency of lung
- D. Volume of lungs

Answer: B

Solution

1. Hydrostatic test/ Raygat's test:

Principle:

- Specific gravity of lung before respiration is 1.04–1.05 and it becomes 0.94–0.95 after respiration.
- This makes the respired lung to float.

Procedure:

- Dissect out the fetal lungs & Put into water and observe (keep liver is used as control)

Inference:

- If they **sink**—unrespired lung.
- If they **float**—remove them from water, cut into small pieces and then squeeze or compress firmly between sponges, and again put into water.
- If they **sink**—unrespired lung.
- If they **float**—respired lung.

Explanation:

Floatation observed for second time is because of *residual air* that remains in the lungs which cannot be squeezed out by pressing, if the fetus has breathed after birth.

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.N.Reddy and Dr.O.P.Murty, 33rd edition, Page no: 385

Q. A 5-month-old baby has been declared dead on arrival. The parents claim that the baby was found breathless and unresponsive in the morning when the mother had tried to wake him up for breastfeeding. The baby had been healthy and had not shown signs of any discomfort or disease. The forensic doctor has concluded that it indeed is a "Sudden Infant Death Syndrome". Which statement among the following, is not true about SIDS?

- A. Also known as cot/crib death
- B. Threefold increase in twins
- C. Incidence common in females
- D. Cigarette smoking by pregnant mothers increase the risk

Answer: C

Solution

Sudden infant death syndrome (SIDS) / COT DEATH / CRIB DEATH

- not a positive finding;
- diagnosis is made when there is no other medical explanation for the abrupt death of an apparently healthy infant.
- rare after 7 months and almost never in older than 12 months.

Sudden, unexpected death of a seemingly normal, healthy infant under one year of age that remains unexplained even after a thorough postmortem investigation, including an autopsy and a review of the case history.

- infant seemingly healthy = no preceding symptoms
- complete investigation fails to find a cause of death
- no associated child abuse or illness

Factors associated with SIDS :-

1. Age = **Infant**
2. Sex = **Male**
3. Time = **early morning**
4. **Twins**
5. Mother = **smoking during pregnancy**

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.N Reddy and Dr.O.P.Murty, 34th edition, Page no:418



27 TRACE EVIDENCES

SEMINAL STAINS

00:00:50

Samples can be

1. Clothes

- Towel
- Underwear
- Bedsheet
- Carpet

2. Swab collected from

- Vagina
- Perineum
- Thigh
- Matted pubic hair etc
- Normal quantity of semen is around 2-6ml
- It is viscous, colourless & has specific odour



Cloth sample

Constituents of semen

00:02:21

Cellular component

Contain

- Spermatozoa
1ml of semen contain 60-150 million cells
- Epithelial cells
- Out of 60-150million spermatozoa, 90% would be motile
- Invivo motility can be seen upto
Vagina 6-12hrs
Uterus 3-5days

Acellular component (Enzymatic)

- Seminal vesicles
 - Secrete choline & lecithin
- Prostrate secretes
 - PSA (Prostatic Specific Antigen)
 - Acid phosphatase
 - Spermine .



UV light florescence

CHEMICAL TESTS

00:06:45

Florence test

- Seminal stain extract is taken and Florence reagent is added & observed under microscope,
- It shows dark brown rhombic crystals
- These crystals are choline iodide
- I.e we are detecting choline in the stain

Barberios test

- If we add Barberios reagent to the seminal stain extract, yellow needle crystals are seen
- This is d/t spermine picrate (i.e spermine in semen combines with picric acid in reagent & produce these crystals)
- Spermine is detected in this test

PHYSICAL EXAMINATION

00:04:50

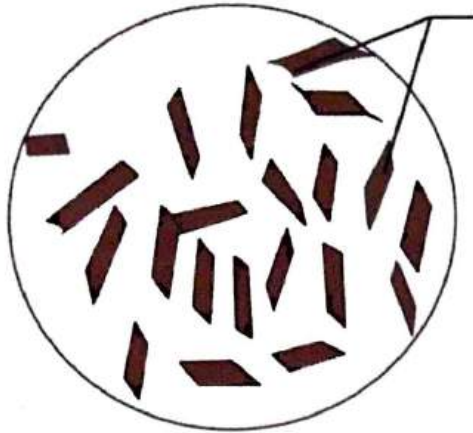
Cloth

- Show starchy appearance & is irregular in outline
- It is not specific for semen. Starch, pus, vaginal discharges can produce this appearance
- On examining under UV light, we get blue-white florescence d/t choline present in the semen

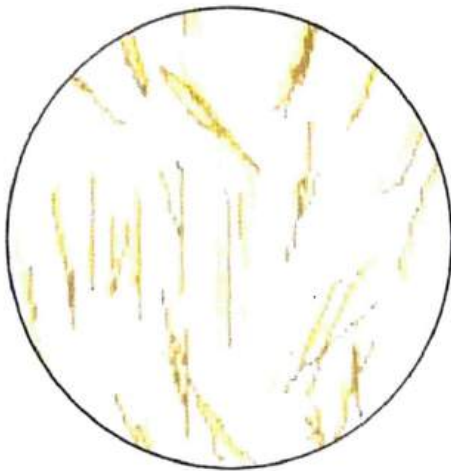


How to remember

- Last letter in Barberios is S. thus we detect spermine
- C in Florence is for choline



Florence test



Barberis test

ENZYMATIC TESTS

00:10:51

1. Acid phosphatase test

- Normal range is 320-360 BU
- If we find > 100 BU in the sample, it indicates that intercourse happened in <24 hrs

2. Creatine phosphokinase test (CPK)

- It used to check even 6 months older stains
- But it is not specific for semen
- Normal range is 660 IU/ml

ANTIGEN TESTS

00:13:14

Advantages

- Even if the person is Aspermic (i.e even if pt. had undergone vasectomy/ any sterilization surgery) antigens can be detected
- They are specific to humans (species specific)
- Most important antigens are
 1. Prostatic specific antigen (PSA) i.e P30 Ag
 2. Seminal vesicle specific antigen (SVSA) aka MHS-5

3. Mab-4eb is test to detect sperm surface antigen

4. Sperm specific LDH (lactate dehydrogenase)

- LDH-C4, LDH-X are specific for sperms

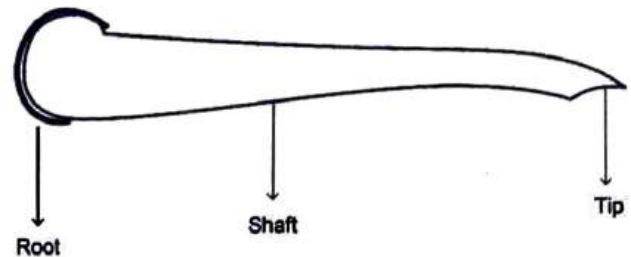
Microscopic examination

- If we are able to see at least 1 intact spermatozoa, it is confirmatory for seminal stain
- Precipitin test is done to identify the species (i.e human origin/ animal origin)

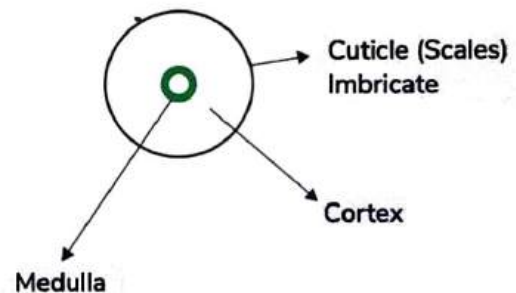
TRICHOLOGY

00:18:20

- Study of hair is k/a Trichology
- Hair contain root with a sheath, shaft, tip



- If we examine cut section of hair under microscope, we can see
 - Outer cuticle, where imbricate arrangement of scales are noted
 - Cortex, where keratin pigments are deposited
 - Inner medulla

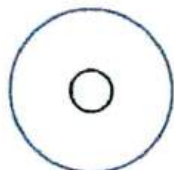


- In humans, cortex will be wider & medulla is smaller
 - Medullary cavity is variable in humans. I.e it is continuous in some region, fragmented in some region, absent in some regions etc

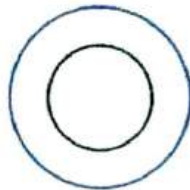
Forensic Importance

00:20:11

- When ever we get a hair sample, we have to identify whether it is hair follicle or fibre (jute, cotton etc)
- After confirming that it is hair, we should identify the origin i.e human/ animal origin



Wide



Narrow

Differences between human & animal hair ⌚ 00:20:40

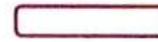
	Human hair	Animal hair
Cuticle	Fine, thin	Coarse, thick
Scales	Imbricate	Coronal arrangement
Cortex	Wide	Narrow as most of space is occupied by medulla
Medullary cavity	Narrow	Wide & continuous
Pigments	Deposited near cortex	Deposited near medulla
Medullary index (ratio b/w diameter of medulla to diameter of entire hair)	<0.3	>0.5

- Pubic/ axillary hair: thick, curly hair
- Beard: thick, straight hair
- **Cause of death**
 - Singeing (hair is curled, blackened, twisted d/t exposure to fire) is indicative of burns
 - If ends are abruptly cut, it is indicative of sharp trauma
 - If the ends are splitted, it is indicative of blunt trauma
 - We can check the deposition of metallic poisons

Singeing



burns



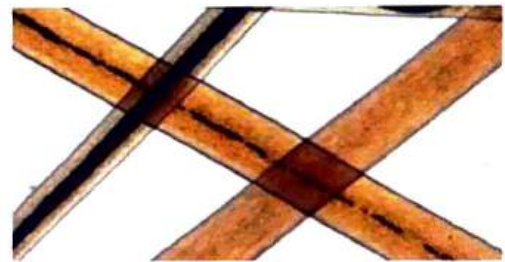
Sharp trauma



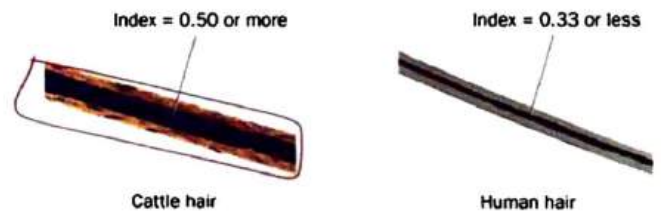
Blunt trauma

● **Time since death**

- Scalp hair grows at the rate of 0.4mm/day
- Thus, if we know the last date of shaving, we can find approximate time of death



Microscopic appearance of hair [human hair]



BLOOD STAINS

⌚ 00:30:01



By examining hair, we can determine

- **If the hair fallen naturally or d/t any trauma**
 - If the root is atrophied, it is natural fall
 - If the root sheath is torn, it may be traumatic fall
- **Sex of the person by**
 - DNA fingerprinting
 - Barr body
- **Age**
 - If it is pubic hair, it indicates age is above puberty
 - If greying of hair is seen, age is >40 yrs
 - If lanugo hair (fine, non-medullated, non-pigmented hair) is present, it is indicative of fetus
- **Part of the body**
 - Scalp: long/ straight hair

Tests to confirm blood stains

Presumptive tests

- Have more sensitivity
- Used for screening purposes

Eg.

- Colour test
- Luminescence test

Confirmatory tests

- Have more specificity
- Used to confirm the diagnosis

Eg.

- Microchemical test
- Spectroscopy test
- Microscopy test



Luminol spray

1. Colour test

🕒 00:31:50

• Principle

- Blood has got peroxidase property of the hemoglobin, which is used in colour test
- Blood stain [peroxidase] is mixed with peroxide & chemical reagent
 - If the suspected stain is blood stain, it cleaves this peroxide resulting in production of nascent oxygen [O]
 - This nascent oxygen convert the reagent to produce colour
- Tests done are
 - **Benzedine test**
 - Blue colour is positive
 - As it is carcinogenic, this test isn't used routinely
 - **Phenolphthalein test**
 - Aka Kastle mayer reaction/ test
 - Pink colour is positive
 - **Orthotolidine test**
 - Blue colour is positive

2. Luminescence tests

- **Advantage**
 - It is useful even in old stains & washed stains
- Tests like UV-light & Luminol spray are done
- It shows luminescent property of blood



UV-light showing blood stain

CONFIRMATORY TESTS

🕒 00:36:10

1. Microchemical tests

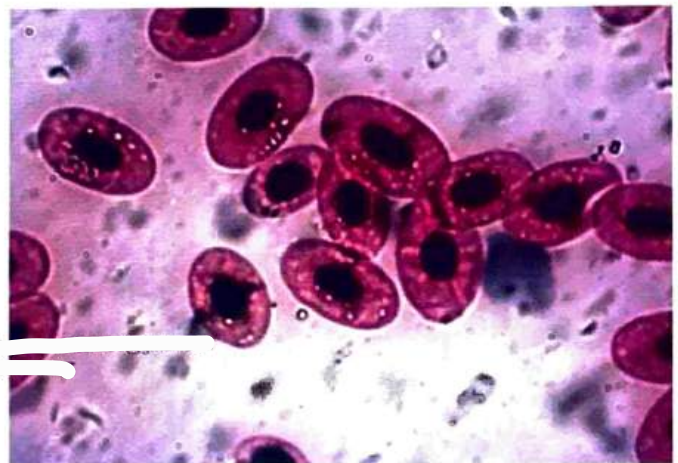
- It should be examined under microscope [Hence k/a Micro-chemical test]
- It includes
 - Teichman's test
 - Shows Dark-brown rhombic crystals
 - These crystals are hemin crystals
 - Takayama's test
 - Shows pink-feathery crystals
 - It is hemo-chromogen

2. Spectroscopy

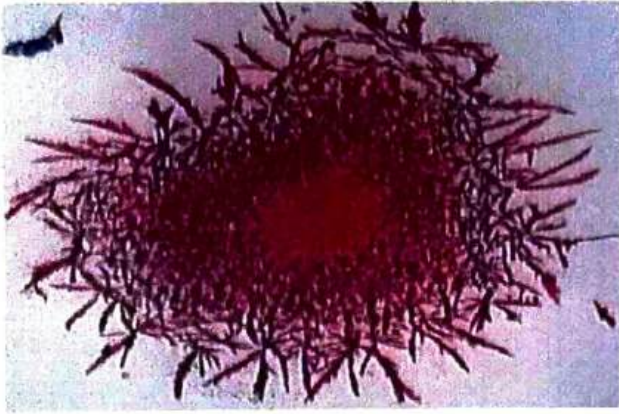
- Shows bands
- Can detect both recent & old stains
- It is most definitive/ confirmatory test

3. Microscopy

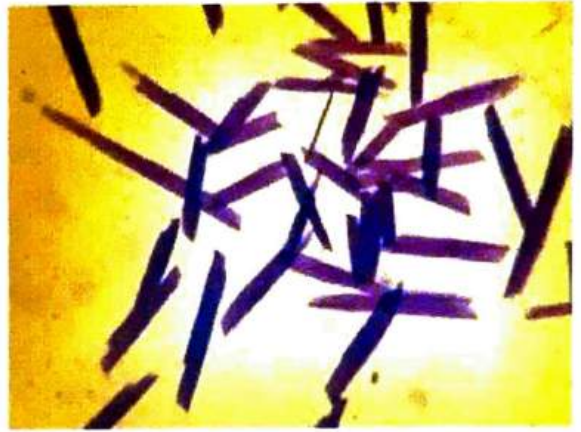
- It differentiates human blood from animal blood
- If the RBCs are circular, concave, anucleated, it is human blood
- If RBCs are oval, convex & have nucleus, it is animal blood



Oval nucleated RBCs of animals



Pink-feathery crystals in Takayama test



Brown-rhombic crystals – Teichman's test



CLINICAL QUESTIONS



Q. Seminal stain can be detected by?

- A. Phenolphthalein test
- B. Reine's test
- C. Barberio's test
- D. Paraffin test

Answer: C

Solution

TESTS FOR SEMINAL STAINS

- Creatine phosphokinase test
- Acid phosphatase test^o
- Florence test^o (**Choline iodide** crystals)
- Barberio's test (crystals of **spermine picrate**)

#Spermatozoa contains **high concentration** of **creatin phosphokinase** which is more than double then found in any other body fluid the enzyme is stable and can be demonstrated even in **old stains of 6 months**.

- Motile spermatozoa should be found in vagina for **6-12 hrs**
- they are likely to be found **upto 3 days** later, and occasionally they are found 7 days later.
- According to the Guidelines (given by Ministry of Health and family welfare for rape victim examination):
 - o **Vaginal swab** should be taken **within 72hrs**
 - o after this time period chances of demonstration of sperm (which might be potential evidence) are very less.

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.N Reddy and Dr.O.P.Murty, 34th edition, Page no:429

Q. A 30-year-old man has been accused of rape by his 26-year-old female friend. The woman allegedly was lured by the man on a pretext of helping with an assignment but had later spiked her drink and raped her while she was unconscious. The team has taken swabs of his urethral lining to test for the presence of vaginal cells. The test that would be done for the same is?

- A. Lugol's iodine test
- B. Takayama test
- C. Florence test
- D. Precipitin test

Answer: A

Solution

- **Lugol's iodine test** is to detect **vaginal epithelial cells containing glycogen**.
- Takayama test is to detect blood stains; while Florence test is test for seminal stain.

Reference: The Essentials of Forensic Medicine and Toxicology by K S N Reddy -33rd edition Page No: 426



28

BATTERED BABY SYNDROME



- Unemployed
- May be cigarette smoker
- History of drug abuse is very common
- Parents would have been the victims of child abuse i.e. battered child becomes the battering parent

CLASSICAL FEATURES

00:03:13



Synonyms

00:00:30

- Caffey syndrome
- Caffey-Kempe syndrome
- Parent-Infant Traumatic Stress Syndrome
- Maltreatment syndrome

BATTERED CHILD

00:00:50

- Battered child is the child who had received repetitive physical injuries d/t non-accidental violence produced by the parent/ a guardian

Predisposing factors regarding the child



- Mostly, male children who are < 3yrs of age are affected
- Youngest/ eldest child is MC affected
- Usually, unwanted child/ illegitimate child is affected

Features related to Parent/ Guardian

- Unmarried couple, literacy rate may be low

1. There is obvious discrepancy b/w the types of injuries present & the explanation given by the parent
 - I.e there isn't correlation b/w the injury & history given by the parent
 - **Eg. 1:**
 - **History given by the parent:** child slipped on the floor while playing
 - **Actual injury:** Fracture of shaft of long bones
 - **Eg. 2:**
 - **History given:** Child was playing close to the hot water, suddenly hot water spilled & the child got burnt
 - **Actual injury:** Looks like scalds produced d/t immersion
 - **Eg.3:**
 - **History given:** Child was playing on the floor, he got hit by furniture & got contusion
 - **Actual injury:** Looks like slap mark/ pinch mark/

cigarette burn

2. There is obvious delay b/w the time of injury & seeking of medical attention, which can't be explained
3. Injuries are at different stages of healing
 - I.e one injury is recent, another one is of 1 week old, another one is of 1 month old etc
 - It suggests that the baby is subjected to trauma chronically

INJURIES

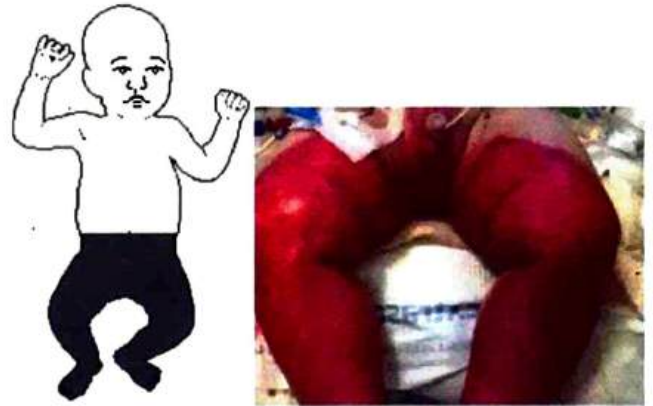
00:05:15

- All the injuries will be of varying ages of healing
1. Laceration of oral mucosa with tearing of lip frenulum.
 - It is most characteristic injury
 - When the child is crying, parent get irritated & forcefully closes the mouth of the child, which produces this kind of injury
 2. Skin shows presence of slap marks, lash marks, pinch marks
 - D/t skin pinching, butterfly bruises can also be seen
 - Six penny bruises can be seen
 3. Eye
 - Retinal detachment/ Retinal hemorrhages are seen
 4. Burns [most characteristic injury to child abuse]
 - Small, circular, pitted cigarette marks can be seen



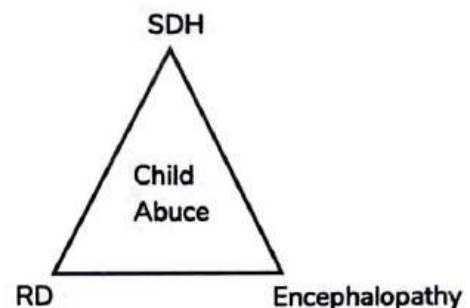
- Scalds d/t immersion into hot water
 - Clear demarcation line b/w normal skin & affected area is seen
 - When hands are immersed into the hot water, it produces glove pattern
 - When legs are immersed into hot water, it produces sock pattern

- Thus, glove & stocking pattern of scalds can be seen
- Person makes the baby to sit on the hot water forcefully. Thus, lower part of the abdomen & upper part of the thigh are injured



5. CNS injuries

- Common when the baby is shaken violently
- Thus, it is k/a shaken baby syndrome/ Infantile whiplash syndrome
- Head of the baby is larger & is easily movable. Thus, when the baby is held by abdomen & shaken violently, head moves independently
- When head moves independently, brain & skull vault moves at different base
- D/t this, bridging veins rupture, resulting in Sub-Dural hemorrhage [SDH], Retinal detachment & Encephalopathy



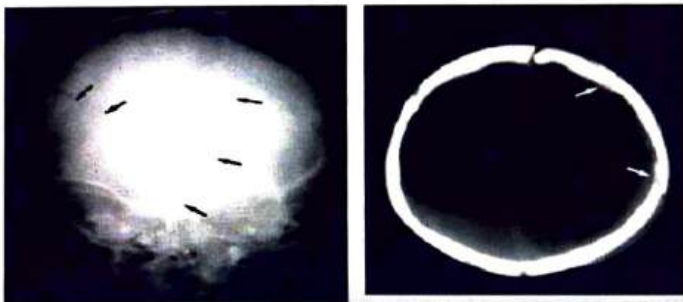
- SDH is the most consistent sign of this condition



6. skeletal injuries

I. skull

- Fissure fracture, commonly k/a Egg shell fracture is seen



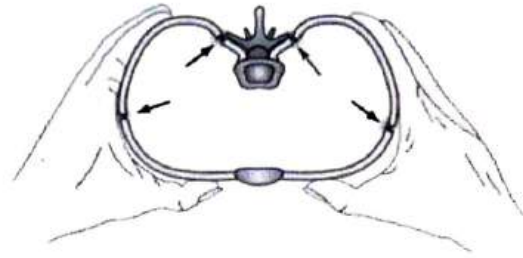
II. Long bone fracture d/t twisting/ squeezing/ pulling/ pushing of bones

- Spiral fracture d/t is seen twisting of the limb
- CML [Classical Metaphyseal Lesions]
- D/t torsion/ twisting effect, metaphyseal avulsions occur
- Occurs at lower part of the tibia/ upper end of the femur/ long bones of upper extremities
- These are k/a Corner fractures/ Bucket handle fractures
- It occurs d/t chronic accumulation of micro-injuries

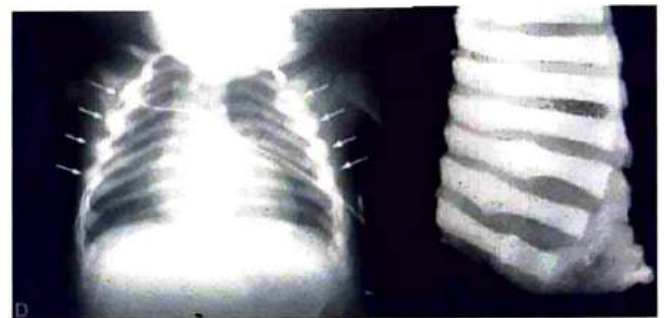


III. Chest

- Chest fractures are d/t compression of chest of the baby laterally/ antero-posteriorly



- When baby is compressed antero-posteriorly, fracture occurs at lateral end of the ribs i.e at Mid-axillary line
- When the baby is compressed laterally, fracture occurs at posterior end of the ribs i.e Para-vertebral cut
- D/t compression, fracture of multiple ribs occurs posteriorly, k/a Nodding fractures
- When fractures heal, deposition of callus occurs; which gives String on beads appearance



- Complete physical examination should be done, before informing the police

MUNCHAUSEN'S SYNDROME BY PROXY

🕒 00:17:05

- It is a type of child abuse
- Parent brings the child by fabricating illness & attends the hospital to gain medical attention
- The child is brought to the hospital with vague illness/ complaints repeatedly
- In this condition, child is perfectly normal. But the parent is suffering from psychological illness
- E.g.
 - Mother pricks the finger of the child, add that blood to the urine & attends the hospital with the complaint of hematuria
 - Mother gives laxatives to the child, attends the hospital with the complaints of diarrhea

- o Mother gives emetics to the child & the child is brought to the hospital with the complaints of vomiting
- o Insulin is given to the child. The child gets seizures d/t hypoglycemia; then the child is brought to the hospital with complaints of seizures

Diagnosis

- Presenting illness doesn't conform with the expected presentation of the illness
- Signs & symptoms doesn't correlate with the lab & imaging findings
- Child's condition becomes worse, when the parent is close to the child
- Child becomes better, when the parent is absent
- Previous history shows repeated hospitalization/ admissions

SUDDEN INFANT DEATH SYNDROME

🕒 00:20:25

- Aka Crib death/ Cot death
- Sudden, unexpected death of a previously healthy child is seen, whose death remains unexplained even after thorough investigation [-ve autopsy]
- Incidence is 0.2-0.4%
- Common in child with age b/w 2 weeks to 2 years. MC in b/w 2 months to 4 months
- Sex: Male children are MC affected
- Twins: If 1 of the twins is affected, another twin is also

more prone to it

- Time of death: Commonly noted in early mornings
- Prematurity increases the risk
- Alcohol & cigarette smoking of the parent increases the risk of sudden infant deaths

Autopsy findings

- Usually autopsy findings are negative
- Face of the child may be cyanotic
- Milk/ blood-stained froth at mouth & nostrils can be seen
- Most important & constant finding is presence of Multiple petechial hemorrhages in Lungs, heart & sometimes liver, thymus etc

Etiology

- No proven etiology is seen.
- Only hypothesis is given like deficiency of calcium/ magnesium/ selenium/ allergy to cow's milk etc.
- MC accepted hypothesis is Prolonged sleep apnea
- Respiratory infection: viremia may cause sleep depression of respiratory center
- Hypersensitivity to Cow's milk

Medicolegal implications

- Sometimes, it can be trialed/ suspected as an infanticide
- A case of infanticide can also be projected as sudden infant death syndrome



CLINICAL QUESTIONS



Q. A 2-year-old girl child has been declared dead on arrival at the hospital. Her dad claims that she had fallen off the balcony when left unsupervised by them for a few hours. The doctor, after a thorough examination of the victim's body, is determined that it is a case of "Battered baby syndrome". He has arrived at that conclusion after noticing all of the following, except?

- A. Subdural haemorrhage occurs in 40 % of fatal cases
- B. Nobbing fractures on the anterior angles of the ribs
- C. Vitreous and subhyaloid hemorrhages in the eyes
- D. Torn frenulum on the lower lip is a characteristic lesion

Answer: B

Solution

Battered baby syndrome/ Caffey's syndrome/non-accidental injury of childhood: "collection of injuries sustained by a child as a result of repeated mistreatment or beating. If a child's injuries indicate intentional trauma appear to be more severe than could reasonably be expected to result from an accident, battered child syndrome should be suspected.

1. **Nobbing fractures** occur on the posterior angles of the ribs in the paravertebral gutter region
 2. Subdural haemorrhage occurs in 40 % of fatal cases
 3. In the eyes, retinal detachment, retinal haemorrhages, Vitreous and subhyaloid haemorrhages are seen
 4. Torn frenulum on the lower lip is a characteristic lesion
- Head to toe examination to find other injuries
 - Interview possible witnesses about other injuries that the child may have suffered.
 - obtain the caretakers' explanation for those injuries, and
 - assess the conclusions of other medical personnel who may have seen the victim before.

Reference: The essentials of forensic medicine and toxicology by dr. K.s. Narayan reddy-33rd edition Page no : 445

Q. The school requested the help of a psychologist to understand why a particular girl was on leave frequently, citing health issues. The school was unable to deny her leave when the request was submitted by her own mother. After thoroughly questioning the student and her mother, the psychologist contacted the police under her Privileged communication rights. She believed that the mother of the child showed symptoms of "Munchausen's syndrome by proxy" and requested further questioning of the mother. All of the following are diagnostic criteria of Munchausen's syndrome by proxy, except?

- A. Illness produced or alleaed or both by a parent
- B. Repeated requests for medical care of a child
- C. Parental acceptance of knowledge of cause of symptoms
- D. Regression of symptoms on separation from parents

Answer: C

Solution

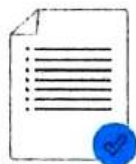
Munchausen syndrome: a psychiatric disorder that causes an individual to self-inflict injury or illness or to fabricate symptoms of physical or mental illness in order to receive medical care or hospitalization.

Munchausen's syndrome by proxy: Variation of the Munchausen syndrome in which an individual, typically a mother, intentionally causes or fabricates illness in a child under her care.

(Rosenberg criteria):

1. Illness produced or alleged, or both by a parent.
2. Repeated requests for medical care of a child, leading to multiple medical procedures.
3. Parental denial of knowledge of the cause of symptoms.
4. Regression of symptoms on separation from parents.

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.N Reddy and Dr.O.P.Murty, 33rd edition, Page no.446, 447



LEARNING OBJECTIVES

UNIT:6 – FORENSIC TOXICOLOGY

1. Toxicology introduction

- Terminology
- Poison
- Pioneers
- Poison Vs Toxin Vs Venom
- Classification of Poisons
- Ideal Homicidal Poison Vs Ideal Suicidal Poison

2. Diagnosis of poisoning in case of living

- Types of poisoning
- Clinical History
- Physical Examination – Toxidromes
- Dermal Signs
- Lab Diagnosis
- High Anion Gap Acidosis

3. Diagnosis of poisoning in case of dead

- History
- External Examination
- Internal Examination
- Investigatory Tests

4. General guidelines in the management of a case of poisoning

- Duties of a doctor in poisoning cases
 - Medical duty
 - Legal duty
- Narcotic drugs and psychotropic substances act
 - Possession of narcotics
- Drugs and laws for controlling the poisons
- Drugs & cosmetics act 1940
- Drugs & cosmetic rules, 1945
 - Schedules & their contents

5. Corrosives

- Groups of corrosives
- Classifications of Acids and Alkalis
- General Principles in Management of Acid Ingestion
- Sulphuric Acid

- Vitriolage
- Nitric Acid
- Hydrofluoric Acid
- Boiled Lobster Syndrome(Boric Acid Poisoning)
- Carbollic Acid
- Oxalic Acid

6. Metallic poisons

- Arsenic
- Types of poisoning
- Acute arsenic poisoning
- Chronic arsenic poisoning
- MLI
- Lead
- Routes of Poisoning
- Plumbism & Treatment
- Mercury
- Minamata disease and erethism
- Acrodynia
- Chronic Hg poisoning
- Copper & Chronic Cu poisoning
- Cadmium

7. Non-metallic irritants

- Phosphorous
- Sources of phosphorus& its Poisoning
- Stages of toxic symptoms
- Treatment
- Post Mortem Findings
- Chronic phosphorus poisoning

8. Animal irritants

- Snakes
- Venomous vs Non-Venomous Snake
- Different Families of Snakes
- Morphology of Venomous Snake
- Symptoms of Snake Bite
- Tests
- Management&Specific Treatment
- Snake Venom Ophthalmia
- Scorpion Sting

9. Plant irritants

- Ricinus Communis
- Abrus Precatorius
- Croton Tiglium

- Semecarpus Anacardium
- Fatal Doses
- Capsicum Annum
- Calotropis
- Spanish Fly

10. Cerebral poisons

- Somniferous poisons
- Derivatives of Opium
- Clinical Features of Morphine Poisoning&Treatment
- Heroin
- Inebriants – Ethanol
- Metabolism&Effects of Alcohol
- Methanol
- Treatment

11. Deliriant

- Datura
- Autopsy Findings
- Cannabis&Effects of Cannabis
- Cocaine&Effects of Cocaine

12. Cardiac poisons

- Aconite &Toxic Principles of Aconite
- Oleander
- Digitalis Purpura

13. Spinal poisons

- Strychnosnux vomica
- Kuchila seeds
- Treatment

14. Asphyxiants

- Carbon Monoxide
- Mechanism of Toxicity of CO
- Acute CO Poisoning
- When to Suspect
- Lab tests&Management
- Post-Mortem Findings
- Cyanide
 - Uses of Cyanide
 - Clinical Features
 - Mechanism of Toxicity of Cyanide
 - Management
- Autopsy Findings

15. Agricultural poisons

- Insecticide
- Organophosphorus compound
- Mechanism of Toxicity
- Clinical Features of OPC
- Diagnosis of OPC
- Treatment of OPC
- MLI
- Delayed Effects

16. Miscellaneous

- Chloral hydrate
- LSD
- Alcoholic withdrawal syndromes
- Chronic alcoholism
- Conium Maculatum



29

TOXICOLOGY INTRODUCTION



- Study of poisons in relation to environment
- 5. Toxinology**
- Study of toxins.

The Dose Makes the Poison!!
All things are poison and there is nothing which is not a poison.

Solely the dose differentiates a poison from the remedy

The above quote is given by Paracelsus, who is regarded as Father of Toxicology

- Study of poisons is k/a Toxicology
- Acute poisoning case is a medical emergency
- In India itself, 1-1.5 million cases of poisoning occur every year

EPIDEMIOLOGY

🕒 00:02:24

Peak age group	18-30yrs
Sex	Males > Females
Marital Status	Married
MC Poison used	<ul style="list-style-type: none"> • OPC • Aluminium Phosphide
Manner of death	Suicidal > Accidental > Homicidal



Mathew Orifila

TERMINOLOGY

🕒 00:04:00

1. Toxicology

- Study of poisons in relation to
 - Mode of action
 - Clinical Features (toxic features)
 - Fatal dose
 - Treatment/management

2. Forensic Toxicology

- Application of toxicology in the administration of justice
- It is about medico-legal aspects of poisoning

3. Occupational toxicology

- Study of poisons in relation to specific occupations

4. Ecotoxicology



Father of Modern Toxicology

CLASSIFICATION OF POISONS

🕒 00:09:05

Poison	Toxin	Venom
<ul style="list-style-type: none">Any Substance in any form (Solid, Liquid, gas) given through any route (topical, injected, inhaled, ingested), which results in ill effects / death through its local / remote actions is k/a poison	<ul style="list-style-type: none">Any Substance produced by a living organism (bacteria, virus, animal) is k/a toxin	<ul style="list-style-type: none">It is a variety of toxin

CLASSIFICATION

🕒 00:12:08

- Poisons Include 6 Groups
 - C- Corrosives
 - I- Irritants
 - N- Neurotoxins
 - C- Cardiotoxins
 - A- Asphyxiants
 - M- Miscellaneous

- Have 4 groups
- I. Metallic irritants**
 - Most important metals are Mercury, Lead, Arsenic, Iron, Copper etc

II. Non-metallic irritants

- Include Phosphorus, chlorine, Bromine, Iodine etc

III. Plant irritants

- Includes
 - Ricinus communis
 - Abrus precatorius
 - Semecarpus anacardium (BILAWA)
 - Croton tiglium
 - Calotropis
 - Ergot
 - Capsicum etc

IV. Animal Irritants

- Includes
 - Snakes
 - Scorpions
 - Honeybees
 - Centipedes etc

NEUROTOXIC POISONS

🕒 00:17:40

- These poisons can act on CNS / PNS
- In CNS, they can act on Brain/ spinal cord

Brain poisons

- If the poison stimulates brain, it is k/a Deliriant
 - Eg: Datura, Cocaine, Cannabis
- If the poisons depress the brain/ induces sleep, these are k/a Somniferous poisons
 - Eg: Opioids
- Poisons causing intoxication are k/a Inebriants
 - Eg: Alcohol

Spinal poisons

- Include Strychnos nux-vomica, Gelsemium etc

PNS poisons

- Include Conium maculatum/ Hemlock, curare etc

CARDIOTOXIC POISONS

🕒 00:20:45

- Death is caused by inducing cardiac arrhythmias
- CAR- CAR**diac poisons include
 - D- Digitalis
 - O- Oleander
 - N- Nicotine
 - A- Aconite



How to remember

"CINCAM"

1. Corrosives

Corrosives aka Caustics Include

Acids: Induce damage by coagulative necrosis

Alkalis: Induces damage by Liquefactive necrosis

- Corrosives are the group of poisons which cause maximum tissue destruction

2. Irritants

- Induce damage by causing inflammation



How to remember

CAR - DONA

ASPHYXIANTS

00:22:00

- Any poison producing asphyxia like features/ anoxia are k/a Asphyxiants
- Eg- Toxic gases like CO, CO₂, H₂S, HCN etc

Miscellaneous

- Agricultural poisons [OPC, Carbamates, organochlorines etc]
- Food Poisonings

00:23:40

	Ideal homicidal poison	Ideal Suicidal Poison
Characters	<ul style="list-style-type: none">• Colourless• Tasteless• Odourless	<ul style="list-style-type: none">• Colour does not matter• Sweet/pleasant• Odour does not matter
Cost	<ul style="list-style-type: none">• Cheap	<ul style="list-style-type: none">• Cheap
Availability	<ul style="list-style-type: none">• Easily available	<ul style="list-style-type: none">• Easily available
On set of Symptoms	<ul style="list-style-type: none">• Delayed onset [so that no one suspects]	<ul style="list-style-type: none">• Should have high fatality
Toxic symptoms	<ul style="list-style-type: none">• Toxic symptoms should resemble natural disease	<ul style="list-style-type: none">• Painless death
Detection	<ul style="list-style-type: none">• Should not be detected by any routine tests	<ul style="list-style-type: none">• Does not matter
Post mortem	<ul style="list-style-type: none">• Should not produce any specific post-mortem findings	<ul style="list-style-type: none">• Does not matter
Eg:	<ul style="list-style-type: none">• Thallium is Ideal homicidal poison (but not easily available)• Arsenic is MC used homicidal poison	<ul style="list-style-type: none">• Cyanide is Ideal suicidal poison• Opioids: Most commonly used suicidal poison



CLINICAL QUESTIONS



Q. Iran has returned the body of the 35-year-old man who was executed on charges of drug trafficking. The body has been embalmed prior to repatriation. Although it is usually still possible to identify the presence of drugs, the constituent chemicals in embalming fluids affect not only the detection but also the rate of decay of the majority of both pharmaceutical and illicit drugs in blood and many other bodily tissues, making forensic evidence unsafe and, therefore, usually inadmissible in courts of law. Which tissue sample will the forensic team prefer in this case for toxicological analysis?

- A. Bile
- B. Vitreous
- C. Spinal cord
- D. Skeletal muscle

Answer: D

Solution

- The best specimen used for toxicological analysis in embalmed body is SKELETAL MUSCLE FROM BUTTOCK
- In embalmed body its very difficult to detect volatile poisons.

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no.125

Q. Role of sodium fluoride as a preservative for blood in viscera packing are all except

- A. It prevents glycolysis
- B. Acts as anti-coagulant
- C. Inhibits bacterial growth
- D. Inhibits enolase enzyme

Answer: B

Solution

- 10 mg/ml **Sodium fluoride (grey vial)** used for blood preservation.
- Acts as preservative by
 - Prevents glycolysis
 - Inhibits bacterial growth
 - Inhibits enolase enzyme

#Potassium oxalate – anticoagulant and

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no. 124

Q. A 35-year-old woman who was rescued from a fire that had allegedly been started by a short circuit, showed a decreased level of consciousness, low blood pressure, and high lactic acid. The doctor considers the possibility of poisoning with one of the following which would have a "bitter almond" odor. Which one is the doctor suspecting it to be?

- A. Phenol
- B. Datura
- C. Cyanide
- D. Chloral hydrate

Answer: C

Solution

Poisons and Smell

- Organophosphorus compounds: **Kerosene (due to the addition of AROMAX)**
- Arsenic, Aluminium phosphide: **Garlic**
- Cannabis: **Burnt rope**
- Smell of carrot/mousy: **Hemlock (conium maculatum)**
- Alcohol: **Fruity (due to congeners)**
- Cyanide: **Bitter almond**
- Hydrogen sulphide: **Rotten egg**
- Chloral hydrate/Paraldehyde: **Acrid pear**
- Naphthalene: **Moth ball**
- Salicylate: **Menthol**
- Zinc phosphide: **Fishy**

Reference: Essentials of forensic medicine & toxicology, Dr KSN reddy, 33rd edition Page no : 540



30 DIAGNOSIS OF POISONING IN CASE OF LIVING

Diagnosis of poisoning can be done in living pts. & dead

TYPES OF POISONING

🕒 00:01:01

1. Fulminant poisoning

- Massive dose of poison causes symptoms of poisoning.

2. Acute poisoning

- Large dose of poison causes symptoms of poisoning.

3. Sub-Acute poisoning

- Small dose of poison, within short interval causes symptoms of poisoning.

4. Chronic poisoning

- Small doses of poison given for long duration causes symptoms of poisoning.

Clinical History

🕒 00:02:26

- Patient presents with Non-Specific Manifestations i.e
 - Impaired consciousness
 - Seizures
 - Respiratory depression
 - Cardiac arrhythmias
 - Hypothermia

Poisoning is suspected if

- Symptoms appear suddenly in a healthy person
- Symptoms if appear just after intake of food
- Several people suffering simultaneously

PHYSICAL EXAMINATION OF PATIENT

🕒 00:04:19

Toxidromes

- Patient will present with a group of symptoms / signs which will help to presume the particular group of poisons consumed by the patient
- It helps in treating the pt.

1. Cholinergic Toxidromes

- D – Diarrhoea
- U – Urination
- M – Miosis
- B – Bradycardia, Bronchospasm
- E – Emesis
- L – Lacrimation
- S – Salivation



How to remember

- DUMBELLS

Examples of cholinergic poisons

- OPC
- Carbamates

2. Anti-cholinergic Toxidromes

HR	↑
Blood pressure	↑
Temperature	↑
Pupils	Mydriasis (dilation of pupils)
Skin	Dry, hot
Sweating	Absent
CNS	Delirium, Hallucination
Others	<ul style="list-style-type: none"> • Urinary retention • Decreased bowel sounds

Examples of anticholinergic poisons

- Datura
- Atropine
- Tricyclic antidepressants
- Anti-parkinsonism agents
- Antihistamines

3. Sympathomimetic Toxidromes (Overactivity of Sympathetic system)

HR	↑
Blood pressure	↑
Temperature	↑
Pupils	Mydriasis
Skin	Increased Sweating
CNS	Symptoms of CNS Stimulation <ul style="list-style-type: none"> • Tremors • Tachypnea • Hyperalert • Convulsions

Examples

- Theophylline
- Amphetamines
- Cocaine
- Epinephrine

4. Sedatives / Opioid toxidromes

HR	↓ [Bradycardia]
Blood pressure	↓ [Hypotension]
Temperature	Hypothermia
Pupil	Miosis
CNS	<ul style="list-style-type: none"> • Respiratory depression • Coma

Examples

- Opioids
- Barbiturates
- Benzodiazepines

DERMAL SIGNS

00:13:00

If Skin	Poisoning
Is dry & hot	Datura
Shows profuse Sweating	OPC
Has Blisters	<ul style="list-style-type: none"> • Barbiturates • CO
Shows cherry red discoloration	CO [carbon monoxide]
Shows flushing	Sympathomimetics
Needle marks	Heroin, Morphine [Drug addict]

Lab diagnosis

00:14:48

- Best samples are blood & Urine

Blood	Urine
	Black Coloured Urine
Methemoglobinemia ↓ Chocolate Coloured blood	Green Coloured Urine
	Oxalic acid crystals
	Ethylene glycol poisoning

Phenol Poisoning

Oxaluria

- ECG
 - Continuous ECG monitoring is needed (Many poisons present with Cardiotoxic features eg: digitals, oleander)

High Anion Gap acidosis

00:16:29

- Following poisons present with high anion gap acidosis
 - Methanol
 - Paracetamol
 - Iron
 - Ethylene glycol

E.g. of High anion gap metabolic acidosis are

00:17:00

- M - Methanol poisoning
- U - Uraemia
- D - Diabetes
- P - Paracetamol poisoning
- I - Iron
- L - Lactic acidosis
- E - Ethylene glycol poisoning
- S - Salicylates poisoning



How to remember

- MUDPILES



31

DIAGNOSIS OF POISONING IN CASE OF DEAD

- We can diagnose the poison from

00:01:04

Refer Table 31.2

Refer Table 31.1

EXTERNAL EXAMINATION

00:01:19

1. Hypostasis

Colour of Hypostasis	Associated poisoning
Cherry red	CO Poisoning
Bright red/Brick red	Cyanide Poisoning
Brown	P - Potassium Chlorate, Phosphorus A - Aniline (sometimes show Blue color) N - Nitrate
Bluish green	H ₂ S Poisoning
Purple	Methanol
Black	Opium

2. Smell

- During external examination of dead body, Smell can be perceived from vomitus/ container (i.e, even before dissection, smell can be perceived from the body)

INTERNAL EXAMINATION

00:04:53

1. Smell

- To perceive the smell, open the cranial cavity first



Previous Year's Questions

- Q. Patient was brought to OPD with greenish color skin and rotten egg smell poisoning. The poisoning could be? (FMGE Aug 2020)
- Co
 - Cyanide
 - Nitrate
 - Hydrogen sulphide

Nephrotoxic Poisons

- N - NSAIDs
- E - Ergot alkaloids
- P - Potassium Chloride
- H - Heavy Metals
- R - Rhabdomyolysis
- O - Oxalic acid



How to remember

- NEPHRO

TESTS/INVESTIGATIONS

00:10:28

1. Viscera preservation

- Organs Preserved & sent for forensic analysis are
 - Stomach & its contents [Organ of food storage]
 - Small Intestine (Proximal 30 Cm) [Organ of absorption]
 - Liver (500 gms) [Organ of metabolism]
 - Kidney (1/2 of each kidneys) [Organ of excretion]
- Apart from the above organs, we also have to preserve
 - Blood (preserved from the peripheral vein)
 - Urine
- Above are the routine samples to be preserved in all the cases of poisoning



Important Information

Ideal Samples for analysis of poisoning are

- Blood
- Urine

- In Infants, entire small intestine, Liver, Kidney can be preserved
- Depending on the type of poison, we can preserve other organs as well

Preserved organ	Poisoning
Brain	Cerebral poisons
Spinal Cord	Strychnos nux vomica, Gelsemium poisoning
Lungs	Volatile poisons
Heart	Aconite
CSF	Alcohol
<ul style="list-style-type: none"> • Bone • Hair • Nail 	Heavy metals
Bile	<ul style="list-style-type: none"> • Opiates • Barbiturates • Alcohol
Fat (Mesenteric fat)	Pesticides

PRESERVATIVES

- Preservatives are added to prevent decomposition of the organs, so that sample analysis becomes easy.
- Commonly used preservatives are
 - Saturated solution of NaCl
 - Cheap. Thus, it is most commonly used preservative
 - Rectified Spirit is best preservative

Contraindications for using salt as a preservative

- A – Aconite

00:18:16

- C – Corrosives [as they chemically react with salt] except phenol (carbolic acid) poisoning



How to remember

- Avoid NaCl

Contraindications for using rectified spirit as a preservative

- In Alcohol detection as it gives false positive
- Acetone
- Phosphorus
- Paraldehyde
- Phenol
- Formalin [gives false positive]

Other preservatives

- To preserve blood sample, Sodium Fluoride & Potassium oxalate are used
- To preserve urine sample, Thymol, NaF can be used



Important Information


- Formalin is never used in poison detection (chemical analysis/ toxicological analysis) as it destroys poison in the tissues
- Formalin can only be used for Histopathological examination

Table 31.1

History	External examination	Internal examination	Tests (Investigations)
<ul style="list-style-type: none"> Can be obtained from: Relatives/Police 	<ul style="list-style-type: none"> While examining the body externally, look for <ol style="list-style-type: none"> Hypostasis Smell 	Smell	Viscera preservations

Table 31.2

Smell	Associated Poisoning
Burnt Rope	Cannabis
Bitter almond	Cyanide
Garlic	<ul style="list-style-type: none"> T- Thallium O- OPC A- Arsenic S- Selenium T- Tellurium
Rotten egg	H ₂ S
Acrid pear	<ul style="list-style-type: none"> Chloral Hydrate Mercaptans
Kerosene	OPC (due to Aromax), sometimes OPC shows garlic smell as well
Coal Gas	Co [Carbon monoxide]
Shoe polish	Nitrobenzene
Moth balls	Naphthalene
Fruity	Alcohol
Fishy	Zinc Phosphide
Winter green	Methyl Salicylate

 **How to remember**

- TOAST



32 GENERAL GUIDELINES IN THE MANAGEMENT OF A CASE OF POISONING

DUTIES OF A DOCTOR IN POISONING CASES

🕒 00:00:18

177 IPC

1. Legal Duty

- It is to follow the legal formalities, documentation to save the doctor himself

2. Medical duty

- It is to treat the patient & save the patient
- Medical Duty is more important than legal duty



Important Information

- If any poisoning case is brought to the hospital / clinic. every hospital/ clinic has got the legal obligation to treat the patient (at least first aid)

1. LEGAL DUTY

🕒 00:01:41

i. Preservation of the samples / evidences

- Food Sample
- Vomitus
- Clothes
- Gastric Lavage material
 - If any doctor discards the gastric lavage material, it is punishable; as it amounts to loss of evidence



Important Information

- If any person is not preserving the evidences intentionally. It amounts to disappearance of evidence & is punishable under 201IPC.

ii. Proper documentation

iii. Police intimation

- Whenever suspicious / unknown poisoning cases comes, we should Inform the police
- In Homicidal poisonings, we have to Inform the police
- According to 39 CrPC, police intimation is necessary in case of any crime/ suspected crime
- If a doctor is not informing the police, it is punishable under 176IPC
- If a doctor gives false information, it is punishable under

In Suicidal poisoning cases,

- If the patient is alive & confronts that he attempted the suicide himself, it is not mandatory to inform the police
- Attempt to suicide is not punishable
- But, if there is even least suspicion as well, Inform the police
- If the patient dies during the course of Rx / due to complications or
- If the Patient is dead on arrival, we need to Inform the Police

iv. Dying Declaration

- If the patient is at the verge of death, but he is conscious (i.e in compos mentis), we can arrange for dying declaration

NARCOTIC DRUGS AND PSYCHOTROPIC SUBSTANCES ACT

🕒 00:08:05

- NDPS Act, 1985
- Narcotic drugs include
 - C- Cocaine
 - H- Hemp (Cannabis)
 - O- Opium
 - P- Poppy Straw



How to remember

CHOP

- Psychotropic drugs: Any drug that alters the mind is k/a psychotropic drug
- Eg:
 - LSD
 - Phencyclidine
 - MDMA/Ecstasy

Cocaine

- Includes Coca leaf, cocaine Salt & its derivatives

Hemp

- Includes Ganja / Hashish

Opium

- Includes Opium plant and its derivatives

Poppy Straw

- Includes any part of the poppy plant except seeds
- Earlier we have following 3 important acts
 - Opium Act, 1857
 - Opium Act, 1878
 - Dangerous drug Act, 1930
- The purpose of NDPS act, is to restrict or prohibit the cultivation, manufacture, transport, storage, sale, purchase of the Narcotics (i.e. These are legally restricted)
- Violation of NDPS act is punishable

Possession of Narcotics

For personal use (small qty), it's Punishment is 6 months imprisonment (upto 1 year)

For commercial usage (larger quantities), the punishment is 10-20 yrs imprisonment

- Addict of narcotic drugs is also punishable.
- If he volunteers for rehabilitation program, he will not be punished (but this exception is given only for once)

Drugs and Laws for Controlling the poisons 00:15:28

- Drugs & Cosmetics Act, 1940
- Drugs & cosmetics Rules, 1945
- Drugs & Magic Remedies Act/ Objectionable Advertisement
- NDPS Act, 1985

Drugs & cosmetics act 1940 00:16:43

- **Purpose:** To control manufacture, import, sales of drug / cosmetics
- **Definitions**
 1. **Misbranded drug**
 - Coloured, coated, polished to conceal the damage or to make it appear better.
 - If the labels with fake/ false claims are present, it is k/a Misbranded drug
 2. **Adulterated drug**
 - Reduction of quality / purity of a drug
 - The drug contains decomposed/ putrid / harmful contents
 - The drug contains unpermitted colours
 3. **Spurious drug**

- It is Imitation of another drug
- It is done by a fictitious company
- If the contents are substituted by another drug, it is spurious drug
- **Eg:**
 - Midaz (original drug)
 - Midazz (Spurious drug)
- If the spurious drug is likely to cause death / grievous hurt, Punishment is 10 years to life imprisonment

Drugs & Cosmetic rules, 1945 00:22:10

- Schedules show guidelines for manufacture, storage, selling

Schedule	Contents
C	Biological products
E ₁	List of poisons used in Ayurveda, siddha, Unani etc
F	Blood products / vaccines / sera
H	Drugs to be sold only on prescription by RMP [Registered Medical Practitioner]
H (Added in 2013)	<ul style="list-style-type: none">• To decrease the drug resistance• Contains Antibiotics, Anti-tubercular drugs
X	Drug of abuse
J	List of conditions / diseases for which no cure is to be advertised Eg: <ul style="list-style-type: none">• Diabetes• AIDS• Blindness• Deafness



33

CORROSIVES

🕒 00:00:30

- Corrosives / caustics gives maximum tissue destruction.

Acids	Alkalis
<ul style="list-style-type: none"> • Causes coagulative necrosis • Outer edges form a crust around the wound to prevent further damage • Spread will be limited 	<ul style="list-style-type: none"> • Causes Liquefactive necrosis • Lateral spread is more compared to acid • Thus, alkalis are more dangerous



Important Information

- Hydrofluoric acid causes both Coagulative necrosis & Liquefactive necrosis

CLASSIFICATION & EXAMPLES

🕒 00:03:37

Acids		Alkali
Inorganic acid	Organic acid	
<ul style="list-style-type: none"> • Primarily shows local action only as there is no Systemic Absorption • Eg. <ol style="list-style-type: none"> 1. H_2SO_4 2. HNO_3 3. HCL 	<ul style="list-style-type: none"> • It has systemic absorption • Hence, shows Local action + systemic action • Eg. <ul style="list-style-type: none"> • Carboic acid (Phenol) • Oxalic Acid • Acetic Acid • Boric Acid • Hydrofluoric acid 	Eg. <ol style="list-style-type: none"> 1. $NaOH$ 2. Potassium hydroxide 3. Sodium Carbonate 4. Potassium Carbonate 5. Ammonia

GENERAL PRINCIPLES IN MANAGEMENT OF ACID INGESTION

🕒 00:06:45

1. Airway Monitoring & Management

- Early Intubation is ideal [if we suspect any injury i.e perforation, regurgitation of acid into vocal cords, vocal cord spasm etc]
- Cricothyroidotomy can also be done if there is airway compromise

2. NPO [Nill Per Oral]

3. No Gastric Lavage [to prevent gastric perforation]

4. No Emesis [as it may regurgitate & cause respiratory compromise]

5. No Neutralization with Carbonates [as neutralization emits gas & may cause further airway injury]

6. Diluents (H_2O) & Demulcents (Milk, Starch) can be given cautiously i.e it shouldn't induce any kind of vomiting

7. Pain Relievers [IV] can be given

8. Steroids: Prednisolone can be used to avoid long term complication i.e. strictures

9. IV Fluids In case of Circulatory shock

10. Symptomatic reliefs

1. SULPHURIC ACID (AKA OIL OF VITRIOL)

🕒 00:11:51

- Aka battery acid
- Used for toilet cleaning
- If it is in contact with skin for 30 seconds, it can cause full-thickness burns

Properties

- It is Colourless, Non-fuming, Odourless
- Hygroscopic in nature [absorbs water from the tissues]
- It causes Carbonization i.e tissues become charred & turn into black colour

Signs & symptoms

- Contact with skin causes corrosion of the skin & skin becomes dark-brown / black colour
- C/F on Oral Consumption of H_2SO_4 are

Mouth	Oesophagus	Stomach
<ul style="list-style-type: none"> Burning pain Intense thirst [but shouldn't drink the water] Tongue: Swollen, Charred, black Teeth: Chalky white deposits 	<ul style="list-style-type: none"> Odynophagia (MC presenting symptoms) Vomiting <ul style="list-style-type: none"> Initially Acidic Vomitus is seen Later, Coffee ground vomitus [acid + blood] is seen 	<ul style="list-style-type: none"> Intense Abdominal Pain Gastric perforation results in Chemical Peritonitis
<ul style="list-style-type: none"> If acid spill over into Larynx, the pt. presents with <ul style="list-style-type: none"> Dyspnea Glottic edema, Stridor → Emergency cricothyroidotomy should be done 		

Complications

- Peritonitis
- Circulatory Shock
- Laryngeal edema
- Long standing complication is stricture

Autopsy Findings

Dissection of abdomen shows

- Wet blotting paper Stomach
- Black, Charred Gastric mucosa
- If the quantity of acid is more, entire stomach gets converted into black charred mass



Important Information

VITRIOLAGE

00:21:19

- Throwing of any corrosive on a person [mostly on face]
- Eg: H_2SO_4 (MC), HNO_3 , Phenol, juice of *Semecarpus Anacardium* etc

C/F of Vitriolage

Burns

- Painless burns are seen
- No vesication is seen
- High chances of Contractures is seen

Rx

- Wash with H_2O
- Topical: Apply thick paste of Magesium oxide / Carbonate
- Give Antibiotics

On Exposure of acid to eye

- Wash with H_2O/NS
- Apply Olive oil to eyes
- 5g of $NaHCO_3$ can be used

LEGAL ASPECTS

00:24:50

- 357 © CrPC
 - For victims of rape/vitriolage, all govt. Hospitals / Pvt Hospitals, have to give first Aid / treatment, for free of Cost & Police intimation should be given by the doctor.
 - Failure to do so, will be punished under 166B IPC
- 326(A) IPC
 - Punishment for causing grievous hurt (acid attack)
- 326 (B) IPC
 - Punishment for attempt of Acid Attack.



Vitriolage

2. HNO_3 (NITRIC ACID)

00:29:17

- Aka Aqua fortis
- When HNO_3 comes in contact with tissues, it forms picric acid aka trinitrophenol (yellowish staining)
- This reaction is k/a Xanthoproteic Reaction
- It results in
 - Yellow staining over skin
 - Yellow teeth
 - Yellowish / brown stomach mucosa

3. HYDROFLOURIC ACID

00:31:50

- It is a unique acid as it can cause both
 - Coagulative necrosis (by H^+ ions) & → This results in local effects
 - Liquefactive necrosis (by Fluoride ions) → This results in systemic effects

Mechanism of toxicity

- Liquefactive & coagulative necrosis
- Decalcification + intense destruction of the bone
- When it comes in contact with calcium/ magnesium, it forms Insoluble salts

- Thus results in hypocalcemia & hypomagnesemia

C/F

Local Exposure / Effects

Skin

- Causes deep burns & severe excruciating pain primarily in subungual area

Systemic effects

Irrespective of the route of entry, following systemic effects are seen

- Hypocalcemia [predominantly]
- Hypomagnesemia
- Hyperkalemia
- Cardiac arrhythmias
- Metabolic acidosis

Inhalation

- Causes Irritation, cough, Lung injury & pulmonary edema

Ingestion causes

- Burning Pain
- Hemorrhagic gastritis
- Hematemesis

Management

- ICU admission
- Continuous ECG Monitoring for Cardiac arrhythmias
- Continuous serum electrolytes monitoring (hourly)
- Surface decontamination [wash skin with water]
- No gastric Lavage / emesis

RX

- Topically apply 2.5% calcium gluconate, if available
- In cases of deep/large burns SC injection of 10% calcium gluconate is given
- Correct Electrolyte imbalance
- IV Calcium gluconate



Important Information

00:40:51

Boiled Lobster syndrome

- Affected part will be looking as a **boiled lobster**
- It is dermatological manifestation of **boric acid poisoning**
- The affected part will show intense erythema & desquamation/exfoliation of skin

4. CARBOLIC ACID

00:41:50

- Aka phenol
- Primarily used as disinfectant/anti-septic
- Pure phenol looks like pink-colored needle crystals
 - It is normally colourless; **but** on exposure to air, it becomes pink



Pure phenol



Phenolic derivatives [disinfectant]

- **Phenolic derivatives**
 - Cresol
 - Resorcinol
 - Lysol
 - Thymol
- Odour: Hospital/Phenolic odour
- It can cause both acute & chronic poisoning
 - Acute poisoning is k/a Carbolism
 - Chronic poisoning is k/a phenolic marasmus
- On exposure to skin, it causes painless burns & white eschar
- On oral congestion [mouth → absorption into stomach],
 - Initially the pt. presents with burning pain
 - Later, only tingling & numbness is seen as sensory nerve endings are destroyed
 - D/t this, there is decreased vomiting

- On systemic absorption, it enters the liver
 - Liver metabolizes phenol into pyrocatechol, Hydroquinone
 - These are responsible for all the toxic effects of phenol
 - These metabolites get deposited in cornea, cartilage, skin
 - When it is deposited into the skin, it results in blackish discoloration k/a Ochronosis
 - These metabolites are excreted by the kidney, resulting in Carboluria
 - When urine is kept under room air, its colour becomes green & then dark d/t oxidation of metabolites
 - They may cause convoluted tubule damage, PCT necrosis & renal failure



Important Information

- Green color urine is seen in Acute Phenol poisoning

CNS Effects

- Profound Convulsions
- Later act as CNS Depressant
- Miotic pupils

CVS Effects

- Profound Hypotension
- Feeble Pulse & cold, clammy peripheries

Diagnosis

- Done by history + phenolic odour + Dark Urine

Rx

1. Rapid decontamination of
 - Skin
 - Burns by applying LMW-Poly-ethylene glycol/water
2. Gastric lavage is Indicated as gastric mucosa gives leathery consistency in phenol poisoning [d/t gastric mucosal edema]
 - Olive oil can be used
3. Hemodialysis
4. Treat hypotension/ shock, cardiac arrhythmias, convulsions



Important Information

- Q. Gastric lavage is allowed in which corrosive poisoning? (JIPMER – 2017)
- A. Paint thinner ingestion
 - B. Lysol ingestion
 - C. Crude toilet disinfectant ingestion
 - D. Battery acid ingestion

AUTOPSY FINDINGS

00:53:44

- Leathery/ Buff white stomach mucosa
- Phenol delays putrefaction as it is anti-bacterial

5. OXALIC ACID

00:54:44

- Aka acid of sugar / Salt of Sorrel
- Pure oxalic acid appears as colorless crystals



- It is used as Ink removal solution / Iron stain remover



- Used in forging signature

FOODS HIGH IN OXALATE



Toxicity

- Oxalic acid when it comes in contact with calcium, it forms Calcium Oxalate Crystals

Signs & symptoms

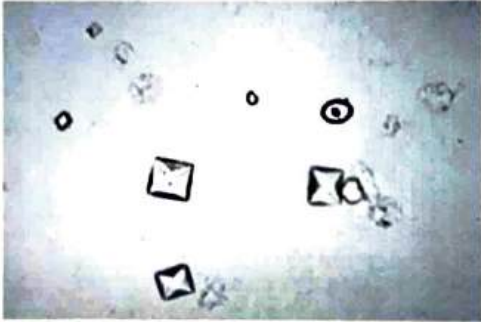
On ingestion of oxalic acid, it causes

- Burning pain in mouth, throat, epigastrium
- Coffee ground vomitus with shreds of stomach mucosa

On systemic absorption, it causes

- Oxalic acid combines with calcium & forms calcium oxalate crystals
- This results in hypocalcemia & features of tetany
- These crystals are excreted in the urine by the kidney k/a Oxaluria

Oxalic crystals in urine



- These crystals can get precipitated in the tubules, causes tubular damage & eventually renal failure [delayed cause of death in oxalic acid poisoning]
- The pt. can present with uremia



Important Information

Poisons resulting in hypocalcemia are

- Hydrofluoric acid
- Oxalic acid
- Ethylene glycol



Important Information

Q. In corrosive acid case. Stomach is opened along?(FMGE-JUNE-2019)

- A. Lesser curvature
- B. Greater curvature
- C. Vertical
- D. Pylorus

Rx of Oxalic Acid

1. Gastric lavage with calcium Lactate is done
2. Antidot: Oral calcium gluconate / Lactate
 - Calcium gluconate binds with residual oxalic acid present in gastric cavity, forms a complex & gets eliminated by stools
 - Thus, absorption of oxalic acid into blood is prevented
3. IV calcium gluconate (for severe Hypocalcemia)
4. Hemodialysis for uremia



CLINICAL QUESTIONS

1. A 5-year-old boy has been brought to the emergency with complaints of 8 episodes of vomiting. The vomit has bluish-green color and has been associated with severe abdominal pain. On examination, he was seen to be hypotensive and had elevated serum creatinine. On HD 2, a rash appeared on the palms, soles and buttocks. The doctor was able to document the triad of Erythema, Desquamation, and Exfoliation of the skin. This triad is seen in poisoning with which one of the following?

- A. Boric acid poisoning
- B. Sulphuric acid poisoning
- C. Phosphorus exposure
- D. Carbolic acid poisoning

Solution:

Boric acid (Hydrogen borate/Orthoboric acid)

- Weak acid, used as an antiseptic, insecticide (especially for cockroaches), flame retardant and as a neutron absorber.
- **GIT:** mimics acute gastroenteritis, nausea, vomiting (bluish-green), diarrhoea (bluish-green), haematemesis, and occasionally crampy abdominal pain
- **Skin:** generalized **erythema** creating a 'boiled lobster' appearance with massive areas of **desquamation** & exfoliation
 - D/D: Toxic epidermal necrolysis, Staphylococcal scalded skin syndrome
 - Rash is particularly seen on the palms, soles and buttocks
- **CNS:** Irritability, seizures, delirium and coma.
- **Renal:** Oliguria, renal tubular damage and elevated serum creatinine.
- **CVS:** Tachycardia, hypotension. Death results from circulatory collapse.
- **Medico-legal:**
 - Because of wide availability, accidental intake by children occurs frequently.
 - It may be taken by mistake and suicidal purposes.

Reference: Essentials of forensic medicine & toxicology, Dr KSN reddy, 33rd edition, Page no : 524

2. A 35-year-old man, while etching glass in a glass factory, accidentally was exposed to this acid which was not readily noticed or painful, unlike the warning properties of other acids. Skin contacts in concentrations in the range of 20% to 50% may not produce symptoms for almost 8 hours. With concentrations less than 20%, the latency period may be up to 24 hours. The patient began to experience pain that gradually increased in intensity at the site of exposure but there were still no visible signs of a burn. When he described this to the doctor on duty at the factory, the doctor immediately applied 2.5% Calcium gluconate gel on the site. Which acid has the man been exposed to?

- A. Sulphuric acid
- B. Hydrofluoric acid**
- C. Nitric acid
- D. Carbolic acid

Solution:

Hydrofluoric Acid

- Ingestion of hydrofluoric acid is A/W **hypocalcaemia, acidosis, and shock.**
- Hydrofluoric acid burns results in **bone destruction, and excruciating pain.**
- Toxicity result in **hypocalcemia and hypomagnesemia**

On Dermal exposure:

- Severe pain
- Hydrofluoric acid penetrates the skin and mucous membranes, causing deep tissue destruction

On ingestion:

Severe burning pain followed by **retching and vomiting.**

Treatment:

- Topical Skin Therapy: **Local application of 2.5% calcium gluconate gel** is the treatment of choice.
- Systemic: **IV calcium & Magnesium sulphate** until the normal levels are reached in blood.

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no. 527, 530

3. READ THE FOLLOWING STATEMENTS AND CHOOSE THE CORRECT ANSWER

- Mineral acids produce coagulative necrosis
- The extent of injuries caused by alkalis can be told within 48 hours post-exposure
- Stricture formation is more common in alkalis than acids
- Acids cause maximal damage to oropharynx and oesophagus

A.If a, b, c are correct

B.If a and c are correct

C.If b and d are correct

D.If all four (a, b, c, & d) are correct

Solution:

- Acids act by extracting water from tissues, coagulate cellular proteins and convert haemoglobin into hematin
- Acids cause maximum damage to stomach and pylorus; oropharynx and oesophagus have minimal involvement
- Hydrofluoric acid causes liquefaction necrosis; they have no remote action
- Alkalis:
 - Hydroxyl ions produce saponification of fat, soluble alkaline proteinases, cellular dehydration;
 - produces liquefaction necrosis;
 - stricture formation commoner in alkalis than acids
- The extent of injury by acids can be determined within 48 hrs where as in alkali, injuries are predicted up to 6 months

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S. Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no. 530, 536



34

METALLIC IRRITANTS

ARSENIC

00:00:36

- Traditionally called as Inheritance poison/ inheritance powder, as it is used to kill the family member & inherit the property
- It was commonly used for homicidal purposes [many kings in the past like Nepolian, were killed by arsenic poison]
- Now, arsenic is used in industries like insecticide companies, fruit sprays, dyes, rat killers etc
- It is a metalloid [i.e have both metallic & non-metallic properties]

Toxic forms of arsenic

- Arsenic as a metal is non-toxic, as it isn't absorbed from the GIT
- But, compounds of arsenic are absorbed from GIT into the circulation, which are toxic
- These are of 2 forms

Organic form

- Arsine: A gas with garlic odour [phosphorus & thallium also have garlic odour]

Inorganic form [salts]

- Arsenic trioxide: Aka inheritance powder
 - It is colourless, tasteless, odourless
 - Thus, it can be mixed with any food and commonly given as homicidal poison
- Copper arsenite/ Scheele's green
 - It is a green colour powder, which was earlier used for dyes/ wall paints
- Copper acetoarsenite/ Paris green
 - Green coloured pigment, used in paintings

Arsenic



Paris green



Copper arsenite



Arsenic trioxide



- Fetal dose of arsenic is 100-200 mg

TYPES OF POISONING

00:05:37

1. Fulminant poisoning

- Occurs when a person takes massive dose of arsenic [i.e 3gms, single dose at a time]
- Pt. dies within few hrs d/t circulatory failure/ cardiovascular collapse

2. **Acute poisoning** : Occurs when a person takes large dose of arsenic in a short period of time

3. **Chronic poisoning** : Occurs when a person takes small doses of arsenic over a long period of time

ACUTE ARSENIC POISONING

00:06:34

- 2 types i.e GIT type [MC] & Narcotic type [CNS symptoms are predominant]

Features of GIT type

- The pt. may have metallic taste
- Garlic breath
- Burning pain in throat/ abdomen/ chest
- Intense vomiting & Loose stools [d/t intestinal irritation & inflammation]
- It resembles cholera

Differences b/w Arsenic poisoning & cholera

	Arsenic poisoning	Cholera
Clinical features	Pt presents with throat pain, vomiting, loose stools/ purging in sequence	Pt presents with purging, vomiting & throat pain in sequence
Tenesmus	Present	Absent
Lab investigations	Arsenic can be detected in urine sample	Stool sample demonstrates the presence of bacillus

- Pt. may present with hypotension, which can result in subendocardial hemorrhages
- Oliguria can also be seen

🕒 00:10:16

TESTS TO DETECT ARSENIC POISONING

- Urine sample is more reliable than the blood sample, as we can detect the presence of arsenic in the urine
 - Urinary arsenic levels of $>50\mu\text{g}/24\text{hrs}$ is an indication for exposure to arsenic
 - Metabolites like DMA [Dimethyl Arsenic Acid], MMA [Methyl Arsenic Acid]
- Hair & nail samples are taken, as arsenic have the property of depositing in keratin tissues
 - It is sequentially deposited, based on which, we can find out the duration of exposure i.e, whether the exposure is in days/months/years
 - Pubic hair is more reliable sample than the scalp hair, as scalp hair has more chances of external contamination with the environment

Treatment

- Chelation therapy

Autopsy findings

- Rigor mortis starts early & it remains for a long time
- Arsenic inhibits the putrefaction. Thus, process of putrefaction is delayed
- Most important organ to be examined is stomach
 - Gastric mucosa is intensely congested/ hyperemic [d/t inflammation] k/a Red velvety stomach mucosa
 - Multiple hemorrhages are noted in the mucosa giving a Flea-bitten appearance

- If a person had consumed arsenic trioxide, we can see the white arsenic particles stuck on to the mucosa



Important Information

- **Red velvety stomach mucosa is seen in Arsenic poisoning**

CHRONIC ARSENIC POISONING

🕒 00:15:24

- Aka Arsenicosis [i.e toxicity with arsenic]
- **Sources of chronic arsenic poisoning are**
 - Occupational exposure: Commonly seen in ppl working in smelting industries, insecticide industries, rat killer industries etc
 - Exposure through food ingestion, for homicidal purpose
 - Water contaminated with arsenic
 - MC seen in West bengal, Bangladesh etc
 - It leads to Hydroarsenicism

Features of chronic arsenic poisoning

- **Skin**
 - Leucomelanosis [hypopigmentation] is the earliest skin feature
 - Brown pigmentation aka raindrop pigmentation is seen on the body [i.e at forehead, eyelids, neck, shoulder, trunk etc]
 - Skin rash resembles rash of Addison's disease/ fading measles rash
 - Hyperkeratosis i.e thickening of skin, particularly at palms & soles
- **Hair**
 - Arsenic gets deposited in the hair
 - Alopecia
- **Nail**
 - Transverse white line is seen k/a Reynold's line/ Aldrich's line/ Mee's line
 - It is not specific for Arsenic poisoning, as it is seen in thallium toxicity, renal failure pts, chemotherapy pts, severe infections etc
- **Nerves**
 - Arsenic causes peripheral, sensory motor polyneuropathy [i.e affects both sensory & motor nerves]
 - Predominantly, sensory nerves are more affected
 - Thus, it resembles Guillain-Barré Syndrome [GBS] as it shows features of demyelination/ axial

degeneration.



Important Information

Poisons producing GBS like features are **Arsenic** & **Thallium, barium**.

- **Blood vessels**
 - Causes chronic occlusion of the vessels particularly arteries
 - Sclerosis occurs, due to this chronic occlusion
 - Peripheries of the body will not get adequate blood supply leading to periphery ischemia & peripheral gangrene.
 - This is k/a Black Foot Disease.



Important Information

NEOPLASTIC FEATURES OF ARSENIC

- Risk of malignancies is seen with arsenic exposure.
- Particularly, the risk of **Basal Cell Ca. SCC.** and **Bowen's Disease** is increased with arsenic poisoning.

TESTS FOR DIAGNOSIS

🕒 00:23:43

- **Old tests [not used now]**
 - Marsh test
 - Reinsch test
 - Gutzeit test
- **Latest tests [presently used to detect metals]**
 - NAA (Neutron Activation Analysis)
 - AAS (Atomic Absorption Spectrometry)

TREATMENT

🕒 00:25:20

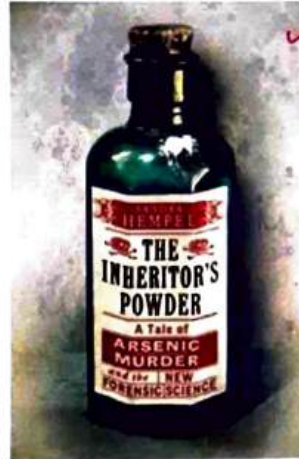
1. First and appropriate step is to removal of exposure
2. Chelation
 - **BAL (British anti lewisite/Dimercaprol)**
 - Given as **deep IM injection**
 - It is oil-based solution
 - It is very painful.
 - **DMSA (succimer):** oral formulation.
 - Supportive measures

MEDICOLEGAL IMPORTANCE

🕒 00:26:31

- **Arsenophagists**
 - People who eat arsenic are Arsenophagists
 - This process is k/a Arsenophagia
 - They believe that doing so will increase the libido

- Thus, arsenic is used as Aphrodisiac
- Gradually these ppl develop tolerance even to higher dose of arsenic i.e upto 300mg of single dose of arsenic.
- It is ideal homicidal poisoning [nearly]
- Disadvantage as homicidal poisoning
 - It retards putrefaction.
 - Even if the body is completely skeletonized, we can detect arsenic in skeletal remains, hair, nails, cremains (burnt bones)
 - Thus, it is not a typical homicidal poisoning
- Arsenic is used as inheritors powder commonly for homicidal poisoning



Rash seen with Arsenic poisoning



Hyperkeratosis in palms [seen in soles as well]



Transverse white lines ALDRICH MEES LINES (also seen in thallium poisoning)



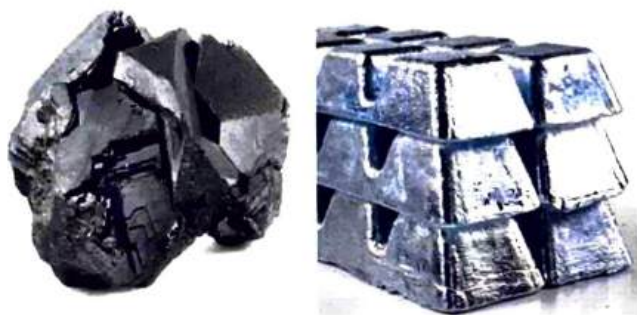
Previous Year's Questions

Q. Hairs are preserved in which poisoning?
(FMGE - DEC - 2019)

- A. Arsenic
- B. Manganese
- C. Phosphorous
- D. Alcohol

LEAD

00:30:06



- It is Ubiquitous i.e commonly present everywhere
 - Eg. Present in water as contaminant, pipes, air, paint etc.
- Acute poisoning is uncommon
- Chronic poisoning of lead is the most common heavy metal poisoning seen; commonly k/a Plumbism/ Saturnism

Toxic Forms

- **Organic form of lead**
 - Di/Tetra ethyl lead [toxic]
 - Di/tetra-methyl lead
- **Inorganic forms of lead [include all salts]**
 - Lead tetroxide
 - Lead sulphate
 - Lead acetate (salts)

Lead acetate



- It looks like sugar. Hence, k/a sugar of lead
- It is most common lead salt causing poison

Lead tetroxide



- Commonly used as Vermilion/ Sindoor.
- MC metal used in vermilion is Mercuric sulphite.
- But sometimes lead tetroxide is used as contaminant, which is toxic.

Lead sulphide



- It is black in color
- Ppl commonly use it as Surma [eyeliner]



- It is least toxic salt of lead

Lead carbonate



Lead paint coming as flakes

- It is white in colour
- It is commonly used in white color paints
- Any child having the habit of eating lead paint flakes will develop poisoning.

ROUTES OF POSIONING

🕒 00:33:40

1. Oral ingestion

- Children accidentally eating lead paints.
- Consuming contaminated water stored in lead cisterns.

2. Inhalational

- MC seen with Occupational exposure
- i.e Paint industries, pipe industries, plumbing industries etc.
- It is MC route of lead poisoning

3. Percutaneous [through skin]

- People working in chemical factories, particularly jet fuels and gasoline,
- Lead gets exposed through the skin.

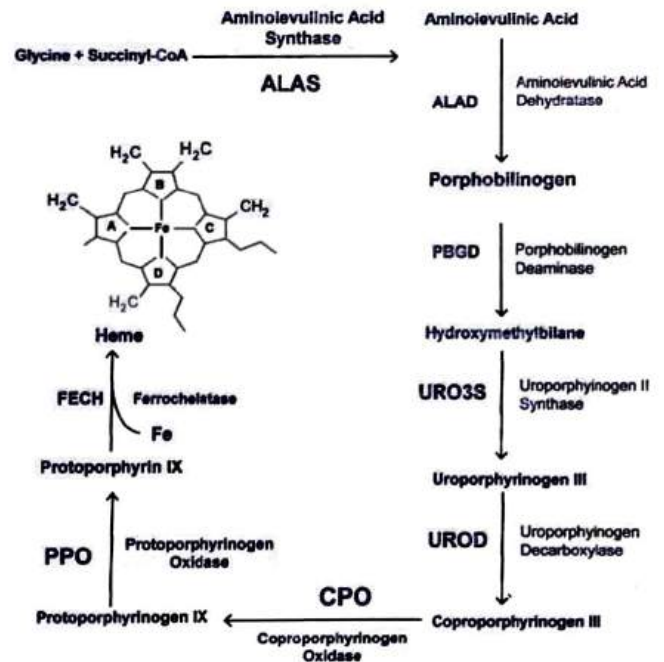
FEATURES OF CHRONIC LEAD POISONING

🕒 00:35:50

- Aka Plumbism/Saturnism

1. Anemia

- Occurs d/t inhibition of enzymes required for Hb synthesis
- Enzymes primarily inhibited are
 - Ferrochelatase
 - Coproporphyrinogen oxidase
 - Aminolevulinic acid dehydratase
- It results in Microcytic hypochromic anemia
- D/t the inhibition of above enzymes, Aminolevulinic acid levels, protoporphyrin-IX levels in the blood & urine are raised



Important Information

Causes of Microcytic hypochromic anemia are

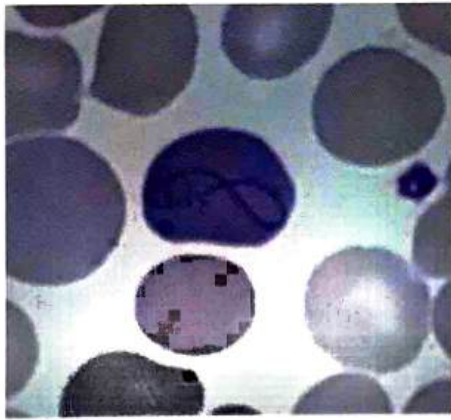
- Iron deficiency anemia
- Anemia of chronic disease
- Sideroblastic anemia
- Thalassemia
- Lead poisoning



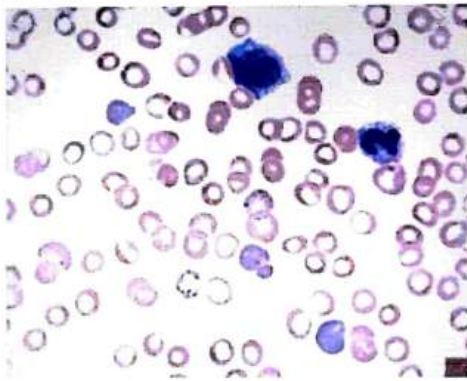
Important Information

BLOOD PICTURE IN PLUMBISM

- Polycythemia
- Microcytic hypochromic anemia
- Anisocytosis
- Poikilocytosis
- Cabot's ring
 - Ring shaped inclusion bodies seen in RBC
- Basophilic stippling
 - When Reticulocyte is maturing into RBC, degradation of ribosomes occurs by the enzyme 5-primidine nucleotidase
 - In lead poisoning 5-primidine nucleotidase is inhibited & ribosome degradation doesn't happen, resulting in basophilic stippling of RBC



Cabot's ring



Basophilic stippling of RBC [Granular things in RBC]

2. Burtonian Line/ Burtons Line

- It is blue deposits in the gums (at junction btw gums & the teeth)
- Particularly seen in Caries teeth
 - In caries teeth, bacteria is present & food accumulation occurs
 - These bacteria will decompose the food, resulting in H_2S production
 - This H_2S combines with lead to form lead sulphide
 - This lead-sulphide deposits at the junction between gums & teeth resulting in Burtonian lines.
 - It can be seen even with 1 week of exposure



Burtonian Line/ Burtons Line

Bone line (lead line)

- In children, radiopaque, dense transverse bands are seen in metaphysis of the long bones k/a Bone line
- MC lower end of femur/ upper end of tibia are involved
- It is d/t deposition of calcium
- Lead inhibits osteoclastic activity of bones resulting in increased deposition of calcium in the bones



3. Colic/ Constipation

- Severe spasmodic pain is seen k/a Painter's colic [as lead is used in paints]
- Aka Devonshire's colic/ Colica pictorum/ Saturnine colic
- Intense nocturnal, spasmodic pain is seen which is typically relieved by pressure

4. Drop

- Lead affects motor nerves, which causes muscle paralysis
- This results in wrist drop/ foot drop



Important Information

- In lead, motor nerves are more affected than sensory nerves
- In arsenic, sensory nerves are more affected than motor nerves

5. Encephalopathy

- MC seen with children
- Children will have learning disorders, personality disorders, memory issues, aggressiveness etc
- Every pt. will have this feature in varying degree
- It is permanent

6. Facial pallor

- Circum-oral facial pallor is seen
- It is d/t vasospasm [spasm of capillaries]
- It is most specific sign of plumbism

7. Gout

- Aka saturnine gout
- Lead inhibits uric acid excretion, resulting in hyperuricemia & gout-like features

Lab Investigations

🕒 00:50:28

- Look for anemia, polycythemia, eosinophilia, anisocytosis, poikilocytosis, punctate basophilia in peripheral smear
- Blood shows
 - Increased lead levels
 - Increased free erythrocyte porphyrin
→ Blood sample is more reliable [In Arsenic, urine sample is more reliable]
- Urine sample shows
 - Increased ALA
 - Increased Coproporphyrinogen
 - Increased free erythrocyte porphyrin
- Radiological findings
 - X-ray of long bones shows Bone line [at metaphyseal region]
 - X-ray of abdomen shows presence of lead chips
 - X-ray fluorescence is best test to find out total lead burden in the body

Treatment

🕒 00:53:20

- Removal of exposure
- Use Calcium Disodium EDTA [chelating agent]
 - It increases excretion of lead in the urine
 - Thus, if the pt. is suffering from renal failure, EDTA can't be given
- BAL
 - Used in pts. With renal failure
- Supportive measures

Plumbism/Saturnism includes

- **A** – Anemia
- **B** – Basophilic stippling, Burtonian line
- **C** – Colic, constipation
- **D** – Drops (Wrist drop, foot drop)
- **E** – Encephalopathy
- **F** – Facial pallor (D/t vasospasm)
- **G** – Gout. (Saturnine gout)



How to remember

- ABCDEFG



Previous Year's Questions

Q. Which metal results in "Saturation gout" formation? (FMGE – JAN – 2018)

- A. Cadmium
- B. Lead
- C. Beryllium
- D. Mercury

MERCURY

🕒 00:55:00

- It is liquid metal
- Commonly k/a Quick silver
- Chronic mercury poison is k/a Hydrargyrum
- Mercury is used in
 - Photography
 - Fingerprint powder
 - Thermometer/ Barometer
 - Electroplating
 - Thiomersal
→ Used in vaccines to decrease bacterial contamination
→ It is a product of ethyl-mercury
 - Dental amalgam

Occupational association

1. Hat industries
 - Mercury nitrate is used to process leather/ silk etc of hat
 - Thus, hatters may suffer from mercury toxicity



2. Glass blowing occupation



- Reflective surface of mirror is made up of coating of mercury



How to remember

Hg [chemical formula of mercury]

- H- Hatters
- G- Glass blowers

TOXIC FORMS OF MERCURY

00:58:24

1. Elemental mercury

- It isn't absorbed in the GIT
- If a person swallows the thermometer, the effects of injury is d/t broken glass pieces.
- Elemental mercury in the thermometer doesn't produce any effects as it isn't absorbed from the GIT
- It is toxic, if it is injected IV/ inhaled as a vapour

2. Organic mercury

- Includes Methyl mercury, Ethyl mercury etc.

3. Inorganic mercury

- Includes 2 types of salts. They are
 - Mercuric salts

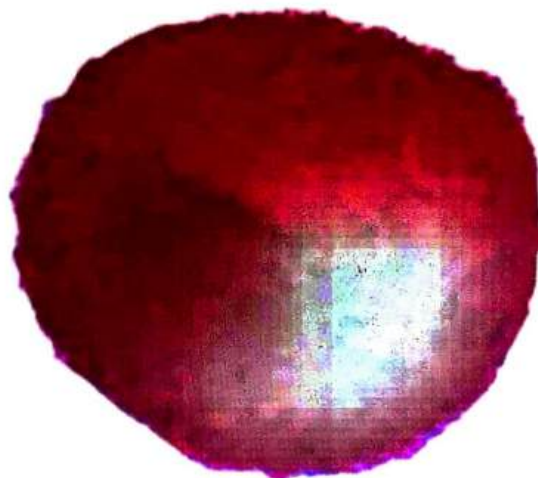
Eg:

- Mercuric chloride
- Mercuric nitrate
- Mercuric sulphide
- Mercuric thiocyanate etc.

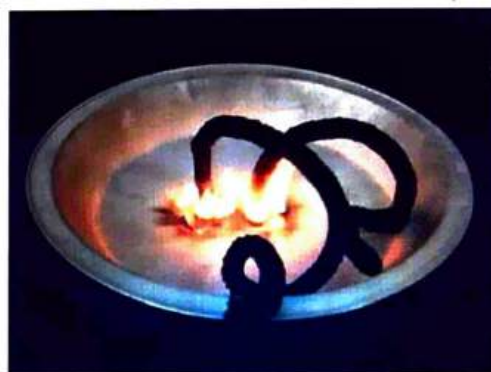
- Mercurous salt

Eg:

- Mercurous chloride/ Calomel



Mercuric sulphide [commonly used as sindoor]



Mercuric thiocyanate [on burning gives Pharaoh serpent, a type of cracker]

01:03:38

DISEASES CAUSED D/T MERCURY SALTS

1. Disease d/t inorganic mercury

Mercurialism

- If elemental mercury is injected IV, it causes Mercurialism
- Pt. presents with
 - Granulomas in the lungs [most striking feature]
 - Pulmonary embolism, dyspnea
 - Fever etc

Inhalation of mercuric vapour

- These pts. Presents with
 - Fever
 - Dyspnea
 - Skin rash etc.

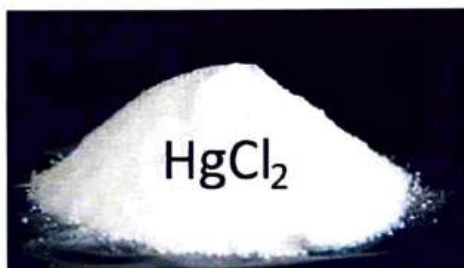
Mercuria lentis

- When a person is exposed to mercurial vapours, these vapours get deposited in the Anterior lens capsule
- Vision is normal
- Slit lamp examination shows Malt-brown reflex in the



Important Information

- Most toxic form of mercury is Organic mercury > Inorganic mercury
- Among inorganic mercury most toxic form is. Mercuric salt > Mercurous salt
- I.e order of toxicity = Organic mercury > Mercuric salt > Mercurous salt



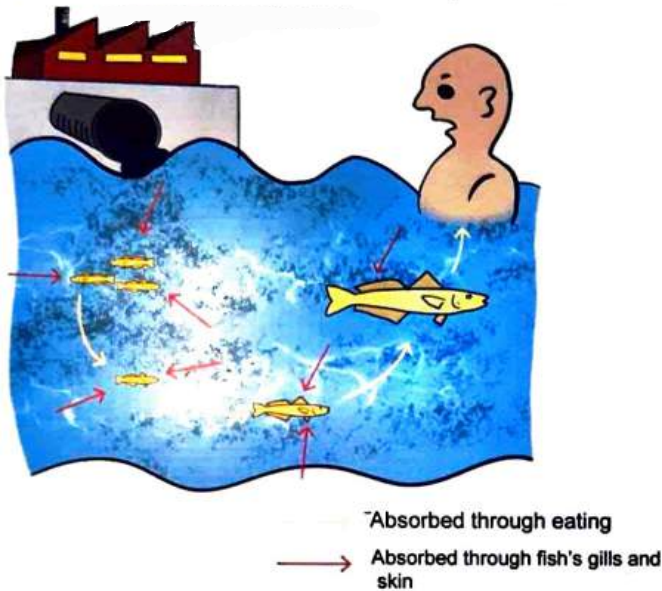
- lens of the eye
- It is bilateral

2. Disease d/t organic mercury

🕒 01:06:31

Minamata disease & Hunter russel syndrome

- Pt. presents with
 - Ataxia, tremors
 - Speech disturbances
 - Vision/hearing disturbances
 - Numbness in the peripheries [fingers & toes]
 - Coma in severe cases
- It doesn't occur d/t direct exposure to organic mercury [i.e methyl mercury]
- Minamata disease occurs d/t consumption of fish



Chain of Minamata disease

- When ppl gets exposed to mercuric salts, they develop Mercurial erethism
- When ppl gets exposed to mercurous salts, they develop Acrodynia

Mercurial erethism/ Erethism

- The pt. presents with neuro-psychiatric manifestations

Neurological manifestations

- The pt. presents with tremors, which are k/a Hatter's shakes/ Glass blowers shakes [as it is commonly seen in occupations of hatters & glass blowers]
- Both resting tremors & intentional tremors are seen
 - These tremors initially develop in the hands/ fingers
 - Then it involves Tongue arms & legs whole body [in sequence]
 - Thus, the pt. presents with typical symptom, which is 'Worsening of the hand-writing'

- Involvement of tongue results in slurring of speech
- Involvement of arms & legs results in ataxia



Important Information

- When the whole body is involved, the person will be completely bed-ridden k/a **Concussion mercurialis**
- It is d/t progression of tremors
- These tremors are k/a **Danberry tremors**

Psychiatric manifestations

- Initially, the pt. presents with Emotional instability i.e the pt. presents with timidity, shyness, depression, irritation etc
- These ppl are k/a Mad hatters [as ppl working in hatter industry develop psychiatric symptoms]

ACRODYNIA

🕒 01:15:20

- Pt. presents with painful peripheries
- Aka Feer's disease/ Swift-feer's disease/ Calomel's disease [as it occurs d/t exposure of Calomel]
- It specifically affects children
- The pt. presents with
 - P- Peeling of skin
 - Thus, this disease is k/a Pink disease
 - D/t peeling, ulcers are seen, which resembles Kawasaki disease/ Muco-cutaneous lymph-node syndrome
 - P- Pruritis
 - P- Parasthetic
 - P- Perspiring [sweating peripheries]
 - P- Painful, puffy peripheries [swollen toes & fingers]



How to remember

All the features starts with 'P'



Important Information

Q. Which poisoning resembles Kawasaki disease?
 Ans: **Mercury poisoning/ Acrodynia**

CHRONIC MERCURY POISONING

01:17:40

- Aka Hydrargyris
- It is commonly seen in Hatters & Glass blowers

Clinical features

- M- Minamata disease
- E- Erethism
- T- Tremors [Hatter shakes/ Glass-blower shakes]
- A- Acrodynia [Aka Pink disease]
- L- Mercuria Lentis/ Blue-Line in the gums [Also seen in lead, copper, iron poisoning]
- I- Insomnia
- C- Colitis [It resembles Diphtheric/ membranous colitis]
- H- Hunter-Russel syndrome
- G- Greyish stomach mucosa [d/t its corrosive property]



How to remember

METALLIC Hg



Acrodynia/ Pink disease



Hatter's/ Glass-blower's shakes

Treatment

01:21:00

- Remove exposure
- Give chelating agents
 - BAL is most preferable
 - It is contraindicated in organic mercury poisoning [as it is toxic]
 - DMSA can also be used

COPPER

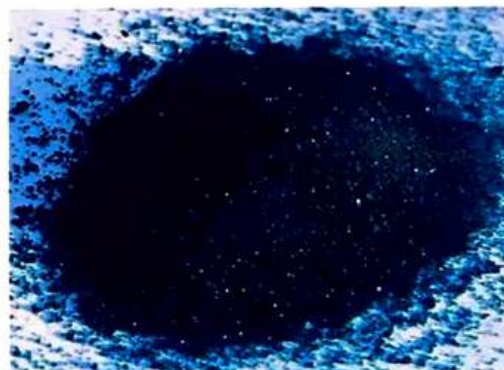
01:22:00

Toxic forms of copper



Copper sulphate

- Copper sulphate is blue coloured, crystalline
- Copper sulphate is also k/a Blue vitriol
 - Oil of vitriol is sulphuric acid



Copper sub-acetate aka Verdigris



Copper arsenate/ Scheele's green



Paris green/ Copper aceto-arsenate

Treatment

01:27:00

- Remove the source
- Gastric lavage doesn't show any significant role; because d/t vomiting, most of the copper had already come out
- D-Penicillamine is the most important chelating agent used
 - L-penicillamine isn't used as it is toxic

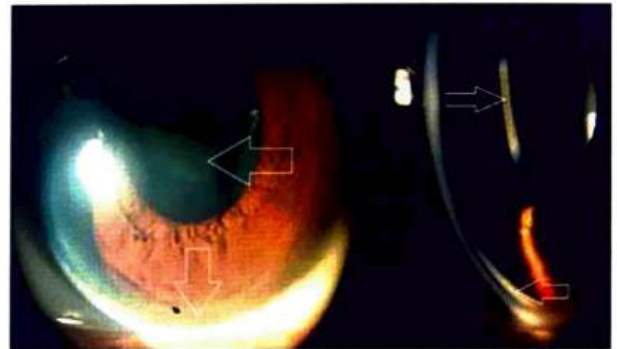
CHRONIC COPPER POISONING

01:27:44

- It can be d/t
 - Occupational exposure
 - Consuming contaminated water/ food → Cooking in uncoated copper utensils etc
 - Genetic diseases like Wilson's disease

Clinical features

- Chalcosis oculi: Deposition of copper in eyes
 - KF ring: Deposition of copper in Descemet's membrane
 - Sunflower cataract d/t subcapsular deposition of copper [in lens]

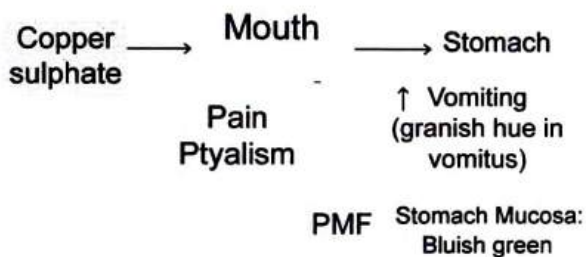


Chalcosis oculi

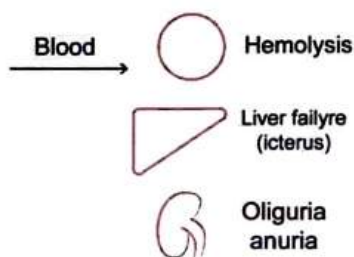
COPPER SULPHATE POISONING

01:23:10

- Its accidental poisoning is common in children
- When copper sulphate is consumed, the following features are seen
 - Pain in mouth, throat, chest, abdomen etc
 - Increased salivation aka Ptyalism [also seen in OPC poisoning]
 - Greenish hue intractable vomitus → Autopsy shows Bluish-green staining of stomach mucosa



- On systemic absorption, following features are seen
 - Hemolysis → It is predominant feature of copper sulphate poisoning → It results in hemoglobinemia, hemoglobinuria etc.
 - Liver failure features like icterus etc
 - Kidney is affected, resulting in Oliguria, anuria etc. In severe cases, renal failure is seen



Vineyard's sprayer lung disease



- Copper sulphate is used as spray in grape yards
- When Ppl working in grape yards chronically inhale this copper sulphate, it results in Vineyard's sprayer lung disease
- Victim presents with Interstitial fibrosis, granulomas,

- dyspnea etc
- o It is carcinogenic

- **Wilson's disease**

- o It is d/t abnormality in copper metabolism
- o It is Autosomal recessive disorder
- o Pt. presents with features of Hepato-lenticular degeneration

- **Greenish hair**



- o Copper sulphate is used as algicide in swimming pools
- o D/t exposure to this external contamination of water, the pt. may present with green-colored discoloration of hair



CADMIUM

- **Source**

- o Smoking
- o Occupational hazard: Ppl working in battery industries, welding industries, plastic industries etc.
- o Ingestion of contaminated food/ water

- **Features of chronic cadmium toxicity**

- Yellowish staining of teeth k/a Cadmium ring

- Cadmium replaces calcium from the bone d/t which, the bone becomes soft & fragile, showing
 - o Bone softening (Osteomalacia) resulting in multiple bony deformities [kyphosis, scoliosis etc]
 - o Pathological fractures of the bone
 - o D/t this, the pt. presents with intense bone pain. It is characteristic feature of chronic cadmium toxicit
 - o This is k/a Itai Itai disease/ Ouch Ouch disease
- It is Nephrotoxic
 - o It causes PCT necrosis, which results in Renal failure



Mass consumption of rice resulting in Cadmium toxicity in Japan

Tests

🕒 01:38:27

- Acute exposure shows elevated blood cadmium levels
- Chronic exposure results in Increased urine cadmium levels

Treatment

- DMSA is used to treat cadmium toxicity
- BAL is contraindicated in cadmium toxicity

🕒 01:33:10



CLINICAL QUESTIONS



Q. A middle aged man from West Bengal presents with paraesthesia of hands and feet, hyperkeratosis, lines in the nails and rain drop pigmentation in the hands. The most likely causative toxin for the above-mentioned symptoms is:

- A. Lead
- B. Arsenic
- C. Thallium
- D. Mercury

Answer: B

Solution

The symptoms mentioned in the question are classic features of chronic arsenic poisoning.

Chronic Arsenic poisoning: It is insidious in nature. The onset of symptoms usually occurs after 2–8 weeks of exposure. Chronic poisoning may occur among persons engaged in smelting and refining of ores and in the subliming of arsenic in the manufacture of weed killers, dyes etc.

Clinical Features of Chronic Arsenic poisoning:

1. GIT symptoms: loss of weight, malaise, loss of appetite, salivation, colicky pain, diarrhoea and vomiting.
2. Liver: Hepatomegaly, jaundice, cirrhosis
3. Skin symptoms: usually begin with a persistent erythematous flush leading to hyperkeratotic skin and desquamation. Hyperkeratosis is most prominent in the distal parts of the body. Pigmentation is patchy ('raindrops pigmentation'). Skin cancer (Squamous cell carcinoma and basal cell carcinoma) also occurs.
4. Nails: Aldrich Mees lines (transverse white striae of the fingernails) may also be seen.
5. Hairs: Alopecia occurs
6. Hematological: Anaemia, leukopenia, Thrombocytopenia and Bone marrow hypoplasia are seen. Anaemia is normocytic and normochromic
7. Peripheral neuropathy: Sensory and motor polyneuritis (sensory symptoms usually predominate) manifesting as numbness and tingling in a 'stocking glove' distribution.
8. Blackfoot disease: Due to platelet activation and hypercoagulability of blood in peripheral arteries.
9. Encephalopathy
10. Nephritis

Reference: Text book of forensic medicine and toxicology, 5th edition, Krishan Vij, page 466

Q. The following terms denote chronic poisoning syndromes , except

- A. Iodism
- B. Bromism
- C. Plumbism
- D. Carbolism

Answer: D

Solution

	Clinical Symptoms
Chronic Iodine poisoning (Iodism)	Pain over the frontal sinus, running nose, conjunctivitis, bronchial catarrh, salivation, nausea, vomiting, purging, emaciation, lymphadenopathy, parotid swelling (iodide mumps), acne or erythematous patches on the skin, urticaria, etc. (ioderma).
Chronic Bromide poisoning(Bromism):	Skin rashes in the form of red papules (Bromine rash), similar to acne vulgaris, which may transform into a pustular lesion/ ulcerate at the hair roots (Bromoderma), on the face, neck and upper part of the chest.
Chronic lead poisoning (Saturnism or Plumbism)	<ul style="list-style-type: none">• A - Anaemia• B - Burtonian line/Basophilic stippling, Bone lines• C - Colic, Constipation (dry belly ache)• D - Drop (wrist/Foot drop) - Lead palsy• E - Encephalopathy• F - Facial pallor (earliest sign)• G - Gout (saturnine gout)• H - Hypertension• I - Impotence
Carbolism: Acute carbolic acid poisoning	Oxidised to pyrocatechol and hydroxyquinone whose excretion is the cause of green colour urine (carboluria)
Phenol marasmus: Chronic poisoning	pigmentation of skin

Reference: The Essentials of Forensic Medicine and Toxicology by KS Narayan Reddy, 33rd edition, page no : 552



35

NON-METALLIC IRRITANTS

IRRITANT

00:00:20

- Any poison which can cause inflammation is k/a Irritant
- Divided into 2 groups i.e Inorganic, Organic irritants
- Inorganic irritants are divided into Non-metallic & metallic groups

- E.g.: Aluminum phosphate ~~some of the~~ OPC etc., [remaining OPC have typical corrosive smell]

NON-METALLIC IRRITANTS

PHOSPHORUS

00:01:00

- 2 Types of phosphorus are White & red phosphorus
- When white phosphorus is exposed to air, it turns yellow. Hence, it is also k/a yellow phosphorus



Phosphorescence



Crystalline White Phosphorus



Powdered Red phosphorus

Sources of phosphorus



00:02:00

White phosphorous

- Toxic
- Have Garlic odour
- Emits smoke
- Have Luminescent property [i.e glow in the dark] k/a phosphorescence
- It is prone for spontaneous combustion/inflammable.
- To prevent this, white phosphorous is kept under water
- Any compound with phosphorus in it may present with garlic odour

Red phosphorous

- Non-toxic
- No specific odour
- No smoke is emitted
- Non luminescent
- Non-inflammable. Thus, no need to keep under water



- White phosphorus is used in
 - Chemical warfare
 - Insecticides
 - Crackers
 → Thus, white phosphorus poisoning is commonly seen when crackers are being ingested

- Aka Diwali poison, as children may accidentally consume it & suffer from toxic symptoms
- Rodenticide [Rat killer]
 - Ratol is mistakenly used instead of paste
- Red phosphorus is commonly used in match-box [white phosphorus had been stopped to be used in match box d/t its toxicity]



Types of Phosphorus Poisoning

00:06:25

Acute phosphorus poisoning

- Seen whenever there is direct contact/ d/t oral ingestion
- Direct contact even with the intact skin causes deep burns [i.e 2°/3°burns].
- Thus, it is commonly used in chemical warfare

Chronic phosphorus poisoning

- Is d/t vapour inhalation
- Mostly it is d/t occupational hazard in match box industry

In Oral ingestion of phosphorus, 3 stages are seen

Stage 1: Gastrointestinal Phase

- Intense pain [in throat, chest, abdomen etc]
- Burning sensation
- Vomiting
- Loose stools



Important Information

- This vomitus & stools emit smoke d/t presence of white phosphorus. Hence, it is k/a Smoky Stool Syndrome
- These stool & vomitus glow in the dark. Hence, it is k/a Luminescent vomitus & Luminescent stools

- It may last for 12-24 hrs

Stage 2: Asymptomatic phase

- Pt. will not have any kind of symptoms
- We can't discharge the pt., as the pt. may land up in 3rd stage which may occur on 4th / 5th day
- If a doctor prematurely discharges the pt., he/she is liable for medical negligence

Stage 3: Multi-organ failure

- The pt. MC presents with Liver cell failure. Thus, the pt. may present with
 - Icterus
 - Bleeding disorders [spontaneous bleeding from gums, hematemesis, Malena, hematuria etc]
 - Asterixis [flapping tremors]
- Acute yellow atrophy of liver is seen
- Renal failure
- Encephalopathy [d/t direct toxic effect of phosphorus/ d/t liver cell failure]



Burns d/t direct contact with phosphorus

Stage 1: Smoky stool syndrome



Stage 3 : Liver Failure



Treatment

- ABC [Airway, Breathing, Circulation]
- Gastric lavage [Potassium permanganate (KMnO_4) is used]
- Manage Liver failure by giving
 - N-acetyl cysteine
 - Vitamin-K
 - Fresh Frozen Plasma [FFP]
 - Liver transplant [in fulminant hepatic failure]
- Dialysis

Postmortem/ Autopsy findings

- Garlic odour is perceived from the body cavities
- Jaundice
- Brown colored hypostasis
- Multiple hemorrhages in mucosa, skin etc., d/t liver cell failure
- Yellow liver atrophy is the characteristic feature of white phosphorus poisoning

Medico-Legal Importance [MLI]

🕒 00:15:20

- **Suicidal:** Uncommon d/t smell, taste & pain a/w this poisoning
- **Homicidal:** Rare d/t its taste [i.e person can easily detect d/t its taste]
 - Rarely, to mask the taste of phosphorus; it is mixed with coffee/ alcohol
 - If white phosphorus is used for homicidal purpose, it is difficult to identify during autopsy, as it is oxidized in the body
 - It may look like natural disease [i.e liver failure]
- **Accidental:** Very common [children accidentally consume crackers/ by rodenticides]

CHRONIC PHOSPHOROUS POISONING

🕒 00:17:42

- It is an occupational hazard
 - i.e. Ppl. working in industries where white phosphorus is used, are more prone for chronic phosphorus poisoning
 - Earlier, white phosphorus was used in match-box industries

- These ppl are exposed to vapours of phosphorus chronically, leading to Phossy jaw
 - C/F: Tooth pain → swelling → Osteomyelitis of mandible → multiple Sinuses discharging pus [occurs in sequence].
 - Autopsy shows Osteonecrosis of mandible
 - It is also k/a Lucifer's jaw/ Glass jaw
- As we have stopped using white phosphorus in match box industries, this condition is obsolete now



Ppl working in matchbox industries

Phossy jaw

- In olden days, white phosphorus had been used as Arson [burning the hut]



- Fresh cow dung [moist] is made as a ball. white phosphorus is kept inside the ball & thrown on the hut at night time.
- As cow dung is moist & temperature is low at nights, white phosphorus doesn't burn
- In the morning, as temperature increases, cow dung becomes dry & hot
- White phosphorus inside it starts burning resulting in burning of the hut



CLINICAL QUESTIONS



Q. A 45-year-old labourer was admitted with complaints of multiple sinuses discharging foul-smelling pus in the lower jaw bone. The man was employed at a firework factory. While taking a history of his presenting complaints, the doctor was informed that it had begun with toothache about 6 months prior. He had treated himself with over-the-counter pain medication. Gradually he had noticed the swelling of his jaw and also lost 2 teeth in the 6 months since symptoms began. The doctor diagnosed this as a "Phossy" jaw which is caused by which one of the following?

- A. Lead
- B. Mercury
- C. Phosphorus
- D. Arsenic

Answer: C

Solution

Chronic Phosphorus Poisoning (Phossy Jaw/Glass Jaw/Lucifer's Jaw):

- Due to **inhalation of fumes** over years.
- **Toothache (earliest symptom)** & swelling of the jaw
- Loosening of the teeth & **Necrosis of lower jaw**
- Sequestration of bone in the mandible & multiple sinuses discharging foul-smelling pus.

Reference: The essentials of forensic medicine and toxicology; KS. Narayana Reddy; 30th/edition page no : 503–504

Q. A 26 yr old patient presented to ER after five days of alleged ingestion of rodenticide used for pest control at farms. Clinical manifestations seen were abdominal pain and Luminous vomiting followed by a depressed sensorium. Features of acute liver failure including coagulopathy were present. ER doctor confirmed it is a case of Smoky stool syndrome. Smoky stool syndrome is characteristically seen in poisoning with?

- A. Iodine
- B. Bromine
- C. Fluorine
- D. Phosphorus

Answer: D

Solution

Signs and Symptoms of acute phosphorus poisoning

- **Garlicky odour**

- **Luminous vomit and stool** because of the presence of phosphorus
- Fumes emanate from the stools (**smoking or smoky stool syndrome**).
- Acute poisoning causes liver cell necrosis, **fatty liver** and acute yellow atrophy.

Reference: The Essentials of Forensic Medicine and Toxicology by KS Narayan Reddy. 33rd edition page no: 551



36

ANIMAL IRRITANTS

- Animal irritants mainly include snake bite envenomation & scorpion sting

SNAKES

00:0043



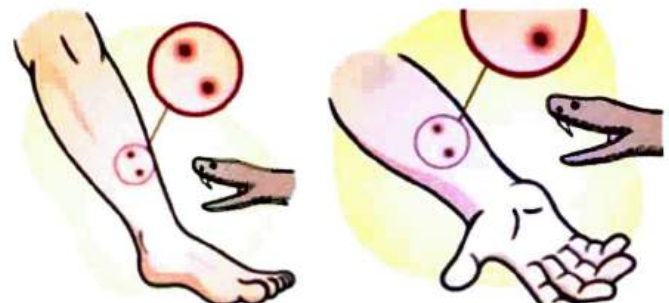
- Study of snakes is k/a Ophiology
- If a snake bites a man [i.e. injects toxin into the man] & the man develop symptoms; then it is venomous snake. This process is k/a Snake bite envenomation
- If a man eats snake [having toxin] & develop symptoms; then it is k/a poisonous snake
- Very rarely, man bites the snake. Man survives but the snake dies

Snake bite cases

- Globally, we have 5.4 million cases of snake bite annually & 1.3 lakh deaths do happen
- In India, we have 2.8 million cases of snake bite annually; among which 50,000 deaths do occur



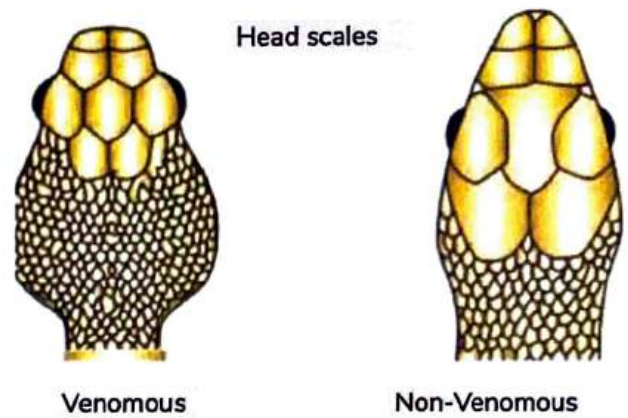
- Snake bite cases are commonly seen in rural areas, villages, among agricultural workers, particularly in sugar cane & paddy fields
- MC site involved is Extremities [foot & hands]



- There are 3,500 species of snakes around the world, among which only 300 species of snakes are venomous
- In India, 330 species of snakes are available, among which 50-70 species are venomous
- Most of snakes are non-venomous. Only few snakes are venomous

Differences between Venomous & nonvenomous snake

🕒 00:05:40



	Venomous snakes	Non-Venomous snakes
Head Scales	Smaller Exceptions 1. Cobra • 3 rd Supra-labial scale is largest & it touches the eye shield	Larger



2. Krait

- 4th Infralabial scale is largest



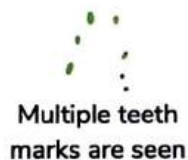
Belly Scales/ Ventral surface of the snake	Large & cover entire breadth of the belly	Small & doesn't cover entire surface of the belly
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Tail	Compressed	Non compressed/ round
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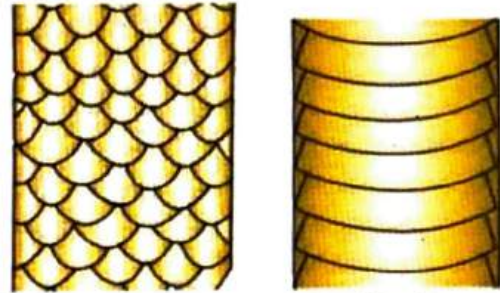
Mouth	2 Fangs are present, which are like hypodermic needles that pierces the skin & injects venom	Multiple small teeth are present
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Bite	•• 2 punctate marks are seen	
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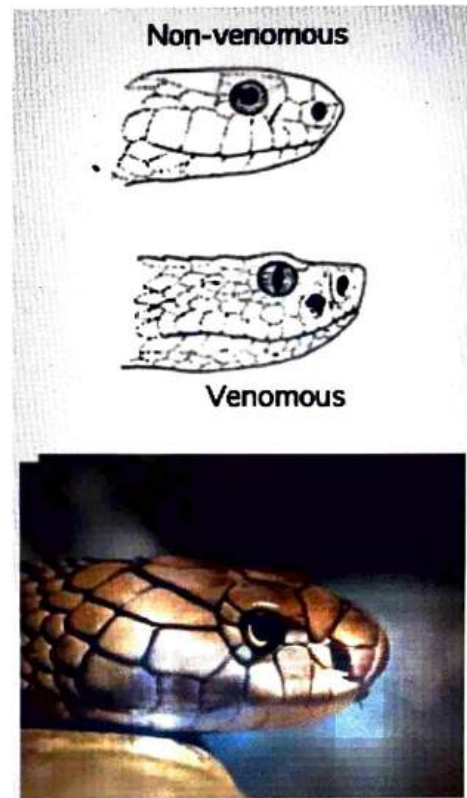
Habit	Usually nocturnal	Diurnal
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BELLY SCALES



Non-Venomous

siddharth.jain2461130@gmail.com
917208635887
Venomous



- Cobra [large 3rd supra-labial scale, touching the eye shield]

CLASSIFICATION OF THE FAMILY OF SNAKES

00:12:48

Elapidae	Viperidae	Hydrophidae
<ul style="list-style-type: none">• Neurotoxic venom• Eg.<ul style="list-style-type: none">○ King Cobra○ Common cobra○ Krait	<ul style="list-style-type: none">• Hemotoxic / Vasculotoxic• Eg.<ul style="list-style-type: none">○ Russell's Viper○ Saw scaled Viper○ Hump nosed viper	<ul style="list-style-type: none">• Myotoxic venom• Eg: Sea Snake



Important Information

- Common cobra, krait, Russell's viper & saw scaled viper are commonly referred as 'Big-4' as they are predominant in India
- Thus, Indian polyvalent snake venom is effective only against these 4 snakes
- These 4 snakes + Hump nosed viper is k/a 'Big-5'
- Most dangerous venom is of Krait's [fatal dose of krait's venom = 6mg]
- Fatal dose of king cobra's venom = 12mg. But it injects venom of around 200-250mg per bite [quantity is more]

OPHIOPHAGUS HANNAH [KING COBRA]

00:18:47



- Ophiophagus means snake eating another snake
- It is the longest venomous snake in the world
- Max. no. of king cobras are in India, but not found

throughout the country. Found only in western ghat region. Hence, it isn't included in Big-4

- Average length of king cobra is 15 feet
- Maximally, it can grow upto 20 feet
- Usually, cobra forms a hood.
- 3rd supra-labial scale is larger



King cobra



Common Cobra (Naja Naja)

COMMON COBRA

00:19:41

- Smaller in length. Usually, grows upto 5 feet
- Mark [Spectacle/ Binocellate mark] is seen on an expanded hood. It is used to differentiate b/w king cobra & common cobra
- Belongs to Elapidae family & have Neurotoxic venom



KRAIT

00:21:00



- It is dark, jet-black & grows upto 5-6 feet
- It is purely nocturnal
- Scientific name is Bungarus caeruleus
- Toxin produced by this snake is k/a Bungarotoxin
- 4th Infra-labial scale is larger
- Hexagonal scales [in midline] & white bands are seen on

the dorsum of the body



RUSSELLS VIPER

🕒 00:22:04

- It has scales at an angle, which when coiled around itself produces wrestling sound



HUMP NOSE VIPER

🕒 00:23:45



- It's scientific name is *Hypnale hypnale*
- It has a snout, which is elongated to form a hump

- Scientific name is *Daboia russelii*
- 3 rows of Brown spots/ diamond shaped markings [1 on the top; 2 on the sides] are seen on the dorsum of the snake
- It belongs to Viperidae family & its venom is vasculotoxic/ hemotoxic

SAW SCALED VIPER

🕒 00:22:49

- Scientific name is *Echis carinatus*



SEA SNAKE

🕒 00:24:54

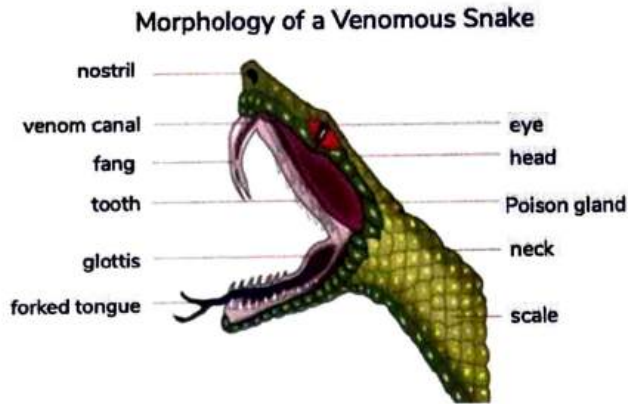


- It has a flat tail, which helps in paddling



MORPHOLOGY OF A VENOMOUS SNAKE

00:25:08



- Venomous gland is modified salivary gland of the snake
- Venom itself is nothing but toxic saliva of the snake. Thus, it contains lot of enzymes/ proteins
- Venomous gland is connected to the duct, which opens into the tip of the fang. This is venomous apparatus of the snake
- If a person ingests the venom, all proteins in the venom are degraded by the GIT & nothing happens to the person
- But, if there is ulcer in GIT, venom can enter the parenteral route through the ulcer & cause toxicity

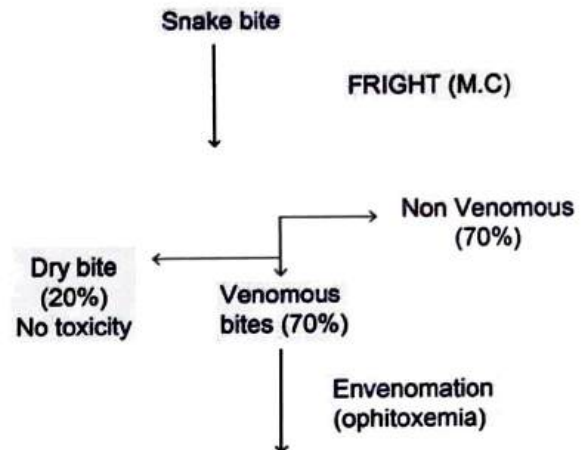
SIGNS & SYMPTOMS OF SNAKE BITE

00:27:11

- MC symptom is Frights (anxiety, palpitations, chest pain etc)
- If there are exaggerated symptoms of this fright, even if the person is bitten by a non-poisonous snake/ even if the person had misunderstood thorn prick as snake bite, the person may die
- Thus, if a snake bite person is brought to you, 1st thing to do is to reassure the pt. & calm him down
- Approximately, 70% of the bites are d/t non-venomous snakes [psychological reaction plays a major role in these cases]
- Remaining 30% of bites are d/t venomous snakes
- Even if venomous snake bites a person, it's not confirm that the person always develop toxemic features. Only few percentages of ppl show toxic features of envenomation
- This is d/t Dry bite i.e., the snake had bitten the person, but it didn't inject the venom [counts approx. 20% of cases]
 - The person doesn't show any kind of toxicity except

the bite

- These dry bites are MC seen with cobra
- Snake bite envenomation is k/a Ophitoxaemia
 - i.e. snake has bitten, injected the venom & the pt. is showing the features of toxemia



Clinical features of Ophitoxaemia

00:31:17

1. Local symptoms [i.e at the bite site]

- Pain
- Swelling
- Blisters
- Bleeding from bite site is the most important feature, as it indicates viper's bite & is important sign to start ASV immediately
- Necrosis
- Regional lymphadenopathy: It is also an important sign for starting ASV
- These features are commonly referred as painful progressive swelling. It is commonly a/w Viper bites



Important Information

- Local symptoms are more with Viper bites
- No local symptoms, no pain, sometimes no fang marks i.e occult bite is seen with krait bite

2. Neurotoxic features

- MC seen with Elapid snake bites as their venom is predominantly neurotoxic
- Ptosis [bilateral drooping of the eyelids] is the most important presenting complaint
- Diplopia [d/t paralysis of extra-ocular muscles i.e., ophthalmoplegia]
- Dysphagia [d/t paralysis of pharyngeal muscles]

- Dysarthria [d/t paralysis of tongue muscles]
- Dysphonia [d/t paralysis of vocal cords]
- Stridor
- Dyspnea [d/t paralysis of respiratory muscles]. We should immediately put the pt. Under mechanical ventilation
- I.e Descending paralysis occurs & death of the pt. is d/t respiratory failure
- Rx: ASV / Neostigmine + atropine / mechanical ventilation for respiratory failure

3. Vasculotoxic/ Hemotoxic features

- Commonly seen with viper bites
- DIC [Disseminated Intravascular Coagulation] is the most important complication of viper bites.
 - Spontaneous bleeding is seen everywhere
 - I.e epistaxis, bleeding gums, hematemesis, melena, hemoptysis, hematochezia, bleeding from injection site are seen
- Local bleeding/ systemic bleeding is indication for viper bite
- D/t DIC, person can land-up in renal failure
- Rx: ASV, FFP [Fresh Frozen Plasma], Local surgical debridement for local necrosis

4. Myotoxic features

- Commonly seen with Hydrophidae/ sea snakes
- Pain, swelling is seen at the bite site
- Venom causes myonecrosis, rhabdomyolysis resulting in myoglobinemia, myoglobinuria & renal failure
- If a person presents with neuroparalytic symptoms + occult bite [no local findings of bite] + abdominal pain + vomiting, it is indicative of Krait bite
 - Rx: ASV, Mechanical ventilation if needed
- If abdominal pain is seen in viper bite, it is suggestive of retro-peritoneal bleeding

BED-SIDE TESTS

🕒 00:40:11



- For descending paralysis, we can start examining from the forehead itself. Features are
 - Loss of frowning
 - Drooping of eyelids [ptosis]
 - Slurring of speech, dysarthria, dysphagia, dyspnea



Ptosis seen after cobra bite



Gum Bleeding in Viper Bite

Local symptom seen in viper bite

- Check for spontaneous bleeding seen in DIC

TESTS

🕒 00:41:45

1. 20 WBCT [20 mins whole blood clotting test]

- Take whole blood in a new, clean & dry test-tube & wait for 20 mins
- Then tilt the test tube, which shows one of the following results
 - If the blood had already clotted, it is suggestive of normal or elapide bite
 - If the blood didn't clot, it is suggestive of DIC d/t viper bite. Start the anti-snake venom immediately
- Repeat this test every 6th hourly, until it becomes normal

(N)

Viper bite



- It is a bed-side test & it can be done anywhere

2. Single breath count

- The pt. has to count numbers in a single breath.
- This test should be repeated for every 15mins.
- If the count decreases consecutively from the 1st count, it indicates that the person is going into respiratory paralysis
- It determines the respiratory reserve of the pt.
- This test is done, when we suspect Elapid bites

MANAGEMENT OF SNAKE BITE

00:46:06

First Aid Approach

- **Carry** - Carry the pt.
 - If the pt. walks, venom spreads all over the body fastly.
 - Thus, do not allow the pt. to walk
- **No** - No ligation/ tourniquet; No suction; No Cautery/ electric shock
 - If a limb is ligated, it may occlude the blood vessels of that limb resulting in ischemia & gangrene
- **No** - No coffee/alcohol, as these tend to increase the heart rate, which increases the spread of the venom
- **R** - Reassurance [most important to do, as MC feature of snake bite is fright]
- **I** - Immobilization [Immobilize complete limb]
- **GH** - Get to the Hospital immediately
- **T** - Tell the doctor, systemic signs of envenomation



How to remember

- "CARRY NO RIGHT"

Pressure immobilization

- Apply crepe bandage/ sutherlands wrap & immobilize the entire limb
- Do not apply it too tightly, as it can cause ischemia [we should be able to insert 1 finger into the bandage]
- Its objective is to occlude the lymphatics [as venom spreads through lymphatics], but not the blood supply
- For upper limb, we can apply upto 40-70mm of Hg
- For lower limb, we can apply upto 55-70 mm of Hg
- Done mostly in cobra bites
- It's not done in viper bites, as local symptom [pain, swelling, blisters, necrosis] & the risk of developing compartment syndrome are more

Specific treatment

- Indian polyvalent ASV (Anti-snake venom) is the Antidote
- It is effective against common cobra, krait, russell's viper, saw scaled viper [I.e Big 4]
- Source of ASV is hyper-immunized horse serum
- Since it is developed from non-human origin, there is a risk of developing allergic reactions, as severe as anaphylaxis
- If the pt. doesn't develop any features of systemic envenomation, we don't have to give ASV, as ASV itself is very dangerous
- There is no need to give test dose, as it itself can sensitize the pt.
- While starting the ASV, keep adrenaline loaded in the syringe & be vigilant. If the pt. is developing any allergic reaction [itching, breathlessness etc], give adrenaline inj. immediately
- **Route of administration:** Intravenous route, slow administration I.e 1-2ml/min
- It is available in the form of freeze-dried powder; which should be mixed with diluent before using it
- Time: It is very effective, if we start ASV within 4-6hrs after the snake bite
- Dose: 10 vials [irrespective of age & sex]
- If it is neuroparalytic envenomation, ASV should be repeated till the clinical improvement occurs
- If it is vasculotoxic venom, ASV should be continued till the clotting becomes normal [repeat the 20 min clotting test, till it becomes normal]



Pressure immobilization

ASV is effective against

00:57:58

Cool Shah Rukh Khan [Or]

CSK Rocks

- C - Common Cobra
- S - Saw scaled viper
- R - Russell's viper
- K - Krait
- C - Common Cobra
- S - Saw scaled viper
- K - Krait
- R - Russell's viper



How to remember

- Cool Shah Rukh Khan
- CSK Rocks

Indications for ASV

- ASV is given only when there is
 - Severe local envenomation
→ I.e. when pt. has pain, severe bleeding, rapidly progressive swelling
 - Severe Systemic envenomation
→ I.e. Bleeding tendencies/ Neurotoxic symptoms/ Abnormal 20 mins WBCT

2. Neostigmine + Atropine

- Neostigmine reverses the neuro-paralysis
- It is effective for cobra bites
- It is not that effective for krait, as most significant action of the krait venom is presynaptic [I.e useful in venom with post-synaptic action]
- Rx
 - Cobra: ASV, Neostigmine+ atropine, mechanical ventilation
 - Viper: ASV, FFP, local surgical debridement for intense local necrosis
 - Krait: ASV, Mechanical ventilation if needed
 - Antibiotics is given to prevent secondary infections
- TT injection

SPITTING COBRA

01:03:25



- Spits the venom on face
- If eye is exposed to the venom, toxic features develop, which is k/a Snake Venom Ophthalmia

PYTHON

- Non-venomous snake
- It encircles the victim, causes traumatic asphyxia & kills the person

SCORPION STING

01:04:08



- Dangerous scorpions are
 - Black scorpion
 - Indian red scorpion
→ It belongs to the family Buthidae
→ It's scientific name is Mesobuthus tumulus
- Quality of the venom is similar to cobra
- It has neurotoxin, hemotoxin; yet, it's fatality is less, as the amount of venom injected is less

Mode of Toxicity

- Scorpion venom affects the Na⁺ & K⁺ Channels, causes uncontrolled release of Catecholamines into the circulation
- I.e. It causes Autonomic storm

Features

- Intense pain, swelling, blisters are seen at local site
- D/t autonomic storm, systemic features like sweating, chest pain, anxiety/ palpitations, mydriasis etc. are seen
- Priapism [painful penile engorgement] can be seen

Rx

- Immobilization
- Pain relief by giving NSAIDS, systemic/ local pain killers
- Alpha blockers like Prazosin is given
- Anti-scorpion venom is given if available



Black Scorpion



Indian Red Scorpion



CLINICAL QUESTIONS



Q. There are four species groups of snakes (of the nearly 300 different species in India) primarily responsible for what is likely to be the highest death rate from snakebite in any country in the world, the 'Big Four': cobra (four species), krait (eight species), saw-scaled viper (two subspecies) and Russell's viper. All are widely distributed throughout most of the country although areas like the far Northeast, the Himalayan region, and the Andaman's and Nicobar Islands have distinctive snake fauna. Since snakebite is a rural problem, primarily affecting India's farmers, rural laborers, and their families it would make sense for antivenom and associated treatment to be available at Primary Health Centers and other rural medical facilities. However, this is often not the case and training in snake identification and snakebite treatment is woefully inadequate. Which of the following statements is not true of snake bites?

- A. Anti-snake venom is effective for pit viper
- B. Cobra venom is neurotoxic
- C. Atropine premedication should be used before administering neostigmine
- D. ASV administration is done only after the test dose

Answer: A

Solution

Anti- snake venom is not effective for pit viper. It is effective only for-

1. Common cobra
2. Russel's viper
3. Saw-sealed viper
4. Krait
 - Cobra belongs elipidae family & is neurotoxic
 - Atropine premedication should be used before administering neostigmine (which is used for cobra bite). Anti Snake Venom administration is done only after the test dose.

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 34th edition, Page no.519

Q. Snakes belonging to the family Viperidae are Vasculotoxic/Hemotoxic whereas those from the family of Hydropidae are Myotoxic. Toxicity of which system is seen in bites by snakes from the family of Elapidae?

- A. Vasculotoxic
- B. Neurotoxic
- C. Musculotoxic
- D. Nontoxic

Answer: B

Solution

Elapidae are Neurotoxic

Elapidae are a family of venomous snakes commonly referred to as elapids. This family includes cobras, adders, mambas, common kraits.



VIPERIDAE are vasculotoxic/hemotoxic. This family includes russel viper and saw scaled viper



Hydrophidae are myotoxic and this family includes sea snakes.



Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no. 558



37

PLANT IRRITANTS

1. RICINUS COMMUNIS

00:00:31

- Common names are Arandi, Castor plant



Castor Plant



Castor seeds (shiny, smooth seeds with white markings)

Castor seeds [shiny, smooth seeds with white markings]

- Intact Castor seed is non-toxic
- Crushed Castor seeds are toxic
- Castor oil is non-toxic & can be used for cooking
 - It's residue contain active principle (RICIN). Thus, it is toxic

Active Principles

- Ricin
- Ricinoleic acid

Mechanism of Action

- Ricin is RIP i.e Ribosomal Inactivating Protein
 - It inhibits protein synthesis, resulting in cell death, necrosis & inflammation

Clinical features

- The pt. presents with
 - Abdominal pain
 - Vomiting / Diarrhoea
 → Sometimes, bloody diarrhoea is seen, which results in dehydration, cardio-vascular collapse & death

2. ABRUS PRECATORIUS

00:04:50

- Common names are Indian liquorice / Jequirity
- Seeds are k/a Gunchi Seeds / Crab's eye / Rati Seeds / Rosary Beads



egg shaped

- These seeds are egg shaped, scarlet red, with black tip

Active Principles

- Abrin (most potent)
- Abralin
- Abralic Acids
- Abrine
 - When the seeds are crushed & ingested, the pt. presents with abdominal symptoms



Important Information

SUINEEDLES

- These are needle prepared from crushed abrus seeds
- Used as arrow poisoning
- When this sui needle is injected, it results in extensive local necrosis a/w systemic toxicity, which resembles viperine snake venom
- Thus, it is k/a Ideal cattle poison (animal poison) [even though the cattle died d/t sui needle, it resembles as snake bite]

- Each seed of abrus weighs about 108 mg

3. CROTON TIGLIUM

00:09:30



- Aka Jemal Gota
- Croton seeds are k/a Jemal Bean

Active Principles

- Crotin (most potent)
 - It causes intense purgation [severe diarrhoea]
- Crotonoside
- Crotonic acid

Toxic parts

- Every part of the plant is toxic, especially the seeds



Dry croton seeds

mark on the cloths

- Thus, it is commonly k/a Marking Nut
- This juice is pro-inflammatory

Active Principles

- Semi carpol
- Bhilawanol



Marking nut [heart shaped with protrusion on the top]

- When its black coloured juice is exposed on to the skin, it causes blisters
 - Thus, it is used to produce Artificial bruise
- When it is consumed orally, it causes GIT irritation

4. SEMECARPUS ANACARDIUM

00:11:30



- Common name is Bhilawa Plant
- Seeds are k/a Bhilawa seeds
 - Black colour juice obtained from the seeds is used to



Important Information

Artificial Bruise can be produced by

- P – Plumbago
- S – Semecarpus
- M – Madar [Calotropis]

PLANT	FATAL DOSE
Abrus	1 seed
Crocin	5 seeds
Ricinus	10 seeds
Semi carpus anacardium	5-10 gms

5. CAPSICUM ANUM

00:15:46

- Common name is Chilli/ Mirchi

Active principles

- Capsicin

- Capsaicin

Clinical features

- If it is orally consumed, it causes GIT irritation
- On exposure to eye, it causes conjunctivitis



Important Information

- Chronic exposure of chilli powder results in contact dermatitis k/a Hunan's hand syndrome

Medicolegal importance

- Thrown on eyes, to facilitate robbery
- Applied on eyes, face etc & used to torture



- Seeds of chilli are yellowish, resembling Datura seeds

6. CALOTROPIS

🕒 00:18:21



- Have 2 Species
 - Calotropis Gigantea
 - Calotropis Procera

- Common names are Madar/ Akdo
- Every part of the plant is toxic

Active Principles

- Calotropin
- Calotoxin
- Calactin
- Uscharin
- Gigantin

Oral	Eyes	Uterus	Skin
GIT Irritation	Conjunctivitis	Criminal Abortion	Blisters
• used as Infanticides	• used for Malingering	• used a Abortion stick	• used to produce artificial bruise
• Cattle poisoning			
• Accidental poison			

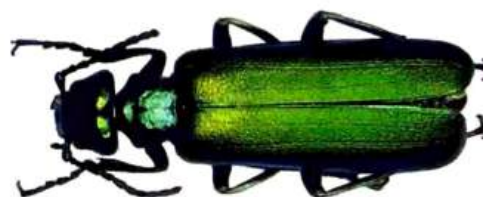


Flower of Calotropis

7. SPANISH FLY/ BLISTER BETTLE/ CANTHARIDES

🕒 00:21:46

- When fly is crushed on the skin, it causes blisters on the skin
- Active Principle is Cantharidin
 - 1 beetle contain 0.2 - 0.7 mg of cantharidin
- On exposure to skin, it acts as local irritant & produces blisters
- On Oral consumption
 - It acts as Aphrodisiac (↑ libido)
 - Sometimes it may cause priapism
 - It can cause Loin pain, hematuria & renal failure (nephrotoxic)



Spanish fly / Blister beetle



CLINICAL QUESTIONS



Q. A 3-year-old boy was brought to the emergency with complaints of persistent crying, weakness, and inability to stand. The family had been picnicking near the woods and the child was left unattended for some time so the parents are unsure of what caused the sudden onset of symptoms experienced by the child. During the time the team waited for the results of the initial investigations, the doctor noticed that the child was beginning to show difficulty in lifting the arms as well. Poisoning with which one of the following could cause such Ascending paralysis?

- A. Botulism
- B. Hemlock poisoning
- C. Zigadenus poisoning
- D. Cobra bite

Answer: B

Solution

Conium Maculatum (Hemlock)

- This plant is also known as spotted hemlock, because of the purple spots on its stem.
- All parts of the plant are poisonous.
- The whole plant has a mousy or carrotodour which is intensified by crushing the leaves or stems
- Active principles: Coniine, methyl coniine and six other alkaloids.
- Action:
 - A peripheral nerve poison
 - It causes paralysis of the motor nerve terminals in the muscles, gradually spreading to the motor cells of the spinal cord and the brain.
 - This is followed by progressive muscular paralysis due to depression of the motor nerves.
 - The lower limbs are affected first and the paralysis ascends till the muscles of respiration are affected results in death.



Reference: Essentials of forensic medicine & toxicology, Dr KSN reddy, 33rd edition Page no : 528

Q. Marking nuts are black, heart-shaped. They have a thick, cellular pericarp that contains an irritant juice that is brownish, oily,

and acrid but turns brown on exposure to air. Applied externally, the juice causes irritation and a painful blister that contains acrid serum, which causes eczematous eruptions of the neighbouring skin with which it comes into contact, and there is itching. What is the scientific name of this plant poison, which causes such an "Artificial bruise"?

- A. *Strychnos nuxvomica*
- B. *Semicarpus anacardium*
- C. *Abrus precatorius*
- D. *Capsicum annum*

Answer: B

Solution

Artificial bruise:

1. Cause: Juice of *Semicarpus anacardium* (marking nut tree), *Calotropis* or *Plumbago rosea*
2. Colour: Dark brown
3. Shape: Irregular
4. Site: Exposed accessible parts
5. Margins: Well-defined and regular, covered with small vesicles
6. Redness and inflammation: Seen in surrounding skin
7. Itching: Present
8. Vesicles: May be found on fingertips due to scratching
9. Contents: Acrid serum
10. Chemical tests: Positive for the chemical

Reference: The Essentials of Forensic Medicine and Toxicology by KS Narayan Reddy. 33rd edition page no : 555



38

CEREBRAL POISONS

SOMNIFEROUS POISONS

- Somna means sleep. Thus, these poisons act by inducing sleep
- Among these poisons, opium is most important

OPIUM

🕒 00:00:44

- Scientific name of opium plant is *Papaver somniferum*
- Opium is aka Afim/ Madak/ Chandu
- It is permitted by the government only in 3 states [i.e its cultivation is legally done in these states]
 - R - Rajasthan
 - U - UP
 - —MP



- Ideal time for making an incision is when the capsule is greenish/ bluish



Capsule of Opium

- Opium plant have a capsule & a long, tall stalk
- When vertical incisions are made on unripe Capsule, it produces milky juice/ exudate
- After sometime, this milky juice becomes dry, brown exudate; which is k/a Crude opium

Multiple vertical incisions on capsule [Tears of Opium]



Dried, dark brown exudate k/a Crude opium

- All alkaloids are obtained from this crude opium



Poppy seeds/ Khas khas

- Multiple seeds are seen inside the capsule k/a Poppy seeds
- These seeds are k/a Khas khas, which are non-toxic & used for cooking

DERIVATIVES OF OPIUM

🕒 00:04:21

- These are classified into 3 important groups

Natural derivatives	Semi-synthetic derivatives	Synthetic derivatives
<ul style="list-style-type: none"> • Morphine • Thebaine • Codeine 	<ul style="list-style-type: none"> • Heroin/ Di-acetyl morphine • Pholcodine 	<ul style="list-style-type: none"> • Methadone • Tramadol • Pethidine

Clinical features of Morphine poisoning

🕒 00:06:02

- Pt. shows following 3 stages
1. Stage of excitement
 - Pt. will be excited & euphoric
 2. Stage of stupor

- Pt. will have
 - Drowsiness
 - Vomiting
 - Decreased sensibility
 - Pin point pupils [Miosis]

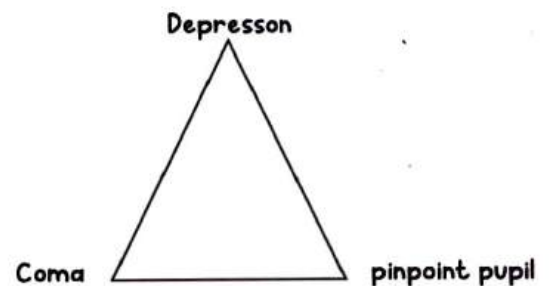
3. Stage of coma

- Pt. presents with
 - Hypothermia
 - Respiratory depression
 - Typical pin-point pupils



Important Information

- Triad of Respiratory depression, Coma & Pin-point pupils is diagnostic for Opioid toxicity



MORPHINE

Causes

- M- Miosis, Marquis test
- O- Orthostatic hypotension
- R- Respiratory depression
- P- Physical dependence, Intense Pain relief
- H- Hypothermia, Induce Histamine release
- I- Increased Intra-cranial tension, Infrequency in GIT motility [i.e constipation]
- N- Antidot for morphine is Naloxone
- E- Induce Emesis, Euphoria
- S- Sedation



How to remember

- MORPHINES

Treatment for Morphine poisoning

🕒 00:12:00

1. Stabilize the pt.
 2. Give gastric lavage
- Even if the pt. presents with parenteral administration of morphine, we need to give gastric lavage as it undergoes Entero-hepatic circulation [i.e morphine is excreted into

the GIT]

- Entero-hepatic circulation is shown by Barbiturates as well
- We need to give KMnO₄ solution while doing gastric lavage, as it oxidizes the morphine

3. Give antidotes like

- Naloxone sodium
 - Preferred route is IV
 - Have short half-life i.e 2-3 hrs
 - Caution: If the pt. has taken long-acting opiates, repeated doses of Naloxone may be needed
 - Don't discharge the pt. prematurely
- Nalmefene
- Naltrexone

Tolerance of Morphine

🕒 00:15:22

- Initially, even if the pt. takes 5mg of Morphine, he gets pleasant/euphoric features
- After chronic abuse, he has to take 10mg [double of initial dose] to get the same pleasant symptoms [as 5mg doesn't produce any effects]
- After some time, he has to take 20mg of morphine to get this effect
- I.e the pt. keeps on increasing the dosage to get the euphoric effects
5mg → 10mg → 20mg → 40mg → 80mg etc
- This phenomenon is k/a Morphinomania/ Morphinism [tolerance to high doses of morphine]

Withdrawal symptoms of morphine

🕒 00:17:12

- Occurs when there is sudden stoppage of morphine
- It includes
 - Increased Yawning
 - Increased secretions [particularly Rhinorrhea]
 - All the opposite effects of morphine [fever etc]

HEROIN

🕒 00:18:05

- It is Di-acetyl Morphine
- It is initially discovered to replace morphine
- Later, it is discovered that Heroin is more addictive & potent than morphine
- Aka Smack, Dope, Junk

Forms of Heroin

Base	Salt
Include 2 forms 1. Black tar: It is less pure & unrefined 2. Brown sugar: It is less refined	Heroin hydrochloride [white powder]
<ul style="list-style-type: none">• These are taken by smoking & sniffing• If it is taken by IV, it causes sclerosis & thrombosis of the vein	<ul style="list-style-type: none">• It is pure & highly refined• It is taken by IV/ IM injection



Black tar



Brown sugar



White powder

Methods of abuse

- Black tar & Brown sugar are abused by
 1. Chasing the dragon [MC type]
 - Place the powder on aluminum foil & heat it from below
 - It emits smoke, which is inhaled by the person
 2. Sniffing
 3. IV/ IM [causes sclerosis]
- Sometimes, fillers like talcum powder, sugar etc are used for brown sugar
- Heroin-hydrochloride, is abused by
 1. IV route [main-lining]
 2. Skin popping [i.e injected into the skin]
 - D/t this, multiple punctate scars are seen, which may be concealed by tattooing
- If the person uses contaminated needles, the person may develop infections & ulcers k/a Needle tract ulcers



Important Information

- If the heroin is mixed with cocaine to increase potency & is taken by IV, it is k/a Speed ball
Heroin [He] + Cocaine [She] given IV = Speed ball
- If this mixture is smoked, it is k/a Moon rock
- Mixture of Heroin + Strychnine is k/a Hot shot
 - If the potency/ dose of heroin is high, it may result in accidental death
 - Homicidal hot shot can also be done



Chasing the dragon



IV [Main lining]; if injected into the skin, it is k/a Skin popping



Previous Year's Questions

Q. Inhaling the cloth soaked in drug is? (FMGE June 2019)

- A. Bagging
- B. Spraying
- C. Huffing
- D. Sniffing

INEBRIANTS

🕒 00:26:30

- These are the substances that produce intoxication
- Include alcohols like
 - Ethanol
 - Methanol
 - Isopropyl alcohol etc



Important Information

Toxicity of different types of alcohols in descending order

Isopropyl alcohol [most toxic] > Methanol > Ethanol [least toxic]

ETHANOL

🕒 00:27:48

- It is produced by fermentation of sugar by yeast & then distillation
- Alcoholic drink contains Alcohol + Water + Congeners
- Congeners are byproducts produced during fermentation. These are responsible for specific smell of alcohol i.e fruity odor

Types of alcohol

🕒 00:29:00

1. Absolute spirit
 - It is strongest
 - Has 99.95% of alcohol
2. Rectified spirit
 - Used to preserve viscera
 - It has 95% alcohol
3. Denatured/ Methylated spirit
 - It has 90% ethanol, 10% methanol



Important Information

Q. Which of the following commercial derivatives have highest percent of alcohol

- A. Beer
- B. Whisky
- C. Wine
- D. Rum

Absorption & Metabolism of alcohol

🕒 00:31:09

- Only absorption of alcohol occurs. Digestion of alcohol doesn't occur
- Most of the alcohol [80%] is absorbed in small intestine
- Only 20% of alcohol absorption occurs in stomach

Factors influencing the absorption of alcohol

1. Factors favoring the absorption

- Addition of carbonated drinks
 - Air-bubbles in carbonated drinks increases the surface area of stomach, which increases the absorption
- Drinking in empty stomach
- Addition of hot water

2. Factors decreasing the absorption

- Addition of iced water
- Cigarette Smoking

Metabolism of ethanol

🕒 00:34:45

- Ethanol is metabolized by Alcohol dehydrogenase enzyme & is converted to Acetaldehyde
- This acetaldehyde is metabolized by aldehyde dehydrogenase enzyme into Acetic acid
- This acetic acid is in turn metabolized into Co₂ & water

Ethanol

↓ Alcohol dehydrogenase

Acetaldehyde

↓ Aldehyde dehydrogenate

Acetic acid

- Alcohol dehydrogenase has more affinity towards Ethanol

Equilibrium of alcohol with regard to body fluids

🕒 00:36:26

- Body tissues takes up alcohol in proportion to its water content i.e.,
 - Tissue with more water content takes up more alcohol
 - Tissue with less water content takes up less alcohol
- Female tend to have more effects to a given quantity of alcohol than males [as they have more fat content & less water content]
 - I.e Males tolerate alcohol than females
 - Reason
 - Males have more water content in the body.
 - Thus, alcohol is evenly distributed throughout the body & blood-alcohol concentration is lesser

Blood alcohol

🕒 00:38:45

- If the blood alcohol content is 1mg%; alcohol content in different body fluids are
 - CSF: 1.1 mg%
 - Vitreous: 1.2mg%
 - Urine: 1.3mg%
 - Alveolar air: 0.0021%
 - This principle is used for breath analyzer/ Alcometer/ Drunkometer
 - The % of alcohol in breath is used to calculate the percentage of alcohol in blood
- Statutory limit of blood alcohol level in drivers of India is 30mg%
- If blood alcohol level in driver is >30mg%, it is punishable under 185 MVA [Motor Vehicle Act]

Effects of Alcohol

🕒 00:42:38



- CNS depression
 - This effect is dose dependent

Refer Table 38.1

How to differentiate b/w opioid coma & alcohol coma

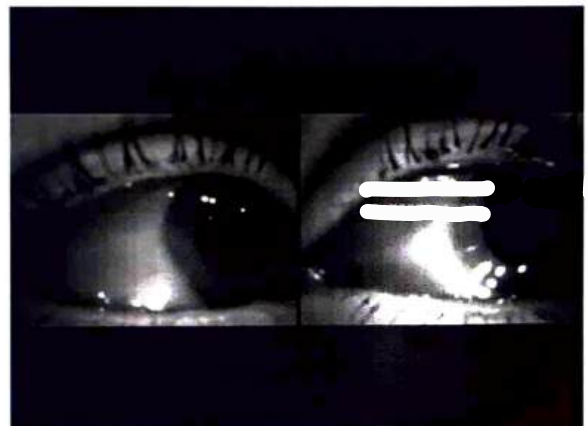
🕒 00:48:35

Mc Ewan's sign

- Seen with alcoholic coma
- Initially, pupils are constricted
- When mild stimulus is given, the pupils dilate for sometime & then gradually returns to constricted state

Alcoholic gaze nystagmus/ Lateral gaze nystagmus

- Nystagmus: Abnormal, involuntary, rhythmic oscillations of the eye ball
- It is seen at 80-100mg% of alcohol



Samples used to estimate alcohol levels in the body 🕒 00:50:55

1. Blood sample
 - While withdrawing the blood, **never use rectified spirit** for disinfection; as it may give false positives
2. Urine sample [blood alcohol can be estimated from urine alcohol levels]
3. Alveolar air
4. Vitreous humor
 - It is specifically useful during autopsy
 - Particularly when we are dealing with decomposed bodies



Important Information

Preservatives

- Blood: NaF [Anti-bacterial] + Potassium oxalate [anti-coagulant]
- Urine: NaF/ Thymol/ Toludene

WIDMARK'S FORMULA 🕒 00:54:13

- $a = prc$
 - a- total amount of alcohol in the body
 - p- body weight in kgs
 - r- constant
 - c- blood alcohol concentration
- Thus, with this formula, we can find total amount of alcohol in the body
- If we know only urine alcohol concentration (q), we can use the following formula to calculate the amount of alcohol present in the body

$$a = \frac{3}{4} prw$$

Tests used to estimate alcohol levels in the body 🕒 00:55:59

Quantitative tests

- Used to find whether the alcohol is present or not
- Kozelka & hine test
- Cavett test

Qualitative tests

- Used to find the amount of alcohol present in the body [i.e quantify the alcohol]
- Gas chromatography [Best test]

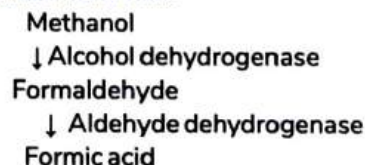
METHANOL 🕒 00:57:16

- Commonly k/a Wood alcohol/ illicit liquor
- Methanol is MC alcohol responsible for Hooch tragedy [large group of ppl gets intoxicated & develop symptoms

by consuming alcohol]

Metabolism

- Methanol is converted into formaldehyde by alcohol dehydrogenase enzyme
- This formaldehyde is converted into formic acid by aldehyde dehydrogenase enzyme
- Among all, formaldehyde is 33 times more toxic
- Formic acid is 6 times more toxic



Clinical features 🕒 01:00:08

- Abdominal pain/ vomiting [MC presenting complaint]
- Eye disturbances d/t formaldehyde & formic acid
 - Retinal edema
 - Blurring of vision is seen k/a Snow field vision
 - Formaldehyde accumulates in the optic nerve & causes Optic neuritis, optic atrophy & eventually blindness
- Metabolic acidosis d/t excess accumulation of Formic acid

Treatment 🕒 01:02:05

1. Stabilization
2. Decontamination by giving gastric lavage
3. Reduce the conversion of methanol into formaldehyde by giving
 - Ethanol
 - As alcohol dehydrogenase have more affinity towards ethanol, it will be converting ethanol [methanol is not converted to formaldehyde]
 - Ethanol acts by competitive inhibition
 - Fomepizole [inhibitor of alcohol dehydrogenase] is used as Antidot
4. IV NaHco3 [sodium bicarbonate] is given to treat metabolic acidosis
5. Folinic acid increases the excretion of formic acid
6. Hemodialysis



Previous Year's Questions

Q. A chronic alcoholic started experiencing visual hallucinations talking irrelevant. Disoriented, tremors after 48 hrs of stopping alcohol. The probable condition is? (FMGE Aug 2020)

- A. Wernicke's encephalopathy
- B. Delirium tremors
- C. Alcoholic hallucinations
- D. Automatism

Table 38.1

	Stage of excitement	Stage of incoordination [Muscle incoordination]	Stage of coma
% of Alcohol	• 50-150mg%	• 150-250mg%	• >300mg%
Effects	<ul style="list-style-type: none"> • Loss of Social inhibition • Increased talkativeness • Decreased judgement • Increased false confidence 	<ul style="list-style-type: none"> • Loss of motor coordination • Slurred speech • Ataxia • Impaired vision • Increased reaction time <ul style="list-style-type: none"> ○ Thus, incidence of road traffic accidents are increased 	<ul style="list-style-type: none"> • Respiratory depression • Coma
Pupils	• Dilated	• Dilated	• Constricted



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DELIRIANTS

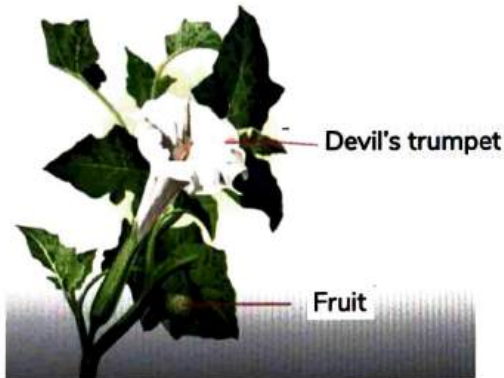
🕒 00:00:28

- Deliriant are the poisons which can cause Delirium
- Includes
 - Datura
 - Cocaine
 - Cannabis

DATURA

🕒 00:00:53

- Common names are Hell's bell, Devil's trumpet etc
- Common species are
 - Datura Alba: Have White Flowers
 - Datura Niger: Have Black colored Flowers
 - Datura Stramonium
- Datura Stramonium is commonly k/a Jimson's Weed. Ppl use this as a hallucinating agent



Datura flower aka Devil's trumpet

- Every part of the plant is toxic
- Roots & seeds of datura are most toxic



Datura Alba (Bell shape white flowers)



Fruit of Datura

Fruit of Datura

- Fruit of the datura has multiple spikes on it. Thus, it is commonly called as Thorn Apple [especially the fruit of Datura Stramonium]
- Hundreds of seeds are present inside the fruit, which are most toxic



Important Information

- Datura seeds are **dark brown** in colour, which resembles the **chilli seeds**
- Thus, ppl can mistakenly consume the datura seeds by thinking it as chilli seeds
- Fatal dose of Datura is **100-125 seeds**
- Each fruit is capable of killing **4-5 adults**

Active Principles of Datura

🕒 00:03:50

- Hyoscine (Most important) aka Scopolamine
- Hyoscyamine
- Atropine [trace amounts]



Important Information

- All the active principles of Datura are **Anti-cholinergic**
- Pt. presents with **Parasympatholytic symptoms**

Signs & Symptoms

🕒 00:05:22

- Anti-cholinergic symptoms
 - Dry Skin
 - Dry Mouth
 - Dysarthria
 - Dysphagia
 - Drunken gait [pt. walks as if he is drunk]
 - Dilated Pupils
 - Dysuria [results in Urinary retention]
 - Delirium
 - Death

- Gastric cavity contains seeds of Datura
 - These seeds resist putrefaction. Thus, seeds are found even in decomposed bodies
- Non-specific signs like congested organs etc can be seen



Important Information

- Arsenic & phenol poisoning inhibits putrefaction
- But, in datura poisoning seeds doesn't inhibit the putrefaction. They just resist the putrefaction



Important Information

- Datura poisoning causes **Muttering delirium**
- Pt. presents with typical feature k/a **Carphologia**
- Carphologia
 - It is Hallucination in which **purposeless movements** are seen
 - I.e. the pt. will be threading an imaginary needle/ pulling out threads from nails. clothes/ limb picking/ throws imaginary objects etc

MYDRIATIC TEST

🕒 00:08:20

- Few drops of patient's urine are installed into rabbit's eye
- If pupil of the rabbit gets dilated, it is diagnosed as Datura poisoning
- It is only of theoretical importance, not routinely used

Diagnosis

- Datura poisoning can be diagnosed based on clinical findings & history itself

Treatment

🕒 00:08:47

- Gastric lavage is done to decontaminate the pt
- Physostigmine, which is cholinergic drug is given (Antidote)
 - OPC aren't given to these pts as they are poisonous
 - Neostigmine doesn't cross blood brain barrier. Thus, physostigmine is preferred
 - Pilocarpine doesn't have any practical importance
- Supportive measures
 - Treat hyperthermia, delirium etc.

Autopsy findings

🕒 00:10:05

Medical Legal Importance

🕒 00:11:03

- Datura is most commonly used as stupefying agent
 - Datura is given to facilitate crimes like robbery, murder, rape etc.



Seeds of Datura

- These seeds are crushed, mixed with food & given to travelers in train/road
 - Thus, it is commonly k/a Railway Poison/ Roadside Poison



- If this victim gets delirious & commits crime, he isn't responsible for the crime

- It is given under section 85 IPC i.e Involuntary drunkenness
 - 328 IPC: Gives punishment for causing hurt by administering poison, with an intent to commit crime/ with an intent to facilitate crime
1. It is used as aphrodisiac as it increases libido
 - Thus, it is one of the commonly used love philter, as it increases the affection b/w giver & taker
 2. Accidental poisoning is commonly seen as datura seeds resemble chilli seeds
 3. Corn picker's pupil
 - Corn fields have more no. of datura plants
 - Ppl working in corn fields might get exposed to datura seed's dust & show dilated pupils [unilateral/ bilateral]. It is k/a Corn picker's pupil

Differences b/w datura & chilli seeds

🕒 00:16:26

Features	Datura	Capsicum/ chilli seed
Color of the seed	Dark brown color	Yellow color
Shape of the seed	Kidney shaped	Round
Consistency	Thick	Thin
Surface of the seed	Contain numerous depressions	Smooth surface
Odour	Odourless	Pungent smell
Taste	Bitter	
Embryo	Curved outwards	Curved inwards

CANNABIS

🕒 00:19:07



- **Species:** Cannabis Indica, Cannabis sativa etc
- It is dieocious plant i.e male & female plants are separate
- **Street Names of cannabis are**
 - Joint
 - Reefer
 - Hash
 - Grass
 - Rope
 - MJ
 - Indian hemp etc
- Most commonly used/abused illicit drug
- It is under the control of NDPS act [Narcotic Drugs and Psychotropic Substances Act]
- It's cultivation, transportation, possession etc is illegal & is punishable under NDPS act

Active Principles of cannabis

🕒 00:21:55

- Active principles are basically Cannabinoids, which include
 - Cannabinol
 - Cannabidiol
 - Cannabolic acid
 - THC (Tetra Hydro Cannabinol): Most important active principle
- In the plant, flowers & leaves have more percentage of active principles, whereas roots & seeds have less % of active principles

Preparations

🕒 00:23:17

1. Bhang

- Mc used & is legally sold
- Prepared from Dried Leaves
- <15 % concentration of Active Principle [AP] is present
- It is used in the form of juice, milk, sweet etc
- Majoon is the Sweet made from Bhang.
 - It is a mixture of Bhang + Honey + Ghee



Bhang

2. Ganja

- It is prepared from dried flowers of the female plant
- contain 15 to 25% of AP
- If it is smoked in the form of Cigarettes, it is k/a Joint / Reefer



3. Hashish / Charas

- It is prepared from dried resin exudate.
- Contain 25 to 40 % of AP (Most Potent)
- Oil extracted from this is k/a Hash oil. It contains 70-90% of active principle



Important Information

- Most potent form of Cannabis is Hash oil > Charas/ Hashish

4. Sinsemilla

- Prepared from unpollinated flowering tops
- It isn't available in India

Fatal dose of cannabis

🕒 00:26:46

- Fatal dose of cannabis is too high. Thus, it is extremely rare to find a case of death d/t isolated cannabis abuse
- If the person is abusing cannabis with some other drug, then the fatality is very common
- Fatal dose of
 - Bhang = 10 gm/Kg body weight
 - Ganja = 8 gm / kg body weight
 - Hashish/charas = 2 gm / kg body weight

Effects of cannabis

🕒 00:28:08

1. Effects with low doses

- Euphoria, increased false sense of confidence
- Temporal disorientation [slowing of time is noted]

- Spatial disorientation [person is on the floor; but he feels as if he is flying in the air]

- Intensification of Sensation / perception

2. Effects with high doses

- Psychosis
- Hallucinations [MC erotic]
- Increases duration of coitus. Thus, it is commonly used as Aphrodisiac

3. Effects of chronic Cannabis usage

i. Amotivational syndrome

- Pt will be completely frustrated/ depressed
- Have low esteem
- Lack of interest in day-to-day activities
- Suicidal tendencies can also be seen

ii. Cannabis induced psychosis

- Pt. will have increased incidence of schizophrenia & its relapses
 - Thus, if the pt has any family history of schizophrenia, cannabis should be completely avoided

Hemp Insanity/ Cannabis induced insanity/ Hashish insanity

- Pt develops psychosis, which is k/a Run amok
- RUN AMOK
 - Initially, the person gets depressed
 - Then, he gets excited & Homicidal impulse is seen
 - It is followed by a phase of depression i.e. Depression → Homicidal impulse → Depression
 - The phase where the person gets homicidal impulse is k/a Run amok
 - The person runs deliriously & kills everyone
 - The person isn't responsible for this crime [section 84 IPC]
 - 84 IPC: offense committed by an insane person isn't liable/ responsible for the offense
 - After this episode, when the person enters the phase of depression, he might develop suicidal impulses & commit suicide

iii. Cannabis induced hyperemesis syndrome

- Intermittent vomiting seen d/t cannabis
- It subsides when the person takes hot showers. It is typical feature seen d/t cannabis abuse

iv. Flash Back Phenomenon

- Recurrence of the effects even without the drug intake is k/a Flash Back Phenomenon
- It is MC seen with LSD. But it can be seen with cannabis as well.

v. Koro

- After chronic abuse of Cannabis,
 - Males believe that his penis is shrinking
 - Females believe that their breast is shrinking

Preparations of cannabis



Bhang (prepared from dried leaves)



Charas/ Hashish (resin exudate in the form of cake/ ball)

COCAINE

00:40:56

- It is a CNS stimulant
- It is 2nd MC abused substance

Street names

- Coke/ crack
- White lady
- Snow
- She [Heroin is commonly referred as 'He']

Source

- Cocaine is an alkaloid obtained from leaves of *Erythroxylum Coca*.



Erythroxylum coca

Derivatives of cocaine

00:42:39

Salt

1. Cocaine hydrochloride

- It is powdery & white in color. It is pure form
- Used as an injection



Joint/ Reefer (smoked in the form of cigarette) i.e Ganja



Ganja

2. Crack

- It is mixture of Cocaine + Baking Soda
- It is smokable form of cocaine
- When we heat it, it produces crackling sounds. Hence, it is k/a Crack

Routes of Cocaine abuse

00:43:49

1. Inhalation/ Snorting is MC route
 - Onset of action occurs immediately with inhalation
2. Smoking
3. IV Injection
4. Oral ingestion



Cocaine hydrochloride



Crack (crystalline form)



Snorting



Heating & inhaling the smoke

Effects of Cocaine intake

00:49:10

- Cocaine is sympathomimetic toxidrome [i.e it increases sympathetic outflow]
- It inhibits the reuptake of Noradrenaline/ Dopamine in the presynaptic membrane
- Thus, lots of Noradrenaline/ Dopamine molecules accumulate in the synaptic cleft resulting in excess sympathetic effect

Effects of Sympathomimetic toxidrome

- Initially it produces excitation
- As the dose increases, it produces depression

Features	Low dose	High dose
CNS effects	• Pt. gets excited, euphoric, hyperactive	• Pt. gets Excited delirium, agitated, convulsions
Heart rate	• Increased [tachycardia]	• Uncontrolled tachycardia resulting in Cardiac arrhythmia
Vessels	• Vasoconstriction	• Chest pain d/t MI
Blood pressure	• Increases	• Intracerebral hemorrhage resulting in stroke
Respiratory rate	• Increases	• Increases
Temperature	• Increases	• Increases resulting in Crack fever
Sweating	• Increases	• Increases
Pupils	• Dilated/ Mydriatic	• Dilated & fixed

- These pts. may develop involuntary movements k/a Crackdance
- High dose is commonly seen in acute poisoning



Important Information

Body Packer Syndrome

- Seen in Acute Cocaine Poisoning
- Body Packers/ Mules: Swallows the packs of drug [cocaine/ heroin] & Smuggle
- Body stuffer: Person who wants to conceal the drug by swallowing

- **Body Packer Syndrome** occurs when one of the packet ruptures inside the GIT itself
- Sudden release of cocaine in GIT results in excess cocaine effects like delirium, chest pain/ MI, agitation, dilated pupils, excessive sweating etc
- X-ray abdomen/ USG shows Cocaine packs
- X-ray signs seen in Body packer syndrome are
 - Double condom sign
 - Tik tac sign
 - Halo sign



X-ray of Body packer

Treatment of cocaine poisoning

🕒 00:54:53

- ABCD [stabilize the pt.]
- Prime reason for mortality is either MI or Stroke d/t increased BP & HR
 - Thus, Amyl nitrate is given to control the Blood Pressure
- Supportive measures/ symptomatic treatment [like treating hypothermia etc] is given

Tests for cocaine

🕒 00:56:10

- Scott test
- Gold chloride test

Chronic Cocaine abuse

🕒 00:56:57

- Commonly k/a Cocainism
- Cocainomania/ Cocainophagia
 - Irresistible impulse/ craving to take cocaine
 - He will be having a phase of rush followed by a crash
 - Rush: As soon as he takes cocaine, he gets excited

- Half life of cocaine is so less [i.e. 45-90 mins]. Thus, we just have to control the BP by giving amyl nitrate until the effects of cocaine subside
- Once the effects subside the pt immediately goes for crashing/ depression
- Thus, these pts. take cocaine again & again to maintain its effect, which results in tolerance to cocaine
- These pts can tolerate high doses of cocaine k/a Cocainomania/ Cocainophagia

Effects of chronic cocaine abuse

1. Septal ulceration/ perforation
2. Black staining of tongue/ teeth
3. Peripheral Gangrene [tip of the lobule/ tip of the nose/ fingers etc.] d/t persistent vasoconstriction
4. Cocaine induced psychosis
 - Pt develops delusion, hallucinations & delirium
 - These pts. develop specific hallucinations k/a tactile hallucinations
 - Pt. feels as if multiple insects are crawling on the skin
 - This is k/a Mangan's symptom/ Cocaine bugs / Formication



Important Information

Mangan's symptom/ Cocaine bugs / Formication

- It's a tactile hallucination where the pt feels as if multiple insects are crawling on the skin
- Tactile hallucinations are seen in
 - Arsenic poisoning
 - Ergot poisoning
 - Cocaine poisoning

- D/t excessive scratching, pt. may develop excoriations resulting in ulceration



Previous Year's Questions

Q. Mangan's symptom is seen in? (NEET Jan 2020)

- A. Datura
- B. Cocaine
- C. Opium
- D. Cannabis



CLINICAL QUESTIONS



Q. The HR of a company had to send a notice to an employee who had been absent quite frequently that month. The 28-year-old man was known to be a confident employee, who was quite alert at work and had no signs of tiredness while at work. On questioning his closest colleagues, the HR learnt that sometimes he had white powder around his nostrils. In recent times, he had become distant and quite irritated around his colleagues. One of his friends had also noticed that his pupils were dilated. He had also complained of having the sensation of insects crawling beneath his skin. In which of the following condition is such a "Tactile hallucination" seen?

- A. Parkinsonism
- B. Chronic depression
- C. Chronic cocaine poisoning
- D. Acute barbiturate poisoning

Answer: C

Solution

Magnan's Syndrome / Cocaine Bugs

- This is seen in cocaine addicts.
- It is a type of tactile hallucination.
- There is a feeling as if grains of sand are lying under the skin or small insects are creeping on the skin giving rise to itching sensation (formication).

Reference: The Essentials of Forensic Medicine and Toxicology by KS Narayan Reddy. 33rd edition 2010. Page no : 603

Q. A 25-year-old woman has been brought in for admission in a semiconscious state. She was found by her roommate in her hostel room with some bottles of alcohol and some drugs by her side. On observation, the patient's hands were seen moving in a pill-rolling pattern. Occasionally she was also threading imaginary needles. The doctor documented the same as Carphologia. On examination, she had a body temperature of 38.0°C and dry skin and mucosa, with tachycardia (heart rate – 111 beats per minute), and blood pressure of 135/61 mmHg. The ECG revealed sinus rhythm with the right bundle branch block, without any changes of the ST segment or T wave. Ultrasound showed severe urinary retention. Carphologia is seen in?

- A. Datura poisoning
- B. Digitalis poisoning
- C. LSD overdose
- D. Alcohol withdrawal

Answer: A

Solution

Carphologia is seen in Datura poisoning

- Typical pill rolling movements
- Pull imaginary threads from fingertips
- Threads imaginary needles

Other sign and symptoms:

- Dry mouth, irrelevant slurred speech, dry and hot skin, dilated pupils.
- **Physostigmine**, a reversible acetylcholine-esterase antagonist, is effective treatment for severe anticholinergic poisoning.

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 34th edition, Page no. 556



40 CARDIAC POISONS

- Includes cardiotoxic plants like
 - Aconite
 - Oleander
 - Digitalis

00:00:28

- These features are absent in horseradish. Thus, these features are used to differentiate b/w these two

ACONITE

00:00:47

- It is commonly k/a Devil's helmet
- Aka Monks hood/ Meetha zaher [have sweet taste]/ Meetha bish



- Its blue colored flower is also k/a blue rocket
- All parts of the plant are toxic. But root is most toxic



Roots of Aconite

- Roots of Aconite resembles horseradish. Thus, ppl may mistakenly consume it [1 of the sources of accidental poisoning]
- Aconite roots are conical, dry, wrinkled with rootlets.

? Previous Year's Questions

Q. Choose the incorrect statement regarding the given image? (AIIMS May 2018)



- A. Causes AV block
- B. Atropine is the antidote
- C. Only root is poisonous
- D. Sweet taste

Active principles of Aconite [Alkaloids]

00:03:06

- Aconitine [most potent]
- Meso-aconitine
- Picro-aconitine
- Indo-aconitine etc

Mechanism of toxicity

- Causes persistent activation of voltage-sensitive Na^{+2} channels

Clinical features

1. GIT

- Increased GIT motility
- Vomiting
- Pain

2. Nerves

- Affects sensory nerves > motor nerves
- Numbness/ tingling sensation in the hands, circum-oral region, face etc
- This paresthesia is most specific feature of aconite

toxicity

3. Heart

- It affects the conduction system of the heart, resulting in bradyarrhythmias/tachyarrhythmias

Treatment

- Treatment depends upon the presenting symptoms of the pt.
 - Gastric lavage
 - For heart block, give Atropine
 - For tachyarrhythmias, give Flecainide
 - Supportive measures

Medico-legal importance

🕒 00:08:15

- Accidental poisoning is common, as it is mistaken for horse radish
- It is one of the ideal homicidal poison as it is
 - Cheaper
 - Small quantity is enough to kill a person. Fatal dose is 1-2 gms
 - It's symptoms mimics natural disease [cardiac arrhythmia]
 - It is destroyed by putrefaction. Thus, it can't be detected during autopsy

OLEANDER

🕒 00:10:45

- 2 types are Pink oleander & yellow oleander. Both are very toxic

	PINK OLEANDER	YELLOW OLEANDER
Scientific name	• Nerium odorum	• Cerbera thevetia
Common name	• Kaner	• Pila kaner
Toxicity	• All parts [leaves, fruits, stem, decoction from the leaf etc] are toxic	• All parts are toxic
Active principles	• Oleandrin • Folinerin • Digitoxigen	• Cerberin • Thevetoxin A & B • Peruvoside • Ruvoside • Neriifolin

Mode of Toxicity

- These are similar to cardiac glycosides i.e Digitalis
- It inhibits Na^+ - K^+ ATPase pump whose function is efflux

of 3 sodium ions out of the cells & influx of 2 potassium ions into the cells

Clinical features

- **GIT symptoms:** Abdominal pain, diarrhea, vomiting, hematochezia etc
- **Heart:** Bradyarrhythmias [heart block], Tachyarrhythmias [fibrillations]
- **Electrolyte abnormalities:** Hyperkalemia is the most important electrolyte disturbance encountered, which leads to fatality [hypokalemia can also be seen]

Treatment

- Stabilize the pt, then decontaminate the pt. by giving gastric lavage
- Antidote of digitalis i.e Digibind [Fab fragment of antibody], is the antidote for oleander as well [as it is similar to digitalis]
- Atropine is given for AV-block
- Lignocaine is given for tachyarrhythmia
- Correction of electrolyte abnormalities [specially potassium abnormalities]
 - Correct hyperkalemia by giving dextrose+ insulin infusion
 - Correct hypokalemia/hypomagnesemia



Pink oleander/ Nerium odorum

- Commonly seen in gardens [ornamental plant] as less water is required for it's growth



Yellow oleander [long slender leaves, bell shaped flowers]



Previous Year's Questions

Q. A 32-year-old woman presents to ER with history of ingestion of crushed plant seen (picture). She was treated with stomach wash and active charcoal. She is at risk of developing which of the following electrolyte substance?

(JIPMER May 2019)



- A. Hypocalcemia
- B. Hypercalcemia
- C. Hypokalemia
- D. Hyperkalemia



- **Active principles:** Digitoxin, Digoxin
- **Mechanism of toxicity:** Inhibits $\text{Na}^+ - \text{K}^+$ ATPase pump resulting in electrolyte abnormalities & cardiac arrhythmias
- **Management is same as oleander i.e**
 - Gastric lavage
 - Correct electrolyte abnormalities
 - Give antidote i.e Digibind
 - Treat arrhythmias [tachy/bradyarrhythmias]



CLINICAL QUESTIONS



Q. A 32 – year – old woman presents to ER with history of ingestion of crushed plant seed (Picture). She was treated with stomach wash and activated charcoal. She is at risk of developing which of the following electrolyte disturbance?



- A. Hypocalcemia
- B. Hypercalcemia
- C. Hypokalemia
- D. Hyperkalemia

Answer: D

Solution

- The given plant is of yellow oleander--> contains thevetin(cardiotoxic)-->produces both tachyarrhythmia and bradyarrhythmia.
- It causes both hyperkalemia and hypokalemia, but more dangerous and life threatening is hyperkalemia which needs to be managed quickly.
- hyperkalemia is managed by insulin dextrose solution.

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no.617.

Q. In traditional Chinese medicine, the roots of this plant are used only after processing to reduce the toxic alkaloid content. Soaking and boiling during processing or decoction preparation will hydrolyse into less toxic and non-toxic derivatives. However, the use of a larger than recommended dose and inadequate processing increases the risk of poisoning. A characteristic finding in the case of poisoning with this plant toxin is the presence of "Hippus", where the Pupils alternately contract and dilate. Which one of the following is being described here?

- A. Opium
- B. Curare
- C. Aconite
- D. Datura

Answer: C

Solution

Aconite poisoning



- **GIT:** Nausea, vomiting, salivation, pain in the abdomen and diarrhoea.
- Bitter-sweet taste, severe burning and tingling of tongue, mouth, perioral area and throat, followed by numbness.
- **CVS:** Hypotension, chest pain, palpitations, bradycardia, sinus tachycardia, ventricular ectopics and ventricular tachycardia/fibrillation.
- **CNS:** Vertigo, restlessness, headache, giddiness.
- **RS:** Respiration is slow, laboured and shallow.
- **Ocular:** Pupils alternately contract and dilate (**hippus**). Diplopia and impaired vision occur.

Reference: The Essentials of Forensic Medicine and Toxicology by KS Narayan Reddy. 33rd edition 2010. Page no : 619



41

SPINAL POISONS

00:00:23

2 types of spinal poisons are

- Strychnos Nux-Vomica: Excitatory poison
- Gelsemium: Spinal inhibitory poison

STRYCHNOS NUX VOMICA/ KUCHILA

00:00:52



- Fruits have white pulp inside, where we can see 3-5 Nux vomica seeds

Seeds

- Looks like RBC/Disc shaped [button-like]
- These are odor less & bitter in taste
- Commonly called as Kuchila seed or Dog's button [used to kill stray dogs]
- Intact seed is non-toxic
- But, even 1 crushed seed is fatal



Nux Vomica seeds

Active principles

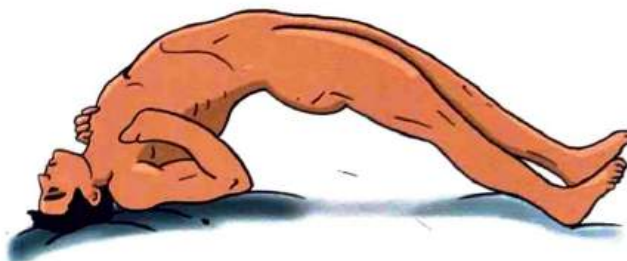
- Strychnine (Most potent)
- Brucine
- Loganin

Mechanism of action

- Site of action: Anterior horn cells of the spinal cord

Normally,

- when impulse pass through the α -Motor neuron, it results in muscle contraction
- This nerve gives a collateral, which ends in Renshaw cell
- Renshaw cell inhibits the α -Motor neuron by secreting Glycine [Type of negative feed-back inhibition]
- Thus, contraction of the muscle is under control



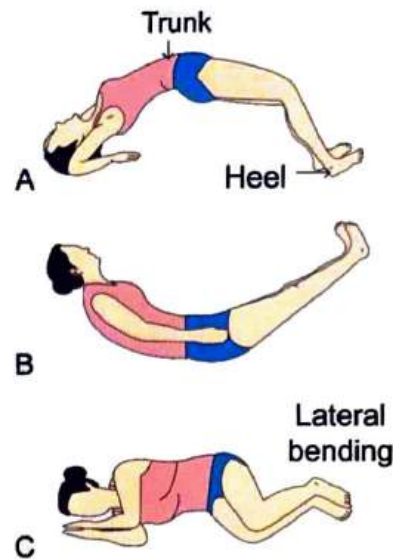
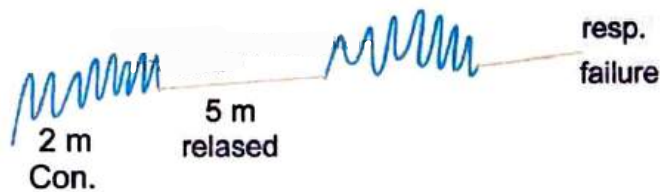
When the strychnine enters the system,

- It inhibits Renshaw cell & Glycine
- As inhibitory control of glycine is lost, it results in hyper-excitation leading to uncontrolled muscle contractions/ Convulsions
- Thus, Nux vomica poisoning resembles Tetanus

Clinical features

00:05:55

- Pt. typically presents with alternative phases of seizures [convulsive phase] f/b muscle relaxation [relaxed phase]
- Initially, duration of relaxation phase is > convulsive phase
- Gradually, duration of convulsive phase keeps on increasing, while duration of relaxation keeps on decreasing
- Thus, after 5/6 convulsions, pt. goes into status epilepticus & die d/t respiratory failure



Important Information

- In Nux vomica poisoning, all the muscles are involved simultaneously & pt. is conscious throughout the convulsions
- In Tetanus, sequential involvement of muscles is seen

I. Risus sardonicus

- Spasm of facial muscles, resulting in widening of the tooth



II. Tonus

- **Opisthotonus:** Backward arching of the body. I.e., hyperextension of the spine
 - It is MC type of Tonus
- **Emprosthotonus:** Forward arching of the body. I.e., hyperflexion of the body
- **Pleurosthotonus:** Lateral arching of the body. I.e., Lateral flexion of the body

Treatment

00:08:30

- Primary modality is to control the seizures
 - Place the pt. in dark, isolated room [as any kind of stimulus can provoke convulsion]
 - Give Benzodiazepines/ Phenobarbitone/ Skeletal muscle relaxants/ General anesthesia, depending on the response of the pt.
 - We don't give gastric lavage in initial stages, as insertion of gastric tube itself can provoke convulsions [it should be done after controlling the seizures]
- Supportive measures

PM findings

00:09:40

- Rigor mortis starts & disappears early
- PM caloricity is present [body remains warm even after 1-2 hrs after the death]
 - In normal cases, cooling of the body is seen after the death
- Kuchila seeds resists putrefaction
- Spinal cord/ brain are preserved during autopsy, along with the routine organs [I.e stomach, intestine, liver, kidney]



CLINICAL QUESTIONS



Q. Which of the following is not true about the poisoning caused by seeds shown below?



- A. Pleurosthotonus
- B. Post mortem calorcity
- C. Uncrushed seeds will not lead to poisoning
- D. Toxin potentiates neurotransmitter glycine effect at pre-synaptic receptor

Answer: D

Solution

- The seeds in the given picture are of 'kuchila' or 'Nux vomica' the seeds are highly fatal.
- Even one crushed seed is fatal.
- It contains 3 active toxins

Principle:

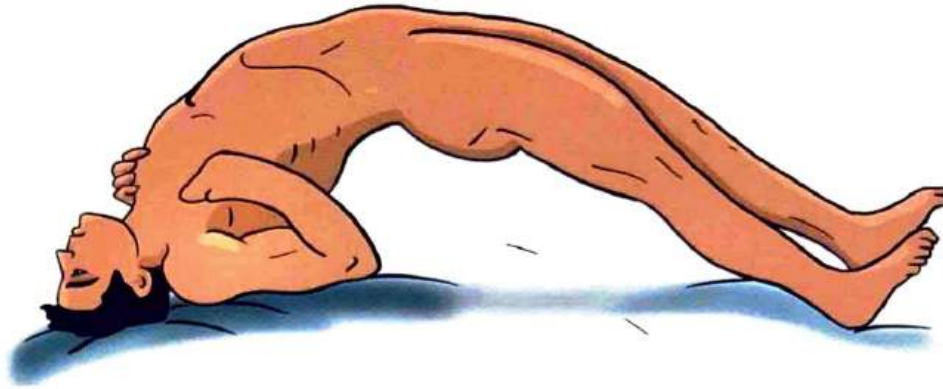
- Strychnine which (acts on anterior HORN cells of spinal cord) inhibits glycine preventing the inhibitory effects of glycine on the **post synaptic neuron**
- Neurotransmitter nux vomica poisoning resembles 'tetanus' since it causes muscle convulsion.

3 features are seen

1. Opisthotonus (most common)
2. Pleurosthotonus
3. Emprosthotonus
 - After death ' post-mortem calorcity' phenomenon occurs i.e initially after death, the patient remains warm for few hours.

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no.570

Q. Which poison can cause the Feature shown in image?



- A. Phosphorus
- B. Snake bite
- C. Strychnine
- D. Arsenic

Answer: C

Solution

- The image shows **Opisthotonus** which is a characteristic feature of **Strychnine poisoning**

Opisthotonus-It is due to powerful extensor spasm causing the body to be hyper extended with arching of the back.

- **Strychnos nux vomica (kuchila):** Strychnine is a powerful spinal stimulant.
- **MOA:** Inhibits the uptake of **glycine** at inhibitory synapses in anterior horn cells of the spinal cord.
- **Clinical Features:** Net excitatory effect, and minimal sensory stimulation can set off powerful muscle contractions.

Reference: Review of forensic medicine and toxicology by gautum Biswas, 3rd edition, page no: 573



42 ASPHYXIANTS

🕒 00:00:21

- Asphyxiants include toxic gases, which produces asphyxia like features
- Eg. Carbon- monoxide [CO], cyanide
- Cyanide exists in all the 3 forms

CARBON-MONOXIDE [CO]

🕒 00:00:51

- It is commonly k/a Silent killer

Properties of CO

- Colorless
- Odorless
- Lighter than air [thus, it always stays in upper part of the room]
- Non-irritant

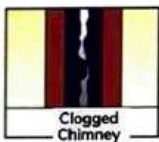
Sources of CO poisoning



- Commonly occurs d/t exhaust gas from the engine. i.e car engine running in closed garage
- Clogged chimney
- Gasoline heater [where exhaust isn't working properly]
- Wood burning fire place



Car left running in attached Garage



Clogged Chimney



Corroded or Disconnected Water Heater Vent Pipe



Gas or Wood-Burning Fireplace

Mechanism of toxicity [MOT]

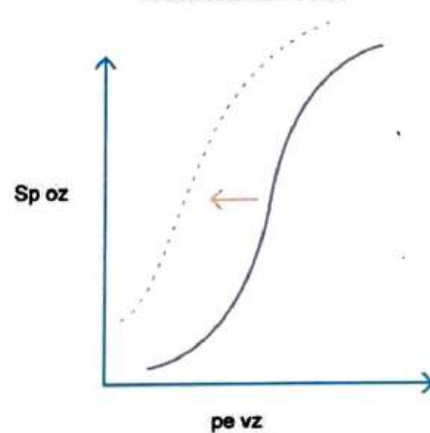
🕒 00:02:35

- CO binds with iron containing proteins in the body i.e.
 - Hemoglobin
 - Myoglobin [10-15%]
 - Cytochrome c oxidase [complex-IV of ETC]
- CO has 210 times more affinity than oxygen, towards

hemoglobin

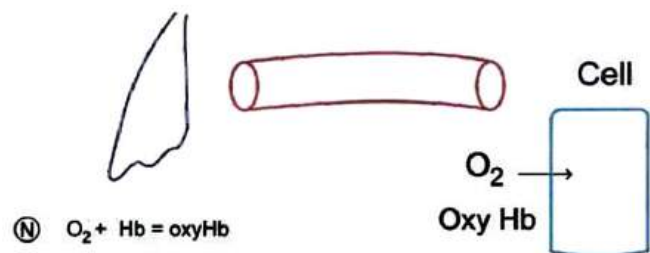
- When carboxy-hemoglobin forms, oxygen-Hb dissociation curve shifts to left
- It results in decreased unloading of oxygen to the tissues

Hb dissociation Curve

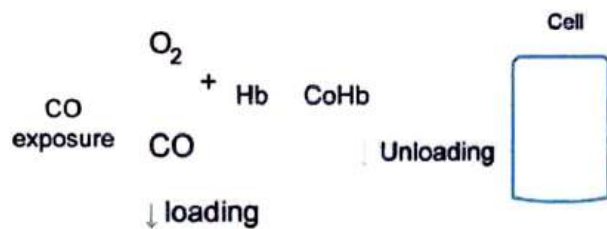


Effects of CO binding to hemoglobin

- Normally Oxygen binds to Hb in pulmonary capillaries & forms Oxy-hemoglobin. This is circulated & delivered to the cells through blood



- On CO exposure, CO binds with Hb before oxygen as it has high affinity
- It results in Carboxy-hemoglobin [CO-Hb] & decreased loading of oxygen [at pulmonary level]
- Decreased unloading of oxygen is seen at cellular level
- D/ t this oxygen is not delivered to the cells, which is k/a Anemic anoxia/ Anemic hypoxia



- As the cell isn't getting oxygen, there is stimulation of anaerobic metabolism, resulting in production of lactic acid
- Thus, the person will be having High Anion-Gap Metabolic Acidosis [HAGMA]

Effects/ Clinical features of CO intoxication 🕒 00:10:28

1. Acute CO poisoning

- Clinical features correlate with the level of Carboxy-Hb

Level of CO-Hb	Associated Clinical features
0-10%	• No symptoms
10-20%	• Mild headache
20-30%	• Headache increases & the person develops emotional instability
30-40%	• In addition to headache, emotional instability; there is impaired judgement; disorientation, increased reaction time
40-50%	<ul style="list-style-type: none"> • The person develops Ataxia, hallucinations, disorientation, slurring of speech • These features mimics as if the person took alcohol i.e Drunkenness
50-60%	<ul style="list-style-type: none"> • CVS features: MI, arrhythmias • CNS features: Coma, convulsions
60-70%	• Profound coma occurs which results in death



Important Information

- At 30-40% of CO-Hb, Cherry-red discoloration/ Hypostasis occurs
- CO poisoning mimics drunkenness
- Brain & heart are more susceptible for hypoxia
- Hippocampus, basal ganglia etc. of brain are more susceptible for hypoxia

- In addition to above features, skin blisters are seen; which is one of the typical features of CO intoxication, particularly at friction areas like interdigital areas, gluteal region, calf region, knee etc.
- Similar kind of skin blisters are seen in barbiturate poisoning
- No cyanosis is seen in CO-poisoning d/t the presence of free oxygen in the blood & presence of Carboxy-Hb [not deoxy-Hb]

Delayed effects 🕒 00:15:04

- Seen after 2 days to 2 weeks after exposure
- These pts. presents with neuro-psychiatric manifestations like
 - Ataxia
 - Tremors
 - Personality disorders etc.

When to suspect CO-intoxication 🕒 00:16:04

- When whole family/ a person complaining of headache after
 - Driving old car
 - Using gasoline heater in winter
 - Indoor barbeque
 - Fire in the building
 - Engine running inside the closed garage



Important Information

- If we check oxygen saturation of these pts. with pulse oximetry, it can be normal [i.e it gives false reading]
- Thus, we need to be in caution while using pulse oximetry in these pts.

Lab tests 🕒 00:17:23

- Serum CO-Hb levels

	Serum CO-Hb levels in	
	Non-smoker	Smoker
Normally	1%	4%
CO-poisoning	2%	10%

• CT brain

- Shows symmetrical low-density areas d/t hypoxic injury
- It is seen in globus pallidus, putamen etc.

- **High anion-gap metabolic acidosis** d/t anaerobic respiration
- **Hoppe seyley's test**
- **Kunkel's test**
- **Spectroscopy**

Treatment

🕒 00:20:16

- Remove the source of exposure immediately
 - We don't have to remove the clothing of the pt. as CO doesn't diffuse through the skin
- Give continuous high-flow oxygen
 - This oxygen competitively displaces CO & binds to hemoglobin



Important Information

- **Caution**
 - After removal of CO from Hb. CO bounded to myoglobin. displaces from myoglobin into the blood. then bind with Hb & can cause rebound toxicity
- If symptoms are so severe, we can give Hyperbaric oxygen
 - Hyperbaric oxygen has the risk of causing barotrauma
 - Thus, high flow oxygen is usually preferred over hyperbaric oxygen

Postmortem findings

🕒 00:22:30

- Cherry red hypostasis
- Skin blisters in frictional areas
- Lesions in the Basal ganglia
 - Necrosis & cavitation in globus pallidus & putamen



Cherry red hypostasis d/t presence of lot of free oxygen in the blood

Medico-legal importance

🕒 00:23:18

- Suicidal poisoning is very common particularly at

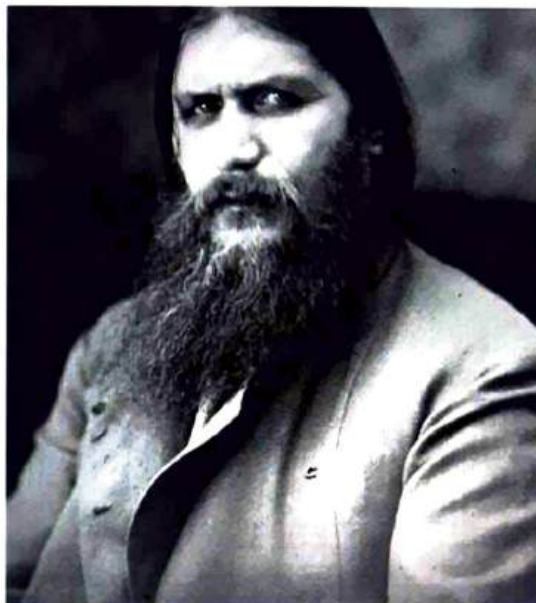
western countries

- i.e. Garage death: The person starts engine in the closed garage, inhales CO & die
- Accidental poisoning is common in industrial exposures, firefighters, while burning wood etc.

CYANIDE

🕒 00:24:15

- It is available in natural sources as well.
- E.g.
 - Peach
 - Almond
 - Apple
 - Linseed plant [accidental poisoning to cattle is MC]



Russian who had been given cyanide in bread & wine [but he escaped from death]



Gas execution chamber of Hitler [from Germany]

- Cyanide exists in 3 forms i.e.
 - Liquid form: Hydro-cyanic acid
 - Gas form: Hydrogen cyanide or Cyanogen gas
 - It is one of the Rapid poisons. It's onset is instantaneous
 - It is an ideal suicidal poison as the person dies rapidly without any pain
 - Opium is another ideal suicidal poison as it causes painless death
 - Cyanide gas has the smell of oil of bitter almond
 - Only 60% of the general population can perceive this smell
 - Perception of smell itself is Sex-linked recessive trait
 - Even if the person perceives this smell, within short time, they may become tolerant
 - Salt forms: Potassium cyanide [KCN], Sodium cyanide [NaCN]
 - These salts are basically non-toxic
 - When sodium cyanide [non-toxic salt] enters the stomach, it mixes with HCL & liberates hydrocyanic acid, which is toxic



Uses of cyanide

🕒 00:29:37

- Photography
- Fumigation [particularly in big ships]
- Electroplating
- Fingerprint powder
- Used by Goldsmiths
- Earlier, it was used as a rodenticide

Clinical features

🕒 00:30:18

- **GIT symptoms**
 - Burning pain in throat, abdomen
 - Feeling of throat constriction
 - Vomiting
 - Breath smell of almond
 - Froth from the mouth d/t pulmonary edema
- **CNS features**
 - Dizziness
 - Confusion, anxiety
 - Respiratory depression
 - Eyes: cornea will be bright & glistening
 - Coma, death

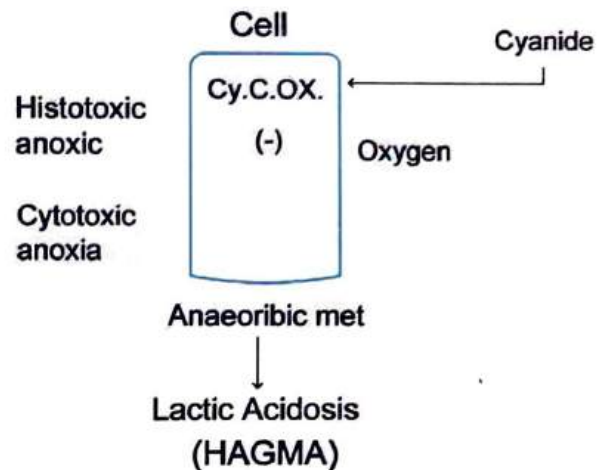
Mechanism of toxicity

🕒 00:31:09

- Cyanide has more affinity towards ferric ions [Fe+3]
- Thus, cyanide binds with cytochrome c oxidase enzyme & inhibits Electron transport chain
- D/t this, the cell can't utilize oxygen, resulting in anoxia. It

is k/a Histotoxic anoxia/ Cytotoxic anoxia/ Tissue anoxia/ Cellular anoxia

- The cell has to go into anaerobic metabolism, which results in production of Lactic acid
- Lactic acid accumulation results in High Anion-Gap Metabolic Acidosis [HAGMA]



Treatment

🕒 00:33:52

- It's affinity towards ferric ions is used to treat these pts.
 - Induce the formation of meth-hemoglobin [have ferric ion] by giving nitrites like Amyl nitrite/ Sodium nitrite
 - All cyanide binds to meth-hemoglobin & form cyanometh-hemoglobin
 - Later, Sodium thiosulphate is given, which combines with cyanometh-hemoglobin & forms Thio-cyanate, which is water soluble & is easily excreted by the kidney in the urine
 - After this, Cytochrome c oxidase enzyme will become free & ETC works
- Eli Lilly's antidote has
 - Amyl nitrite/ sodium nitrite
 - Sodium thiosulphate

Risk

- If concentration of meth-hemoglobin increases too much, that itself results in toxicity
- To prevent this, we can give Hydroxy-cobalamin
 - Hydroxy-cobalamin combines with cyanide & forms cyano-cobalamin, which can be excreted by the kidney in urine
 - It doesn't have the risk of production of meth-hemoglobin



Important Information

Rx of cyanide poisoning

- Remove the exposure & clothing [as it is absorbed from the skin as well]
- Oxygen
- Antidote
 - Hydroxy-cobalamin > Eli Lilly's antidote. Dicobalt EDTA [Kelocyanor]
- Sodium bicarbonate [for metabolic acidosis]

Medico-legal importance

🕒 00:41:21

- Suicidal poisoning is common
- Accidental poisoning is common d/t industrial exposure/ship fumigation



Important Information

- Cherry red hypostasis is seen in Carbon-monoxide poisoning
- Brick-red hypostasis is seen in Cyanide poisoning

Autopsy findings

🕒 00:40:20

- Face
 - Eye shows Bright & glistening cornea
 - Froth in the mouth
- Brick red hypostasis
- Smell of bitter almond is perceived
 - Cranial cavity is opened 1st to perceive this smell



CLINICAL QUESTIONS



1. The forensic doctor is doing the autopsy on a 35-year-old woman who had not survived the fire that had engulfed her hut. Staining of the post mortem lividity (hypostasis) revealed a Cherry red colour thereby confirming poisoning with?

- A. Nitrites
- B. Aniline
- C. Phosphorus
- D. Carbon Monoxide**

Solution:

Condition	Colour of Post mortem staining
<ul style="list-style-type: none">• Usual colour• CO• HCN• Hypothermia, drowning• Opium• P or acute Cu poisoning• Nitrites, Nitrates, potassium chlorate, Potassium bicarbonate, nitrobenzene, acetanilide, bromates, Aniline• Hydrogen Sulphide• CO₂ Asphyxia, Aniline	<ul style="list-style-type: none">• Reddish purple• Cherry red• Bright Red or Dark Red or Brick Red• Bright Pink• Black• Dark Brown or Yellow• Red Brown or Copper Brown or Chocolate Brown or Coffee Brown
<ul style="list-style-type: none">• Haemorrhage, Anaemia• Clostridium Perfringes	<ul style="list-style-type: none">• Bluish-green• Deep blue (In Aniline Deep blue as well as Red Brown colour can occur)• Pale• Bronze

Reference: Simpson's Forensic Medicine, 13th edition, page 45

2. A 21-year-old white woman was referred to a hospital after exposure to CO from a faulty furnace. She developed acute weakness, dyspnoea, nausea, and vomiting. An ECG revealed sinus tachycardia, non-specific ST-T wave abnormalities, and a prolonged QTc interval. The chest X-ray revealed pulmonary edema and the 2-D echo revealed decreased LV systolic function with an EF of 25%. The treatment for this woman, among the following, would be?

- A. Ascorbic acid
- B. Intravenous methylene blue
- C. 100% Oxygen**
- D. None of the above

Solution:

Treatment of carbon monoxide

- Remove the victim from source of exposure.
- Maintain patent airway, fresh air and ortho-baric oxygen (high-flow or 100% oxygen at atmospheric pressure) Oxygen therapy is started if COHb > 10% and should be given for 4–6 hours
- Blood transfusion, if required.
- Gastric lavage to prevent aspiration pneumonia.
- Cerebral edema is treated by mannitol

Extra: Tests that may be used for the diagnosis of CO poisoning:

- Spectroscopy
- **Hoppe-Seyler's test**
- **Kunkel's test**
- Potassium ferricyanide test
- Katayama's test

Reference: The Essentials of Forensic Medicine and Toxicology by KS Narayan Reddy. 33rd edition Page no : 622



43 AGRICULTURAL POISONS

Agricultural poisons



- MC poisoning method used in rural areas

INSECTICIDE POISONING

00:01:00

- Insecticides are classified into following groups

Alkyl group	Aryl group
<ul style="list-style-type: none"> • H - HETP • O - OMPA • T - TEPP • M - Malathion 	<ul style="list-style-type: none"> • Parathion (Folidol)[commonly encountered poison] • Diazinon (Tik 20) • Chlorthion



How to remember

- HOT Mallika
- All 'thions' comes under Aryl group except Malathion

1. Organophosphorus compounds (OPC)

- Causes irreversible inhibition of Acetylcholinesterase enzyme by phosphorylation of the enzyme

2. Organo carbamates

- Causes reversible inhibition of Acetylcholinesterase enzyme by carbamylation of this enzyme
- Includes
 - Aldicarb
 - Propoxur [Baygon spray]
 - Carbaryl

3. Organo chlorines

- Inhibits sodium channels
- Eg.

- Aldrin
- Endrin [commonly k/a Plant penicillin]
- DDT
- Endosulfan

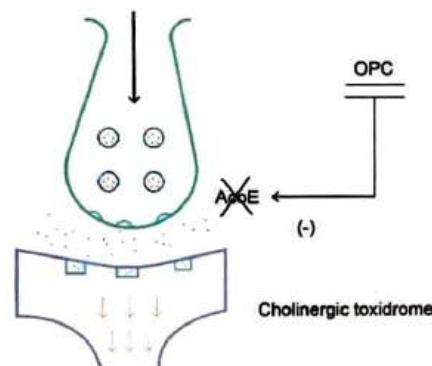
4. Pyrethroids

- Inhibits sodium channels
- E.g.: Mosquito repellants

ORGANOPHOSPHORUS COMPOUNDS [OPC]

00:07:27

- Odour
 - Typical kerosene smell [due to presence of aromax, which is a petroleum distillate compound]
 - Some of these compounds may have garlic smell d/t presence of phosphorous
- MOA: Irreversible Inhibition of acetylcholinesterase enzyme
 - When an impulse reaches the pre-synaptic membrane, vesicles fuse with the presynaptic membrane & release acetyl choline molecules into the presynaptic cleft
 - These acetylcholine molecules bind to its receptors present on the post-synaptic membrane & produces its action
 - After this, all the residual AChE molecules in the cleft are cleared/ lysed by Acetylcholinesterase enzyme [AChE]
 - In OPC poisoning, ACE enzyme is phosphorylated & irreversibly inhibited
 - D/t this excessive Ach molecules gets accumulated in the cleft resulting in Cholinergic toxidrome
 - Increased parasympathomimetic action is seen [In Datura poisoning increased parasympatholytic action is seen]



- In OPC poisoning, 3 types of syndromes are seen

1. Acute syndrome
2. Intermediate syndrome
3. Delayed syndrome

Clinical features

00:12:56

Muscarinic [5 types]

- **D** – Diarrhea [increased GI motility, Bowel sounds]
- **U** - Increased frequency of Urination
- **M** - Miosis pupil
- **B**-Bradycardia [by activation of M2 receptors]
- **B**-Bronchorrhea, Bronchospasm
- **E** - Emesis
- **L**-Increased Lacrimation
 - Red tears/ chromodacryorrhea is seen d/t secretion of porphyrin in tears
- **L** - Lethargy
- **S** - Salivation

Nicotinic [Nn, Nm]

- Initially, it causes muscle fasciculations
- Later, muscle paralysis occurs [Type-1/ Acute syndrome]
- Death occurs d/t paralysis of Respiratory muscles [i.e respiratory failure]



How to remember

- **DUMB BELLS**



Previous Year's Questions

- Q. A 72yr farmer presents to the hospital with pin point pupils and increased secretions. The diagnosis is? (FMGE Dec 2019)
- A. Alcohol poisoning
 - B. Opioid
 - C. Organophosphorus poisoning
 - D. Datura poisoning

Diagnosis

00:16:19

- Diagnosis is based on history given + clinical features



Alkyl group OPC



OTHER INVESTIGATIONS

00:17:14

Assay of cholinesterase enzyme levels

True cholinesterase / RBC cholinesterase

- It is very specific
- Levels of RBC cholinesterase *correlates* with clinical features
 - If RBC cholinesterase comes down to <25% of the normal, it is mild attack
 - <20-10% of normal level: Moderate attack
 - < 10% of normal level: Severe attack

Pseudocholinesterase/ Plasma cholinesterase/ Butyryl cholinesterase

- It is very sensitive i.e even with milder dose of OPC itself, its level comes down

Treatment

00:19:25

1. Stabilization
2. Decontamination
 - Routes of absorption of OPC are GIT, skin, lungs [inhalation]
 - Thus, decontamination should be specific for that particular route
 - In oral ingestion, gastric lavage is done
 - In skin exposure, wash the area with water & remove the clothing
 - In inhalational poisoning, give fresh oxygen & remove the person from the source

Antidotes

00:20:25

1. Atropine sulphate

- It is a specific antidote [counteracts the muscarinic effects of OPC]
- Dose: 2-4mg I.V & keep on repeating it for every 10-15mins till atropinization
- Status of pupil isn't reliable for checking atropinization
- Decreased secretions of the lung i.e., clear & dry lungs is the sign for atropinization
- If atropine is given to hypoxic/ cyanosed pt, it predisposes to arrhythmia.
- Thus, make sure that the person doesn't have hypoxia & is properly oxygenated when atropinization is done

2. Oximes [take care of Nicotinic effects]

- Oximes reactivates the cholinesterase enzyme by removing the phosphate group from the enzyme
- E.g.

- Pralidoxime [P2Am] : MC used & has synergistic effect with atropine
- Obidoxime
- The bond b/w AchE & OPC increases with time & becomes irreversible. This is k/a aging of the enzyme.
- Thus, oximes should be given as early as possible [it has no use after aging of the enzyme]

Medico-legal importance

00:24:04

- Suicides with OPC is very common [d/t its smell & taste, it is commonly mixed with alcohol & consumed]
- Homicide is rare
- Accidental exposure is common [in ppl working in agriculture]

Delayed effects

00:24:51

Intermediate syndrome [Type-2]

- Occurs after 1-4 days of exposure d/t Inadequate Rx of acute episode
- **Clinical features**
 - Muscle paralysis; particularly neck flexors & proximal group of muscles are involved
- **Rx:** Supportive/ symptomatic treatment
- Both oximes & atropine are ineffective

Delayed syndrome [Type-3]

- Aka OPIDPN [Organo-Phosphorous Induced Delayed Poly-Neuropathy]
- Presents in 1-4 wks after exposure
- It causes paralysis of the muscles [distal group of muscles] + Peripheral neuropathy
- **Rx:** Supportive/ symptomatic treatment

Summary of Rx for different types of poisons 00:28:01

	OPC	Carbamates	Organo chlorines	Pyrethroids
Atropine	✓	✓	X	x
Oximes	✓	X	X	x

- Symptomatic Rx is given for organo-chlorines & pyrethroids



Previous Year's Questions

- Q. Atropine is not an antidote in? (AIIMS Nov 2017)
- Tik 20
 - Endrin
 - Baygon
 - Parathion



CLINICAL QUESTIONS



Q. 50-year-old farmer has been brought unconscious to the emergency after being discovered in the fields with an empty bottle of an organophosphate compound. The mainstay of medical therapy includes atropine, pralidoxime (2-PAM), and benzodiazepines (eg, diazepam). In order to achieve adequate atropinisation quickly, a doubling approach is typically used, with the escalation of doses from 1 mg to 2 mg, 4 mg, 8 mg, 16 mg, and so on. Poisoning with an OP compound is characterized by all of the following, except?

- A. Pulmonary oedema
- B. Pinpoint pupil
- C. Constipation
- D. Vomiting

Answer: C

Solution

Symptoms of OP Compound Poisoning:

Muscarinic symptoms:

- Bronchoconstriction
- Bronchorrhea
- Bradycardia
- Miosis
- Sweating
- Salivation
- Lacrimation
- Micturition
- **diarrhea**

Nicotinic symptoms

- Fasciculation
- Dyspnoea
- Cyanosis

Reference: KSN Reddy, Essentials of Forensic Medicine & Toxicology, 33rd Edition page no : 517

Q. Paraquat ingestion is a leading cause of fatal poisoning in many parts of Asia, Pacific nations, and the Americas. Paraquat is a rapidly-acting, nonselective herbicide that is relatively inexpensive. Paraquat is reasonably safe to use in agriculture: dermal or spray exposure generally causes only limited localized injury. However, accidental or deliberate ingestion has an extremely high case-fatality rate. Poisoning with Paraquat can cause which one of the following?

- A. Renal failure
- B. Cardiac failure
- C. Respiratory failure
- D. Multiple organ failure

Answer: D

Solution

- Paraquat poisoning causes Multiple organ failure.
- Paraquat is a very toxic compound, 2 g can be potentially fatal (10 ml of concentrated 20% solution).
- Initial signs of toxicity are due to its corrosive effects on the GI tract and Oropharynx.
- Paraquat absorbed and is sequestered in the lungs--> form hydrogen peroxide and superoxide anions--> cell death--> acute alveolitis.

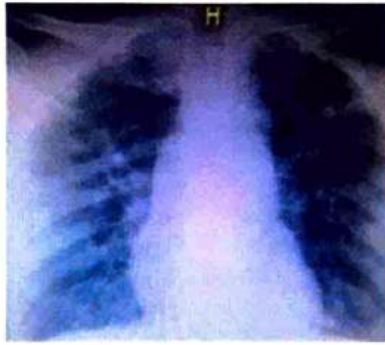
Management

- providing supportive care
- activated charcoal to reduce absorption.
- Excessive oxygen supplementation can actually increase pulmonary toxicity

Paraquat poisoning by skin absorption



Oral mucosa is observed with edema, jaundice and ulcerations.



bilateral opacities of peripheral and parahilar predominance.



Liver enlarged in size and weight, congestive and indurated, gallbladder with cholestasis.

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no. 526

Q. In June 2007, India banned 25 pesticides. On the 'banned' pesticides and formulations list, are aldrin, Benzene hexachloride, Calcium cyanide, Chlordane, Copper ceto-arsenite, Cibromochlopropane, Endrin, and 19 others. All the following statements about Endrin are true, except?

- A. Least toxic organochlorine
- B. Also known as plant penicillin
- C. Has kerosene like smell
- D. Resists putrefaction

Answer: A

Solution

ENDRIN:

- **MOST toxic** organochlorine
- Also known as **plant penicillin**
- Has kerosene-like smell
- Resists putrefaction

Reference: Essentials of Forensic Medicine & Toxicology, KSN Reddy, 33rd Edition Page no : 525



44 MISCELLANEOUS

🕒 00:00:15

CHLORAL HYDRATE

- It is an inebriant
- Aka Dry wine, as it is colorless, crystalline substance



Chloral hydrate

- It has a smell of Acrid pear
- Commonly called as Knock-out drops

Even a few drops of chloral hydrate solution can knock-out a person

- In olden days, it was specifically used for robbery
- Aka Mickey's fin



- When tourists attended Mickey's bar, he used to add few drops of chloral hydrate in the alcohol, knock-out them, rob them & throw them in the ditch/ kill them
- Hence, it is k/a Mickey's fin
- It is a combination of Alcohol + Chloral hydrate

LSD [LYSERGIC ACID DIETHYLAMIDE]

🕒 00:02:40

- Aka Acid, Blotter, Acid blotter, Paper stamp [as it is available in the form of stamp like paper, which is kept on the tongue for absorption]
- MOA: It is 5-HT receptor agonist
- It doesn't cause any physical dependence [psychological dependence can be seen]. Thus, there is no presence of severe withdrawal symptoms



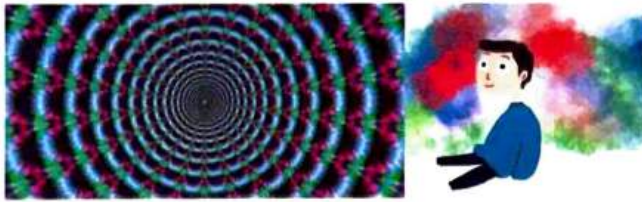
Effects of LSD

- Effects are commonly called as Trip [perceptual effects]
- Average time of trip is 2-6 hrs [Effects may start with in half hr & last upto 2-6 hrs]
- Trip may have somatic effects like fever, vomiting, dilated pupils, confusion etc

Effects of Good trip

- Causes perceptual changes like
 - Depersonalisation [person feels as if he is detached from his body], most important effect
 - Pt. loses the sense of time

- Visual hallucinations
- Synesthesia
- When 1 sense is stimulated, another modes of senses are also experienced
- Eg: pt. Can taste the colors/ smell can be heard
- It is typically seen after LSD intake



Effects of bad trip: Panic attacks

FLASHBACK PHENOMENON

🕒 00:07:30

- Recurrence of the effects of LSD, even without taking LSD [history of intake of LSD is present]
- Aka Free trip
- If it is a good trip, its not a problem.
- But, if its a bad trip, pt. becomes so anxious.
 - Thus, anxiolytics & symptomatic management should be given to the pt
- This phenomenon is MC seen with LSD

ECTASY

🕒 0008:35

- It is MDMA [Methylenedioxyamphetamine]
- It is a Rave drug/ club drug/ date rape drug
- It is used to get Euphoria [psychological/ physical energy]
- Combination of LSD + Ecstasy is k/a Candy flapping

ALCOHOLIC WITHDRAWAL SYNDROMES

🕒 00:09:57

- If a chronic alcoholic pt. suddenly stops taking the alcohol, following symptoms occur
 - Within 6-8 hrs of cessation, pt. gets tremors [MC symptom]

- Within 8-12hrs, Alcoholic hallucinosis occur
- MC Auditory hallucinations are seen
- Pt. may get multiple impulses like homicidal impulse/ suicidal impulse & may commit crime/ suicide
 - In 12-24 hrs, Rum fits /chronic seizures [MC= GTCS] are seen
- If a pt. presents with focal seizures, find out if any organic lesion is present
 - In 2-3 days [i.e 48-72hrs], Delirium tremens are seen
- It is an acute attack of insanity d/t sudden stoppage of alcohol
- Sometimes, excess of alcohol/ infection/ high fever/ stress can also precipitate an episode of delirium tremens

Clinical features of delirium tremens

- Features of Delirium: Clouding of consciousness [altered sensorium], Disorientation [no orientation to time, place & person], irrelevant thought content
- Features of Tremens i.e., Coarse tremors are noted
- Hallucinations
 - Visual hallucinations: Person may get frightened by these hallucinations. This is k/a Delirium of horror
 - Lilliputian hallucination: Everything looks very tiny
 - Tactile hallucinations
- Autonomic disturbances like fever, high BP, Increased heart rate, sweating etc are noted
- If a person commits crime d/t these hallucinations & delirium, the person isn't liable for the crime [i.e. person can't be punished as it is acute attack of insanity]

Features a/w Chronic alcoholism

1. Wernicke's encephalopathy

- It is d/t B1 /Thiamine deficiency

Clinical features

- **G** - Global confusion
- **O** - Ophthalmoplegia [Nystagmus]
 - Paralysis of abducens nerve is seen commonly
- **A**-Ataxia [d/t cerebellar dysfunction/ peripheral neuropathy]
- **P** - Peripheral neuropathy
- Generally, it presents as acute condition



How to remember

- GOA-P

2. Korsakoff psychosis

- Occurs due to B1/Thiamine deficiency
- Inability to learn new information i.e. Anterograde amnesia is seen
- To compensate this short-term memory, pt. shows confabulation

3. Marchiafava-Bignami syndrome

- MC seen in chronic alcoholic males
- Demyelination of Corpus callosum is seen
 - Pt. may present with seizures/ coma/ ataxia & finally may result in death

CONIUM MACULATUM

🕒 00:20:00

- Aka spotted hemlock [stem has purple colored spots]
- All parts of the plant are toxic
- Have specific mousy odour
- Active principles: Coniine, Methylconiine
- **Mechanism of Toxicity [MOT]**
 - It initially affects motor nerves & causes paralysis
 - Then, it progresses to spinal cord & gradually affects brain as well
- **Clinical features**
 - Pt. Initially presents with paralysis of lower limbs
 - Gradually, it progresses upwards
 - When respiratory muscles are paralysed, the pt. dies

- There is no specific antidote for this
- Gastric lavage & symptomatic management are given
- **Medico-legal importance**
 - Accidental poisoning is very common
 - In history, Greek philosopher Socrates had been administered by this hemlock for killing him [as a form of execution]



Spotted Hemlock





LEARNING OBJECTIVES

UNIT-7 – STARVATION DEATHS

1. Starvation deaths

- Types of starvation
- Causes
- Fatal period
- Post mortem appearance
- Medico-legal aspects



45

STARVATION DEATHS



- If Food alone is stopped [water is given], death occurs in 6-8 weeks
- Loss of body weight by > 40% is fatal
- Loss of protein by 20% is fatal
- Loss of fats by 70% is fatal

PM FINDINGS

00:04:05



- Most characteristic autopsy finding: The person will be completely Emaciated with loss of body weight & organ weight [i.e atrophied organs]
- Complete lack of fat in the subcutaneous & deep fat depots



STARVATION

00:00:17

- Actual withholding of food or food & water by an individual necessary for the maintenance of the body

Types

00:00:46

1. Acute/ Complete Starvation

- When food is withheld suddenly & completely for a continuous period

2. Chronic/ Partial Starvation/ Malnutrition

- When food intake is deficient, either quantitatively or qualitatively
- Deficiency of vitamins, proteins, minerals can occur

Causes

00:01:25

- Famine
- Being trapped in pits, landslides, mines
- Neglect on the part of parents or guardians
 - Ex: Child abuse [Battered baby syndrome]
 - Deficiency of nutrition, love, care etc is seen
- Willful withholding of food.
 - Eg: Elderly
- Willful refusal to take food.
 - Eg: Religious rituals (Fasting), hunger strikes etc

FATAL PERIOD

00:02:59

- If Food & water, both are stopped, death occurs in 10-12days

- Atrophy of all the organs can be seen ~~except~~ brain
- Gall bladder would be distended with bile
 - Because bile is secreted only in the presence of food
- GI tract would be empty. Sometimes, stones can be seen, which are eaten by the pt. d/t hunger

- Seen in prisoners, mentally ill Pts. or hysterical woman

Homicidal

- Elderly abuse or victims of child abuse [Battered baby syndrome]

Accidental

- Occurs when ppl are trapped
- I.e during Famine, shipwreck, trapped in mines or landslides during earthquakes

MEDICO LEGAL IMPLICATIONS

00:06:04

Suicidal

- Person doesn't want to take the food

HOMICIDAL STARVATION

Kerala Man Held for Locking Elderly Parents in Room Without Food for Weeks, Father Dies of Starvation



Reji's father Podiyan (80) died due to acute starvation on Tuesday, while his mother Ammini (76), who was found in a decrepit condition by some local health workers, is currently undergoing treatment at the Kottayam Medical College hospital and her condition is said to be stable.

ACCIDENTAL STARVATION

Women starves to death after being trapped inside elevator for a month





LEARNING OBJECTIVES

UNIT-8 – FORENSIC PSYCHIATRY

1. Forensic psychiatry

- Symptoms of psychiatric disorders
- Delirium
- Delusion
- Erotomania - De Elerambault Syndrome
- Capgras Syndrome
- Hallucination
- Impulse
- Phobia
- Lucid Interval
- Mental Illness
- Right of Mentally Ill Person
- Civil Responsibilities of an Insane
- Indian Renal Code 84
- Rules and act
- Criminal Responsibility in other Situations



46 FORENSIC PSYCHIATRY

FORENSIC PSYCHIATRY

🕒 00:00:27

Deals with the application of psychiatry in the administration of justice

COMMON SYMPTOMS

🕒 00:00:50

- Delusion
- Hallucination
- Illusion
- Impulse

DELIRIUM

🕒 00:00:56

Condition in which there is

- Clouding of consciousness,
- Where there is impaired orientation,
- Blunted critical faculties and
- Irrelevant thought content.

Seen in

- Mental unsoundness,
- Drug intoxication,
- Datura poisoning and
- Continuous high temperature.

Medico legal importance

- Any person who is committing a crime in this condition is not liable to be punished.



- Can be seen in mania
2. DELUSION OF PERSECUTION/PARANOID



- Person imagines that people are after him and may kill him, poison him (wife, son or parents) or harm him.
- The person remains suspicious & depressed & may commit some crime
- He may commit suicide or kill innocent person thinking them to be his enemy

3. DELUSION OF REFERENCE



- Person believes that everybody is thinking about him only & being referred by all agencies, media and persons around him in all matters (usually of negative nature)



Previous Year's Questions

Q. A person is criminally not responsible for his action if at the time of doing it by reason of unsoundness of mind. In incapable of knowing the nature of his action or that he is doing what is either wrong or contrary to the law?

(AIIMS - Nov - 2017)

- A. Mc Naughton rule
- B. Curren's rule
- C. Durham's rule
- D. Irresistible impulse test

Types

1. DELUSION OF GRANDEUR OR EXALTATION

- Person imagines that he is very rich and powerful while he may be a pauper.

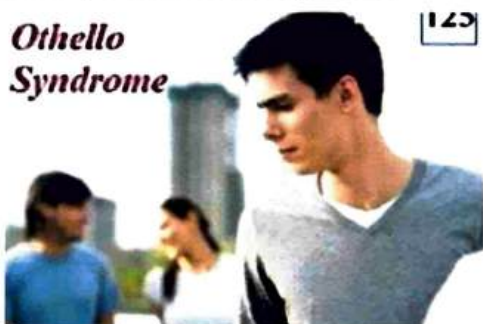
4. DELUSION OF INFLUENCE/ CONTROL



- Patient complains that his thought process & actions are being influenced & controlled by some external power like radio, hypnotism or telepathy.
- On the basis of imaginary 'command' he may commit a crime.

5. DELUSION OF INFIDILITY/ JEALOUSY/ OTHELLO SYNDROME

- The person thinks that his/ her spouse is not loyal to him/her
- Usually, males suffer more from this delusion as compared to females.
- Person may commit crime in this state.



6. NIHILISTIC DELUSION

- Negative delusion.
- Person does not believe in his existence or that the world exists
- They may commit suicide or kill others
- Commonly seen in depression

7. HYPOCHONDRIAL DELUSION



- Person thinks that he is ill always, while medically he may be completely fit
- All investigations will be normal in this person but he will still believe he is ill.
- He keeps on visiting doctors & usually gives vague complaints.

8. EROTOMANIA – DE CLERAMBAULT SYNDROME

- In this, a women thinks that a particular person, especially superior, is in deeply love with her
- Develops an obsession for the person & starts believing that the other person is reciprocating
- She tries to get in close to the person through telephone calls, emails, letters, gifts & visits
- More common in women than men.

9. CAPGRAS DELUSION

- Patient believes that someone close to him (family member) has been replaced by an exact double (imposter)



10.FREGOLI'S DELUSION

- Patient believes that various people whom he meets, are actually same person coming in different appearances (disguise)
- Wife coming in different appearances to spy on husband.

HALLUCINATION

🕒 00:12:40

- False sense of perception without any external stimulus to produce it.
- Purely imaginary & may affect any or all the special senses

TYPES OF HALLUCINATIONS

1. VISUAL HALLUCINATION (mc in organic mental disorder)
2. AUDITORY HALLUCINATION (mc)
3. OLFATORY HALLUCINATION
4. GUSTATORY HALLUCINATION
5. TACTILE HALLUCINATION: seen in cocaine abuse (Magnan's symptom)



Visual hallucination



Tactile hallucination



Auditory hallucination



Gustatory hallucination



Olfactory hallucination

ILLUSION

🕒 00:14:46

- It is false interpretation of a stimulus or external object which has real existence.
- Optical illusions are common in deserts (water may be seen at places)
- Rope may be seen as snake at night

IMPULSE

🕒 00:15:30

- Sudden, irresistible force which compels a person to do an action without motive or forethought
- A normal person always tries to analyze his actions whether they are consistent with law & not act accordingly
- But in impulse, a person is not able to control himself

TYPES OF IMPULSE

- **Kleptomania:** An irresistible desire to steal things usually of low value.
- **Pyromania:** Impulse to set things on fire
- **Mutilomania:** Impulse to maim animals
- **Dipsomania:** Impulse to drink alcohol at periodic intervals
- **Homicidal Impulse:** Impulse to kill someone
- **Trichotillomania:** Impulse to pull one's own hair
- **Oniomania:** Impulse to buy things
- **Suicidal Impulse:** Impulse to commit suicide. Seen in depression, schizophrenia, mania.



KLEPTOMANIA



PYROMANIA



TRICHOTILLOMANIA



DIPSOMANIA



ONIOMANIA

PHOBIA

00:19:24



- Excessive or irrational fear of a particular object or situation

TYPES:

1. **Acrophobia:** fear of height



2. **Agarophobia:** fear of public or crowded place



3. **Claustrophobia:** fear of a confined or closed space.



4. **Nyctophobia:** fear of darkness



5. **Mysophobia:** fear of germs



6. **Arachnophobia:** fear of spiders



7. **Nomophobia:** Fear of being without mobile phone

8. **Phobophobia:** Fear of phobias

- A person with phobophobia experiences anxiety even at the thought of a situation, where they can become feared.

LUCID INTERVAL

🕒 00:22:07

- Period of sanity between two periods of insanity.
- In this period the symptoms of mental illness may completely absent

MEDICO LEGAL IMPORTANCE

- Criminally responsible for unlawful acts
- Valid will

- Testify in court of law
- Enjoys all civil rights

DIFFERENCE B/W TRUE & FEIGNED INSANITY

TRAIT	TRUE INSANITY	FEIGNED INSANITY
Onset	Gradual	Sudden
Motive	Absent	Always present
Predisposing factor	Always present	Absent
Signs & symptoms	Uniform & points towards a particular mental illness	Irregular & Exaggerated
Facial appearance	Vacant look	Voluntary exaggeration
On exertion	Can with stand exertion without any sign of fatigue	Cannot with stand
Habits	Dirty & Filthy	Clean
Appetite	Can resist days together	Fails to do so
Frequent examination	Does not mind at all	Resents frequent examination for the fear of detection
Sleep	Suffer insomnia	With difficulties for 1-2 days

MENTAL HEALTH CARE ACT 2017

🕒 00:26:39

- Came into effect in April 2017
- It is not mental health amendment Act
- Divided into 16 chapters
- It is not lunatic, insane- it is Mentally ill person
- It is not mental hospital- it is mental health establishment.

“MENTAL ILLNESS”

- A substantial disorder of
- Thinking, mood, perception, orientation or memory
- That grossly impairs judgment and behavior
- Capacity to recognize reality or ability to meet the ordinary demands of life impaired.

Note

- Mental Retardation is Excluded
- Condition associated with drug and alcohol abuse included.

ADVANCE DIRECTIVE FEATURES 00:30:08

- Directive in advance- directions towards the medical treatment even before the condition arise.
- Any major can write an Advance directive but it should be registered in mental health review board.

The advance directive should contain 3 imp components

- The way he wishes to be cared/treated for a MI
- The way he wishes NOT to be cared/treated for a MI
- His nominated representative

FEATURES

- It is the duty of every psychiatrist to treat, in line with AD.
- Not applicable at the time of emergency
- If the psychiatrist or care giver does not want to follow the AD, in the best interest of the patient, he can apply to the mental health review board.

PROHIBITED PROCEDURES 00:33:48

- ECT without the use of muscle relaxants and anesthesia.
- ECT for minors is prohibited.
- Sterilization of men or women, when such sterilization is intended as a treatment for mental illness.
- No PMI in an MHE shall be subjected to compulsory tonuring.
- A PMI shall not be forced to wear uniform provided by the MHE.
- No Chaining.

Sec 115 Decriminalization of suicide

- Attempt to suicide was punishable before.
- Any person who attempts to commit suicide shall be presumed unless proved otherwise to have severe stress and shall not be tried and punished under 309 IPC

Admission- Independent admission

- Admission of PMI as independent patient or independent admission
- Any person, desires to be admitted may request the medical officer in charge for admission.

Admission- Supported admission

- Patients lack the mental capacity to decide and he needs high support.
- The nominated representative may apply to the medical officer in charge for admission of such PMI.
- 2 independent examinations stating that the person has a mental illness of high support needs
- Threat of causing bodily harm to himself or others or property.

Admission- Supported admission

- The nominated of minor representative may apply to the medical officer in charge for admission of minor.
- The Incharge may admit the minor, after examination by a team of 2 independently.
- Incharge should inform the mental health review board within 72 hrs.
- The NR may stay with the minor

Emergency Treatment

- Any registered medical practitioner can initiate emergency treatment, if there is threat to self, objects or property.
- Within 72 hrs patient should be referred to mental health institute.

VARIOUS RIGHT OF MENTALLY ILL PERSON 00:44:04

- Right of confidentiality
- Professionals conducting research should take sign in informed consent of mentally ill person/ consent from board
- Right to access to medical records

CIVIL RESPONSIBILITIES OF AN INSANE 00:45:19

TESTAMENTARY CAPACITY

- Testamentary capacity refers to the capacity of a person to make a valid will.
- A will is a document detailing the disposition of property owned by a person.
- Person who makes the will is referred to as the testator. Testator should be a major, and should be in sound mind
- Duty of doctor is to certify that person is in sound state or in compos mentis.
- If the testator is writing the will in his own handwriting- it is k/a holographic will

MANAGEMENT OF PROPERTY

- When a relative of a mentally ill person applies to the district court, that because of mental illness, a person is incapable to manage his properties & he is not violent & dangerous

- The court may hold a judicial inquisition
- If the medical examination states the mental illness of the person, then
- The court appoints a manager granting him necessary power to take care of property & prepare its amounts
- On cessation of the mental illness after second examination the person can take charge of his property himself

INSANITY & CONSENT

- A mentally ill person cannot give a valid consent (**sec 90 IPC**)

INSANITY & MARRIAGE CONTRACT

- The marriage will be considered null & void, if it is proved that either of the partner at the time of his/ her marriage was of unsound mind
- Mental illness after marriage cannot be ground for divorce
- But at times divorce can be demanded provided that the insanity seen is incurable, even after continuous Rx for a period over 3 years

INSANITY & BUSINESS CONTRACT

- Contract made by a mentally ill who does not understand the nature & quality of contract will be considered invalid
- Contract made during lucid interval will be held valid

INSANITY & WITNESS

- If the insane person is able to understand the question and answer then he is competent
- Due to insanity, he does not understand the questions put forward and answer, and then he is not competent.
- It is given under sec 118 IEA
- He can be regarded as competent during lucid interval.

INSANITY AND CRIMINAL RESPONSIBILITY

- In India, sec 84 IPC discusses about the criminal responsibility of Insane persons
- Any enquiry (328 CrPC), trial (329 CrPC) and criminal liability (84 IPC) depends on sanity of person. If person is insane we cannot conduct any of these.
- According to law, **ACTUS NON FACIT REA NISI MENS SIT REA** i.e. An act does not make the person guilty unless the mind is guilty.

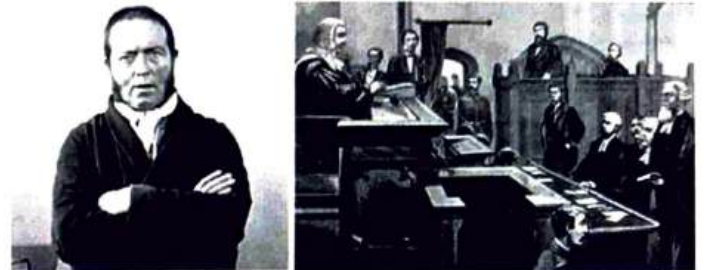
RULES RELATED TO INSANITY

🕒 00:55:07

1. Mc Naughten Rule/ Right Or Wrong Test/ Legal Test (1843)
2. Durham's Rule (1954)
3. Currens' Rule (1961)
4. The Irresistible Impulse Act (new Hampshire Doctrine)
5. The American Law Institute Test [ali]

- In India, none of the rules is followed. Here it comes under sec. 84 IPC which is based on principles of MC NAUGHTEN RULE.
- Insane- irresistible impulse test
- C- currens's rule
- A- ALI
- N- Naughten's rule
- Defend- Durham's rule

MC NAUGHTEN RULE/ RIGHT OR WRONG TEST/ LEGAL TEST (1843)



- To establish a defence on the ground of insanity it must be clearly proved that, at the time of the committing of the act, the accused was laboring under such a defect of reason, from disease of the mind, as not to know the nature and quality of the act he was doing; or that he did not know what he was doing was wrong.

84 IPC

- Based on MC Naughten rule
- Nothing is an offence, which is done by a person, who at the time of doing it, by any reason of unsoundness of mind, is incapable of knowing the nature of the act or that, what he is doing is either wrong or contrary to the law.

DURHAM'S RULE (1954)

- An accused person is not criminally responsible,
- If his unlawful act is the product of mental disease or mental defect

CURRENS' RULE (1961)

- An accused person is not criminally responsible,
- if he did not have the capacity to regulated his conduct to the requirements of the law, as a result of his mental disease or defect

THE IRRESISTIBLE IMPULSE ACT (NEW HAMPSHIRE DOCTRINE)

- An accused person is criminally not responsible
- Even if he knows the nature & quality of his act,

- If he incapable of restraining himself from committing the acts,
- Because the free agency of his will has been destroyed by the mental illness

THE AMERICAN LAW INSTITUTE TEST [ALI] 1972

- A person is not responsible for his criminal acts,
- As result of mental disease or defect
- He lacks adequate capacity to appreciate the criminality of his conduct or
- To adjust his conduct to the requirement of the law.

 01:03:38

CRIMINAL RESPONSIBILITIES IN OTHER SITUATIONS

- Somnambulism- not liable to be punished
- Somnolentia- not in full consciousness. Not liable
- Delirium tremens- seen in alcoholic when he suddenly stops alcohol, he is also not liable
- Run amok- seen in chronic cannabis addict an episode of acute psychosis. Not liable to be punished.
- Kleptomania- impulse to steal things of little value. He is liable to be punished.
- Hypnosis- both the persons i.e. who is hypnotized and who hypnotized that person are liable to be punished.



Previous Year's Questions

- Q. As per mental health act. an individual with a known psychotic disorder on treatment and is not a minor. can choose to decide the caretaker and course of treatment. This is called as?

(AIIMS - Nov - 2018)

- A. Advance directive
- B. Treatment directive
- C. Mental will
- D. Future directive



Previous Year's Questions

- Q. A 14-year female in the school is brought to principal by teacher that she is always crying inattentive. not taking interest in any activity. On further investigation that girl told that she was inappropriately touched by her uncle at private parts at her home. Whom should principal inform?

(FMGE - Aug - 2020)

- A. Child welfare committee
- B. Parents
- C. Police
- D. Magistrate



CLINICAL QUESTIONS



1. Sudden and irresistible force compelling a person to commit an offence consciously is known as:

- A. Illusion
- B. Obsession
- C. Twilight state
- D. Impulsiveness**

Solution

Impulse

- This is a sudden and irresistible force compelling a person to the conscious performance of some action without motive or fore-thought.
- As cognitive aspect is not impaired the person knows the nature of the act committed but unable to control himself.
- Considered as not guilty as per Irresistible impulse test, however, treated as guilty under IPC 84 (India)

Types of Impulse

- **Kleptomania** - an irresistible desire to **steal** articles of little value.
- **Pyromania** - an irresistible desire to set things to **fire**.
- **Mutilomania** - an irresistible desire to **mutilate**.
- **Dipsomania** - an irresistible desire for **alcoholic drinks** at periodic intervals.

Sexual impulses- including sexual perversions.

Suicidal and homicidal impulses.

Twilight state is seen in visual hallucinations, Epilepsy, Head injury, Hysteria, Punch-drunkenness.

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no.482

2. Sleep drunkenness is otherwise called as?

- A. Somnolentia**
- B. Somnambulism
- C. Automatism
- D. Hypnotism

Solution

- **Somnolentia** – sleep drunkenness
- **Somnambulism** – sleep walking
- **Automatism** - act committed during a state of unconsciousness or grossly impaired consciousness.
- **Hypnotism** - mesmerism

Reference: The Essentials of Forensic medicine and Toxicology, Dr.K.S.Narayana reddy and Dr.O.P.Murty, 33rd edition, Page no. 496, 497

3. Syndrome characterized by an elaborate delusion that the patient is passionately loved by another person is also known as:

- A. Ekbom's syndrome
- B. De Clerambault's syndrome**
- C. Querulous paranoia
- D. Othello syndrome

Solution

Erotomania (de Clérambault's syndrome)

- Condition in which a person holds a delusional belief that another person, usually of a higher social status, is in love with him/her.
- Erotomaniac tries to get close to the person through telephone calls, e-mails, letters, gifts and visits.
- MC in women than in men.

Ekbom syndrome (delusions of parasitosis)

- A form of psychosis wherein the patients acquire a delusional belief that they are infested with parasites, whereas in reality no such parasites are present.

Delusion of infidelity/jealousy (Othello syndrome)

- Person holds a delusional belief that his spouse is unfaithful.
- Males are more affected.

Capgras syndrome

- False belief that a familiar person or place has been replaced with an exact duplicate.

Fregoli delusion

- Delusion of doubles, is a false belief that different people are in fact a single person who changes appearance.

Cotard syndrome

- It is a false belief that they are already dead, are putrefying, or have lost their blood or internal organs.

Reference: Essentials of forensic medicine & toxicology, Dr KSN reddy, 33rd edition, P 481.

4. Rules for criminal responsibility of the insane are all, **except:**

- A. Morrison's rule**
- B. American Law institute's rule
- C. New Hampshire doctrine
- D. Curren's rule

Solution

Rules related to the criminal responsibility of an insane person

- **The Irresistible Impulse test or the New Hampshire doctrine**
 - Argues that a person may have known an act was illegal, but because of a mental impairment, he couldn't control his actions.
- **Durham's rule (1954)**
 - An accused person is not criminally responsible, if his unlawful act is the product of mental disease or mental defect.
- **Curren's rule (1964)**
 - States that an accused person is not criminally responsible, if at the time of committing the act, he did not have the capacity to regulate his conduct to the requirements of the law as a result of mental disease or defect.
- **Mc Naughten rule (Right or wrong test)**
 - Every man is to be presumed to be sane and to possess a sufficient degree of reason to be responsible for his crimes, until the contrary be proved. An insane person is punishable "if he knows" at the time of crime.

American Law Institute test (Brawner decision/rule)

- It combines elements of the McNaughton rule and the irresistible impulse rule.
- "A person is not responsible for criminal conduct if at the time of such conduct as a result of mental disease or defect he lacks substantial capacity to appreciate the wrongfulness of his conduct or to conform his conduct to the requirements of the law."

Morrison rule (1964)

- This rule states that the crown heel length of the foetus in centimetres, divided by five gives the age in month.

Reference: THE ESSENTIALS OF FORENSIC MEDICINE AND TOXICOLOGY by DR. K.S. NARAYAN REDDY-33RD EDITION(Pg-493)

5. A man is convinced that his penis is receding into his body and fears that, when his penis disappears completely, he will die. Man is suffering from?

- A.Koro
- B. Sangue dormido
- C. Amok
- D. Dhat

Solution:

Culture-Bound Syndrome delusional disorder

- **Koro (shrinking penis or genital retraction syndrome)**
 - characterized by a sudden and intense anxiety connected to the belief that the penis is receding into the body and that death will follow when it has totally disappeared.
 - despite the lack of any true longstanding changes to the genitals.
- **Sangue dormido**
 - Characterized by muscle and joint pain, numbness, trembling, paralysis, convulsions, stroke, blindness, heart attack, and (among pregnant women) miscarriage.
- **Running amok or amok or gone amok or going berserk**

- Randomly aggressive, destructive and homicidal behaviour under influence of Cannabis.
- The 'amok run' ends with suicide, or alternatively, the exhausted individual may be overpowered, who then may claim amnesia for his actions.
- **Dhat syndrome**
 - Commonly present with features of **depression, anxiety, multiple nonspecific somatic symptoms, sexual dysfunction, fatigability, and impairment of concentration, which are attributable to semen loss.**

Reference: KNS Narayan Reddy, Essentials of Forensic Medicine & Toxicology, 33rd Ed., page 480

6. Fear of darkness is called?

- A. Nyctophobia
- B. Mysophobia
- C. Claustrophobia
- D. Agoraphobia

Solution:

Phobia: A type of anxiety disorder

- The fear is out of proportion to the demands of the situation
- The fear cannot be explained or reasoned away
- The fear is not under voluntary control and leads to an avoidance of the feared situation.

Phobias may develop to almost any object or situation eg fears of dirt, excrement, snakes, spiders, heights, water, blood, etc.

- **Claustrophobia** fear of **closed** spaces
- **Mysophobia** fear of **contamination**
- **Nyctophobia** fear of **darkness**
- acrophobia, fear of heights
- aerophobia, fear of flying
- arachnophobia, fear of spiders
- astraphobia, fear of thunder and lightning
- autophobia, fear of being alone
- claustrophobia, fear of confined or crowded spaces
- hemophobia, fear of blood
- hydrophobia, fear of water
- ophidiophobia, fear of snakes
- zoophobia, fear of animals

Agoraphobia: Fear of **open** space that might cause them to feel trapped, helpless or embarrassed

- symptoms of a panic attack (rapid heartbeat and nausea, when they find themselves in a stressful situation)
- They may also experience these symptoms before they even enter the situation they dread.
- In some cases, the condition can be so severe that people avoid doing daily activities, such as going to the bank or grocery store, and stay inside their homes most of the day.

Reference: KNS Narayan Reddy, Essentials of Forensic Medicine & Toxicology, 33rd Ed., page 482



PREP NUGGETS




Prep Nuggets

Timeline	Colour	Reason
Fresh	-----	-----
Hours to 3 days	-----	-----
4 th days	-----	-----
5 th - 6 th days	-----	-----
-----	Yellow	-----
2 Weeks	-----	-----



Prep Nuggets

Adipocere	Mummification
Body exposed to warm, moist, Climate	-----
-----	-----
-----	-----
-----	Otourless
3 Weeks - 6 Months	-----

 **Prep Nuggets**


Shot Gun Cartridge

Primer

Bullet

Wad

Rifle Gun Bullet

 **Prep Nuggets**

Eruption

Temporary

Permanent

First tooth Lower central
