Chapter-1

Legal Procedures

Forensic Medicine: It is a branch of medicine. Forensic means court law. Some other names given to the forensic medicine are Legal Medicine, State Medicine etc. It should not be confused with Medical Juris Prudence or Judicial Medicine, which is a branch of law dealing. "Juris" means Law and "Prudentia" means Knowledge. Jurisprudence by definition is *"knowledge of law in relation to practice of medicine". "Forensic medicine is branch of medicine which deals with application of principle of medical knowledge to the purposes of law and furthering of justice. It also includes legal relations of a medical man and medical ethics".* In fact Forensic medicine is the bridge between medicine and law. Being a subject it is application of medical knowledge and involves higher domains of mind and higher mental faculties. It deals with relationship between *doctor-&-patient, doctor-&-doctor and doctor-& state. "Any medical fact, opinion or technique if utilized by law enforcement or in administration of justice becomes Medicolegal Issue"*

Forensic Team: forensic team consists of:-

- Forensic expert
- Forensic artist
- Pathologist
- Radiologist
- Odontologist
- Chemical examiner
- Psychiatrist
- Anatomist
- Pharmacologist

Law: The principles and regulations established in a community by some authority and applicable to its people, whether in the form of legislation or of custom and policies recognized and enforced by judicial decision. Law is of following types:

1. Civil Law: it is code of behavior or dealing between individual meant for better society.
2. Criminal Law: it is law implemented by the government state meant for better government.
3. Common Law: un-written law based on conventions and traditions of society.
4. Statutory Law: it is written law given by the parliament e.g., PPC, CPC (it is also called fortified law).
5. Islamic Law: it is based on teachings of Holy Quran and Sunnah. It is both civil and criminal.

Oath / Affidavit: is solemn affirmation for any declaration required by law to be made before public servant. Or it is a statement on oath before a person authorized to take oath.

Crime: is a social harm defined and made punishable by law.

Deposition: is a written statement on oath before judicial officer, in the presence of witness and signed by him and judicial officer.

Complaint: it is an allegation made orally or in writing to a judicial authority.

Offense: is an act of commission or omission made punishable by law. It is of two types:

Cognizable: offense for which police can arrest without warrant

Non-cognizable: offense for which police cannot arrest a person without warrant

Conduct Money: fee or money offered to a witness for attending courts. In civil cases the party summoning the case pays this fee to the witness; in criminal cases court pays the fee.

Summon: or Subpoena, it is written order issued by court signed -and stamped, requiring the person named there in to attend the court at a certain time and place with reference to the matter named there in the subject.

If summon is not obeyed, then court issues warrant bail able or non-bailable. A summon is send in duplicate. One is sent back and second copy is kept with the person. A witness can reject the summon if he feels that conduct money is less than the expenditures and other needs, but he has to inform the court. The term subpoena is different from summon in the following way: if a person does not attend the court after summon he is not punished but if he does not attend the court after subpoena he is punished.

Suicide: Intentional self-slaughter / killing:

Homicide: Killing of one human by another.

Murder: Unlawful killing of other person with malice (road accidents) afore thought.

Court: refers to all Judges, Magistrates and all persons except arbitrators, legally authorized to take evidence.

Hurt: is bodily pain, disease or infirmity caused to any person.

Injury: is any harm whatever illegally caused to any person, in body, mind, reputation or property.

Plaintiff: is the person who brings the action in the court of law.

Inquiry: is referred to every inquiry other than a trial, conducted by a magistrate or court.

Jury: is body of persons sworn to render verdict in a court of justice.

Warrant: is a written authority under hand and seal. It is used for the arrest of the persons or for their forcible production in a court of law.

COURTS IN PAKISTAN

Court: refers to all Judges, Magistrates and all persons except arbitrators, legally authorized to take evidence.

Types of Courts

1. Civil Court: it deals with civil cases, and cases of violence of non-cognizable nature
2. Criminal Court: these include

- Supreme Court: It is highest court of appeal. It supervises all the courts in Pakistan. Laws declared by this court are binding on all courts in Pakistan. It deals with the referred cases or appeals against High Court. It can pass any sentence and it is located in Islamabad.
- High Court: It is a mixed court, a court of appeal and trial. It can pass any sentence authorized by law. When section 30 CPC Magistrate passes sentence of imprisonment exceeding for 4 years, its appeal lies to high court. It is located in capital of each province.
- District Court: These are of district session judges and of additional session judge court. These can give any punishment, which can be confirmed from high courts.

- Magistrate Court: It is a court of trial. It can impose fine or punishment.

  Class 1 Magistrate: can pass sentence not more than 3 years and fine not more than Rs.15000/-

  Class 2 Magistrate: can pass sentence not more than one year and fine not more than Rs.5000/-

  Class 3 Magistrate: can pass sentence not more than one month and fine not more than Rs. 1000/-

  Section 30 Magistrate: can pass sentence not more than 3 years and fine (not limited).

  Juvenile Magistrate: these are usually ladies and tries juvenile offenders (age below 15 yr.)

3. Federal Shariat Court: it gives justice according to Islamic Law and is located in Islamabad.

- Everybody is sane and responsible for his action
- Everybody is innocent unless proved otherwise
- It should be proved accused is guilty
- If at conclusion of court proceeding, the court is in reasonable amount of doubt, doubt is resolved in favor of accused
- No hanging is executed to a juvenile upto 18 years and to anyone above it if he was under 18 years at the time of commission of offence
- Whipping cannot be awarded in following cases: Female (except in case of Zina); Male above 45 years; Sentenced to imprisonment for 5 years or more and less than 3 months

INQUEST

Inquest: is legal or judicial inquiry into the cause of sudden death. Types of inquest (only the first 2 types are conducted in Pakistan)

1. The Police inquest:

   It is conducted by a police officer not below the rank of Assistant Sub-Inspector (ASI). It is carried out to ascertain the cause of death. After receiving report from the scene of crime, he arrives there inspects the area meets the people and investigates the case. If some foul play is suspected, the dead body is sent for autopsy to the nearest authorized medicolegal officer, together with the requisition and the Panchnama. Autopsy report is then sent to investigating officer.

   Panchas are the respectable witnesses of the locality also called Panchayatdam who help the investigating officer to prepare Panchnama.

   Panchnama is the report about probable cause of death judged by the investigating police officer and Panchas.

2. The Magistrate's Inquest:

   It is conducted by the magistrate. A Panchnama is forwarded to the District Magistrate or the Subdivisional Magistrate. It is held in case of:

   1. Death in jail, police custody, police investigation and police firing
   2. Death in mental hospital
   3. Admission in mental hospital
   4. Exhumation

3. The Coroner's Inquest: (not in Pakistan)

The government appoints the coroner. The rank is of first class magistrate. The coroner functions under the coroner's act. it is not carried out in Pakistan.

Because of his association with the subject of forensic medicine, coroner is able to investigate on right lines and thus judge the cause of death in proper perspective. He is able to judge the case properly. In a clear case of suicide he will not ask for autopsy. There are no Panchas so there is no question about their reliability.

4. The Medical Examiner's System: in USA
5. Continental System: in France
6. Modified Continental System: in Indo-Pak
7. Russian System

Coroner's Court	Magistrate Court
• it is presided by coroner • it is a court of inquiry • accused need not be present • this court cannot impose fine or punishment; or it can give punishment when offence is committed in the premises of this court	• it is presided by the magistrate • it is a court of trial • accused should be present in the court • this court can impose fine or punishment when the offence is committed in or outside this court

LAW OF EVIDENCE

It was given by the British Government but Pakistani Government has modified according to our own requirements.

Evidence: refers in all legal means (excluding arguments) which help to prove or disprove any matter of fact, the truth of which is submitted to judicial investigation. It can be documentary, oral or circumstantial.

Main principles are

1. Evidence must be confined to "the matter in issue"
2. Hearsay evidence must not be admitted
3. Evidence best suited to the issue must be given in all cases

Types of Evidence are

1. *Oral Evidence:* it includes all statements, which court permits, or requires to be made in relation to matters of fact under inquiry. Oral evidence is of three types
   (a) Direct Evidence: it refers to the evidence of a person who has no personal knowledge of facts in relation to particular incidence
   (b) Indirect Hear-Say Evidence: it refers to the evidence of a person who has no personal knowledge of facts but repeats only what he has heard others say. it is not permissive at all, but in some exceptions.
   (c) Circumstantial Evidence: it refers to the fact from a crime detection lab.
2. *Documentary Evidence:* it refers to all documents produced for inspection of court. It is of 2 types
   (a) Primary Evidence: when document is itself produced for inspection of court or it is produced in parts; each part is primary evidence.

   (b) Secondary Evidence: when original document is not possible, it is very big, in the custody of opponents or has been destroyed then we bring a secondary evidence in court; i.e. certified copies of original document.

The documentary evidence can be accepted without oral evidence and cross-examination. It is possible in following cases:

- Dying declaration
- Expert opinion expressed in treatise
- Deposition of medical witness taken in lower court
- Chemical examiner report
- Evidence by witness in previous judicial proceedings
- Statements by person who cannot be called as a witness

WITNESS

Witness: is a person who gives sworn evidence (testimony) in a court of Law as regards facts and inference that can be drawn (here from.

Types of Witness

1. Common or Ordinary Witness: it is the one who testifies the facts observed by himself.
2. Expert or Skilled Witness: It is the one who is expert in foreign science or art e.g., the doctor.
3. Hostile Witness: It is a witness who bears the hostility to the party who called him. If such a witness is unfair for the party, which calls him, and intentionally declares himself as hostile witness the affected party may he given a chance to cross-examine this witness, ordinarily the opposite party cross-examines the hostile witness of a party.

PROCEDURE IN COURT

Summon: or Subpoena, it is written order issued by court signed and stamped, requiring the person named there in to attend .the court at a certain time and place with reference to the matter named there in the subject. Its purpose is:

- To give evidence or to produce a document or any other thing
- To appear in a case in which the person has been accused of an offence

If summon is not obeyed, then court issues warrant bailable or non-bailable. A summon is send in duplicate. One is sent back and second copy is kept with the person. A witness can reject the summon if he feels that conduct money is less than the expenditures and other needs, but he has to inform the court. The term subpoena is different from summon in the following way: If a person do not attend the court after summon he is not punished but if he does not attend the court after subpoena he is punished.

Conduct Money: fee or money offered to a witness for attending courts. In civil cases the party summoning the case pays this fee to the witness: in criminal cases court pays the fee.

Oath / Affidavit: is solemn affirmation for any declaration required by law to be made before public servant. Or it is a statement on oath before a person authorized to take oath.

Oath is not executed in case of dying declaration and in case when witness in court is below 12 years of age.

Having been sworn, a witness is examined as follows:

Examination in Chief: it is conducted by the lawyer of party producing witness. Witness is asked certain questions; no leading question is asked. Objective is to lay all prevalent facts before the court:

Cross-Examination: it is done by the lawyer or council of opposite party. All leading questions are allowed. Cross-examination continues till the court interferes. Court can disallow objectionable questions. Objectives are:

- To impede credibility of witness
- To assess the general value of evidence

Re-Examination: it is done by the party, who calls him to resolve doubts created by cross-examination.

Court Questions: court can ask questions at any time for clarification.

DYING DECLARATION

If a witness is precarious and death is imminent and there is no time to arrange for administration of oath; then verbal deposition is being taken. A credible person must write his evidence. In hospital responsible person is doctor.

Conditions necessary for its acceptance are:

1. It must be a case of homicide
2. Death of deceased must be the subject of declaration

The rules for its writing include:

1. Words used by deceased must be written unchanged. Questions and answers should be written.
2. Any body movement or head nod must also be noted
3. Writer must believe that patient is going to die
4. Doctor should give statement that person was alright at that time
5. This written statement should be read over him, signed and then sent to the area magistrate
6. If person survives then this written statement is not valid in court
7. Should be signed by M.O and two witness

DYING DEPOSITION

It is a statement on oath made by a dying person regarding circumstances leading to the death.

1. It is an oath
2. It is made by magistrate
3. Accused and his lawyers must have an opportunity to cross-examine it
4. Doctor should certify that person is fit enough to give an oath
5. It is valid in court whether person survives or dies

DOCTOR IN COURT

1. Attend the court at proper date and proper time
2. Doctor should be well prepared
3. He should study the case thoroughly
4. Doctor should not use technical language
5. Listen carefully to the asked questions
6. Always address the courts

7. Be polite even if questions are unpleasant
8. Answer the questions with sense
9. Be impartial, do not support any party
10. Do maintain professional secrecy
11. Give opinion carefully
12. Before leaving the court get a certificate and permission from court

Difference Between

Dying Declaration	Dying Deposition
1. Magistrate is not present	1. Given in presence of Magistrate
2. accused / his lawyer are not present	2. Present.
3. Invalid if the victim survived.	3. Remains valid.
4. It is an Indirect evidence	4. It is a Direct evidence.
5. It is only for a criminal case.	5. It can be recorded in any case.
6. It only includes statement of dying person	6. it includes statement and the cross examination by accused.

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Chapter-2

Law in Relation to Medical Man

Adult: A person who has attained age of 18 years (for males) or 16 years (for females) or who has attained puberty, whichever is earlier

Authorized Medical Officer: A medical officer or medical board constituted by provincial government is called authorized medical officer or board.

Qisas: It means punishment by causing similar hurt at the same part of the body of convict as he has caused to the victim or by causing his death if he has committed qatl-e-amd (in exercise of right of victim or a wali).

Diyat: Means compensation specified in section 323 payable to heirs of victim by the offender.

Arsh: Means compensation specified in Qisas and Diyat Ordinance paid by the offender to the victim or his heirs.

Daman: Means compensation determined by the court to be paid by the offender to victim for causing hurt liable to Arsh.

Tazir: Punishment other than Daman, Diyat, Qisas and Arsh and any other form of compensation.

Wali: Wali is legal heir of victim or deceased or victim himself. In case of Qatl; wali is heir of victim or if the victim is unknown then government.

Arsh for Single Organ: Arsh for causing itlaf of an organ, which is found singly in human body, shall be equivalent to value of diyat i.e., nose and tongue.

Arsh for Organs in Pairs: Arsh for causing itlaf of such organs shall be equivalent to value of diyat, if itlaf is caused to only one such organ then amount of arsh shall be half of diyat.

Medical Officer Incharge: It is the one who is in charge of a psychiatric hospital or psychiatric nursing home (for the time being).

Medical Practitioner: it is the one who possesses a recognized medical qualification, as defined in Medical Council Act.

LAWS RELATING TO DEATH

Qatl-i-Amad:

- To cause death of a person with full intention and with the knowledge of causing death with full intention of a specific person (300)
- If the death of another person has occurred, other than whose death was intended (301) it is also Qatl-i-Amad
- Punishment for Qatl-i-Amad is (302)

  To punish with death as Qisas

  If Qatl-i-Amad is not liable to Qisas punish with death or imprisonment for life as Tazir

  Qatl-i-Amad is not liable to Qisas when offender is insane

Qatl-i-Amad is not liable to Qisas when offender causes death of his child or grand child (as he is Wali in these cases)

Qatl-i-Shibh-i-Amad:

- Intention is to cause harm but death has occurred, death of same or any other person by means of a weapon or an act which in ordinary course of nature is not likely to cause death is said to commit Qatl-i-Shibh-i-Amad (315)
- Whosoever commit Qatl-i-Shibh-i-Amad shall be liable to diyat or imprisonment up to 14 years as
- For example person 'A' gives blow on abdomen of 'B' and 'B' goes into shock and death occurs. In ordinary course of nature blow is not likely to cause death.

Qatl-i-Khata:

- To cause death or harm which leads to death without intention by mistake of act or fact is said to commit Qatl-i-Khata (319)
- Whosoever commits Qatl-i-Khata shall be liable to diyat (provided that Qatl is committed by rash or negligent act) in addition to diyat the person will also be punished with imprisonment up to 5 years as Tazir (319)
- Example of Qatl-i-Khata is, hunter shoots a bird but a man is killed

Qatl-bis-Sabab:

- To cause death of a person or harm which leads lo death without any intention by an unlawful act is Qatl-bis-Sabab (3 12)
- Whosoever commits Qatl-bis-Sabab is liable to diyat. Fix value of diyat which is not less than 30630 grams of silver (322)
- 'A' digs a pit for some purpose and 'B' falls into it while passing over it and is killed. It is Qatl-bis-Sabab

Attempts to Cause Death:

- *Attempt to Commit Qatl-i-Amad:* if Qatl has occurred then offender will be punished by laws of Qatl-i-Amad and if only hurt is caused then offender will be punished by laws of hurt caused
- *Attempt to Commit Suicide:* if someone attempts suicide, if he survives then punishment is given (that is one year imprisonment or fine or both). If does not survives nature punishes him

Table: Classification of Qatl (culpable nominate)

Type	Legal Definition
Qatl-i-Amd	Killing of specific person or another with intention and knowledge of causing death.
Qatl Shibh-i-Amd	Killing with intention only to harm, but the death occurs which is unlikely.
Qatl-i-Khata	Killing without intention to kill or harm, but death occurs by mistake of act or fact.
Qatl-bis-Sabab	Killing without intention to cause harm or death, but death occurs during the course of an unlawful act.

LAWS RELATING TO HURT

Definition: whosoever causes pain, harm, disease, infirmity, injury to any person or impairs, disables, dismembers any organ of body or part of body of a person; without causing death is said to cause hurt (322)

Following are Kinds of Hurt:

1. Itlaf-i-Udw (Sec-333)
2. Itlaf-i-Salahyiat-i-Udw (Sec-335)
3. Shajjah (Sec-337)
4. Jurh (Sec-337-B)
5. Other hurts

1. Itlaf-i-Udw: Whosoever dismembers, amputates, severs any limb or organ of body of another person is said to cause Itlaf-i-Udw (333)
2. Itlaf-i-Salahyiat-i-Udw: Whosoever destroys or permanently impairs the functioning power of an organ of body of another person or causes permanent disfigurement is said to cause Itlaf-i-Salahyiat-i-Udw (335)
3. Shajjah: Whosoever causes on head or face of any person any hurt which does not amount to Itlaf-i-Udw and Itlaf-i-Salahyial-i-Udw, is said to cause Shajjah (337). Shajjah is of following kinds:
   a) *Shujjah-i-Khafifah:* in it bone is not exposed by injury 337-(a)
   b) *Shajjah-I-Mudiah:* in it bone is exposed without fracture (it is non-bailable). Many a time it is misused, because after healing no one can say that either bone was exposed or not and even X-ray cannot tell us about the exposure of bone 337-(b)
   c) *Shujjah-i-Hashimah:* bone is exposed and also fractured but its ends are not displaced 337-(c)
   d) *Shajjah-i-Munaqqilah:* underlying bone is exposed, it is fractured and its ends are displaced 337-(d)
   e) *Shajjah-i-Ammah:* underlying bone is fractured and membranes of brain are exposed but no damage to brain 337(e)
   f) *Shujjah-i-Damighah:* there is fracture of bone of skull, membranes are exposed and damage to brain
4. Jurh: Whosoever causes on any part of a person other than head and face a hurt which leaves mark of wound, either temporary or permanent (337-IJ). Jurh is of 2 types:
   a) *Jurh Jaifah:* in this type, injury extends body cavity
   b) *Jurh Ghair Jaifah:* in this type, injury does not extend into the body cavity. It is following sub-types:
      1. Damiyah: skin is ruptured and bleeding occurs
      2. Baddiah: there is cutting and incising of flesh but bone is not exposed
      3. Mulalahimah: injury is by blunt weapon but bone is not exposed
      4. Mudiah: incised or lacerated wound by firearm but bone is exposed
      5. Hashimah: injury is open or causing bone fractures without displacements of its ends
      6. Munaqillah: bone is fractured and ends are displaced

Table: Classification of hurt (332).

Types	First subtype	Second subtype	Extent of damage
Itlaf-i-Udw (333)			Causing of dismemberment, amputation, severement of any limb or organ of the body
Itlaf-e-Salahiyyat-I-Udw (335)			Destroying or permanently impairing the function or capacity of an organ of the body or causing permanent disfigurement.
Shajjah (337)			Hurt on the head or face which does not amount to Itlaf-i-Udw or Itlaf-i-Salahiyyi-udw.
	Shajjah-i-Khafifah 337-(a)		Hurt without exposing of bone.
	Sbajjah-i-Mudihah 337-(b)		Exposing of bone without its fracture.
	Shajjah-i-Hashimah 337-(c)		Fracturing of bone without displacement.
	Sbajjah-I-Munaqqilah 337-(d)		Fracturing of bone with displacement.
	Shajjah-i-Ammah 337-(e)		Fracturing of bone and the wound touching the membranes of brain.
	Shajjah-i-Damighah 337-(f)		Fracturing of bone with rupturing of the brain membranes.
Jurh (337-B)			Hurt on parts of the body other than the head and face bearing mark of a wound which may be temporary or permanent.
	Jaifah 337-C		Wound extending to the body cavity of the trunk.
	Ghayr-Jaifah 337-E		Jurh not amounting to Jaifah.
		Damiyah 337-E(a)	Rupturing of the skin with bleeding.
		Badiah 337-E(b)	Cutting of the flesh without exposing the bone.
		Mutalahimah 337-E(c)	Lacerating of flesh.
		Mudihah 337-E(d)	Exposing of bone.
		Hashimah 337-E(e)	Fracturing of bone without displacing it.
		Munaqqilah 337-E(f)	Fracturing of bone with its displacement.

LAWS

337-G: Punishment for hurt by rash or negligent driving - person is liable to Arsh or Daman specified for kind of hurt and also imprisonment of 5 years as Tazir

337-H: Punishment for hurt by rash or negligent act - person is liable to Arsh or Daman specified and also imprisonment upto 3 years as Tazir

337-I: Punishment for causing hurt by mistake (Khata) is Arsh or Daman specified

337-J: Punishment for causing hurt by poison- whosoever administers to or causes to be taken by any person any poison or any stupefying, or unwholesome drug or such other thing with intent to cause hurt to such person or with intent to commit or facilitate commission of an offense he will be punished with Arsh or Daman also with imprisonment up to 10 years as the hurt is.

337-K: Causing hurt to extort confession or compel restoration of property - Qisas, Arsh or Daman and punishment of imprisonment if Qisas cannot be awarded

337-L: Punishment for other hurts:

L_1: Whosoever causes hurt not mentioned before, which endangers life or causes the sufferer to remain in severe bodily pain for 20 days or more or renders him unable to follow his ordinary pursuits for 20 days or more - shall be liable to Daman and imprisonment upto 7 years. Dangerous hurts are:

- Hurt on abdomen omentum coming out
- Hurt on skull, brain is exposed

L_2: Whosoever causes hurt not covered in L_1 shall be punished with imprisonment upto 2 years or Daman or both

337-M: Hurt not liable to Qisas

- When offender is minor or insane
- When offender at instance of victim causes hurt to him
- When offender has caused Itlaf-i-Udw of physically imperfect organ of victim
- When organ of offender liable to Qisas missing

337-N: Causes in which Qisas shall not be enforced

- When offender dies before execution of Qisas
- When organ of offender liable to Qisas is already missing
- When victim waives Qisas
- When right of Qisas devolves to such a person who cannot claim Qisas against offender (such as son against father)

EXECUTION OF QISAS

a) Qatl:

309 (1) Weaving of Qisas without any pressure, intentionally by legal heirs

310 (2) Compounding of Qisas in court without any pressure

314 (3) Execution of Qisas

316-319 (4) For oath other than Qatl-i-Amad Wali can forgive compensation - Diyat

b) Hurt:

337-P (1) Executable shall be executed in public by authorized medical officer and does not exceed the hurt on victim and not causes death. Before execution individual is examined that he does not die during execution of Qisas and hurt should not exceed the hurt on victim

337-Q (2) Non-executable - by paying compensation that is Arsh and Daman

337-M (3) Hurt not liable to Qisas (already discussed)

337-N (4) Qisas cannot be enforced (already discussed)

ALLOPATHIC SYSTEM ORDINANCE 1962

Prevention of Misuse

1. Prohibition of use of word doctor and its abbreviation unless he or she is an RMP or a person whom a doctor's degree other than a medical degree has been confirmed
2. Prohibition of use of medical degree or diploma unless issued by institution recognized by PMDC
3. Prohibition of surgical operations by an unqualified person (circumcisions and injections and abscess drainage can be done)
4. Prohibition of prescription of some drugs (antibiotics) unnecessarily
5. Restriction on the sale of medicines unless labeled and formula is written on packing or within packing

DRUG ACT 1976

Drugs are used to:-

1. Prevent ill health
2. Maintain health
3. Prolong life

Drugs should not be used:-

1. for the sake of addiction
2. for self-medication

Objectives of Drug Act:-

1. Marketed drugs (imported / locally manufactured) should be of required quality. For this various measures are taken. Federal government has appointed inspectors, who take the samples and send to the government laboratories and act accordingly.
2. New drug should be tested/ evaluated for safety / efficacy.
3. Medical practitioners should be kept informed about their desired and undesired effects.
4. Over advertisement should be controlled

Drug act 1976 has got 43 sections. Important sections are 5,7,8,9,10,11,22,43.

Section 5: It regulates grant of license to manufacturers by a central license board, consisting of representatives from central and provincial government.

- Director General Federal Government
- Secretary Health Punjab
- Secretary Health Sindh
- Member from Pharmaceutical Company N.W.F.P
- Member concerned with pharmaceutical company from Baluchistan

Section 7: It describes that all marketed drugs should be registered with registration board, which consists of:-

- Director General Health
- One Professor from clinical side
- One Professor of Pharmacology

- One representative of pharmaceutical companies
- One representative from AMC
- Deputy Director General Health

Section 8: It is about National Formulary

Section 9: It is about appellant board constituted by Federal Government. It gives decisions on complains of any party about registration of drugs

Section 10: Government can constitute various committees

- Drug Evaluation Committee
- National Formulary
- For Advertisement Control

Section 11-22: These provide guidelines for quality and control of drug, which is achieved by establishing drug-testing laboratories, at Federal and Provincial levels. It also empowers inspectors to take samples and send them for testing.

Section 43: It provides power to control government to frame regulations regarding quality control of drugs in provinces and about sale, availability, offenses and punishment.

DRUG REGISTRATION

It is defined as means to evaluate a drug for weighing its efficacy against its safety for intended/ prophylactic use and its conformity to specification regarding its:

1. Identity
2. Strength
3. Purity
4. Other Characteristics

DANGEROUS DRUG ACT 1930 & DANGEROUS DRUG RULE 1958s

Dangerous Drugs: Means drug of addiction, which are used to treat the disease and prolong life but they become dangerous if person gets addicted e.g., cannabis indica, opium, etc.

In some countries alcohol is not a dangerous drug as it is thought a religious drink. Rules regarding dangerous drug act are 8,13,14,17

Rule 8:

It tells a guideline for procedure, which a licensed chemist should follow, while selling a drug to a patient and an RMP.

a. Licensed chemist may sell dangerous drug to an RMP known to him subject to following conditions:
   - RMP should sign the register in present or send written and signed order
   - Licensee shall satisfy himself as to genuiness of signatures and qualification of RMP
   - If drugs are sent to post, they are sent by registered post
   - In case of real emergency drugs may be supplied on oral message, provided RMP gives undertaking that written order will be furnished within 24 hours

b. Licensed chemist may also sell to any person on prescription, subject to conditions as:
   - Dangerous drug should be sold in such a quantity and for the use of such person only as specified in the prescription
   - If prescription does not have a superscription - drugs should be sold once and prescription shall be retained with the chemist
   - If it bears superscript, the licensed chemist shall enter the date of sale and shall sign or seal the prescription, provided that it appears that the drugs have already been sold 6 times or such number of times as prescription is required to be repeated. He must not sale the drugs unless it has further been superscribed by RMP.
   - Licensed chemist shall maintain a written record of every such sale in such manner as the commissioner may direct

c. Licensed chemist may also sell dangerous drug to any person authorized under rule 17 of dangerous drug act:

Rule 13:

An RMP may possess following qualities of drugs for use in his practice and not for sale:

1.	Medical hemp (Cannabis Indica)	3 Ounces
2.	Medical Opium	3 Ounces
3.	Coca derivatives	60 grains
4.	Opium alkaloid derivatives	60 grains

Rule 14:

1. An RMP may import or transport such quantities of manufactured-drugs other than prepared opium, as he may lawfully possess (under last preceding rule). But no RMP shall import coca derivative from outside the province
2. An RMP shall obtain his supplies from a licensed chemist only and shall maintain a register in prescribed form and a separate part of register shall be arranged to various columns for drug, and preparations
3. Entries in the register shall be made on the day on which drug is received or displaced. Entries may not be made by the RMP himself but must be verified by him on the next day
4. If an RMP practices at more than one places a separate account for each place should be maintained
5. Every entry is to be made in ink, if any correction is made, it shall be as marginal note and specify date of correction. Cancellation or alteration by cutting is not allowed.
6. Stock of drug shall be opened for authorized officer
7. RMP shall submit information relating to transaction in drugs if demanded by authorized officer
8. If message is sent by RMP to take delivery of these drugs. The messenger must be given a signed authority indicating his name
9. RMP should keep these drugs and register under lock and key
10. While transporting it to the house of the patient, precautions must be taken for safety of drugs, any theft should be reported to the nearest excise or police officer
11. All records including register and day book should be retained for not less than 2 years from date of last entry there in

Rule 17:

The collector may with the previous sanction of commissioner by general managing or supervising charge of a hospital or dispensary to possess import and transport such quantities of manufactured drugs other than prepared opium in such manner as may be specified in that order.

P.M.D.C. ORDINANCE

Laws relating to medical man were also present in ancient court laws even in the era DC. In 1928 first attempt was made to regulate the service of medicine in England. It was that all those who were practicing medicine get themselves registered. In 1858 an act was passed by British Parliament which established a general medical council to register a doctor and to lay down qualification and other rules of practice for doctors. British Government made this act operative in India; Medical act of 1933. Pakistan inherited that act. Pakistan medical and dental council PMDC was established in 1962 under PMDC Ordinance # XXXII. In 1973 this ordinance was updated. Important sections of PMDC Ordinance are 3,5,22,23,27,28,29,30,31.

Section 3 and 5: (Establishment of PMDC)

Establishment of medical council is responsibility of Federal Government of Pakistan.

PMDC consists of 2 types of members:

1. **Elected Members:**
   - i. One from National Assembly — 1
   - ii. One from each Provincial Assembly — 4
   - iii. One from each Medical and Dental College — 17
   - iv. One from each Syndicate of University Teaching staff — 10
   - v. 4 RMPs who are not in government service — 4
   - vi. 2 Registered Dental Surgeons who are not in government service — 2

   Total = 38

2. **Nominated Members:**
   - i. One from each health department usually health secretaries — 4
   - ii. 4 from Federal Government; One must be from Army Medical Corp — 4
   - iii. One legal member is from Federal Government nominated by Chief Justice of Pakistan on recommendation by DC Health — 1

   Total = 9

Beside legal members all the members must be:

- RMP
- Resident of Pakistan (also the legal members)

Terms of Office: members and president are selected for 5 years. Unless one does not attend 3 consecutive meetings or stays outside Pakistan for 3 years and is declared insane from Psychiatry.

Meeting of Council: Once a year

Executive Committee: it is selected amongst the members of PMDC as: 2 from the nominated members and 5 from the elected members. President and Vice presidents are elected from these 7 members.

Section 11-22: (Functions of PMDC)

1. Supervision of standards of proficiency for registration
   a. Recognition of basic registerable medical and dental qualification in and outside Pakistan
   b. Recognition of additional postgraduate qualification granted in and out of Pakistan
   c. Power of having detailed information as to courses of study and methods of examination of all those institutes whose qualification is recognized
   d. Power of appointing inspectors to check the standards of teaching and examination
2. Maintenance of official register of medical and dental practitioners There are 3 parts of PMDC register
   - Part I: Provisional registration for one year. It continues till the member goes on paying fee
   - Part II: Registration after completing MBBS or BDS
   - Part III: Registration for higher post graduates degree this is open for public for their interest
3. To take disciplinary measures

   There are 3 punishments
   - Warning
   - Temporary removal of name from PMDC register
   - Permanent removal of name from PMDC register

Appeal against PMDC decisions is made only in High Courts

PREVILEGES OF AN R.M.P.

1. **Employment:** no one other than RMP should be competent to hold dental or medical appointment in civil or military
2. **Medical Certificate:** no medical certificate should be valid unless signed by RMP giving his registration number
3. **Fee for Attendance:** no person other than RMP should be entitled to charge fee for professional services
4. **Dangerous Drug Prescription:** only RMP can prescribe drugs of addiction (dangerous drugs)

OBLIGATIONS OF RMP

1. RMP must notify the change of his or her address to PMDC in 30 days
2. RMP must not use any
   - Name
   - Title
   - Symbol
   - Any other qualification that is not in notice of PMDC

MEDICAL ETHICS

Medical Ethics: is a code of behavior accepted voluntarily within the profession as opposed to statutes and regulation imposed by official legislation.

Much of the medical ethics consists of good manners, civilized behavior in general sense, but there are certain matters, which are particular to the practice of profession.

Code of Medical Ethics: the oldest code of medical ethics is Hippocratic Code. It was restored in modern style by 'World Medical Association. It was based on declaration of Geneva in the meeting of WMA. Every applicant at the time of registration shall submit the following written and signed declaration:

1. I solemnly pledge myself to devote my life to service of humanity
2. I will give my teachers due respect and gratitude which is their due
3. I will serve my profession with devotion and dignity
4. Health of my patient will be my first priority
5. I will respect secrets which are confined in me
6. I will maintain by all means, in my power the honor and noble traditions of medical profession
7. My colleagues will be my brothers.
8. I will not permit consideration of religion, nationality to intervene between my duty and my patients
9. I will maintain, utmost respect for human life from time of conception till death
10. Even under threat I will not use my medical knowledge contrary to the laws of humanity

DUTIES OF A DOCTOR

- What a doctor must do?
- What a doctor must not do?

Duties in General: a doctor must always maintain the highest standards of professional conduct. Doctor should not practice by motives of profit, following practices are unethical:

1. Self-advertisement
2. Connection with non-qualified person
3. Receiving any money from patient other than fee
4. Any abuse of his skills etc.

Doctor - Patient Relationship:

1. A doctor must be decent and co-operative with patient
2. Complete loyalty to patient
3. Preservation of absolute secrecy
4. Emergency care as a humanitarian duty

Doctor - Doctor Relationship:

Basis of Doctor - Doctor Relationship is

1. Cooperation
2. Understanding
3. Avoiding of Professional jealousy

PROFESSIONAL SECRECY

In the course of medical practice doctor comes to know the secrets of the patients and must not disclose to anybody. However professional trust and confidence between a doctor and patient may be broken under one of these conditions:

1. Consent of patient for disclosure of relevant information. It is better to obtain written consent or at least a witness to consent
2. As statutory duty laid down by law
   - Notification of infectious and communicable diseases
   - Various industrial diseases
3. By order of court of law (Doctor may refuse but continuous refuse may render him at risk of fine or imprisonment)
4. In interest of community. Such as
   - Patient cooking food with chronic infectious disease
   - Driving public vehicle with serious disease e.g., epilepsy
   - Patient suffering from AIDS
   - Patient driving vehicle who is colorblind

PROFESSIONAL MISCONDUCT

"Justice Lopasc" it is defined as the conduct on the part of a medical man during practice, which would reasonably be regarded as disgraceful or dishonorable by his professional brethren of good repute and competency.

Medical council takes cognizance of any offense of misconduct committed by a registered medical practitioner only when:

i. A written complaint in this respect is received by PMDC
ii. An RMP is convicted by a court of law

Professional misconduct involves:

i. Abuse of doctor's privileges
   - False medical certification
   - Providing drugs of addiction
ii. Abuse of doctor-patient relationship
   - Indecent assault
   - Not keeping secrecy
iii. Association with unqualified person (providing him shelter to practice)
iv. Advertisement and canvassing
v. Criminal abortions
vi. In drunken state while on duty

Depending upon severity of offense PMDC gives punishment:

1. Warning
2. Temporary erasure of name from PMDC register
3. Permanent erasure of name from PMDC register

PRIVILEGED COMMUNICATION

It is communication made by a doctor to a proper authority that has corresponding legal, social and moral duties to protect the public. It is of 2 types:

1. **Absolute:** it is that which applies to any statement made by a court of law (in course of hearing of a case) by a doctor
2. **Qualified:** it extends to health authority information about infectious and noticeable diseases. Statement must not be malicious, it must be in good faith of the patient. In general unless the patient gives consent, doctor should make no effort to notify the police or higher authorities except:
   - When possibility of repetition of grave illness or even death
   - When there is evidence of attempting poisoning
   - In battered baby syndrome cases when parents do not stop beating child in spite of repeated instructions from doctor

Other important issues include

- Criminal abortions must be avoided
- Euthanasia should not be done
- Advertisement should be avoided
- Avoid use of humans for research purposes

MEDICAL NEGLIGENCE

The act of omission which reasonable man would do or doing something which a reasonable man would not do is called Medical Negligence or lack of reasonable care and skill or willful negligence on the part of a medical practitioner in the treatment of patient where by the health or life of a patient is endangered.

To achieve success on an action for negligence, patient or his representative must be able to establish to the satisfaction of court that:

i. Defendant (Doctor) owed him a duty
ii. Doctor committed a breach of that duty
iii. Patient or his relatives suffered from actual damage
iv. Doctor's conduct was direct or proximate cause of incurred damage

If he proves this then he is entitled to damages in terms of money. Failure to provide evidence or any one element will result in dismissal of case.

Legal Position:

1. Neither doctor can be forced to start treatment nor patient can be forced to submit to treatment
2. When both are agreed they enter into an "implied contract" having their shares of responsibilities
3. Treatment must proceed till
   - Discharge of the patient being cured
   - Discharge of the doctor by the patient

Law requires careful treatment of the patient. Careless performance of duty results into damage to health, or life of patient, doctor should be held responsible. Generally there are 3 situations

1. Treatment by non-expert
2. Treatment by an expert
3. Treatment by non-expert when required by an expert

Resipsa Laquitar:

Means "things Speak of themselves". Usually it is for patient in an action for negligence to establish the guilt of doctor under some uncommon circumstance burden of proof shifts from the patient to the doctor. Three essential conditions considered necessary are:

1. Nature of injury suggests by common knowledge or expert opinion that without negligence it does not occur
2. Patient must not contribute to his own injury
3. Doctor must be in exclusive control of instrumentality

In such case error is so self-evident that if case comes to trial the doctor has to establish his innocence rather than the patient having to prove the doctor's guilt. For example patient has undergone an operation for relief of Dupytren's contracture affecting 2 fingers of one hand by an experienced full time surgeon. Hand was splinted for 4 days. When splint was removed, it was found that beside 2 already affected fingers 2 more were affected. So the patient was left practically with a useless hand. Resipsa Laquitar was successfully pleaded in this case. In Pakistan due to lack of awareness and extreme loyalty to doctor cases of such claims are rare.

Types of Medical Negligence:

1. *Civil Negligence:* it is a failure to apply reasonable degree of skill and care by medical practitioner while treating his patient the burden of proving negligence and damage resulting from, lies on the patient. Reasonable circumstantial evidence of actual negligence must be proved to the satisfaction of court. Fact that something unexpected has happened from some unknown cause is not evidence of negligence. These cases are dealt with civil-courts. Examples are
   - Failure to give ATS (Anti-Tetanus Serum) in injury cases
   - Failure to give X-rays in cases of injury to bones or joints in which there is doubt about diagnosis
   - Excessive exposure of patient to radiation
   - Insufficient care while using dangerous drugs
2. *Criminal Negligence:* when a doctor while treating the patient behaves in a wicked manner showing complete disgrace and disregard for safety of patient's life resulting into death of patient, he has committed criminal negligence. These cases are dealt with criminal courts. Examples are
   - Injecting anesthetic in fatal dose or in wrong tissue
   - Amputation of wrong finger, wrong limb or removal of wrong organ
   - Errors in ligation of ducts, operation of wrong patient
   - Leaving sponges or instruments in abdomen
   - Giving wrong blood
   - Gangrene after tight plasters
   - Paralysis after splints
   - Performing criminal abortions
3. *Contributory Negligence:* it is defined as concurrent negligence by patient and doctor, resulting in delayed recovery or harm to the patient. Negligence of both parties has contributed this harm. If such a conduct is proved on part of the patient; the patient looses his right in part or in whole, that ensured however the doctor is expected to foresee that patient may harm himself and to warn him accordingly when burden of proving such negligence is on doctor the usual defense is:

- Patient did not give correct history
- Patient did not give opportunity to examine properly
- Patient did not follow the doctor's instructions

In such cases doctor cannot be blamed and patient has to blame himself for this condition.

4. *3rd Party Negligence:* this is done by paramedical staff, nurses, and medical students. Here doctor shares the responsibility, as he is respondent superior. It is dealt with civil courts.

Precautions against Negligence:

- Diagnosis where possible should be confirmed by laboratory tests including biopsy
- X-ray should be routinely advised in case of injury to bones or joints or where diagnosis is doubtful
- Consultation with a specialist should be suggested in obscure cases
- Immunization should be considered a necessity where there is danger of infection
- Sensitivity should be done before injecting preparations likely to cause anaphylactic shock
- Drugs to be administered should be verified
- Non-experimental methods should be adopted without prior consent
- No procedure should be undertaken beyond one's skills

Novus Actus interventions:

The assailant is responsible for all consequences of assault (immediate and remote complications) which link the injury to death. Sometimes such a continuity of events is broken by an entirely new and unexpected happening, which is not reasonably said to be foreseeable compilation when this happens Novus Actus interventions is said to have occurred. For example:

A man with a punctured bleeding abdominal wound was brought to the hospital. Patient was operated under general anesthesia. During return to consciousness; patient vomited and choked. In fact anesthetic was misinformed by the patient about the time of his last meal. It was patient's own fault for which assailant could not be held fully responsible and the major failed.

CONSENT IN MEDICAL PRACTICE

Consent: it is an involuntary agreement or permission for medical treatment.

Provision of treatment is an implied contract between patient and doctor there is no specific law for it.

Patient is at liberty to choose any doctor and doctor is also at liberty to accept or refuse any patient. Once accepted the implied contract continues till the:

- Patient cures
- Doctor refers the patient to any specialist for any better treatment
- Patient rejects the doctor
- Death of patient occurs
- Death of doctor occurs

Nature of Consent:

- Consent should be freely and fully given
- Without fear
- Without threat
- There should be reasonable time, between consent and treatment

Doctor's Responsibility: it to exercise skill with care and professional secrecy according to the claim of doctor

Obligation of Patient: these include

- Patient should pay fee (mutually agreed) in private cases
- Care for discipline of hospital
- Must give proper and true history
- Patient should be cooperative

Legal Position: no specific law deals with consent. It is dealt under common law and civil law.

Consent in Eyes of Law: two or more persons are said to be in consent when they agree on something in same sense.

Free Consent: it is a consent in which there is no fraud, misinterpretation or mistake

Types of Consent: these are:

1. *Implied Consent:* mere actions of patient while he comes in hospital and sits on examination stool. For example a patient comes to the doctor and sits on the examination stool for history and examination.
2. *Expressed Consent:* in this terms are stated in distinct languages. It is of 2 types
   - Oral: it is for minor examinations and it is better to take in the presence of a third party
   - Written: it is taken for major operations and also in medicolegal issues. It is more beneficial.
3. *Blanket Consent:* it is not a good form of consent. It is also not good in the eyes of law. It is very common in our hospitals. Patient is not told about anything. A statement like "I am ready for any kind of operation under any kind of anesthesia" is given to the patient and he is said to sign it.
4. *Informed Consent:* In this form doctor gives reasonable information to the patient about the followings and then patient gives the consent:
   - Diagnosis
   - Treatment
   - Result
   - Hospital Stay
   - Alternative Procedure

Procedure: Consent should be taken before the start of examination. It should be taken from patient or legal heirs. There should be consideration of age, mental status and any influence on patient and little about side effects of drugs. But it is better to withhold some information in order to avoid psychic effects. It is better to take informed consent.

Situations Requiring Modification:

- Minor patient: Consent from legal heirs
- Mentally sick patient: Consent from legal heirs
- Unconscious patient with no attendant: No need of consent
- Artificial insemination: From donor and his wife and recipient and her husband
- Transplantation: From donor and recipient
- For life saving emergencies: No need for consent (as patient of Geneva prohibit blood transfusion)

When Consent is not needed to be obtained: when there are

1. Orders from court for psychiatric examination
2. During selection in armed forces
3. Handlers of food or dairyman by health authorities if suspected to be suffering from infectious diseases

Consent for Examination of Dead:

1. For medicolegal purposes from officer of investigating party
2. For hospital autopsy or non-medicolegal autopsy, take consent from legal heirs

Examination of Employees at Employer's Request: No employer has right to enforce medical examination of employees

Special Consideration: as in euthanasia; examination cannot be done with consent of the patient.

INDECENT ASSAULT

It is an offence committed on a female with knowledge to outrage her modesty. Usually this is done without consent.

- Kissing any body part
- Pressing breast or private parts
- Touching private parts
- Exposing her private parts
- Examining a female patient in the absence of a female attendant and stripping her clothes without her consent

CONSENT FORM

I, (Name of the consentee) NIC number (of the consentee), do hereby consent to (my own/relationship with the patient) operation of (name of the operation) under (type of anesthesia) anesthesia. I have been explained fully the nature, purpose and inherit risks involved in this surgery and the type of anesthesia by Dr. (name of the doctor taking consent). No assurance has been given to me that any particular surgeon will perform the operation.

Signature of the Consentee ----------

Date----------

I inform that all-relevant detail in respect of the above-referred operation and anesthesia has been fully explained to the consentee who has signed this form.

Signature of the doctor taking consent----------

Date----------

☆☆☆☆☆☆☆

Chapter-3

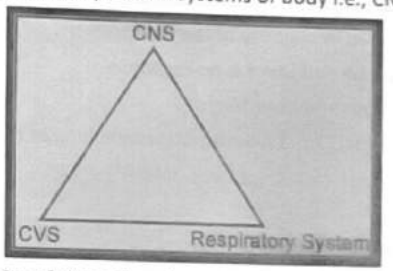
Thanatology

Thanatos Death

Logos Science

Thanatology: It is scientific study of phenomenon and practices relating to death.

Life: Presence and integration of 3 interdependent systems of body i.e., CNS, CVS and Respiratory System



Death; Absence or lack of integrity of these 3 systems constitutes death. Failure of one of these systems leads to failure of other systems, which causes death. In fact it is irreversible loss of properties of living matter. There are 2 stages of death:

- Somatic Death: It is also called clinical or systemic death. It is extinction of vital functions of brain, heart and lungs.
- Molecular Death: also called cellular death. Some cells and tissues continue functioning after somatic death and gradually disintegrate depending upon Oxygen requirements. Complete molecular death occurs within 3-4 hours. Molecular death does not occur just after somatic death. Organs can be functioning after somatic death:
  - Striated muscles respond to electrical or mechanical stimulus
  - Sweat glands respond to pharmacological stimuli
  - Pupils contract by Physostigmine and dilate by Atropine

Organ Transplantation: For organ transplantation time period between 2 stages is very important. Organs must be taken as freshly as possible.

1. Heart should be removed within one hour
2. Liver should be removed in 15 minutes
3. Kidneys should be removed in 45 minutes

Views about Death:

Views of some authorities about death are given below:

1. **Muller 1967:** Dying-is a process not a momentary happening
2. **Clane 1970:** When destruction of brain is established individual is dead for all purposes
3. **Shapiro:** Death is irreversible loss of properties of living matter

4. Rentol and Smith: Complete and persistent cessation of respiration and circulation is death
5. Pope Pius XII: Church's View; Human life for as long as the vital functions distinguished from simple life of organs, manifest themselves without (any help of artificial means
6. Black's Law Dictionary: Cessation of life; the ceasing to exist defined by physicians as total stoppage of circulation, a cessation of essential and vital functions such as respiration and pulsation
7. Camp's Says: There is no distinction between legal and medical definitions of death but decisions
8. World Medical Association: It is impossible to define death today. It should be continued to be a clinical decision

PRESENT CRITERIA TO DIAGNOSE DEATH

1. Howard's Report: It is followed in majority of the countries
   i. Non-receptive for stimuli and there is no response
   ii. No movement for 1 hour and breathing
   iii. No spontaneous breathing for 3 minutes after switching of the artificial means
   iv. No reflexes
   v. Flat ECG

   Again in some cases issue is questionable.
2. Declaration of Sydney: Biologically and legally there is doubt in majority of the cases but in small minority of cases there is no valid unassailable definition, specially, in the case of a person who is in hopeless condition and is kept alive by artificial means for a time and then the apparatus is turned off.

HUMAN TISSUE ACT

- If a person is alive he can make his will for donation of his organs
- If a person is dead then the custodian are responsible

Diagnosis of somatic death is not easy in the following cases:

1. Soon after death when the body is likely to be warm
2. Suspended animation (discussed latter)
3. Hypothermia (in old age)
4. Coma after high doses of sedative or hypnotic specially barbiturates

DIAGNOSIS OF SOMATIC DEATH

Following signs are seen:

1. Cessation of Circulation: it can be diagnosed by:
   i. Palpation for pulse — it is not reliable
   ii. Auscultation over pericardial area for heart sounds ——— be careful in an obese person
   iii. Magnus Test: ligature is applied to finger to occlude the venous return. If circulation is present the distal part of the finger will become pale in respect to the proximal part

   iv. Diaphanous Test: finger web appears translucent red against the light. If opaque yellow color is seen it means no circulation
   v. Heat Test: on heating true blisters are formed with red line of demarcation
   vi. Artery Incision Test: cut a small artery if blood flows in a pulsating flow = circulation is present; if no pulsating flow = no circulation.
2. Cessation of Respiration: it can be diagnosed by:-
   i. Inspection: carefully inspect the chest for chest and abdominal movements
   ii. Auscultation: of chest and larynx
   iii. Mirror Test: hold mirror in front of nostrils or open mouth due to moisture in breath the mirror surface becomes dim
   iv. Feather Test: hold feather (very light object) in front of nostrils or open mouth, it will move with breath
3. Cessation of Reflexes: reflexes cannot be initiated by general sensations in a dead person due to total CNS damage.

SUSPENDED ANIMATION

It is a condition in which vital functions are at very low pitch and condition resembles death. All the body processes are depressed to the minimal levels compatible with life. State of death is not the actual death. For example:-

- **Voluntary:** In Yogis
- **Involuntary:** Drowning, sleeping and sedative over dose etc.

BRAIN DAMAGE

Mainly it means death of areas of brain concerned with the vital functions i.e., areas of brain concerned with control of respiration, circulation and DP. After death different organs stop functions after different intervals:-

Nervous Tissue	few minutes
Muscular tissue	3-6 hours
Cornea	6 hours
Skin	12-124hours
Liver	15 minutes
Kidneys	45 minutes
Heart	1 hour

SUDDEN DEATH

Sudden Death: unexpected death following so rapidly after onset of symptoms that the cause of death cannot be certified with confidence by an RMP.

Important Points are:

1. Sudden death ——— suspicious of foul play
2. May be a case of homicide
3. Cause of death should be determined

4. Examiner should know all the causes of sudden death and areas to be examined
5. Good working conditions and facilities are required
6. Maximum information should be collected before autopsy
7. Investigate the case carefully

Types of Sudden Death;

1. Natural (80%)
2. Unnatural (20%)

Natural deaths are due to some disease or senility. Unnatural may be by introduction of a poison. There are many causes of unnatural sudden deaths. These may be Accidental or Criminal.

Modes of Death

According to Bichat there are three modes of death:

1. Comma → Death from failure of function of Brain (CNS)
2. Syncope → Death from failure of Heart functions (CVS)
3. Asphyxia → Death from failure of functions of lungs (Respiration)

Irrespective of cause of death, modes of deaths are:

1. Coma: by involvement of CNS
2. Syncope: by involvement of CVS
3. Asphyxia: problem in respiratory system

Causes of Sudden Death;

The cause of death is (any disruption in structure or function of normal body systems leading to any one of mode of death.

These are grouped as follows:-

1. CVS:
   - Ischemic heart diseases (in UK, USA and Pakistan)
   - Atheromatous Coronary Stenosis. Stenosis occurs in: 45-64% in anterior descending branch of left coronary artery, 24-46% proximal part of right coronary artery, 3-10% circumferential branch of left coronary artery, in 0-10% cases short main trunk of left coronary artery
   - Hemorrhage from vessel, it depends upon the size of the vessel and site of hemorrhage
   - Peripheral Blockage of vessel: blockage depends upon size of block (partial or complete) and the nature of the vessel (is it a vital vessel or not) and the methods of blockage are atherosclerosis, thrombosis, embolism etc.
   - Disease of heart muscle (inflammation, infection, congenital diseases)
   - Inhibition of heart
2. CNS:
   - Hemorrhage in brain (17% of sudden death cases)
   - Space occupying lesion
   - Meningitis
   - Cerebral malaria
   - Epilepsy

3. Respiratory System:
   - Allergic manifestations of glottis (Diphtheria)
   - Tumors of bronchi and larynx
   - Pulmonary embolism
   - Infections of respiratory tract
4. GIT Diseases:
   - Hemorrhage from duodenal ulcer
   - Tumors of stomach or colon
   - Fulminating viral hepatitis
5. Genital System: (rare in males)
   - Rupture of extrautrine gestation
   - Rupture of ovarian cyst

Causes of Sudden Deaths According to Groups:

1. First Year of Life:
   i. Acute Respiratory Infections
   ii. Aspiration of fluids and vomitus
   iii. Congenital disorders, Tetralogy of Fallot
   iv. Disorders of CNS i.e. Epilepsy
2. 2nd-20 Years of Life:
   i. Acute Respiratory Infections
   ii. Gastroenteritis
   iii. Encephalitis
3. 20-40 Years of Life:
   i. Brain Hemorrhage
   ii. Epilepsy
   iii. Mitral stenosis
   iv. Ruptured Ectopic Pregnancy
4. 40-60 Years of Life:
   i. Coronary Artery Disease
   ii. Intracerebral Hemorrhage
   iii. Pulmonary Embolism
5. Over 60 Years of Life:
   i. Bronchopneumonia
   ii. Intracerebral Hemorrhage
   iii. Rupture of Aorta and other Great Vessels
   iv. Hypertensive Cardiac Failure

DEATH CERTIFICATE

Death Certificate: it is a written document issued by an RMP, which confirms the death of a person.

Recommendation Protocol by W.H.O.

1. Disease, injury or complication which cause death
2. Antecedent cause: morbid condition
3. Underlying condition giving rise to above mentioned cause

Important Points:

1. It is an important document so determine cause of death very carefully
2. It is a legal document so prepare it very carefully
3. Wrong death certificates may produce ambiguities and doubts which are resolved in favor of accused
4. Remember mode of death is not cause of death

Pre-requisites:

- Recognition of presence of death
- Recognition of cause of death

International Form of Medical Certificates of Cause of Death

Cause of Death		Approximate Interval between Onset and Death
1. Disease or condition directly leading to death. Antecedent cause morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	a) ..... (due to or as a consequence of)	Years Months
	b) ..... (due to or as a consequence of)	Days Hours
2. Other significant conditions contributing to the death but not related to the disease or condition causing it	c)	

Signature, designation, degree and registration number of RMP

Name of Institution

Filling of Death Certificate:

It is divided into 2 sections as discussed above

A. Ask for:

- Immediate cause of death
- Morbid condition, antecedent cause if any
- Underlying cause: causing above conditions

B. Ask for: significant condition contributing to death but not related to immediate cause such as, uremia, diabetes, carcinoma of prostate etc.

Avoid:

- Mode of death should be discovered but avoid it as cause of death
- Guessing of cause of death should be avoided
- Cause of death should be ascertained after autopsy

Examples:

1. Child dying of toxemia in an attack of diphtheria. It is sufficient to certify as: Diphtheria — 4 days
2. Child suffering from measles dying of pneumonia:

Pneumonia — 2 Days
Measles — 3 Weeks
Direct cause of death is pneumonia but underlying cause is measles

3. Death of a diabetic who is under insulin control, has degenerative heart condition Myocardial Infarction Diabetes Mellitus Direct cause is MI but the underlying cause is Diabetes Mellitus

V. Important: No Blank Death Certificate Should Be Signed

CHANGES AFTER DEATH

These can be divided as follows:

1. *Immediate:* these are seen just at time of death - Cessation of circulation, respiration and reflexes, pallor of skin, primary muscular flaccidity, contact flattening
2. *Early: are* seen in first 12 hours after death - Cooling of body (algor mortis), Hypostasis or postmortem staining (livor mortis), Rigor mortis
3. *Delayed:* occur in subsequent hours after death - Physical changes (putrefaction, mummification, adipocere formation) and Biochemical changes (in blood, CSF, in ocular fluid)

1. Immediate Changes: these are seen just after death. There may be suspended animation. So very careful examination should be done.

i. Cessation of Respiration: respiration may cease for a short period of time (apnea) such as in case of Chyne-Stokes Breathing and new born infant. Cessation of respiration can be detected by careful inspection of chest and abdomen especially upper anterior abdominal wall. The more accurate method is auscultation (for at least 5 minutes or more not less). There may be apnea in case of cardiac failure and neurological defect for about 20 seconds. While doing auscultation bell of stethoscope should be over larynx. Subsidiary tests are:

1. Mirror Test
2. Feather Test
3. Candle test
4. Winslow's Glass Water Test

In a candle test place a burning candle on anterior chest wall and observe the direction of its flame. It will give an idea whether respiration is going on or not. For Winslow's glass water test, a glass filled with water is placed in a plate and then put whole this apparatus on the anterior chest wall; changing water levels will give an idea about respiratory movements.

ii. Cessation of Circulation:

Pulselessness: it is not definite criteria of death

Auscultation: it should be done for 5 minutes. Stethoscope is placed in 5th left intercostal space. Remember in case of hanging respiration stops and person is dead but heart keeps on pumping for 15 minutes. Examination should be careful in cases of:-

- Obesity
- Feeble Heart
- Emphysema
- Active Slow Rhythm
- Thick Chest wall

Subsidiary tests are:-

1. Magnus Test
2. Finger Nail Test
3. Diaphanous Test
4. Artery Incision Test
5. Heat Test

iii. **Pallor of Skin:** it is not a reliable sign of death. It occurs due to stasis of blood in circulation and drainage of blood from capillaries and venuoles of skin so that skin becomes pale, exceptions are:-

- Prolonged agonal period
- Asphyxial Death
- Carbon monoxide poisoning
- Death by hypothermia

iv. **Primary Muscle Flaccidity:** immediately after death muscles lose their tone and get relaxed so that:-

- Lower jaw drops
- Muscles become soft and flabby
- Thorax collapses
- Joints are flexible, limbs are flaccid and fall freely
- Person looks younger
- Wounds do not gape
- Muscles respond to electrical stimuli till molecular death

v. **Contact Flattening:** the body flattens over areas, which are in contact with surface. It occurs due to loss of muscle tone and by the pressure of weight of body over the areas in contact with surface. Contact flattening occurs at shoulder blades, buttocks, calves etc. In these areas hypostasis does not (postmortem staining) takes place.

vi. **Eye Changes:** Changes are seen in eyes:-

- Eyes stare vacantly
- Bilateral fixed dilation of pupils occur
- Pupillary light reflex is absent
- Corneal reflex is absent
- Cornea is hazy if eyes are open, if pour drops of water haziness vanishes
- Tone of eyeball muscles reduces
- Intra ocular pressure falls from 10-20 mmHg (normal) to zero in 2 hours
- Ophthalmoscopy shows stasis of blood and fragmentation of blood stream called "cattle trucking"
- In 85% of cases optic disc becomes pale in 10 seconds after death

vii. **Cessation of Reflexes:** it is due to damage to CNS. Neurons are destroyed few minutes after death so there is complete cessation of reflexes.

2. <u>Early Changes:</u> these denote molecular or cellular death. These are the following:

i. **Cooling of Body (Algor Mortis):** it is lowering of normal body temperature may be due to:-

- Death
- Hypothermia

Normal body temperature is 37°C or 98.6°F. In living body temperature is maintained by balance between heat production and loss. After death there is no heat production but heat loss is there by:

- Convection
- Radiation
- Conduction (heat loss by conduction is .important)

Surface of body cools more rapidly than core (interior) of body. Reliable method is to record core temperature at time of death. If temperature cannot be recorded at the time of death, then it is thought to be normal at time of death that is 37°C (surface or oral temperature), 1°C more than this is core temperature - per rectal temperature (38°). Usually there is hypothermia before life extinguishes mainly in case of CCF, massive hemorrhage, and secondary shock. But in some cases there is hyperthermia at the time of death e.g., sunstroke, pontine hemorrhage, asphyxia death, acute bacterial and viral infections; this is called postmortem caloricity.

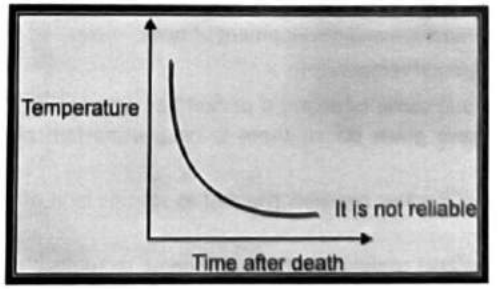
a) ***Temperature Recording:*** special chemical thermometer (thanometer) is used which Dowler first proposed in 1850. It is 25cm long straight tube graduated from 0° to 120°F or 21° to 44°C.

Clinical measurement (orally) ———— 37°C

Medicolegal measurement (PR) ————1°C

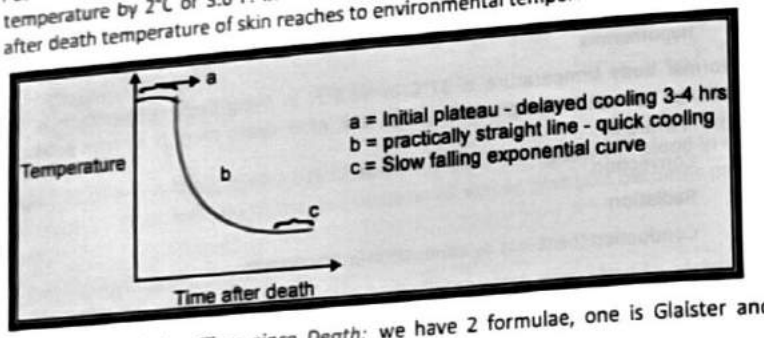
b) ***Procedure of Recording:*** tip of thermometer is inserted 3 to 4 inches into rectum. Recording is taken after 2 to 3 minutes without disturbing the body and the thermometer. 4 readings are taken at half-hour intervals to determine rate of cooling. Record temperature as early as possible. If there is any possibility of sexual interference record temperature after collecting trace evidence or record the visceral temperature from inferior surface of liver by making an incision in midline called sub hepatic temperature.

c) ***Cooling Curve:*** after death body loses heat in a definite pattern by which we can determine the time since death. Body surface cools rapidly than the core of the body. Inner core cools slowly because 2.5cm thick covering of skin covers it and beneath skin is layer of fat.



Initially chemical changes take place in viscera (postmortem Glycogcnolysis) which maintain core temperature for some time and plateau is seen in graph.

d) *Postmortem Glycogenolysis:* it takes place 3 to 4 hours after death. 140 calories raise the body temperature by 2°C or 3.6°F. in 6 to 9 hours skin temperature falls rapidly beyond 12 hours after death temperature of skin reaches to environmental temperature.



e) *Formulae Calculating Time since Death:* we have 2 formulae, one is Glaister and Rontoul Formula and other is Marshal and Hoare Formula.

Glaister and Rontoul Formula: Number of hrs since death = 98.6 - Temp (PR) / 1.5 This above formula is for first hour after death and during next 6 hours formula is: Number of hours since death = 98.6 -Temp (PR) / 2.5

Marshal and Hoare Formula is: (for an unclothed body of adult)

In 1st 3 hours	1°F/hour (rate of cooling of body)
In next 3 hours	2°F / hour
In next 3 hours	2°F / hour
In next 3 hours	1½°F/hour
In next 3 hours	$1^{1/3}$°F/hour

Rate of cooling is 66% slower in clothed body, an average body temperature comes to environmental level in about 20 hours. Obese body takes 41 hours to cool completely or to come to environmental level. Thin and lean body takes 19 hours.

f) *Factors Affecting Rate of Cooling of Body:*

- When a body is exposed to air after death, the factors that affect the cooling are:
  1. Body temperature at death
  2. Clothing and covering of body
  3. Air movement and ventilation
  4. Humidity of atmosphere
  5. State of nutrition and development of body
  6. Environmental temperature
  7. Mode and cause of death: If person has done more physical exertion his, glycogen stores have given off so there is no postmortem glycogenolysis and body cools quickly.
  8. Edema: ECF water contents rise and as specific heat of water is high hence cooling is delayed.
  9. Age: in infants cooling is rapid as compared to adults
- When body is immersed in water. Water is better conductor of heat than air hence, cooling is rapid. Factors influencing cooling in water are:

1. Temperature of fluid
2. Movement of fluid
3. Nature of fluid - in the fresh water; cooling is rapid and in stagnant, sewerage; putrefying water the cooling is delayed

Hypostasis (Livor Mortis): it is also called Suggillation, Postmortem Staining or Lividity.

It is a mechanical phenomenon and is characterized by discoloration of skin and staining of dependent parts of body due to accumulation of blood in toneless blood vessels due to gravity. . Color of hypostasis is same as that of blood but also depends upon mode and cause of death as in some poisoning cases color is somewhat else. .

a) Progression of Hypostasis: Initially mottled red patches appear in 20-30minutes. Then color becomes purplish red in next 1-3 hours. Size of patch increase in next 3-6 hours. In about 6-12 hours the patches coalesce and at 12th hour hypostasis is fully developed and fixed. Phenomenon is due to stagnation of blood and not due to coagulation of blood.

b) Distribution of Hypostasis: Its distribution depends upon
   - Gravity
   - Position of body after death

   Hypostasis is distributed externally on skin and internally on the viscera

   i. External appearance
      - If body is in supine position after death then hypostasis is seen on
        - Dorsal aspect of trunk
        - Extensor surface of head and neck
        - Flexor surfaces of lower limbs
        - Extensor surfaces of upper limb
      - Hypostasis is absent on the areas of contact flattening, as these are the pressure areas and the vessels get occluded by the pressure.
      - If death occurs in sitting position; hypostasis is seen on trunk, thighs, legs and forearms
      - If body is suspended after hanging; hypostasis is seen on lower abdomen, thighs, external genitals, legs and hands
      - In drowning the face is downward and the back of chest is the highest point. Hypostasis is seen on face, front of trunk and limbs
      - If body is in water; the position of body parts goes on changing the position of hypostasis also changes even in some cases hypostasis may not develop

   ii. Internal appearance: in supine position hypostasis is seen on
      - Posterior part of cerebellum and cerebrum
      - Dorsal aspects of the lungs
      - Posterior wall of stomach
      - Dorsal parts of the kidneys and liver
      - Lower most coils of intestine

c) *Extent of Lividity:* It depends upon
   i. Volume of blood

- Faint: in case of haemorrhage
- Marked: in case of CCF

ii. Fluidity of blood
- Rate of IV coagulation
- Concentration of fibrinolysin

If fibrinolysis is active and rate of IV coagulation is slow, blood will remain fluid and also there is marked and rapid hypostasis over extensive areas. In case of prolonged illness slight hypostasis may be present before death.

d) Hypostasis and Congestion:

Hypostasis	Congestion
1. It is post-mortem phenomenon	It is ante-mortem phenomenon
2. It is irregular and on dependent body parts	It can be present anywhere and involves whole organ diffusely
3. No inflammatory exudate and no swelling	Exudate and swelling is present
4. Mucous membranes are lusterless	Mucous membranes are red
5. Appearance of organ is normal	Pathological changes are present
6. Hollow viscera when stretched show alternate stained and unstained areas	Staining is uniform

e) Hypostasis and Bruise:

Hypostasis	Bruise
1. It is present on dependent parts of the body	It can be present on nay part of the body
2. It is post-mortem phenomenon	It is ante-mortem phenomenon
3. It is collection of blood in tone less vessels due to gravity	It is extravasation of blood into tissues from ruptured vessels
4. It is with well-defined margins	Margins are not well defined
5. Color is uniform	Variegated color
6. Give incision and wash: it is easily washed	It is not easily washed
7. Histopathologically blood elements are found within the blood vessels	Blood elements are found in the surrounding tissues

f) Medico-legal importance:

1. It is reliable sign of death
2. By seeing distribution of lipolysis we can determine the position of body at the time of death
3. If before fixing of hypostasis position of body is changed; new areas of hypostasis develop while old areas also persist
4. By hypostasis we can determine time since death:

No hypostasis	less than 1/2 hour
Mottled faint patches	less than 3 hours
Fully developed hypostasis	from 3-6 hours

5. Color of hypostasis can determine the cause of death:

Carbon monoxide poisoning	bright cherry red
KCN-poisoning	pink
Opium poisoning	brown
Nitrite or nitrate poisoning	reddish to pink

6. Hypostasis should be differentiated from bruise and congestion

Rigor Mortis:

Rigor = Rigidity

Mortis = after death

After death muscular tissue of the body passes through following changes

- Primary Relaxation (Immediate change after death)
- Rigor Mortis
- Secondary Relaxation

Rigor mortis is characterized by stiffening and slight shortening of all the muscle fibers of body after death. It is due to chemical changes in proteins of the muscle fibers. There is no measurable shortening of muscles. It occurs after primary muscular relaxation and is followed by secondary muscular relaxation.

a) Distribution and Progression: All voluntary and involuntary muscles are involved. Even the paralyzed muscles show rigor mortis. It is first detectable in small muscles.

Eyelid muscles	3-4 hours
Muscles of the face	4-5 hours
Neck and Trunk	5-7 hour
Upper extremities	7-9 hours
Legs	9-11 hours
Muscles of Fingers and Toes	11-12 hours

There is proximal to distal progress of rigor mortis.

It starts 12 hours after death. Remain for 12 hours. Passes off in next 12 hours in fully developed rigor; state of flexion or extension at joints depends upon initial position of body. If after death body was in supine position; large joints are slightly flexed and small joints of toes and fingers markedly flexed due to shortening of forearm and leg muscles.

b) Special Features of Rigor Mortis:

1. Due to rigor mortis left ventricles get thickened and contracted so it should not be mistaken as hypertrophied heart
2. Postmortem dilation - after rigor mortis is second muscular relaxation period - this causes atria and ventricles to dilate. This can be mistaken as myocardial degenerative dilation.
3. Due to rigor mortis errectorpilae muscles contract there is puckering of skin - cutis anserina (goose skin); it can be mistakenly seen as skin seen after drowning.
4. Due to rigor of pupillary muscles, there is irregularity between apertures of pupils of both sides.
5. Muscles of seminal vesicles contract and seminal fluid may come out
6. Due to rigor uterus postmortem delivery can occur
7. Rigor also develops in paralyzed muscles and it is not concerned with nerve supply

During rigor if you put pressure on a limb, rigor will disappear. Once the rigors sets off (after 36 hours) it will never reappear.

c) *Chemical Basis:* after death ATP synthesis continues for some time but there is no ATP consumption. As local glycogen stores get depleted - no ATP is formed - lactate and phosphate accumulate and muscles become fixed and rigid.

d) *Medicolegal Importance:*

- We can determine the time since death but it is not reliable
- May give clue about position of body at time of death

e) *Factors Affecting Rigor Mortis:*

1. Muscular Activity: if there was a great muscular activity, glycogen stores have got depleted and rigor either does not appear or it appears for a short time as in battle, convulsions etc. If the muscles were active as in the above cases rigor appears after long time and duration is very short. If muscles were not active rigor onset is rapid but duration is prolonged.
2. Environmental Temperature: if environmental temperature is increased as in summer, rigor is accelerated and in cold weather rigor is delayed.
3. Age: in infants, children and old age onset is rapid but duration is prolonged
4. Glycogen Reserves: more reserves - delayed rigor; less reserves - slow rigor less intense

There are some conditions, which simulate rigor:-

Cadaveric Spasm: it is also called instantaneous rigor. It is a condition of muscular rigidity immediately after death without a stage of primary flaccidity.

- It persists until rigor mortis develops
- As secondary muscular flaccidity starts it goes away
- It is a vital phenomenon and involves nervous stimulation e.g., seen in violent death in case of intense emotion as in fighting soldier

Due to cadaveric spasm we can guess the last act of the life. Muscles of the forearm, hands are usually involved but may occur in whole body; when intense nervous tension is present before death. Examples include:

- Suicidal deaths: firearm in hand, knife in hand
- Drowning: grass and weeds firmly catched in hands
- Mountains fatalities: shrubs or branches seized
- Homicide: clothing or hair in diseased hands

Grip of hand should be very tight; remember that absence of cadaveric spasm does not exclude suicide.

Difference Between: (NRA Pg 135)

Cadaveric Spasm	Rigor Mortis
1. It occurs after Rigor Mortis	1. It occurs after primary Relaxation
2. Muscles become soft and flaccid	2. Muscles become Rigid
3. Muscle Reaction becomes Alkaline	3. Muscle Reaction becomes Acidic
4. It is followed by Putrefaction	4. It is followed by secondary relaxation
5. It is instantaneous	5. It sets after 2-3 hours of death

Heat Stiffening: It is found in bodies exposed to heat over 70°C may be in case of burning or body immersed in hot liquids. Coagulation of muscle proteins occurs and muscle fibers shorten. Pulgistic attitude is seen. Due to heat there is flexion of neck, elbow, knee joints and hands are clenched. Bodies are also deliberately burned after death to hide their identity. Heat stiffening can occur at any time till putrefaction even in rigor mortis but if time of rigor mortis has gone rigor mortis cannot occur.

Cold Stiffening: it is rigidity due to cold. It is found in bodies exposed to cold below 3.5 C or 41°F. It is due to solidification of fat and muscles. Cracking sound can be heard due to frozen synovial fluid at knee joint flexion. It can occur before rigor mortis if body is exposed to cold.

3. Delayed Changes: these are following: Physical changes (putrefaction, mummification and adipoccre formation); Physiological changes; Biochemical changes

i. **Putrefaction:**

Putrefaction or mummification is' one of the late changes after death. It is absolute and surest sign of death. Dead body breaks into small component and organic matter is converted into inorganic material. 2 processes are responsible for putrefaction; Autolysis and Bacterial Action.

1. Autolysis: softening and liquefaction of tissues occur even under sterile conditions. Auto = self; Lysis = destruction. It occurs due lo digestive action of enzymes released by the cells. It is not because of action of bacteria. Freezing can prevent it.
2. Bacterial Action: bacteria invade the tissues, blood is excellent medium for bacterial growth. Normally bacteria are present in large intestine. Important is C. welchii. When death occurs, bacteria enter the circulation and spread into whole body and cause putrefaction. In case of death due to bacterial diseases the spread of putrefaction is rapid.

We divide progression of putrefaction into 3 stages:

Stage I

a. There is green discoloration of lower abdominal skin. It appears 2nd or 3rd day after death but may appear earlier e.g. in 24 hours in hot weather. It is 1st seen on the right side at caecal area, then spreads all over the abdomen and chest. Putrid odor becomes evident,

b. Veins on chest, shoulder and groin become apparent give mosaic appearance called marbling, veins are filled with gas bubbles and hemolysing blood,

c. Skin slips occur, as outer layer of skin becomes loose. It seems apparently normal, but if apply pressure the upper cuticle layer can be easily rubbed off and a shiny moist pink base appears. Vital reactions are absent. It must be differentiated from post-mortem scales and ante-mortem abrasions,

d. Blisters over skin appear after sometime. Blisters are filled with blood stained fluid and gas, with putrid odor. These can burst easily leaving a slippery pink surface,

e. In second week gases produced in body (methane, ammonia, carbon dioxide and phosphorylated hydrogen) give an offensive odor.

Stage II

After 2-3 weeks stage I is over. Now abdomen gets distended and ballottement indicates the 2nd stage.

a. There is generalized swelling of the body
b. Identification becomes difficult
c. Eyes are closed, puffy checks, thick lips, and swollen tongue that protrudes through teeth
d. Abdomen becomes distended and blood stained fluid oozes from nose and mouth. Stomach contents and feces also pass out
e. Hair and nails are easily pulled out

Stage III

It is characterized by bursting and liquefaction of body during 4-5weeks after death. Tissue liquefaction depends upon amount of muscles and fibrous tissues. Many tissues are soft, loose, semifluid, ultimately liquefy and broken down. Putrefaction spreads in following order:

a. Intestines, stomach, liver blood and heart blood
b. Air passageways, lungs and liver
c. Brain, spinal cord
d. Kidneys, bladder and testes
e. Voluntary muscles
f. Uterus and prostate (they resist putrefaction and help in sex determination)

Factors Affecting Putrefaction: these include: -

a. **Putrefaction of body exposed to air**
   - Atmospheric temperature: increased temperature cause early putrefaction and vice versa
   - Humidity of air: increased humidity of air result in rapid putrefaction and vice versa
   - State of hydration of tissues: increased water contents cause rapid putrefaction and vice versa
   - Nutrition of body: well-nourished → early putrefaction and vice versa
   - Cause of death: if by infection very rapid putrefaction
   - Bacterial contents of tissues
   - Sex: fat resists putrefaction in females
   - Death of female after child birth due to septicemia = very rapid putrefaction
b. Putrefaction of body immersed in fluid
   - Temperature of fluid: increased temperature = early putrefaction
   - Nature of fluid: dirty infected fluid - early putrefaction
   - Movement of fluid: stagnant fluid - early putrefaction
c. Putrefaction of buried body depends upon
   - Coffin is present or not
   - Type of soil
   - Depth of grave

- Early burial delays the putrefaction

Casper's Dictum: rate of putrefaction remains the same with the temperature being same in each case i.e.,

- One week in air
- 2 weeks in water
- 8 weeks when buried in soil

Putrefaction and Arsenic Poisoning: arsenic poisoning retards putrefaction. Arsenic poisoning also causes dehydration, which resists putrefaction.

Maceration: aseptic autolysis of dead fetus in uterus is called maceration.

- Softening and degeneration of dead tissues occur
- Bony junctions of skull, joints become lax and abnormally mobile
- Skull bones over-ride each other -Spalding's sign - an important radiological sign even when child is in uterus
- No tone in the body muscles child flattens on the table
- Cuticle is raised, blisters are seen which contains fluid, blisters when rupture reddish brown true skin appears
- These changes are noted when fetus is dead before delivery
- If fetal membranes rupture putrefaction occurs instead of maceration

Its medicolegal importance is as:

- Maceration shows dead child birth
- Red condition is important as it shows still birth

Maceration	Putrefaction
1. Aseptic autolysis	Septic autolysis
2. Rancid odor	Foul smell
3. No gas formation	Gas formation
4. Skin is brownish	Skin is purple green

ii. **Mummification:** in dry sand soil of desert, soft body parts shrivel up but retain natural appearance and when environmental conditions cause drying rapidly - decomposition stops skin becomes hard, dry, leathery, rusty brown and adheres closely to bones. Mummification requires well-drained warm environment with ventilation. Time interval varies from 3 months to 2 years. Important factors are absence of dampness and dry or warm air. Cases are reported in which fetus placed in chimney was mummified.

iii. **Adipocere Formation:** also called saponification. When dead body is left in moist place, in water or damp earth, putrefaction stops and is replaced by adipocere formation. 1) is wax like, greasy, soft, white or yellow in color, melts at flame or burns with cheese like smell and floats in water and is soluble in alcohol. Time period required is from 7 to 35 days.

iv. **Physiological Changes:** changes in eyes are important:-

1. There is triangular discoloration of sclera (brownish, discoloration) with base towards periphery within 3 hours.' It is called Tache-Noiches-Scleatiques

2. Area around white disc becomes yellow
3. Choreoretinal vessels give hazy pattern within 3 hours
4. At 6 hour disc outline is blurred
5. At 12 hour disc is very difficult to be seen
6. 12 to 15 hours disc is mingled with deep brown colored macula

Biochemical Changes: when autopsy reveals no significant result then biochemical analysis helps in evaluation of many aspects of cause of death

a. Blood

1. There is rise in non-protein nitrogen upto 100mg/dl
2. Urea nitrogen also increases - about 75mg/dl
3. Lactic acid accumulates
4. Amino acid nitrogen rises upto 12mg/dl

These changes are seen due to increased tissue break down. Other changes are:

5. pH is first acidic due to CO_2 and lactic acid accumulation, 24 hours after death NH_3 is produced due to putrefaction and pH becomes alkaline
6. Plasma Chloride ion concentration falls to 74mmol/L and upto 37mmol/L in 72 hours (normal is 95-105mmol.L)
7. Concentration of Mg^{++} rises to 8 times normal in 72 hours (normal is 0.07-1.2mmol/L)
8. K^+ concentration also rises
9. Enzymes concentration also rises
   - Amylase concentration rises in 34 - 48 hours
   - Phosphatase concentration rises in 34 - 48 hours
   - Transaminase concentration rises in 48 - 60 hours
   - DHG concentration rises 4th day after death
10. Sugar and urea levels also rise due to postmortem glycogenolysis. Glucose concentration in 300mg/dl in the blood of inferior vena cava. Urea level rises up to 150mg/dl and creatinine level rises above 10mg%

b. CSF

CSF amount is 150ml it disappears in 24-48 hours in 1st 15 hours

- Lactic acid concentration rises from 15mg to 20mg%
- Non-protein nitrogen rises from 15mg to 40mg%
- Amino acid nitrogen rises from 1mg to 12mg%;
- If level of amino acid nitrogen is less than 14mg% time since death is less than 12 hours. If non-protein nitrogen level is less than 80mg% time since death is 24 hours or less. If creatinine level is less than 5mg% time since death is less than 12 hours and if phosphorous level is less than 15mg/dl time since death is less than 10 hours.

c. Vitreous

There are no bacteria in vitreous. There is steady rise in K^+ concentration over 100 hours by 0.17mEq/L; it is more reliable. Pyruvic acid and ascorbic acid levels also rise.

TIME SINCE DEATH

1. Cooling of Body:
   - 1°F fall = 1st 3 hours
   - 2°F fall = next 3 hours
   - 2°F fall = next 3 hours
   - 1.5°F fall = next 3 hours
   - 1.75°F fall = in next 12 to 15 hours
2. Postmortem Lividity:
   - Some mottled patches = 1 to 3 hours after death
   - Patches increase in size and coalesce = 3-6 hours after death
   - Fully developed and fixed lividity = 6 to 12 hours after death
3. Rigor Mortis:
   - It commences 2 to 3 hours after death
   - Takes 12 hours to develop
   - Remains for 12 hours
   - Passes in next 12 hours
4. Putrefaction:
   - 12 to 24 hours around caecal area
   - In next 24 hours spread on whole of abdomen
   - Marbling starts 24 hours after death and is prominent in 36 to 48 hours
   - 18 to 36 hours flies lay eggs
   - In about 24 hours there is hatching of eggs
   - 3 to 5 days pupa are formed
   - In 4 to 5 days adult worms are seen
5. Contents of Stomach and Bowel:
   - Chapatties are digested in 2 hours
   - Dals are digested in 2 hours
   - Rice grains are digested in 3 hours
   - If stomach of dead is full and food particles are distinguishable it means death has occurred within 2 hours
   - If stomach of dead is full and food particles are not distinguishable it means death has occurred within 4 hours
   - Breakfast in stomach - death in morning
6. Feces in Bowel:
   - If feces are present in bowel: it may be a night death
   - If feces are not present: probably it can be day time death
7. Contents of Bladder:
   - If bladder is empty: day time death

- If urine is present in sufficient amounts: probably it can be a night time death

8. **Biochemical Changes:**
   - In CSF
   - In blood discussed already
   - In vitreous humor
9. **Circumstantial Evidence:**
   - Hair growth on face is 0.4mm/day
   - Louses die in 3 to 6 days in hair
   - Night death = death at night
   - Freshly shaven face = morning time death (probably)
10. **In Drowning Cases:**
    - Non-digital, non-water proof watches stop immediately as soon as person drowns in water
    - Cooling rate is 2 x that in air
    - Rigor appears early
    - Floating of body in summer; within 24 hours
    - Floating of body in winter; within 2 to 3 days

☆☆☆☆☆☆☆

Chapter-4

Personal Identity

Definition: it is defined as determination of individuality or recognition of a person or dead body, it simply means identification of a person. Person may be specific, unknown and missing.

Complete Identification: it is absolute fixation of individuality of a person.

Partial Identification: means identification of some facts (e.g. race, sex, age, and stature) about identity while other remains still unknown.

Identification: here exact fixation of identity is not possible; for example unknown dead body is found at some place and no one knows about the person. Here police assigns an alphabet for that body.

Quetlet's Rule: for identification scientists make a rule called Quetlet's Rule "No two individuals are same". Question of identification may arise in living and dead both cases.

Corpus Delicti means element of predefined criminal act. It is established after full examination of the body and scene of crime.

IDENTIFICATION IN LIVING

a. In Civil Cases
   - Identification of religions
   - Insurance
   - Inheritance claims
   - Marriage
   - Disputed sex
   - Missing Person etc.

b. In Criminal Cases
   - Absconding Soldiers
   - Criminals
   - Person accused of assault
   - Zina-bil-jabr
   - Impersonation
   - Interchange of new born babies at maternity homes

IDENTIFICATION IN DEAD

In dead identification is required in

1. Cases of fire, explosion, travel accidents etc.
2. When unknown dead bodies are found
3. In cases of decomposed bodies

PRINCIPLES GUIDING ESTABLISHMENT OF IDENTITY

These include the following:-

1. Approach should be systematic
2. Examination should be complete
3. There should be subjective as well as objective approach

IDEAL TEAM FOR ESTABLISHING IDENTITY OF AN ADULT

Establishment of identity is teamwork. It should consist of following members:-

- Medical jurist
- Forensic anatomist
- Forensic radiologist
- Forensic odontologist
- Forensic serologist
- Forensic histopatliologist / bacteriologist
- Forensic analyst
- Forensic science experts

TECHNIQUES OF IDENTIFICATION

a. **Identification in Pakistan:**
   - ID cards with photographs or thumb impression
   - Marks of identification
   - Finger prints

b. **Technology for Criminals:**
   - Identification by Photographs
   - Identity kit

c. **Latest Techniques:**
   - Cheloscopy (lip printing)
   - Finger nail striation pattern
   - Retinal blood vessel pattern
   - Determination of blood stains
   - Speech spectrograph
   - Voice printing
   - DNA finger printing

d. **Surest Method:**
   - Skull suture pattern (by X-ray in life)
   - Dactylography
   - Frontal air sinus pattern (by X-ray in life)

- Dental data (record)

METHODS OF EXAMINATION

There are 3 methods of examination of personal identity:-

1. **Subjective:** it is identity of person be analysis of information collected regarding:
   - Anatomical data
   - Specific data
   - Pathological data
   - Genetical data
2. **Objective:** this method is employed when body is mutilated or in cases of fragmentary remains. Other particulars like bloodstain, hair, fiber dust etc. are present. Association of a particular thing to its source is studied.
   - Biological objective method (hair. nail, bones, DNA analysis etc.)
   - Non-biological objective method, in this clothing, belonging and name tags etc. are examined
3. **3rd Party:** in medical examination there are 2 parties
   - Medical examiner
   - Victim or offender (examinee)

   When a relative, friend or police (3rd party non-of the above 2 parties) identifies the examinee, it is 3rd party examination.

PARAMETERS OF IDENTIFICATION

These include:-

1. General Data
   - Age
   - Sex
   - Stature
   - Religion
   - Race
   - Congenital Features (body prints, anthropometry and congenital malformations)
   - Acquired peculiarities (scars, occupational marks, tattoo marks and acquired malformations)
2. Dental Data
3. Skeletal Data
4. Genetical Data (in case of decomposed body)
5. Radiological Data
6. Identification by Trace Evidence (dust on clothing, nail scrapings etc)
7. Miscellaneous
   - Movements of a person
   - Gait

- Gesture
- Posture
- Personal belongings
- Photographs
- Voice recognition
- Hand writing
- Habits.

1. Age

Ages of Medicolegal Importance

a. Intrauterine Life Time: this is divided into 3 stages

1. From 1 -3 weeks in pre-embryonic stage
2. From 4-8weeks in embryonic stage (organogenesis)
3. From 9th week up to the 10th lunar month is the fetal period

If abortion is done before organogenesis it is called *Isqat-i-Hamal* and after this is called *abortion*. For criminal abortions punishment is more if done after the stage of organogenesis.

b. Extra uterine Life Time: some important aspect of medicolegal aspects of age relating extra uterine life are:

1. A child below 7 years is presumed by law to be incapable of committing an offence, hence no punishment is give
2. A child above 7 years and below 12 is presumed to be capable of committing an offence if he has attained sufficient maturity of understanding to judge the nature and consequences of his act
3. A child under 12 years cannot give a valid will
4. A person becomes major if he has attained age of 18 (for female age limit is 16)
5. A minor cannot sell the property and make a valid will and serve on jury
6. If husband does intercourse with his wife, below 13 years of age (with or without any consent) is rape
7. Below 15 years is child age no child is allowed to work in a factory
8. No one is allowed to work in mine below 17 years of age
9. For government service ordinary limit is 25 years
10. For Pakistan health service age limit is 35 years
11. At the age of 5 years age certificate is required for admission is school etc
12. Kidnapping and abduction:
    - i. Kidnapping refers to taking away minor under (14 year male) and (16 years female) out of their lawful guardian without the consent of such guardian. (U/S 361 PPC)
    - ii. To import girls under 21 years of age from foreign country for purpose of, Illicit intercourse is an offense (U/S 366-B)
    - iii. Abduction refers to a person who compels another by force or by deceitful means to go from on place to another with bad intention (i.e. murder, wrongful confinement U/S 365 PCP). In general terms it applies to grown ups (any age)

Kidnapping	Abduction
Committed only in respect to a minor (male below 14 years & female below 16 years) or a person of unsound mind	Committed in respect of a person of any age
The person is moved out of lawful guardianship. A child without a guardian cannot be kidnapped	Abduction has reference exclusively to the person abducted
The means used may be innocent	Force, compulsion or deceitful means are used
Consent of a person taken or enticed is immaterial	Consent of the person removed, if freely or voluntarily given, condones abduction
Intent of the offender is a wholly irrelevant consideration	It is all important factor
Kidnapping from guardian is substantive offence under the code	It is an auxiliary act, not punishable by itself, but made criminal only when it is done with one or other of the intents specified in section 364 PPC

Parameters of Age Determination

a. **Intrauterine Life:** For determination of fetal age we have 4 parameters

1. *General Appearance:-*
    - i. From 1-3 weeks
        - Crown rump length is about 1-3cm at 3rd week
        - There are 1-3 somites on 1st day
        - There are 40-42 somites on 30th day
    - ii. In embryonic Stage (organogenesis)
        - Length is about 1 -4cm
        - Weight is about 10-15gm
        - Pharyngeal arches appear
        - Limb buds appear
        - Ossification center for skull, mandible, clavicle and vertebrae appear
    - iii. At 5th month
        - Vernex caseosa
        - Languohair
        - Eyebrows
        - Testicles start descending

iv. At 7th month
- Nails at finger tips
- Eye lids open
- Pupillary membrane disappears

v. At 9th month
- Languo hair absent
- Vernex caseosa at joints
- Nails grow beyond tips
- Testicles in scrotum

2. ***Length of Fetus:-***

Hess's Rule:

Before 5th month of intrauterine age; square of number of calendar months is length of fetus in "cm"

After 5th month of intrauterine life multiplication of number of calendar months of gestation with 5 gives length of fetus in "cm"

3. ***Weight of Fetus:-***

At 20th week - 400gms
28th week - 100 to 1300gms
40th week - 2700 to 3500gms

But exceptions are seen in cases of multiple births, sex of fetus (male is 100gm heavier than female counterpart) and placental diseases.

4. ***Appearance of Ossification Centers:***

5-6 week	skull and clavicle
8-week	primary centers for long bones
9th month	ischium and pubis; lower end of femur and upper end of tibia

b Extra uterine Life:

At birth following changes are seen:
- Closure of umbilical vessels
- Closure of ductus arteriosus
- Closure of foramen ovale
- Fetal Hb
- Changes in umbilicus

Age is estimated by following 3 parameters in life:-

1. General Appearance:
- Height

At birth	45-50cm
End of 6th month	60cm
End of one year	68cm
End of 4th year	90-100cm

From 4th year onward great variations are seen.

- Weight

At birth weight is about 2.5-3Kg. Onward till first year it increases by 0.5 Kg/month after first year great variations are seen in the weight of child.

- Puberty Changes

Male
- Genitalia enlarge
- Voice gets deeper
- Adam's apple enlarges
- Pubic hair appear at the age of 14 years
- Axillary hair appear at the age of 14 years
- Hair on chin and upper lip appear between 16 to 18 years

Female
- Genitalia enlarge
- Menstruation starts
- Fat distribution becomes typical
- Pubic hair appear at the age of 15 years
- Axillary hair appear at the age of 16 years
- Breast develops between the age of 13 to 14 years

Development of pubic hair passes through following stages in both the sexes

1. Few, long, curly hair develop on the base of penis and around labia majora
2. Hair become coarser, darker, more curled and spread over junction of bones
3. Hair develop as the adult hair are but they are absent on the medial aspect of thighs
4. Hair are of adult type present on the medial aspects of the thighs and horizontally over pubis in females and towards umbilicus in males

Adolescent development of breast passes through following stages in female

1. Breasts and nipples are elevated as small heaps and areola enlarges
2. More elevation and enlargement
3. Areola and nipples project over breast
4. Areola merges with general contour of breast and only papilla project over it

Old Age Changes Also Called Degenerative Changes

i. Wrinkling on the face (loss of connective tissue in subcutaneous areas) at the age of about 40 years
ii. Arcus senilis (ring of opacity in peripheral zone of cornea due to degenerative changes) appears in about 40 years of age. It is complete at about 60 years.
iii. Appearance of cataract at the age of 40 years
iv. Hair in external auditory meatus seen by the age of 50 years
v. Baldness of scalp and graying of hair 1st start from temple after 40 years; followed by graying efface, axillary, chest, breast and pubic hair after 50/55 years
vi. Menopause by the age of 40/45 years

vii. Brown atrophy of the heart

viii. Calcification of the cartilage after 40 years

2. *Information from Teeth:-*

There are 2 sets of teeth; 1st is temporary (deciduous or milk teeth) start appearing at the age of 6 months and completed about 2½ years of age and begin to shed from 6-7 years (as 1st permanent molar tooth erupts behind 2nd temporary molar tooth. Period of mixed dentine is about the age of 12 to 13 years.

A child should have:

- 8 teeth at 1st year of life
- 16 teeth at 1½ year
- 20 teeth at 2 – 2½ year

Dental Formula of temporary teeth:

	Right			Left		
	Molar	Canine	Incisors	Incisors	Canine	Molars
Upper Jaw	2	1	2	2	1	2
Lower Jaw	2	1	2	2	1	2

Milk or Temporary Teeth:

Teeth	Eruption	Calcification
Central incisors (Lower Jaw)	6 - 8 months	1½ - 2 years
Central incisors (Upper Jaw)	7 - 9 months	1½ - 2 years
Lateral incisors (Lower Jaw)	10 - 12 months	1½ - 2 years
Lateral incisors (Upper Jaw)	7 - 9 months	1½ - 2 years
1st molar (Upper and Lower)	12 - 14 months	1½ - 2 years
Canine	17 - 18 months	1½ - 3 years
2nd molar	20 - 30 months	3 years

Permanent teeth are 32 in number usually appear 1st. in lower then in the upper jaw.

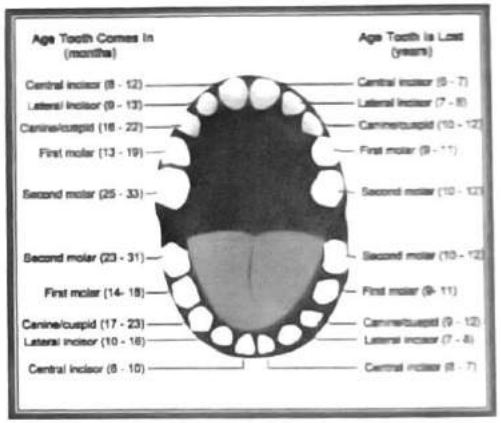
Dental Formula of permanent teeth:

	Right				Left			
	Molar	Premolar	Canine	Incisor	Incisor	Canine	Premolar	Molar
Upper	3	2	1	2	2	1	2	3
Lower	3	2	1	2	2	1	2	3

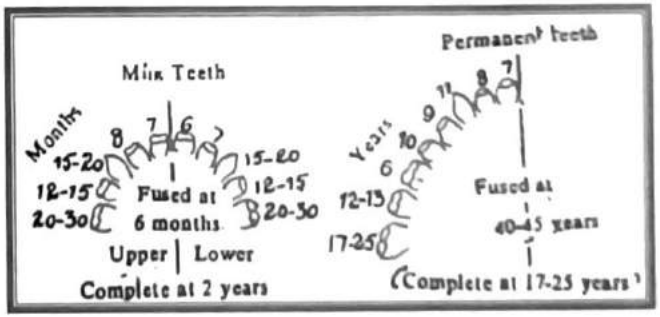
Permanent Teeth:

Teeth	Eruption	Calcification
1st molar	6 – 7 years	9 – 10 years
Central incisors	7 – 8 years	10 years

Teeth	Eruption	Calcification
Lateral incisors	8 – 9 years	11 years
1st bicuspid	2 – 10 years	12 – 13 years
2nd bicuspid	10 – 12 years	13 – 14 years
Canines	11 – 12 years	13 – 15 years
2nd molar	12 – 14 years	14 – 16 years
3rd molar	17 – 25 years	18 – 25 years



Calcification is seen by X-ray



Wisdom Teeth:

Presence of 4 wisdom teeth means that subject has passed the age of 17 years. But absence gives no certain indication of age. If wisdom teeth are retained, X-ray should be taken to ascertain that roots are calcified or not. If not age is below 25 years, complete calcification takes place 3-4 years after eruption.

Boyde's Method:

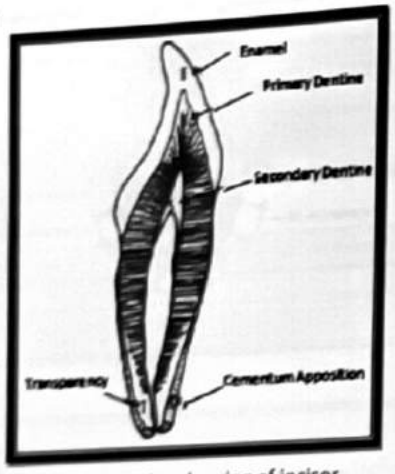
It is age estimation by incremental lines and neonatal line on the teeth. *Incremental Lines* are seen on histological section and represent daily increment of growth. These are in the form of cross-striations.

Their number gives age in days we start counting from neonatal line. *Neonatal Line* is a well-marked line formed at birth.

Gustafson Method:

It is done in elderly people. Gustafson devised Gustafson method; microscopic examination of longitudinal section of central part of tooth to access wear and tear in the teeth by growing age. These changes are graded in 6 types.

1. Gradual wearing out of teeth
2. Periodontosis or loosening of teeth
3. Secondary dentine formation (filling of root)
4. Cementum apposition
5. Root resorption
6. Root transparency



Sagittal section drawing of incisor.

Difference between Temporary and Permanent Teeth:

Temporary Teeth	Permanent Teeth
Small, narrow, light, delicate (except temporary molars are longer than permanent premolars replacing them)	Big, broad, heavy and strong (except permanent premolars replacing temporary molars)
Crowns are china white in color	Crowns are ivory white in color
Junction of crown with fang is marked by ridge	Junction not so marked
Neck is constricted	Neck less constricted
Edges are serrated	Edges not serrated
Anterior teeth vertical	Anterior teeth inclined forward
Molars are larger, their crowns are flat and roots are smaller and divergent	Premolars replacing temporary molars are usually small, crowns have cups roots are bigger and straight
These are 20 in number	These are 32 in number

3. ***Information from bones:-***

It is also known as forensic osteology. Changes in bone occur from fetal life till senility. Study of bone is done by 2 methods.

Objective Method:

Increase in length of long bones is proportionate to increase in height and advancing age upto attainment of maturity (18-25 years). So length of long bones by themselves can be used as an identification of age. Femur is important one to study.

Subjective Method:

Identification is done as:

Appearance of primary centers Appearance of secondary centers Union of epiphysis and diaphysis Retrograde changes

We study the bone by physical examination, dissecting the bone and locating the centers, radiological examination. Union of epiphysis in cartilaginous bones takes place earlier in females by about 2 years.

Age	Particulars
At birth	Centers of ossification appear in talus, lower end of femur, calcaneum, upper end of tibia, head of humerus, cuboid Healing of umbilicus
At 6 month	Fusion of 2 parts of mandible
At 1½ years	Anterior fontanelles should close
At the end of 2 years	Metopic suture close
2 – 6 years	Number of carpal bones indicate the age in years center of 1st at 2nd year, 2nd at 3rd year, 3rd at 4th year, 4th at 5th year, 5th at 6th year
7 – 8 years	Rami of pubic and ischium close
8 years	Center appears for ossification of olecranon
10 – 12 years	Pisifom ossifies
13 – 14 years	Lateral epicondyles of humerus unites
15 – 16 years	Head of calcaneum unites Tri-radiate cartilage of acetabulum units
16 – 18 years	All epiphysis of elbow joint (except medial epicondyle) unite with respective bones
18 – 20 years	Lateral end of clavicle unites Acromion unites with scapula All epiphysis at knee unite
21 – 23 years	Iliac crest fuses

Age	Particulars
23 years	Sacral vertebrae unite
14 – 25 years	Pieces body of sternum unite
After 25 years	Sutures of skull start ossifying. 1st on inner aspect, later on outer aspect
30 – 35 year	Sagital suture ossifies
35 – 40 years	Coronoid suture ossifies
40 years	Xiphistermum unites with the body of sternum
40 – 45 years	Atrophic changes start in vertebral disc
After 40 years	Lipping of vertebrae starts
40 – 50 or at 80 year	Lambdoid suture ossifies
At 70 years	Spheno-parietal suture closes
In old age	Manubrium unites with body

Age from Mandible:

1. Infant: the ramus is short and makes obtuse angle with body, coronoid process project above condyle and mental foramen in lower part and teeth are 10 in number.
2. Adult: ramus makes an angle of 90° with the body, mental foramen is in the center of the body, condyle projects above coronoid process and the teeth are more than 10 in number.
3. Old Age: ramus makes obtuse angle, mental foramen is near upper border of body.

X-rays for Age:

- Child — Wrist & hand
- Adult — Elbow, shoulder, pelvis and knee
- Old age — Skull, vertebrae, sternum

Region	Boys	Girls
Elbow	15-17 years	13-14 years
Wrist	18-19 years	16-17 years
Shoulder	19-20 years	17-18 years
Crest of ileum	18-25 years	21-22 years

2. Sex

Subject: may be dead living or a skeleton. Aim is to identify the sex for civil rights, heirship, marriage, military service, impotency, sexual offences, legitimacy etc.

Inter Sex State: these are the states in which male and female characters co-exist in varying proportions in same individual.

- Cause, defective development of the cells at some stage in early fetal life or defective germ cells formation
- Types: these are mainly divided into 4 main types
  1. *Gonadal Agenesis:* sexual organs have never developed

2. *Gonadal Dysgenesis:* external sexual structures are present but testes or ovaries fail to develop at puberty e.g.

   Klinefelter Syndrome: boy grows and develops normally till puberty but then one or more of the following features appear small formed testes, gynaecomastia, signs of eunuchoidism (long arms, legs, scanty pubic hair and poor or no breast growth. These are chromatin positive with XXY chromosomes called synthetic males.

   Turner's syndrome: girl is characterized by mainly following three features; sexual infantilism (small sex organs), short stature and congenital anomalies. Girls are chromatin negative with OX, called synthetic females.

3. *True Hermaphroditism:* external genitalia are of both sexes and internal may consist of ovaries and testes or ovotestes. Power of self-reproduction is not found and surgical interference is often needed for their social rehabilitation with a particular sex. Nuclear sex usually but not always female.
4. *Pseudohermaphroditism:* there is lack of clear-cut differentiation. Internal genitalia are iso-sexual. These are classified as males or females according to presence of testes or ovaries.

Methods of Sex Determination: there are 7 methods of sex determination:

1. ***General Appearance:***

   In this we see:
   - Facial appearance
   - Body habits
   - Clothing
   - Gait
   - Hair
   - Voice

2. ***Secondary sex Characters:*** these are characters of body, which make their appearance under influence of sex chromosomes at puberty.

   In males:
   - Hair distribution over pubis, along linea alba, on chest, on face, on back
   - Baldness over frontal prominence
   - 1st cracking voice and then typical masculine bass voice
   - Acne
   - Decreased subcutaneous fat

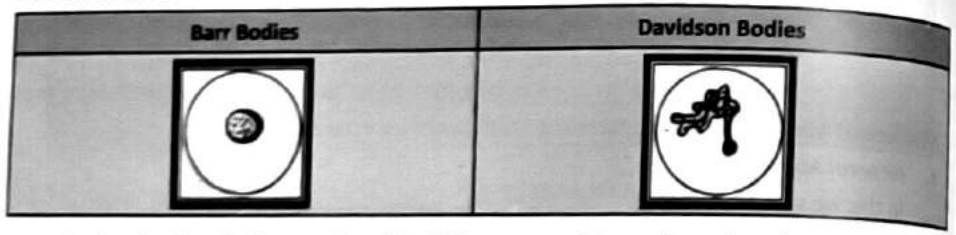
   In females:
   - Hair distribution over pubis and axilla
   - Softness and smoothness of skin
   - High pitched voice
   - Broadening of pelvis
   - Characteristic breast development

3. ***Gonadal Tests:*** these include internal and external examination and also include the gonadal biopsy tests. Tests for sex in adults are:
   - Presence of testes in males
   - Presence of ovaries
   - Menstrual periods in females

- Local examination (PV examination)
- Gonadal biopsy

4. ***Nuclear Sexing:*** It is very helpful in following cases:
   - Doubtful cases
   - Mutilated bodies
   - Fragmentary remains

It is based on the principle that chromatin materials of the two sexes are different. Mr. Barr described the *Barr Bodies*. These are minute condensation of nuclear membrane. Its diameter is 1.5-0 7il. Its shape is Plano convex. *Davidson Bodies* it is thin stalked drum like projection of polymorphs in females. Its diameter is about I5μ. It is present in 6 cells out of every 227 cells. These can be studied from bloodstains.



- In females barr-bodies are found in 40% or more of her cells and so females are called chromatin positive
- In males 10% of his cells or less show barr-bodies and they are called chromatin negative
- Tissues used for identification of barr-bodies are skin biopsy materials, buccal scrapings, cartilage, bone marrow, nuclei of smooth muscle cells

Chromosomes are autosomes and sex chromosomes. There are 44 autosomes; in males we have XY sex chromosomes but in females we have XX.Y chromosome is particular male chromosome and determines the male sex. It is fluorescent to qumacine. Tissues suitable to demonstrate sex chromosomes are blood, cartilage cells, bone marrow, teeth pulp, hair follicle cells (hair are resistant to putrefaction so these are of special interest - as they remain for longer time) *Study of Bones:* It is done to find sex when body is decomposed. Following bones help in sex determination after puberty (pelvis, skull, sternum, sacrum, femur, humerus , mandible, teeth) Chances of Sex Determination: -

Entire skeleton	100%
Pelvis + skull	98%
Pelvis	95%
Skull + long bone	92%
Skull	90%
Long bones	80%
Sternum	80%

For bone examination there are 2 approaches; subjective and objective: -

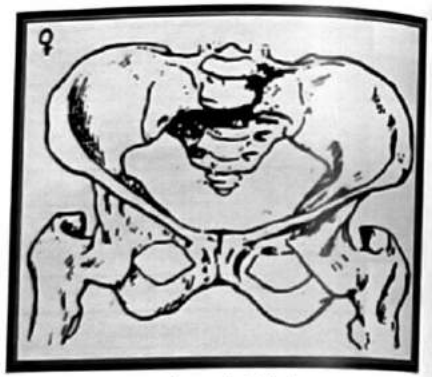
a. Subjective Approach: Here we study morphologic features of bones it may be general and special.
   - General Subjective Approach - male bones are rigid, rough, heavier, larger, and thick in consistency with prominent muscle marks. Female bones are opposite to this
   - Special Subjective Approach - in this distinguishing features of individual bones are considered

Bone	Feature	Male	Female
SKULL	Consistency	Thick	Thin
	Capacity	More	Less
	A-P aspect	Larger	Round
	Fore-head	Rounded	Larger and inclined
	Cheek bones	Heavier	Lighter, cylindrical
	Supra-orbital ridges	Less prominent	More prominent
	Frontal protuberance	Less prominent	More prominent
	Mastoid process	Larger	Smaller
	Occipital protuberance	Very prominent	Less prominent
	Nuchal line	More prominent	Less prominent
	Orbit	Small square	Large round
	Orbital margins	Round	Sharp
	Nasal aperture	Higher, narrow	Broader
	Nasal margin	Sharp	Rounded
	Nasal bone	Large	Small
PELVIS	Ilia	Vertical	Flat, outward spread
	Iliac Crest	Inverted	Everted
	Iliac fossa	Deep	Shallow
	Pubic tubercle	More marked	Less marked
	Preauricular sulcus	Not marked	Less marked
	Acctabulum	Broader	Narrow
	Obturator foramen	Oval	Triangular
	Ischiopubic Rami	Acute	Broad
	Pubic angle	Straight	Everted
	Sacrum	Long narrow	Short, broad
	Iliopectencal line	Small	Long
	Pelvis as a whole	Heavy, thick	Small
	Pelvic brim'	Kidney like	Circular
	True pelvis	Small	Oblique, shallow
MANDIBLE	Mandible as a whole	Large, thick	Small, thin, lighter
	Angle	Rounded	Acute
	Ascending ramus	Broader	Narrower
	Condyles	Larger	Smaller
	Chin	Square	Rounded
FEMUR	Diameter	Large	Small
	Intercondylar width	Large	Small
	Intertrochanteric line	Larger	Smaller
	Neck - shaft angle	125cm	95cm
	Condylar breadth	More	Less

b. Objective Approach: scientific measures are considered in it:

- Ilio-pubic index (IPI) = Ischial length / pubic length X 100
- Sacral index (SI) = Breadth of sacrum / Length of sacrum
- Vertical diameter of head of femur — Male = 47cm or more; Female = 45cm or less
- Condylar width of femur — Male = 78cm or more; Female = 74cm or less
- Vertical diameter of head of humerus — Male > 45.5mm; Female < 41.5mm

Male Pelvis



Female Pelvis

Sex Determination by Looking at Person

Male	Female
Larger built and greater muscles	Smaller built and lesser muscles
Broader pectoral than pelvic region	Broader pelvic .than pectoral region
Waist is ill-defined	Waist is well defined
, Buttocks are flatter and contacted	Buttocks are full and rounded
Thick hairs extending from pubis lo abdomen and more or less on whole abdomen	Thin pubic hairs covering the molls vernis only
Hairiness of face after puberty	No hairiness of face
Scalp hair are shorter, thicker and coarser	Scalp hair are longer, thinner and finer
Adam's apple prominent	Adam's apple not prominent

2. Stature

It is an important character and provides important assessments in identification of human remains. Stature is determined as: -

1. *If Complete Skeleton is Available* stature is determined as
   Stature = Length of skeleton + 2.5cm (for soft body parts)
2. *If Complete Skeleton is Not Available*: body is cut into pieces then:-

- Length between tips of both middle fingers (of hands) when arms are fully stretched = Stature
- (Length from vertex to top of pubic symphysis) X 2 = Stature
- (Length from heel to top of pubic symphysis) X 2 = Stature
- (Length of one arm) X 2 + 34cm for sternum and two clavicles = Stature

3. *Stature from Long Bones:* when only long bones are present then stature is determined as Stature = Length of long bone X multiplying factor (different for different bones)
   - Humerus - 20% of body stature
   - Femur - 27% of body stature
   - Tibia - 22% of body stature
   - Spine - 35% of body stature

   Length of corpse is 2cm more than living person.

3. Race

Race determination arises when an unclaimed dead body is found. This is of considerable importance in air crashes, ship wrecks, railway accidents etc. Race can be determined from:-

1. *General Appearance:* It includes examination of clothes, complexion, hair, lips, eyes, teeth etc.
   - Clothes:
     Pakistani dress - Shalwar kameez
     Indian dress - Dhoti and Sari
     Western dress - Shirt, Skirt, and Frock
   - Complexion:
     Pakistani / Indian - Brownish
     Negro / Southern Indian - Black
     Europeans - White/ fair
   - Hair
     Pakistani / Indian - Black, Long, Fine
     Chinese / Japanese - Black, long, Thick
     Negro - Short, Curly
     Europeans - Brown, Reddish, Golden, Short, Fine
   - Lips:
     Negro - Thick, Everted
     Europeans - Thin, mainly inverted
   - Eyes
     Pakistani / Indian - Black or Brown iris
     Europeans - Blue or Gray iris
   - Teeth:
     Enamel of molar teeth extends up from dentine in Chinese. In Mongolians incisors are chisel shaped.

2. *Bones*: Skull and pelvis are important (by 2 types of examination - subjective and objective)

SKULL

Features	Caucasian	Negroes
Height	High	Low
Sagittal contour	Rounded	Flat
Face height	High	Low
Orbital openings	Angular	Rectangular
Nasal openings	Narrow	Wide
Lower nasal margin	Sharp	Guttered
Palate shape	Narrow	Wide

1. Cephalic Index (C.I.) = (Max. transverse breadth of skull) (max. AP length)

   Breadth = from tip of one mastoid to that of other

   Length = from glabella to external-occipital protuberance

   In Negroes CI = 70-74.9 = Dolicho-cephalic

   In Caucasians = 75-79.9 = Mesate-cephalic

   In Mongolians = 80 or above = Brachy-cephalic

2. Height Index (H.I.) = (Height of skull - from tip of mastoid to bregma) / (length of skull)

   In Negroes =72

   In Europeans = 71

   In Mongolians = 75

3. Nasal Index (N.I.) = (Width of nasal aperture) / Height of nasal aperture) X 100

   In Negroes = 55

   In Europeans = 46

   In Mongolians = 50

4. Religion

Mainly it is not the question, but some times it may arise. We can differentiate between Mohammedan and Hindu by following data:

1. Hindu male is not circumcised but a Muslim and also Jews are circumcised
2. Hindus have sacred thread over left shoulders not the Muslims
3. Hindus mostly have necklace of wooden beads
4. Callosity on the center of forehead, tuberosity of left tibia, tip of left lateral maleolus are seen due to specific posture in prayers in Muslims
5. A tuft of hair in the middle of back of head (grown longer) is seen in case of Hindu males
6. Ear lobules are pierced in case of Hindu male
7. Palm and fingers of Muslim male are sometimes stained with 'Hena'
8. Hindu females have mostly tattoo marks on hands, forehead and chests.
9. Red mark of sandoor is seen on forehead in Hindu females whose husband is alive
10. Hindu women mainly wear Saree
11. Callosities are found due .to offering prayers in cases of Muslim women
12. Muslim women remove pubic hair after menstrual cycle is over

5. Congenital Features

These provide very important information for the identification of a person.

1. ***Anthropometery:*** Anthropos = (Man) Metery = (Measurements)

   It deals with measurements of various parts of human body, it was introduced by French Crimmologist

   - Alphoso Bertillon in 1882 hence called Bertillonage or Anthropomcfery.

   Principle:

   Measurements of various body parts do not alter after adult age (21 years) and no two persons show same measurements in all respects. There is registration of characteristics under 3 headings:-

   i. Descriptive Data = Color of hair, eyes, complexion, lips, shape of nose, ear and chin etc
   ii. Bodily Marks - Moles, scars, tattoo marks etc
   iii. Bodily Measurements - Standing height, sitting height, length of head, breadth of face, length of right ear, span of out-stretched arms, length of left foot, left middle finger, left little finger left forearm and hand.

   Drawbacks:

   i. It is applicable to adults only
   ii. Many errors are introduced due to personal factors making identification impossible
   iii. Well-trained operators are required
   iv. Lot of hard work is required

2. ***Finger Prints:*** Dactylography or Gallon's System. This system was introduced by Sir William J. Herschcl, systematized by Sir Francis Gallon and elaborated by Sir Edward Henry. It means identification by digital - palmar prints. It is very valuable and surest method of identification.

   Principle:

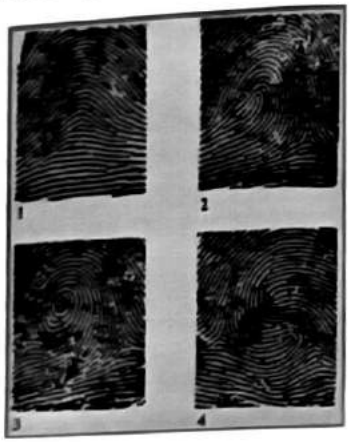
   Skin of balls of fingers and thumbs is covered with characteristic ridges and grooves (pattern of that is specific). Important characters of these are:-

   - Present from birth on dermis and epidermis
   - Remain for whole life cannot be altered
   - They form specific pattern
   - Chances of matching 2 prints are one in 64000 millions

   Classification:

   - Arch Pattern (6-7%): ridges run from one side of print to other in an arch like fashion. Ridges terminate at sides of prints approximately equidistant to each other and do not make back ward turn (no delta, no core). Arch pattern is cither plain or tinted.
   - Loop (67%); ridges in the center of the print arrange like hairpin, ends of which slant down wards. (One delta, one core). Loop pattern is radial or ulnar.
   - Whorl (25%): circular design of ridge grouping is conspicuous. Ridges take clockwise or anti clockwise turn (2 delta, one core).

- Composite (1-2%): It consists of 2 or more arches, loops, whorls with variable combinations. fingerprints are classified into 4 groups.



The four primary types of fingerprints.

1. Arch
2. Loop
3. Whorl
4. Composite

Advantage:

1. It is applicable to persons of all ages
2. Prints can be obtained even from putrefied body
3. Absolute identification is possible
4. No special training or experience or instrumentation is required
5. Actual print is always available to compare it with suspected one
6. Print can be transmitted from one place to another place by code message
7. Print can be preserved for long time

Recording:

- Plain Impression: obtained by lightly pressing inked surface of tip of finger or thumb directly on paper
- Rolled Impression: obtained by rolling inked finger or thumb from side to side

Fingers are washed, cleaned, dried, print is taken by printer's ink and on white paper. In case of criminals impressions of all fingers of both hands are taken. If impressions are faint, they can be made visible by special techniques e.g., by use of dusting powder. In dead body if fingertips are dried up print can be taken after soaking the fingers in alkaline solution for sometime. If skin has been pealed off, prints can be recorded from dermis or even from the pealed of skin hardened by formalin. Preservation:

Finger Prints on paper, wood and cloth may be successfully developed by treating with 5% $AgNO_3$ solution and then fixing with sodium thiosulfate. Fingers and hand are cut and preserved by placing them in 70% alcohol. Practical Application:

1. Identification of both living and dead
2. Recognition of culprits
3. Identification of weapon used
4. Identification of decomposed body
5. To avoid any legal complication

Precautions:

1. Finger should be clean and dry
2. If necessary apply olive oil
3. Apply ink gently
4. In criminal case take fingerprints of all fingers
5. Do not take print if person is suffering from leprosy
6. Members of investigating team should refrain unnecessary touch or handling the objects at scene of crime, as this may destroy the finger prints

3. *Poroscopy: (Locard's Method)* Ridges of the fingers and hands are studded with minute pores; i.e. mouth of ducts of sweat glands. Their pores are permanent, different in number, size, and shape arrangement for a given area in each individual. This method is called poroscopy. Medicolegal Importance: It is useful when only part of finger or fingerprint is available.
4. *Foot Print:* it refers to impression left by sole of foot. Footprints experts maintained by police are "Puggie".

   Principle:

   Skin pattern of toes and heel is distinctive no matter how much feet grow, lines will grow with them and pattern does not changes. Footprints are taken in maternity hospitals to avoid accidental exchange of babies and also in air force pilots to identify him in crashes. Impression persists for 4 years, if not disturbed.
5. *Lip Prints:* Now a days these are thought to be the surest method for identification. It is easy and quick method.
6. *Congenital Malformations:* Include, supernumery fingers, webbed fingers, harelip, cleft palate, undescended testes, birthmarks, moles etc.

6. Acquired Features

Acquired features like scars, occupational marks, tattoo-marks, acquired malformations, help a great for establishing identity.

a. *Scars:* scar is cicatrial mark, which results from healing of a wound

   Features:

   - No hair follicle
   - No sweat gland
   - No pigment
   - No elastic tissue
   - Only few layers of simple epithelium cover it
   - It is permanent or may be removed surgically

   Appearance: appearance of scars depends upon

   - Nature and size of wound
   - Method of healing
   - Presence or absence of sepsis
   - Vascularity of part
   - Age and general health of person

Scars and Causative Agents: scars are caused by weapons and also by diseases

• Linear scar	incised wound
• Wide scar	gaping wound
• Elliptical scar	stab wound
• Irregular scar	lacerated wound
• Circular depressed scar	bullet wound
• Irregular scar with tendency to keloid formation	burns
• Linear scar with stitch marks	surgical operation
• Small pox vaccination scar	circular, pitted, oval

Age of Scar: can be determined by

• Reddish tender soft	up to 2 weeks
• Pale, tender, soft	up to 2 months
• White, little tender, soft	2-6 months
• Tough, while, glistening	6 months onwards

Examination of Scar: good light is very essential; record about:

- Number
- Site
- Size
- Shape
- Color
- Consistency (elevated or depressed)
- Relation to deeper tissues (fixed or not)

Faint scars in living are made visible by exposure to UV light or by massaging the area to increase the blood supply. In dead suspected area can be examined microscopically.
Medicolegal Aspects:

1. These help in identity
2. Shape of sear give clue about weapon used for injury
3. Age of scar corresponds to occurrence of event
4. Sometimes wounds are deliberately kept infected or covered with instants to cause slow healing and obtain big scar
5. Persons may claim scars due to diseases as scars by wounds
6. Scars from rupture of posterior commissure of vagina or tears in external os uteri are indicative of previous labor

b. ***Occupational Marks:*** these marks are characteristics, which result from adaptation to work and sometimes it is possible to determine occupation of a person by the presence of such marks.

Butcher's hand	Callosities
Blacksmith hand	Burn scars
Coal-miner hand	Tattooing
Smoker's hand	Ring marking
Tailor's hand	needle pricking (rough)

c. ***Tattoo Marks:*** these are designed by multiple small punctured wounds in skin by needles or penetrating tools doped in a dye.

Examination: these are examined by

- Microscope
- UV light
- Infra red photography

Describing Tattoo Mark: it includes

- Anatomical situation
- Size
- Color
- Design

Tattoo marks on unidentified putrefied bodies are photographed with sharp definitions. Sometimes loose and cut dermis is removed and design on dermis is recorded. Even if mark have disappeared from skin, evidence may be identified at autopsy on examining regional lymph nodes (for particles of dye). One can eliminate tattoo marks by dermabrasion, application of CO_2 snow, electrolysis, surgery, exposure to laser beam.

Medicolegal Importance:

1. It helps in personal identity
2. May indicate personal event of life (marriage, date of birth etc) Some ones race, religion, profession, social status
3. It may also indicate behavioral characteristics

d. ***Acquired Malformations:*** these are also important for establishing the identity of a person and include:

- Fractures
- Poliomyelitis
- Amputated limb

7. Dental Data

Forensic odontologists are permanent members of the identification team. Teeth are the hardest and chemically most resistant tissues of body. In 19th century 1837 Factory Act was passed; which included: Dental inspection for criminal responsibility

Teeth Development: start in 6th week of intra-uterine life from basal layer of epithelium of oral cavity.

Modes of Identification: by teeth examination are:

1. *Dental Chart:* inspection of teeth is an initial step in identification of dead. Record:
   - Number of teeth
   - Decayed teeth
   - Roots or stumps visible in mouth
   - Extraction
   - Fillings
   - Periodontal diseases
   - Nicotine staining in smokers
   - Pipe smokers may show wear of teeth in areas of supporting stem
   - Mal occlusion of usual type

In England under NIIS act 1971 following way of charting is recommended with symbol:

	M	M	M	P	P	C	I	I	I	I	C	P	P	M	M	M
Up																
Lo																

Following signs are placed in brackets in the boxes above for the corresponding tooth in order to complete the dental chart.

1. Intact tooth (.)
2. Recently extracted (x)
3. Tooth to be extracted (/)
4. Tooth missing (-)
5. Artificial tooth (A)
6. Root present (+)
7. Crown (c)
8. Cavity (o)
9. Filling (0)
10. Direction of movement of tooth

Correspondence with dental chart of unknown and record of an already known person gives proof of identity.

2. ***Identification by Dentures:*** important points to be noted are whether full or partial, upper or lower or both, mark of tooth, shade and mould of tooth.
3. ***Teeth - A Test of Age:***
   a. Intra-uterine Life:
      - 1st tooth develops in 3/4th month of intra-uterine life
      - By 5th month tip of crown of primary incisor calcify
      - By the end of 7th month, calcification in remaining teeth occurs
      - Width of dentine also gives idea in determination of fetal age
   b. At birth:
      - Presence of neonatal line followed by incremental line
   c. Extra-uterine Life:
      - By Boyde's incremental line
      - By Gustafsen's method
      - Types of dentition (Primary, Mixed, Secondary)
      - Eruption and shedding of teeth
      - All are discussed already in determining age by teeth

B. Identification by Skeletal Data

Questions regarding identification are:

- Bones belong to one or more persons
- Sex
- Age

- Race
- Stature
- Time since birth
- Special medicolegal findings, injuries or poisons
- Sex, age, race, stature determination are already discussed under those topics

Time since death:

Exact determination of date is difficult but precise estimation can be done. Steps in examination are: -

1. **Naked Eye Examination:** It is very deceptive. Bones with remains of periosteum, tags of ligaments or some soft tissues are less than 5 years old.
2. **Lab Examination:**
   a. Radioactive "C" estimation: carbon 14 is present in every living person. Its concentration starts decreasing after death. Takes 5600 years to reach half-life of its concentration. So by calculating decrease in carbon 14 age of the remains can be determined.
   b. "N" Contents: fresh bones contain 40-45gm% of "N". It decreases with time. A concentration of 2.5gm% indicates age of at least 350 years.
   c. Amino Acid Contents: upto 20 ammo acids are found in bones, which are less than 100 years old.
   d. Blood Pigments: if present bone is not old than 10 years,
   e. Immunological Activity: antigen antibody reaction occurs only upto few years after death. Another important aspect about bones is that they retain some amount of poisons for years like arsenic, lead, copper etc. mainly heavy metals. Fractures and dislocations can also be demonstrated by examinations of bones.

9. Pathologic and Genetic Data

Disease: Recognition of active or crude disease in living or dead person.

Blood Group: Detection of specific blood groups in a person or dead body helps in various medicolegal investigations e.g.

- Paternity / maternity disputes
- Identification
- Helps to assemble the scattered parts
- Association with crime

Various blood groups systems are based on the red cell antigens, serum groups, red cell enzymes, and human lymphocyte antigen.

Hemoglobin: In normal adult 3 different types of hemoglobin are found. HbA (normal adult Hb); HbA_2 (normally only 2-3% but in case of thalassemia its concentration is 73.5%); HbF (it is normal Hb in fetus, at birth 70-80% and at the age of 6 months and latter only 2%); HbH (it is an abnormal Hb, there is abnormal conjugation of P chains); HbS (found in cases of sickle cell anemia); HbD (found in Punjab); HbEetc.

Blood grouping and Hb type have medicolegal importance: -

1. Helps in paternity
2. In investigation of blood stains

DNA Finger Printing: Genetic make up of no two persons is same. There is a great variety of genetic variations. In this method DNA is cut into pieces, fragments are separated and biologic variations are noted. These have unique pattern may be same in twins.

10. Identification by Radiological Data

It is of considerable use in:

- Intact body
- Decomposed body
- Suspicious amorphous mass

1. *Primary Anatomical investigations:* when no previous radiological data is available. It detects whether bones are present or not; whether bones are of human or not; basic features of these bones.
2. *By Comparison:* when previous radiological data taken during life of person
3. *Detection of Old of Recent Injuries:* involving skeletal structures including deformities.

11. Identification of Trace Evidence

Trace evidence is the material present at the service of crime and traces the crime. Trace evidence includes hair, fiber, dust, blood stains, urine stains, skin dander etc. these things help a lot in establishing identity of an individual either victim or criminal. This topic is dealt in detail in latter chapter.

a. *Identification by hair:* valuable information is retained regarding age, sex, race, and site of body.

Age:

Fetal Hair	Colorless and no medulla
Adult Hair	Longer, darker with medulla
Aging Hair	Grey with loss of scalp hair

Sex:

Male	Darker, thicker wiry than those of females
Nuclear sexing	Mainly done by the cells of hair follicles, as they resist putrefaction

Regional Distribution:

Scalp	Long, soft, tapering, oval in section
Pubic Hair	Short, curly, oval on cut section
Eye Brow	Stiff and triangular on section
Moustache Hair	short, thin, triangular on section

Human / Animal Differentiation:

We take Medullary Index (M.I.)
M.I. = Diameter of medulla / Diameter os shaft
Human M.I. < 0.3, Animal M.I. >0.5

Special Information:

- Dying of hair should be noted
- Mode of separation, plucking / cutting
- Time since death
- Resistant to putrefaction

b. *Identification by Bite Marks:* alignment and occlusion of teeth are specific characteristics of one's identity. It is a tedious work, material of exam may be scanty or modified by interference or delay.

Materials:

Human skin, food stuff
On Human:

Defensive bite marks are on assailant and sadistic are on victim (breast, shoulder, neck, face, thigh, and hands). If saliva, is present grouping is a mean of identification.

12. Miscellaneous Information

1. Sex determination is done from the chromosomes in pulp tissues.
2. Blood grouping substances can be obtained form the teeth and saliva.
3. Pattern of rouge of palate
4. Changes in the lower jaw:
   - At birth it is shallow body, short ramus, oblique angle of 140° of ramus with body
   - In adults body is thick and angle is less than 90°
   - In old age due to dental extraction and absorption of alveolar margins body become shallow and angle increases
5. Mental foramen is also important:
   - In infant near lower margin
   - In adult it is in midway
   - In old age it is in upper margin
6. A person can be identified by his gait, posture, voice, hand-writing, habits etc.

AGE REPORT

Name
Parent's Name / Husband Name:
Age:
Address:
Date and Time of Examination:
Brought by: (name and number of policeman)
Menstrual History in Females:
Examination:
Identification marks
Major findings
Minor findings
Opinion on Basis of Findings: (always state age in range)
Make the report in the presence of the person and take his signature or thumb impression.

IDENTIFICATION OF MUTILATED BODIES, FRAGMENTARY REMAINS IN MASS DISASTERS

Proceed on following lines (described already)

a. Appearance:
   - Complexion
   - Photograph
   - Superimposition photography
b. Clothing, Pocket Contents and Personal effects:
c. Identity Marks:

1. Acquired Peculiarities
   - Occupational marks
   - Tattoo marks
   - Scars
   - Deformities
2. Congenital Malformations

d. Race:

e. Sex:

f. Age:

1. Teeth
2. Bones
   - Long bones
   - Mandible
   - Ossification data
   - Spine and hip bone

g. Stature:

1. Complete skeleton
2. Incomplete skeleton

h. Prints:

1. Finger prints
2. Foot Prints
3. Lip Prints

i. Time since Death:

j. Miscellaneous Data:

1. Presence of disease
2. Operation scar
3. Old deformity
4. Plating
5. Determination of blood group from teeth or cancellous bones

☆☆☆☆☆☆

Chapter-5

Autopsy

Autopsy: It is special type of scientific examination (internal plus external) of a dead body carried out under laws of state for protection of its citizens and to assist in identification and prosecution of guilt.

Terms synonymous to-autopsy are:-

Necropsy:	Necro = Dead	Opsy - View	
Autopsy:	Auto = Self	Opsy = View	To see for one self
Postmortem examination:	Post = After	Mortem = Death	

Postmortem examination is only external examination while autopsy is external as well as internal examination. Autopsy word is derived from "Autopsia" the origin of which is from autopsis. Autopsia means examination of an organ by exploratory incisions.

TYPES OF AUTOPSY

1. **Medicolegal Autopsy:** it is an autopsy, which is carried out under the laws of state for protection of its citizen. It is also called forensic autopsy. Permission for autopsy is granted by state not by individual.

   Objectives of Autopsy:
   - To identify the dead
   - To know cause, manner, mode of death
   - To determine weapon causing injury
   - Time between injury and death
   - Time between death and autopsy
   - To determine that whether the injury is antemortem or postmortem
   - To provide facts and information to the relatives and media
   - To separate natural and unnatural cause of death
   - To separate birth of live or dead child

   Essentials of Autopsy: when essentials of autopsy are fulfilled it becomes a dialogue with the dead
   - Perform autopsy personally
   - Perform thorough and complete autopsy
   - Write down the finding Carefully
   - Always have a photographic record

2. **Psychological Autopsy:** it is not a true autopsy. It helps in removing problems when investigating a case of suicide. Person going to carry out autopsy must have sufficient data about general life style of dead person, habits, relatives, friends, teachers, colleagues etc Questions are asked to all these about dead person. It is in fact psychoanalysis of the dead.

3. **Medical Autopsy:** when death occurs in the hospital, causes are natural causes of death. Doctors take permission from immediate relatives or crowd. Objectives:
   - To know the cause of death
   - Providing co-relation between criminal symptoms and diagnosis
   - Determine efficacy of treatment
   - Study natural causes of disease
   - To educate students and physicians
   - For statistical purposes

   Rate of hospital autopsy is towards decline mainly due to success of clinical methods.
4. **Mini Autopsy:** it is autopsy of a body part or a limb or part of limb is examined only or it may be a needle biopsy mainly carried out to know cause of death.

AUTOPSY PROTOCOL

It is signed document containing a written record, which serves a proof of something (i.e. findings and observation). It is in 2 basic forms:

1. **Narrative (story like)**

   Its advantages are:
   - It is best for people able of telling stories
   - Immediate storage of facts on tape
   - A pathologist by narration can tell the difference between normal and abnormal

   Its disadvantages are:
   - Narration of many pathologists is by sketching
   - It is subjective and personal
   - Minor details are omitted
2. **Numerical (written in numbers)**

   Its advantages include:
   - All autopsy findings are described orderly
   - Prevents omissions of minor details
   - Information are described in detail uniformly
   - It is objective and impersonal
   - Immediate inspection of all autopsy features is possible

   Its disadvantages are:
   - It is lengthy
   - It cannot be typed
   - It is difficult to read
   - Many pages are required

   In Pakistan numerical autopsy protocol is used.

PRINCIPLES OF AUTOPSY

1. It is a very difficult task be very careful
2. Autopsy must be thorough
3. Have a complete and careful study of the case
4. A qualified person should carry out autopsy
5. Doctor must have an authority
6. Perform autopsy in daylight
7. If it is to carry out at night then management should be proper about light
8. Unauthorized person must not be there
9. Dead body should be un-handled
10. Must take photographs and X-rays before starting
11. Never rely on memory
12. Approach should be methodological
13. Collect too much than too little
14. Use non-specific language
15. Avoid omitting and cutting in writing
16. Report should be easily readable
17. Don't delay the report
18. Chain of custody must be maintained

PRE-REQUISITES OF AUTOPSY

Essentials of Medicolegal Autopsy.

1. It should be performed by the Doctor / person himself (not by any other staff).
2. It should never left incomplete.
3. All findings should be preserved by writing and photography.
4. It should be immediate after the arrival of body.
5. If delayed the external examination and injuries should be noted before storage.
6. Finally provide an unbiased professional Report.

Authority: autopsy should be performed by RMP who has special training in forensic medicine. Police superintendent gives second authority in written.

Autopsy Lab: a well-furnished lab with full equipment (scalpel, forceps, knife, scissors, saw, hammer, chisel, blunt probe, needles, blow pipe, costotome, enterptome, china plates, graduated glass cylinders, sponge, gloves, tray, measuring tape, weighing machine, viscera bottles - wide mouthed bottles, glass slides, test tubes, preservatives, facilities of radiography and photography) is required.

Dead Body: it should be un-handled, unwashed and clothed until the forensic man arrives

Papers: authority letters, Merge reports, statement of witness, medicolegal certificate, treatment operation notes, F.I.R. etc must be there

Doctor: should be well prepared. Prior to autopsy authorization of police or magistrate is required in the form of written request. In case of pathological autopsy written authorization of legal heir is required. Documents or papers required are:-

- Dead body challan
- Authority letter
- Inquest report
- Merg report
- First information report (FIR)
- Medicolegal reports
- Treatment record
- X-rays
- Death certificate
- Surgical procedure record

Merge report is of 4 pages and is of 3 types:-

i. Alph: it is filled when death occurs within the vicinity of the hospital or on road
ii. Bay: In case of injuries
iii. Jeem: in case of poisoning

ARRIVAL OF DEAD BODY AT HOSPITAL

When body is brought to hospital - have a paper from reception and papers brought by police must be checked. Body should be as fresh as possible. Always remember, "When there is suspicious of foul play body becomes the property of state".

Post-mortem Report Number: it has 4 parts

1. Doctor's personal number
2. Annual number (register number)
3. Abbreviation of doctor's name
4. Year in which you are doing autopsy

For example one is going to do autopsy on 1.1.2003 1st day of year 2003. At 11:59PM of 31.12.2002 year 2002 ends and all numbers in register come to an end. From 12:00AM 1.1.2003 numbers start in register from 1. A dead body comes in morning it will by 1st autopsy case of the doctor and also 1st case in year 2003 so number will be 1//1/abbreviations of the name of doctor/03. After this shift another doctor comes on 1.1.2003 and another autopsy case is there. It is 2nd case in year 2003 but it is 1st for the second doctor. So number for this will be 1/2/ abbreviations of the name of doctor/03.

PROCEDURE FOR AUTOPSY

Identification: identification of body must be done before carrying out autopsy, by a policeman or accompanying relative. Ask question about name, age, sex, race, religion, social status etc.

Initial Steps:

1. Look for authorization
2. Doctor must go through the history of the case
3. Take photographs

4. Take X-rays if necessary
5. Collect trace evidence
6. Take rectal temperature
7. Weigh the body
8. Collect hair samples by plucking

Examination: it includes:-

1. ***Examination of Clothes:*** never cut the clothes and never throw them on ground. If you want to remove them and feel difficulties un-stitch them and put your signature there. Take the patches of clothes and if there is something present on them and send them to the lab for chemical detection.
   - Look for color, type and texture of clothes
   - Look for laundry marks and tailor marks
   - Look for evidence and sign of struggle
   - Look for loss of buttons, evidence of underlying injury
   - Stain on clothes

Yellow	HNO_3
Black	H_2SO_4
Blood	Injury
Semen	Sexual offences
Vomitus	Poisoning / disease
Feces	Poisoning / disease / asphyxia

   - Smell of clothes

Kerosene	Homicide / suicide
Pungent	Vomitus

   - Soaking of clothes

Blood	Homicide / suicide / accident
Perspiration	Hypoglycemic shock
Mud	Drowning

   - **Trace evidence;** look for dust, grease, fiber, hair, smoke (tattooing) in firearm cases
2. ***External Examination:*** Note age, sex, height, weight, color of skin, nutritional status, disease, general health, muscular development: it is head to toe examination.

Head	color of hair
Eyes	open or closed and color of iris; color of conjunctiva
Mouth	open or closed
Teeth	missing, broken etc
Chest	any type of deformity; any scar mark
Abdomen	striae gravidarum, caput medusae
Circumcision	done or not

   - Look for any sign of rigor or putrefaction
   - External evidence of therapy by punch mark on hand, cubital vein etc and other marks

- External evidence of injury. Start from back with magnifying lens and look for any abrasion, bruise, burn mark, its location, breadth and width etc all things are determined.
- Thoroughly examine natural orifices, nose, ear, mouth, urethra, vagina, anus ad take the swabs of discharge. Look for smell, change in normal position and presence of any foreign particle.
- Estimate the time since death by

  Livor mortis

  Algor mortis

  Rigor mortis

3. ***Internal Examination:*** there are 3 main body cavities:
   - Skull
   - Thorax
   - Abdomen

These are opened and studied. Examination of vertebral column is done on special request of investigating officer for some diseases (convulsions) and injuries of vertebral column. Opening of Skull: make a transverse incision from mastoid to mastoid over scalp remove flaps of scalp one by one, look for any injury edema and hemorrhage. Do not create new injuries; remove the skullcap following a line above super ciliary ridges in front and occiput behind. Inspect the skullcap and cavity. Do not injure meninges.

Oral Cavity: inspect it for injuries on inside of lips, checks, bruising, hyperplasia of gums look for teeth.

Neck, Thorax & Abdomen: following 3 types of incisions are made

i. I or Midline Incision: give a midline incision starting 1" below the symphysis menti upto the pubic symphysis; saving the umbilicus.

ii. V-Shaped Incision: Two lines extending from Mastoid process of Both sides to the center Meeting at Manubrium Sterni. It is done in case of Respiratory failure / Aspyxia.

iii. Y-Shaped Incision: When V-shaped Incision is continued down through I-Incision i.e., from Manubrium sterni to pubic symphisis saving umbilicus.

In the neck examination reflect skin and under tissue outwards on either side of the neck. Cut through floor of mouth close the inner side of mandible, separate the tongue from its base. Open the mouth, press the tongue, cut soft palate and then detach the viscera of neck and examine them.,

iv) Modified Y-Incision: Two lines on both sides from shoulder tip through anterior axillary fold below nipple, meeting the straight incision in the midline then upto pubic sympysis.

4. ***Special Examination:*** it is by dissection
   - To exhibit pneumothorax
   - To observe air embolism
   - Coronary artery lesion
   - Pulmonary artery embolism
   - Spinal cord
   - Base of skull

Always wear thick gloves. Never handle the dead body if needle prick or puncture occurs. Stitch the body after autopsy.

SPECIMEN COLLECTION

Blood: 30 cc (at least from a peripheral vein) of blood taken in a sterile glass bottle add NaF in this in case of suspicion of poisoning by CO, coal-gas, HCN, alcohol, chloroform, snake bite etc.

Urine: almost all that is present in bladder is collected; add 5 grains thymol as preservative in case of alcohol or carbolic acid poisoning.

Feces: add rectified spirit as preservative (in Dhatura Poisoning)

Hair: pubic hair and hair from head are taken in poisoning by minerals i.e. Arsenic, Antimony etc. hair are collected by plucking not by cutting.

Nails: Remove the entire nail and collect in separate envelope; these are collected in case of chronic poisoning.

Muscle: a wedge from quadriceps femoris muscle is taken; it helps in chronic poisoning by arsenic. 7.5 - 10cm long shaft of femur is preserved mainly in exhumed body.

Skin: skin and subcutaneous tissue from area where the poison was given by injection also take a part of skin from other site.

Heart: pieces of heart are taken in case of strychnine poisoning.

Viscera: Liver, kidney, stomach, intestines and spleen; specimens are taken in wide mouthed bottles.

Bottle no. 1:	Pieces of stomach in 2/3rd salt sol. of NaCl
Bottle no. 2:	3 feet small intestine
Bottle no. 3:	1/2 kidney each or one full, whole spleen, 1/3rd liver
Bottle no. 4:	preservative used

Preservative for chemical examination is saturated salt solution but for histopathological examination is 10% formalin.

SPECIMEN HANDLING

Now the doctor seals the specimen under a receipt, along with:-

- Request for tests
- Copy of autopsy report
- Sample of seal on a cloth 2" x 2"

Policeman takes all these to police station and there storekeeper checks the seal and makes an entry in register. When specimen reaches the chemical examiner the clerk verifies the seals and before examination, examiner assures that seals are intact. The specimens are sent to:-

Viscera:	Bacteriologist of Govt. of Punjab
Bones:	Professor of Anatomy Deptt. of the area
Poisons:	Chemical examiner of Govt. of Punjab
Maggots:	Entomologist examiner of Govt. of Punjab

POSITIVE & NEGATIVE AUTOPSY

Positive Autopsy: Autopsy is positive when objectives have been attained, important is cause of death.

Negative Autopsy: autopsy is negative when all the efforts are wasted and no objective is achieved specially the cause-of death; 2-10% are negative autopsies even at the best centers. Following factors may lead to negative autopsy:-

1. Commencement of autopsy without adequate history
2. Lapses in external examination; addicts, snake bite, electrocution, concealed wounds
3. Improper internal examination
4. Insufficient histological examination
5. Lack of interest
6. Concealed trauma (blow on neck, abdomen, pericardium) etc
7. Advanced putrefaction
8. Natural diseases like
   - Lesions in CNS
   - Vasovagal inhibition
   - Lesions of haemopoietic system like sickle cell anemia
   - Lesions of adrenal glands
   - Lesions of myocardium and coronary arteries

AUTOPSY ARTIFACTS

Definition: Any change introduced into the body after death, which can likely lead to misinterpretation of medicolegally significant antemortem finding is called autopsy artifact.

Objectives of Doing Autopsy:

1. Identify the body.
2. Cause of Death.
3. Mode of Death (Coma, Syncope, Asphyxia)
4. Helps in Criminal Cases.
5. Weapon of Murder.
6. Poisoning.

Response of living tissue to physical injury is vital reaction. Where injury is defined as illegal harm to body, mind, property or repute of someone. Vital reaction is not present in post-mortem injuries.

- On gross examination: we see swelling or redness
- On microscopic examination: edema, vasodilatation and WBCs outside the vessel walls are seen
- On histochemistry: increased levels of serotonin, histamine are found

1. *Artifacts during Death & Autopsy*
   a. *Agonal Artifacts:* Regurgitation or aspiration of gastric contents
   b. *Resuscitation Artifacts:* as doctor tries his best to save the life of the patient
      - Marks of intra-cardiac injection
      - Bruises on anterior chest wall (defibrillation)
      - Fractures of ribs during CPR
      - Bruises on neck during carotid massage

   c. Handling and Transportation Artifacts: Like bruises and fractures
   d. Embalming Artifacts: Trocar marks in neck and abdomen look like firearm wound
   e. Rigor & Livor Artifacts: Heart dilation in rigor and congestion of livor.
   f. Decomposition Artifacts:
      - Swelling of body: obesity
      - Blisters: ante mortem burning
      - Deep grove round neck ligature mark
      - Flattening of sulci and gyri brain edema
      - Bloody fluid at nose and mouth it misleads to drowning
   g. Burning Artifacts:
      - Rupture of heart heart hematoma
      - Escape of neck from burning ligature mark

2. *Artifacts during Autopsy*

   These are produced due to negligence
   - Introduction of bubbles in blood vessels
   - Extension of existing fractures
   - Postmortem fractures
   - Tearing of brain
   - Fracture of hyoid bone

3. *3rd Party Artifacts*

   These are produced by insects and animals etc. Misinterpretation leads to
   - Wrong cause and manner of death
   - Suspicion of crime
   - Miscarriage of justice
   - Wastage of time and effort

EXHUMATION

Ex: Outside

Humus: Earth

Exhumation means digging out of buried body lawfully. Different nations have different methods of disposal of dead bodies; as

Hindu: Cremation

Parses: Place the body on the roof of a high tower or building and vultures eat up all the flesh

Jews: Burial

Muslims: Burial (Exhumation is possible)

Medicolegal Aspects: exhumation is done for:-

1. Determining the cause of death
2. For identification
3. For permanent burial

4. Recovering papers when buried with dead
5. For further evidence

Time Period:

In France:	up to 10 years after death
In Germany:	up to 30 years after death
Pakistan:	no limit
India:	no limit
Bangladesh:	no limit
Great Britain:	no limit

Storage of body (Freezer):

Bodies are stored in freezer. For short term preservation the temperature is kept at +4°C. Because at lower temperature histological details are lost. For long term preservation temperature is kept at −20°C.

Pre-Requisites:

1. Authorization from magistrate and commissioner
2. Identity of grave
3. Suitable place for examination
4. Have necessary arrangements (temporary screen formation, wooden table, bucket of water, concentrated Phenyl, instruments of autopsy, bottles for specimens, sealing and packing material).

Procedure:

- Grave is dug up carefully
- Avoid damage to body and coffin
- Collect samples of earth from above below and sides
- If grave is water lodged take water samples also
- Take body out of grave with hands
- Doctor should have a complete history of the case
- Take photographs and x-rays if possible
- Collect the evidence, pack and seal them
- Autopsy report must be prepared
- Internal examination must be complete and thorough

Limitations:

- So a tissue findings may be obscured
- Histopathology may be of no value
- Postmortem artifacts may be diagnosed
- A long time period is itself a great limitation

Precautions:

1. Conduct examination in coolest and brightest part of day
2. Ventilation should be adequate
3. Give sufficient time between taking body out and starting examination allowing escape of putrefaction gases

Benefits: by exhumation we can determine:-

1. Poisoning:
   - Chronic heavy metal poisoning can be determined
   - No acute poisoning can be determined
2. Physical Violence:
   - Only fractures
3. Histopathology:
   - Mainly it is of no value

Autopsy table:

Steel table are preferred because they have attached accessories like:

1. Peripheral drainage arrangements.
2. Big sink at foot end with water supply.
3. Attached instrument tray.
4. Suckers at the periphery.

Autopsy Instruments:

- Probe
- Scalpel
- Scissors
- Knife
- Forceps
- Needles
- Weighing Machine
- Protoscope
- Tray
- Gloves
- Hammers
- Hand Saw
- Measuring tape
- Chisel

Light:

Natural sunlight or ice blue fluorescent light or hanging ceiling light at table level called "Hanolux Spot lamp".

Hazards in Autopsy Room:

1. **Mechanical Hazards:** Injuries to limbs, by fall on wet floor.
   Injuries to back by carrying heavy corpse.
   Injury to hand by cutting from sharp instruments.
   Injury to eye from bone dust.
2. **Biological Hazards:** Bacterial infection,viral infection,Fungal infection.
3. **Chemical Hazards:** From antiseptics, disinfectant, fixatives etc.
4. **Electrical Hazards:** Electrical burns from metallic table etc.
5. **Radiations:** Ionizing radiation from therapeutic isotopes or ultraviolet lamp used for sterilization or electromagnetic radiation.

☆☆☆☆☆☆☆☆

Chapter-6

Examination of Blood, Semen & Hair

TRACE EVIDENCE

INTRODUCTION:

Trace Evidence:

Trace Evidence is defined as the material which when left behind at the locus or on the body of victim / occurred or any other thing acts as a clue and helps identification objectively.

Locard's Exchange Principle: This principle states that: "Every Contact leaves a Trace".

Types of Evidence:

1. Biological:

Blood	Semen
Saliva	urine
Milk	Vomitus
Gastric Washing	Hair and Fibers

2. Non-Biological:

Clothing	Weapon
Glass	Plastic
Earth	Any Item around the body

EXAMINATION OF BLOOD

Objectives:

It is done to find out:

i) Whether the specimen is blood or not.
ii) If blood whether human or animal.
iii) If human the group to which it belongs.
iv) If human either arterial / venous or Menstrual.

I. Physical Examination:

(a) Naked eye Examination:

We can find out:

i) Age of stain: Old or fresh:

A fresh blood stain is usually bright red in colour within 48 hours. It becomes reddish brown. And in 4-5 days it becomes dark brown.

ii) Origin of stain: Arterial or venous:

Arterial blood shows spurting due to high blood pressure, while venous blood simply oozes out.

iii) Character of stain: (from living or dead):

Blood from a living person clots due to the presence of fibrin, while that from a dead person becomes powder on drying.

iv) Sequence of occurrences:

The size and shape of blood stains shows direction of falling of blood. Blood from flat surface usually flattens in the form of a circle and if the height of blood increases the blood stain of circles shows projections. Arterial blood produces an elongated stain resembling an exclamation mark.

(b) Examination under U.V lamp:

We use this to study stains on dark fibers or unwashed off stains.

Fig: U.V Lamp:

SPECTROSCOPIC EXAMINATION

Principle:

When white light passes through prism it splits in to spectrum consisting of its constituent colours. When such a pattern is viewed through blood certain colours are absorbed. The absorbed colours appear as dark bands known as absorption bands and spectrum is called as "Absorption Spectrum".

Hemoglobin and its derivatives show characteristics spectrum when viewed through spectroscope. This is a confirmatory test with sensitivity between 1 in 50,000 to 1 in 100,000. Micro spectroscope are commonly used in forensic practice.

With the help of spectroscope we can see specific spectrum bands due to different types of Hb.

(i) Oxyhemoglobin:

The spectrum shows two dark absorption bands between D and E lines in yellow green area of spectrum.

(ii) Reduced Hemoglobin:

On addition of reducing agents like ammonium sulphide, the two bands of oxyhemoglobin merge with each other to form a single band.

(iii) Carboxy Hemoglobin:

The spectrum is similar to oxyhemoglobin but there is no effect of reducing agent on this.

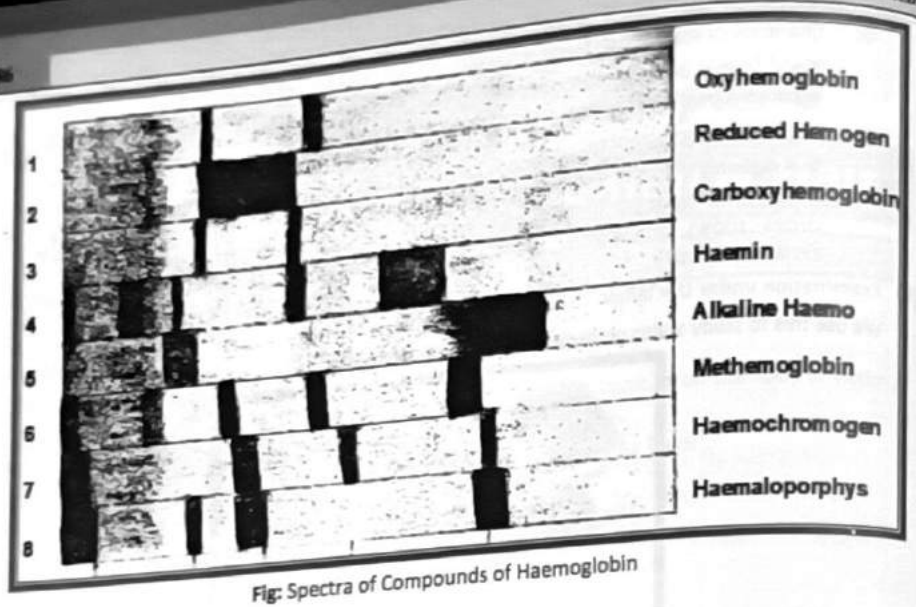


Fig: Spectra of Compounds of Haemoglobin

(iv) Met Hemoglobin:

In old stains oxyhemoglobin is converted to met hemoglobin and it shows four bands. 1 in the red, and 2 similar in position as oxyhemoglobin and fourth faint band in the green area. We can estimate the age of the stain by calculating the ratios of oxyhemoglobin and Met hemoglobin.

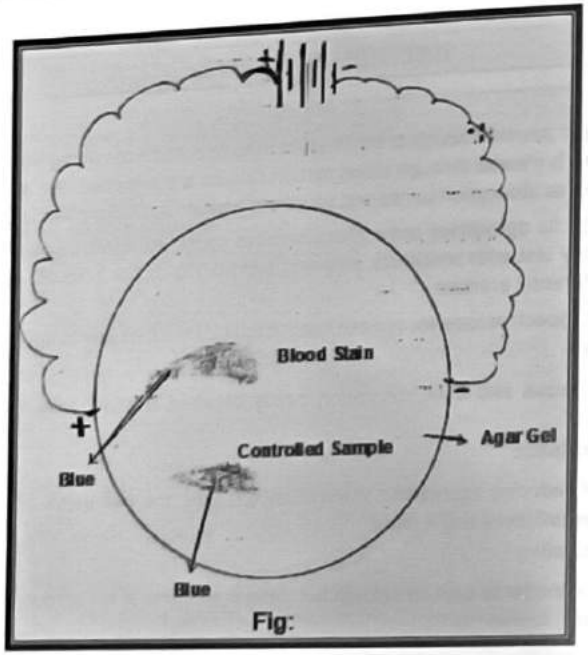


Fig:

PHYSIOCHEMICAL EXAMINATION OF BLOOD

Thin layer Chromatography:

Principle:

Different substances are separated by a process of distribution between two phases. "Mobile" and "Stationary".

R_f Value:

It is the ratio of distance traveled by a substance to the distance traveled by the solvent. Also known as rate of flow. (Rof)

Procedure:

A thin layer of silica gel is applied on suitable sized glass plate. On it's base apply blood stained extract along with a controlled sample of blood. The plate is dipped in a solvent chamber which contains a solvent system containing methanol Acetic Acid and water. After desired time the plate is removed, dried and sprayed with Benzediene. Reagent, and H_2O_2. In case of positive result one see bluish spots having same Rf values.

Electrophoresis:

Procedure:

1% agar gel is applied on glass plate then apply stain extract along with a control sample of blood in the same quantity. Electropheresis is carried out for 30 minutes. Keeping the voltage constant the plate is sprayed with benzedine reagent and H_2O_2. In case +ve result you will see bluish drop like spots with the tails pointing towards Anode.

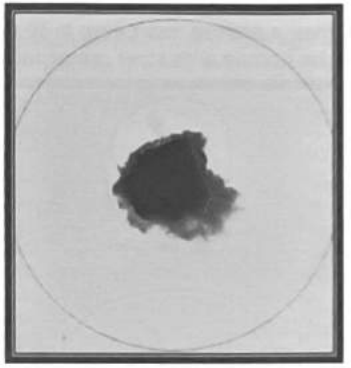


Fig: Benzidine Test Positive

CHEMICAL EXAMINATION OF BLOOD

(A) Screening Test:

(i) Benzidine Test

(ii) Phenalphthalein Test

Principal:

Hemoglobin is responsible for the usual screening test for blood performed in forensic practices. In the presence of H_2O_2 Hemoglobin Oxidizes Colourless compounds like Benzidine and phenolphthalein in to coloured salts.

Benzidine Test:

In this test freshly prepared 10% solution of Benzidine in glacial Acetic Acid and H_2O_2 is required. Benzidine reagent is prepared by mixing. 1.5 gm of $BasO_4$ 30 cc (13 ml) glacial Acetic Acid and 300 cc (57 ml) of distilled water.

Procedure:

Take 3-4 drops of suspected blood stained extract on tbe filter paper. Add 1-2 drops of Benzidine reagent followed by 1-2 drops of H_2O_2. A purple blue colour appears. If the test is positive.

Importance:

It is a highly sensitive test and gives a positive result even in 5 million dilutions. The value is in it's negativity. As this test is also positive with pus, saliva, Mucous, plant juices and other oxidizing agents like $CuSO_4$ and ferric oxide.

(i) Hazzards:

Benzene is a potential carcinogenic agent.

(ii) Phenolphthaline Test:

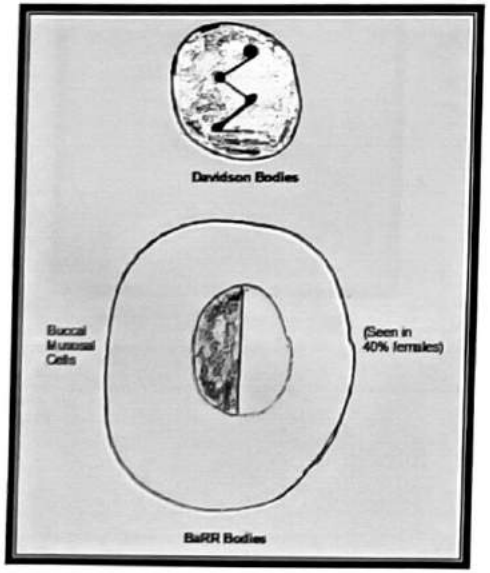
The other name of this test is Kastle Mayer. The constituents of phenolphthaline agent are phenolphthaline powder 130 gm, potassium Hydroxide 1.3 gm, Zinc powder 20 gm and distilled water 100 cc.

Procedure:

Add 1-2 drops of Phenolphthaline reagent followed by 1-2 drops of H_2O_2 on suspected blood stained Aspect. A pink coloration will appear if test is positive.

Importance:

This is a highly sensitive test and given a positive result even in 50 million dilutions. The value of this test lies in its negativity. As this test is also positive with other compounds.



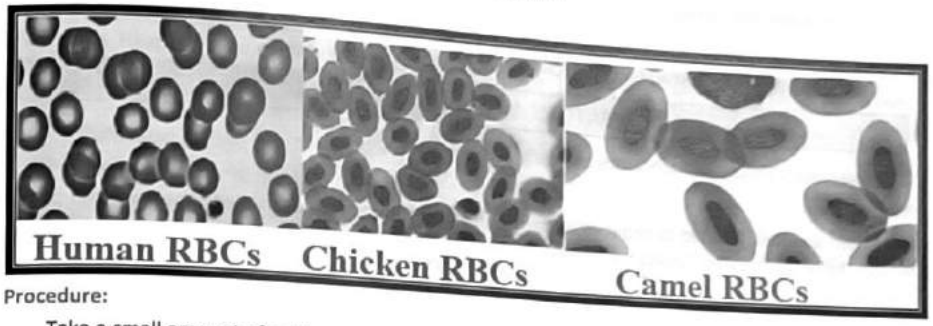
SPECIFIC EXAMINATION OF BLOOD

1. Immunological Test (Precipitine Test):

Principle:

'ntigen Antibody Reaction. We perform an immunological test in which we determine human Antigen by using a specific Antiserum. The Antigens are also called as precipitingogens and the Antibodies are called as precipitine. For blood antigen we can prepare antihuman serum by injecting human blood in small animals like rabbits in repeated doses. After the desired time antibodies are produced in the serum of rabbits. This serum is collected purified and used as Antihuman serum. This test is Highly sensitive and gives +ve result even in 1 lakh dilutions.

This test is based on antigen antibody complex formation.



Procedure:

Take a small amount of antihuman serum in a test tube Add a clear blood stain extract, drop by drop in it. Without mixing. A +ve result will show white precipitates in the form of a ring at the interphase, which is due to Antigen Antibody complex formation.

This test is also known as Ring Test.

Limitations:

1. Pure and clear stain extract is required.
2. Large Amount of costly and strong Antihuman serum is required.

To overcome these limitation we can perform other immunological test.

1. Gel Diffusion Test
2. Immuno Electro Phoresis

2. Microscopic Examination:

For this purpose a slide is prepared from a blood stain extract and staining is done.

Staining of Blood Slide:

Take 1.2 drops of blood on a glass slide and spread it with edge of another glass slide. Dry the slide at room temperature and fix it with ethyl Alcohol for two days. Dip the slide in Leishman or Giemsa stain, after proper staining see the slide under oil emersion lens of Microscope.

Morphology of Blood Cells:

Human RBC's are Biconcave Non-Nucleated having on average diameter 7.2 micrometer. We can also determine sex for example we can see Davidson body in polymorphonuclear leucocytes which are drumstick like extensions of Nuclear Material.

Similarly in non-dividing buccal Mucosal cells. We can see Bar bodies which are condensations of chromatin material on the inner side of Nuclear Membrane.

We can also see-chromosomes (xx – yx) as y chromosomes are fluorescent to Quinacrine.

Characteristics of Animal cells:

(i) Goat R.B.C's:

They are similar to human R.B.C's but smaller in size. Having a diameter of 4.4 μm.

(ii) Camel R.B.C's:

They are oval in shape and Non-Nucleated.

(iii) Chicken R.B.C's:

Oval in shape and nucleated.

(iv) Birds and Fish R.B.C's:

Oval, Nucleated and convexed.

CONFIRMATORY AND MICROCHEMICAL TEST

1. Takayama's Test: (Hemochromogen Test)

Principle:

When an alkali is added to reduced Hb pink crystals of Hemochromogen are formed. For this purpose we use the reagent called Takayamas Reagent.

Constituents:

This consists of:

- 10% NaOH (3ml)
- Pyridine (4ml)
- Saturated Sol. Of glucose.
- Distilled H_2O (7 ml).

NaOH is the alkali, Pyridine is the blood solvent and saturated sol. Of glucose is the reducing Agent.

Procedure:

Take a small quantity of dry stain on a glass slide, cover it with a cover slip, Add 2, 3 drops of reagent under the cover slip. Wait 5-10 minutes. Now see the slide under microscope. Pink coloured feather liked crystals are formed of haemochromogen.

Positive Takayama confirmatory test for blood

Advantages:

(i) Test is easy to perform

(ii) It gives good result with old stain.

(iii) We can reconfirm the heamochromogen crystals with a microspectroscope by observing the typical and absorption bonds on it.

2. Teichman's Test: (Haemin Crystal Test)

Principle:

Hb of the blood stain is converted to heamin, which in presence of halogen is converted to salt and form brown rhombic crystals.

Procedure:

Take a small quantity of dry stain on a glass slide. Add glacial Acetic Acid with mixture of NaCl under the cover slip. Heat the slide gently till a bubble comes out. On cooling see the slide under microscope Brown Rhombic Crystal of hemic chloride are formed.

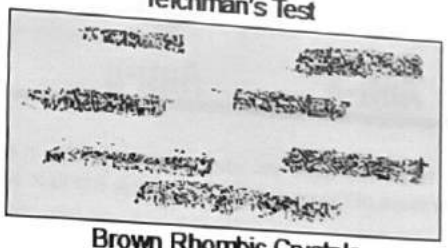
Precautions:

(i) Stain must be dry.

(ii) Glacial Acetic Acid, must be Anhydrous

(iii) The slide should not be over-heated.

Teichman's Test



Brown Rhombic Crystals (Hemic Chloride)

SEROLOGICAL EXAMINATION

Blood Grouping:

Once the blood group of an individual is established it remains unchanged throughout the life. This basic fact constitutes the principle upon which forensic exam of blood is made.

Mendelian's Law of Inheritence:

Mr. Burkenstein elaborated Mendelian's law of Inheritence. He formulated two laws about transmission of genes.

(1) Blood group is transmitted from parents to offspring is established early in life and doesnot change throughout the like.

(2) A blood group genes doesnot appear in offsprings if not present in parents.

Apparatus:

5% RBC suspension, Antisera, Glass slide centrifuge Machine and Microscope.

Procedure:

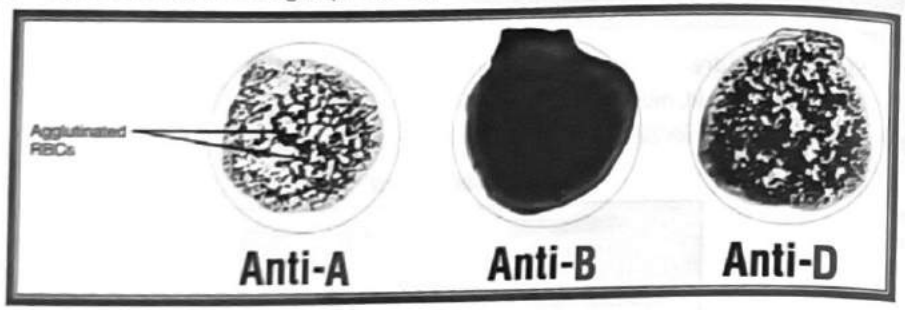
Take blood in a syringe, let it clot and then centrifuge it separate the serum and let the RBC's settle down at the bottom, take 1 drop of this and add 20 drops of normal saline, this is called 5% RBC suspension.

Forward Typing:

It determines the antigen on patient and / or donor cell. Take 3 slides and label them. A, B and D and add few drops of blood on it. Now add few drops of Anti A, Anti B and Anti D sera on the slides observe for Agglutination.

Result:

1. If Agglutination in slide: A then blood group is A.
2. If Agglutination in slide B then blood group is B.
3. If present on both A and B blood group is AB.
4. If present in D then blood group is Rh+ve.
5. If absent in D the blood group is Rh–ve.



Reverse Typing:

It determines Antibody. Take 3 test tubes and label them A, B and D. In each test tube add unknown sera of patient. Now Add few drops of known A cell in test tube A, B cells in test tube B and D cells in test tube D.

Results:

1. If Agglutination is present in test tube A then blood group is B.
2. If Agglutination is present in test tube B then blood group is A.
3. If Agglutination is present in both then blood group will be O.
4. If absent in both blood group is AB.
5. If present in D then blood group is Rh–ve.
6. If absent in D then blood group is Rh+ve.

Medicolegal Importance:

1. Establishment of identify
2. In cases of blood transfusion.
3. To resolve problems of disputed paternity.
4. To resolve disputes of interchanged Babies in Maternity Hospitals.

Blood Group	Forward Group			Reverse Group	
	Anti-A	Anti-B	Anti-A,B	A1 Cells	B Cells
A	+	-	+	-	+
B	-	+	+	+	-
AB	+	+	+	-	-
O	-	-	-	+	+

EXAMINATION OF HAIR

Objective:

Examination of material is done to find out:

(i) Whether material is hair or some other fiber.
(ii) If hair whether human or animal.
(iii) If human, Age, Sex, race, site and other feature of Identification.
(iv) Evidence in relation to crime.
(v) Time since death if possible.

Collection of Material:

By combing cutting or plucking.

Sample type:

(i) Detached Hair
(ii) Intact hair

Physical Examination:

(I) Naked eye Examination:

(II) Examination with hand lens:

Following information can be gathered.

(i) **Site:** Scalp hair are long, soft, tapering and rounded on cross section. Pubic hair are short, curly and oval on cross section. Eyebrows and Eyelashes are short and Tapering.

(ii) **Colour:** It may be
- Black
- Brown
- Yellow
- Grey

or either Dyed.

(iii) **Race:** Scalp hair in negros are dark black, curly and in spirals. Mangolian hair are yellow brown, soft, thin and silky. Cacassians have mixed hair usually wavy.

(iv) **Age:** Adult hair are long thin and strong. Lanugo hair are fine, short non-pigmented present on body of neonate.

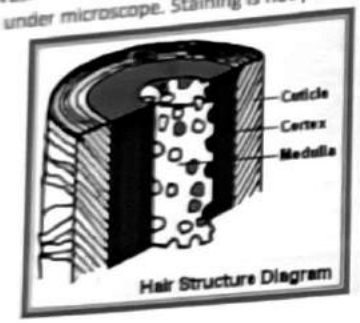
(v) **Sex:** Female scalp hair are long and thin, while those of males are short thick.

(vi) **Evidence of Trauma:** Blunt injuries can cause crushing, stretching, tearing and flattening of hair. Short injuries show cuts. Burning with flame shows singing of hair.

(vii) **Time since Death:** Hair are usually detachable 48-70 hrs. after death. After buried they become brown and dull red within 2-3 months.

Microscopic Examination:

Take a specimen of Hair. Wash it with water, ether and Alcohol. Place it on a glass slide. Put a cover slip on it and examine this slide under microscope. Staining is not provided.



Hair Structure Diagram

Observations:

(i) Cortex is larger than Medula in humans.
(ii) Animal hair: Medula is larger than the Cortex.
(iii) Wool hair: Medula is larger than cortex but have interruptions at various lengths.
(iv) Polyester Fiber: They are Filamentous, homogenous having equal diameters.
(v) Cotton Fibers: They have fiber web like appearance or arrangement, Filamentous, homogenous with variable diameters.

Chemical Examination:

Hair can reveal the presence of poison in living and dead. For this purpose hair are removed with flat tipped forceps. Maximum of 15 hairs are required with intact roots. Examination of successive hair from base to tip gives approx. estimation of a poison Dosage.

Serological Examination:

(i) Blood Grouping:

ABO blood groups and other can be determined even from single hair taken from any part of the body. This helps in identification.

(ii) Sex:

Sex can be determined by studying XY chromosomes from hair root cells of scalp. In Addition beard and mustaches can also be used.

(iii) DNA Profile:

For this 10-15 hair with intact roots are required.

In a dead person since hair resist putrefaction. It forms an important means of identification while Rest of the body is putrefied.

EXAMINATION OF SEMEN

Semen is thick, yellowish white, opalescent secretion with typical odor. Semen has 2 parts:

- Fluid: from prostate and seminal vesicle; it consists of choline lecithin, acid phosphatase, phosphorous, spermine etc.
- Cells: include spermatozoa and epithelial cells

Acid phosphatase is an enzyme and it can be detected even without cellular part. Question of detection of seminal stains arises in cases of bestiality, zina-bil-jabr, sodomy etc.

Collection of Seminal Stain:

1.	On cloth	cut the cloth and make it dry so as to preserve it
2.	From pubic hair	hair are cut and preserved
3.	Thighs	scratching are obtained and dried
4.	From vagina	swabs and smears are prepared
5.	Wet stains from perineal	areas and thighs
6.	Anal Canal	swabs and smears are prepared

Examination of semen:

1. *Physical Method*

   It is by UV lamp; bluish white florescence is seen

2. *Chemical Method*

   It includes following 3 types of tests:-

   a. Acid Phosphatase Test

      This enzyme is important, quantitatively and qualitatively. It is found only in monkeys and humans,

   b. Florescence Test

      We take watery solution of seminal stain and florescence reagent is added (5% iodine, 8% K.I and distilled water) crystals are formed as precipitates, by reaction with choline. Crystals are dark brown needles like.

   c. Barberio Test

      Barberio's reagent (alcoholic solution of picric acid) is mixed with spermatic fluid and result is yellow colored needle shaped crystals of spermin picrate.

3. *Microscopic Examination*

   Take scrapings/ soaked cloth add 0.3% glacial acetic acid or Vibert's fluid now examine, under microscope and see parts of sperms; head, body, tail and typical measurements.

4. *Biological Examination*

   In this we look for antisera and grouping only in secretors. Spermatozoa may be absent in semen in cases of:-

   - Chronic epididymitis
   - Chronic venereal disease
   - Aspermia
   - Vasectomized person
   - By the use of condoms during coitus

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Chapter-7

Traumatology

TRACE EVIDENCE

Traumatology: it is knowledge of trauma or injury.

Trauma or Injury: it is illegal harm to any person in body, mind, repute or property.

In body	Physical Trauma
In mind	Psychological Trauma

Wound: it is discontinuation or disruption of any tissue of body. Every wound is trauma but every trauma is not wound as trauma can be to mind, repute or property.

Hurt: is bodily pain, disease or infirmity caused to any person without Death of that person is called as Hurt.

Assault: is to threat or attempt to apply force.

Battery: actual application of force.

Homicide: killing of a human by conduct of another.

Suicide: is self-murder. It is an unlawful act.

Accident: event neither expected nor desired or designed.

Classification of Injuries: according to mechanism of occurrence injuries are classified as:

1. Mechanical injuries by physical violence
2. Thermal injuries by heat or cold
3. Chemical injuries
4. Electrical injuries
5. Firearm injuries

For causing injury force is required, it is supplied by a moving object on stationary body or moving body and object is stationary or both are in motion. Ewing's postulate about injury is:-

1. One must establish integrity of part at onset of trauma
2. Injury must be adequate to cause growth
3. There must be reasonable interval between injury and onset of growth
4. Disease must appear in locality of injury
5. By microscopic examination existence and extent of growth must be diagnosed

MECHANICAL INJURIES

These are caused by application of voilence to the body. These are classified as:

1. **Closed** Wounds: Bruises; Abrasions
2. **Open** Wounds: Laceration; Incised wounds; Stab Wounds; Perforating Wounds; Punctured

Gunshot wounds are also the perforating wounds but they are discussed as a separate topic. The weapons causing mechanical injuries can be:

1. **Sharp:**
2. **Blunt:** a. Designed b. Not designed

Blunt weapons cause bruises, abrasions, lacerations and the sharp weapons cause incised wounds, stab wounds and also abrasions. Injuries can be:-

1. Simple
2. Grievous
3. Dangerous

Injuries can be:-

1. Antemortem
2. Postmortem
3. Perimortem

1. Bruises or Contusions

Definition: Bruise is infiltration of tissue with, extravasated blood due to rupture of blood vessels (arterioles, capillaries, and venuoles) and this infiltrated blood gives blue color to skin or visceral surface of organ. In bruise external surface may remain intact, only subcutaneous surface is involved. Bruises are 1) externally on the skin and 2) internally on the surface of the organs. Discoloration of skin due to subcutaneous collection of blood is called ecchymosis

Mechanism: bruise is produced by impact of blunt weapon pressure without movement.

Shape and Size: Size may vary from pinpoint to extensive. Shape may be linear (horizontally or vertically). When iron bars chains or club sticks are used shapes are linear. Shape may change by the changes in tissue. Similarly bruises may be at site of injury or ectopic, especially in head injury (injury on forehead - bruise around eye - black eye).

Appearance: it appears 1-2hrs after infliction of injury. If skin is thin it takes less time e.g. eye lid and scrotum. It may appear in 1-2 days if it is in deeper tissues and tense fascia

Factors Modifying Appearance of Bruise are:

1. ***Vascularity:*** greater the vascularity greater will be the size of bruise in that body part
2. ***Force:*** greater the striking force greater will be the bruise
3. ***Age:*** old aged people bruise easily
4. ***Sex:*** females especially obese one bruise easily
5. ***Area:*** bony sites and lax skin bruise easily, while abdominal wall being unopposed and scalp being firmly adherent to skull does not bruise easily. Scalp of newborn bruise easily.
6. ***Texture:*** thin and delicate skin bruise easily.
7. ***Blisters:*** due to oblique blow or fractures of underlying bone blisters are formed over bruise.
8. ***Physical condition:*** obese and unhealthy persons bruise easily
9. ***Diseases:*** persons with coagulation disorders, liver and renal failure bruise easily.
10. ***Complexion:*** bruises are well-marked on persons with fair complexion

Age of Bruise:

a. *Microscopic Examination:* by noting changes in extravasated RBCs and extent of reaction observed in wandering and fixed tissue cells,

b. *Color Changes:* these are due to disintegration of RBCs, breakdown of Hb into haemosiderin, hemotoidin and billirubin. The color first changes at periphery then in the center.

1st day	red
2nd day	violet
3rd day	bluish black
4th day	livid red
5th-6th day	greenish
8th-12th day	yellowish
13th-15th day	normal

There are no bluish or greenish stages in subconjunctival hemorrhage.

Medicolefial Aspects: bruises may provide following valuable information.

1. Identification of objects causing injury
2. Degree of violence
3. Time of injury
4. Purpose of injury: around neck = throttling; around nose and mouth - smothering: on aims and face = sign of struggle; on inner aspects of thighs and genitalia = sexual offence
5. Is bruise true or false?
6. Is injury suicidal, homicidal or accidental?

Antemortem Bruise	Postmortem Bruise
1. Swelling is also seen	No swelling is seen
2. Color changes are seen in antemortem	No color change is seen
3. Epithelium is mostly abraded in antemortem bruise	Not so
4. Margins are not sharp and well defined	Margins are sharp and well defined
5. It can be anywhere	it can occur only 2 hours after death
6. Vital reactions are seen	Not so
True Bruise	**False Bruise**
1. Color changes are seen	No color change is seen (dark brown color)
2. Margins are well defined	Not so much defined margins
3. Swelling is seen	No swelling is seen
4. Extravasation of blood is present	No extravasation is seen
5. There may be blood coagulation	No blood coagulation is seen
6. It may be on any part	Only at accessible parts
7. No itching is felt	Itching is present
8. Area is not corroded	Signs of irritation corrosion are there
9. Chemical tests are negative	Chemical tests are positive
10. Blood is present in true bruise	Serum is present in false bruise
Bruise	**P.M. Staining**
1. It is sub-epidermal	It is epidermal
2. It can be anywhere	On dependent parts
3. Margins not clearly defined	Clearly defined margins
4. Variegated in color	Uniform in color
5. Swelling is seen	No sign of swelling
6. Signs of inflammation are there	No sign of inflammation
7. Abrasions may be there	No signs of abrasions

2. Abrasion

Definition: Abrasion is injury to superficial layers of skin with minimal bleeding caused by contact of blunt or pointed weapon.

Mechanism: Weapon may be moving and body is still or body is moving and weapon is still or both are moving. The epithelial tissue may compile from origin to one end. By this competing of tissue we can determine direction of moving of object. It commonly occurs by nails, needles and mainly seen in accidents.

Types:

1. *Moving Abrasions:-* these are scratches and grazes

   Scratches: these are linear injuries produced by point of sharp weapon by single line or parallel lines. Epithelial cells heap up at the end and there is minimal bleeding

   Grazes: these are produced by contact of body by rough surface like road, brick etc direction is determined by heaping up of tag.

2. *Friction Abrasions:-* some rough objects or ligatures cause damage to skin surface by pressure.
3. *Imprint Abrasions:-* produced by direct impact or pressure contact with some other objects. Object stamps the pattern on skin; nail marks, tyre marks, teeth marks, radiator marks and muzzle marks.

Age of Abrasion: (Pathophysiology)

Fresh	color is red and blood oozes out
12-24hrs	serum dries and scab is formed
2-3 days	scab becomes red brown
4-7 days	healing is seen at periphery
7-9days	lymph rushes to affected site; RBCs, WBCs are present and growth is seen
10 days onwards	healing is complete and scab goes off

Medicolegal Aspects:

1. In cases of throttling and strangulation abrasions are seen in front of neck
2. Superficial abrasions may show attempts to cause deep wounds

3. Abrasions over hyoid bone may show attempts to cause asphyxial death
4. Imprint, size, shape may show the causative agent
5. It may show struggle of a person in zina-bil-jabr, sodomy etc.
6. In water marine and submarine animals produce abrasions on dead body

Antemortem and Postmortem Abrasions:

In case of antemortem abrasions there are vital reactions, pus formation, scab formation and healing. Postmortem abrasions are with well-defined margins and no vital reactions. These are examined by naked eye, magnifying glass and infrared lenses; photographs are also taken. Ants, insects, marine and submarine animals' etc. produce postmortem abrasions.

3. Lacerations

Definition: These are wounds in which skin and underlying tissues are torn due to application of blunt force. It occurs readily when underlying tissue is rigid as on scalp. It occurs less readily, ragged and irregularly if underlying tissue is flexible.

Characteristics;

1. Edges are irregular and bruised
2. Margins are abraded
3. Deeper tissues are irregularly and evenly divided
4. Hair bulb if present are crushed
5. Blood vessels are crushed - early coagulation - no pronounced bleeding
6. It usually contains foreign material
7. There is relation between shape and size of wound and weapon producing it

Classification:

1. Split laceration: skin is crushed between 2 hard objects
2. Stretch laceration: skin is over stretched by blunt tangential impact e.g. glancing kicks with boots
3. Avulsions: laceration is by grinding compression of tissues causing degloving of skin and crushing of underlying muscles e.g. traffic accidents
4. Tears: laceration by irregular sharp objects
5. Cut lacerations:

   Lacerated wounds over bony prominences look like incised wounds but difference is:-
   - Hair and hair bulbs are crushed but not cut
   - Edges are bruised
   - Base of wound has bridging across muscle fibers

4. Incised Wounds

Definition: Injury caused by a sharp cutting edge weapon when drawn across skin e.g. knife, razor, scissors, broken glass, sword, hatchet, axe, chopper, sickle etc.

Characteristics:

1. Wound is broader than edge of weapon
2. It is spindle like and gaping
3. Its superficial breadth is mote than depth

4. Angles are clear cut
5. Deeper tissues are cleanly and evenly divided
6. No bruise is seen on surrounding tissue
7. Bleed profusely
8. Length is more than depth and breadth
9. Hair and hair bulbs are cleanly cut
10. It is tailing - terminal point is less deep

Exceptions:

1. Edges are inverted if muscle layer is closely united to skin as in scrotum
2. Edges are irregular if skin is loose (axilla) or edge of weapon is slightly blunt (axe or broken glass)
3. If wound is over bone and weapon is blunt, edges of wound may be contused
4. On curving areas, straightedge weapon cause semicircular wound or may lift flap of tissue
5. A curved weapon like sickle, pointed end makes stab wound and other area makes incised wound
6. Incised wounds by china utensils and earthen wares are irregular and buried

Hesitation or Tentative Cuts: these, refer to preliminary cuts made by a person intending to commit suicide - by a cutting instrument - before gathering courage to make a final incision. There are: Small
- Multiple
- Superficial
- Merge with main incision
- If wound tails towards right person is right handed
- If wound tails towards left person is left handed

Medicolegal Aspects: homicidal are deep and on any part of the body but suicidal are many and on accessible parts of the body

5. Stab Wounds / Punctured or Penetrating Wounds

Definition: It is wound caused by a pointed weapon when it is driven in through skin and depth is the greatest dimension. It is caused by knife, dagger, needle, spear, arrow, scissors, ice pick etc. If weapon reaches body cavity it becomes penetrated wound. When weapon comes out from other side then it becomes perforating wound (with entry and exit wound).

Characteristics:

1. ***Wound of entry:*** it is bigger than the exit wound as latter is caused by the tapering end of the weapon. Margins of the entry wound are clear-cut and inverted. If weapon is blunt bruising of margin is also seen. Skin aperture is little smaller than the breadth of the weapon due to elasticity of skin. Depth is more than length and breadth. It depends upon length of blade and thrusting force. Direction is taken by drawing a line between entry and exit wound.

Wedge shaped wound	by knife
Elliptical wound	by dagger
Circular wound	by needle
Cruciform wound	by file
Trigonal wound	long pointed weapon
Slit like wound	by screw driver arrow

2. *Exit Wound:* it is smaller as it is caused by the tapering end of the weapon and margins are everted.

6. Fabricated Wound - Self-inflicted or Self-suffered

Definition: it is wound produced, by a person on his own body or caused by another person in agreement with him (self-suffered).

Objectives:

1. To support false charge
2. To escape military service
3. To destroy evidence of certain injury
4. To show self defense

It is revealed by careful examination. Examination of clothes is very important. These injuries are on assessible parts of body half heatedly inflicted and not on vital parts.

7. Defense Wounds

Definition: these are the wounds sustained by a person as a result of his spontaneous reaction to protect himself, when attacked.

Causes of Death from Wounds

Primary or Immediate Causes:

1. Excessive bleeding
2. Injury to vital organs
3. Neurogenic shock
4. Embolism
5. Crush syndrome
6. Combination of these

Secondary or Indirect:

1. Infection
2. Thrombosis
3. Embolism
4. Secondary shock
5. Indirect effect
6. Supervention of new disease
7. Acceleration of pre-existing disease
8. Operational disorders
9. Neglect of patient

Age of Wound

Naked Eye Examination: about abrasion and bruise we have discussed already

1. Abrasion
2. Bruise
3. Aseptic Wound
   - Edges are red and swollen — 12 hours
   - Scab formation — 12 – 24 hours
   - Epithelium begins to grow — 24 – 36 hours
   - Complete epithelial growth — 4 – 7 days
   - Scab goes off — 8 – 10 days
4. Septic Wound
   - Edges red and swollen and lymph oozing — 12 – 24 hours
   - Pus is formed — 36 hours
   - Granulation tissue is seen — 7 days

Histopathology: Inflammatory response

- Vasodilatation and edema — at once
- Margination of WBCs — few minutes
- WBCs enter in damaged area — 30 minutes
- WBCs commence fragmenting — 3 – 5 hours
- Fragmentation is complete — 21 hours

Radiological Examination:

1. Fractured Bone
   - Signs of clot organization — 48 hours
   - Osteoid formation — 3 days
   - Soft callus formation — 7 days
   - Advanced callus formation — 10 – 12 days
   - Soft callus visible — 3 weeks
   - Gap between fractured ends is filled up — 1 month
   - Callus transformed into bone — by 2 months
   - Remodeling and resorption of callus — by 6 months
2. Fractured Skull
   - When there is fissured fracture edges stick together — 1 week
   - Calcification of inner table — 2 weeks
   - Bands of osseous tissues run across fissure — 4 weeks
   - Gap of communicated fracture fills up by fibrous tissue — 1 – 2 months

Antemortem Wounds	Postmortem Wounds
1. There is free hemorrhage (not in lacerated wounds) and mainly arterial	Slight hemorrhage and always venous
2. Arterial sprouting present	Not seen
3. Blood clotting is seen and clot is firm, yellow, can be pealed in layers, composed of fibrin and platelets	Blood clots after 4-5 hours and is dark red in color (may be black), soft, brittle, cannot pealed in layers, composed of fibrin and RBCs
4. Washing cannot remove the staining of edges	Wound staining is easily removed by washing
5. Edges gap and swollen	Edges do not gap and not swollen
6. Vital reactions are seen	Vital reactions not seen
7. Increased serotonin and histamine secretion	Not so
8. Leukocyte and RBCs infiltrate in between muscle fibers	No infiltration

Regional Injuries

1. Injuries to Head: Scalp Skull Brain
2. Injuries to spine and Spinal Cord: Concussion Compression Pithing Laceration
3. On Face
4. On Neck
5. Chest Injuries
6. Abdominal Injuries
7. Injuries to Limbs

1. Head Injuries:

Head injuries include scalp, skull and brain injuries. Head injuries are mainly divided into 2 categories:

a. ***Closed Head Injuries:*** if trauma dura is not torn whether skull is fractured or not

b. Open Head Injuries: if dura is torn and open to infection

Scalp Injuries: most of the wounds are caused by blunt force to head and cause contusions or lacerations or bruise. Scalp injuries are often homicidal and seldom suicidal or accidental. Resulting injury depends upon texture, force and direction of application. In contusions blood comes out and forms haematoma called cephalohematoma. Important is to distinguish it from depressed fracture of skull.

Cephalohematoma	Depressed Fractures of Skull
It is haemorrhagic swelling usually occurs on infant during delivery	It is caused by heavy weapon with a small striking surface, i.e. hammer, stick, stone
Disappears in 14 days	It does not disappears in 14 days
It pits on pressure	Not so
It is raised above skull	Not raised either depressed or at the level at skull
It does not indicate type of weapon	Fracture may indicate type of weapon

Skull Injuries: skull may fracture due to direct or indirect violence. Types of fractures are:

- Linear or fissured
- Bursting (due to bilateral compression)
- Depressed
- Partial (only one table is involved)
- Stellate or radiating
- Communicated
- Elevated
- Sutures separation
- Cuts
- Gutter fractures
- Penetrating fractures

These are fractures of vault of skull caused by accidents, falling, blow of weapon etc. Fractures of base of skull include fractures of anterior, middle and posterior cranial fossae, ring fractures (around foramen magnum). Symptoms observed are:

- Black eye
- Bleeding from ear, nose, mouth
- Concussion
- CSF discharge
- Subconjunctival haemorrhage
- Lesions of nerves
- Shock

Drain Injuries: occur with or without fracture of skull. These include:

i. Contusions and lacerations

ii. Concussion (stunning): Sudden 'impaired conscious; it is rotational injury. It may occur by direct violence on vertex or indirect from feet and buttocks. There is confusion and giddiness and also unconsciousness in severe cases. Memory is also lost in some cases.

iii. Intracranial Haemorrhage: these include extradural, subdural, subarachnoid and in the

iv. compression of brain: it may occur due to depressed fracture of skull, foreign body in skull, intracranial haemorrhage, brain edema, tumour, abscess, inflammation etc.

By direct application of force to skull 2 types of injury result:

- Coup Injury: it is injury, which occurs immediately subjacent to area of impact. It occurs when head is fixed. For example person is lying on ground (head is fixed) there is some violent impact over occiput, there is fracture at the site of impact.
- Counter-Coup Injury: when injury occurs on the contralateral side of area of impact. It occurs when head is free to move. For example a person falls upon his back (head is free to move and his head strikes against ground with his occiput injury occurs to frontal lobes.

2. Injuries to Spine and Spinal Cord:

Fractures of the spine need not necessarily damage the spinal cord. Spinal cord is liable to:-

- Concussion: symptoms include backache, headache, insomnia, sex bladder etc. It occurs by a blow on spine, fall from height, bullet injury, and accidents. There is sudden loss of functions of spinal cord from few hours to days.
- Whiplash Injury: It is momentary dislocation of cervical spine in C_{4-6} region causing laceration of spinal cord. This occurs by a blow on forehead, chin or also by striking of forehead against the dashboard resulting in hyperextension and consequent injury.
- Compression: It is generally due to fracture or dislocation of spine. Commonest sites for dislocation are C_{4-6} (whiplash injury), T_{5-6} , T_{10}–L_3.
- Pithing: It is punctured wound in the area between base of skull and C_1 vertebrae or between C_3 and C_2 vertebrae. It is fatal as there is pithing of vital centers.

3. Injuries to Face:

These are mainly fractures of facial bone the most common is nasal bone and crushing of facial structures like eye, nose, ear, lips and also include injuries to teeth tongue etc. Other important injuries of face include cutting of nose, ear and burning of face due to vitriolage.

4. Injuries to Neck:

Injuries on the neck include bruises and abrasions during throttling, ligature marks, and cut throat. Important is cutthroat and determining whether it is suicidal or homicidal.

Suicidal	Homicidal
On front of neck; from right to left in left handed and from left to right in right handed	On any side
Tentative cuts are also seen	Not so
Sloped upwards	Sloped downwards
Gradual deepening and shallowing	Boldly cut at commencement
Plane of cut is downwards	Plane of cut is upwards
Weapon is firmly grasped in hand (cadaveric spasm is seen)	No cadaveric spasm

Other important findings include:

- If door is locked from inside - suicidal
- If there are signs of struggle in room - homicide
- Cadaveric spasm and weapon is there - suicide
- Suicidal note is there - suicide
- Carry out psychological autopsy; matters of Zar, Zan, Zameen are associated with homicide and one can also get a lot of help in declaring it a homicide or suicide
- Also take the help of finger prints and other trace evidence

5. Injuries on Chest:

Injuries on chest include traumatic asphyxia, fracture of ribs, rupture of vessels, pneumothorax, bruising of heart by fall of weight, rupture of heart by a weapon etc.

6. Abdominal Injuries:

Abdominal injuries are very dangerous as a simple blow can lead to death from shock. Injuries on abdomen include - abrasions, penetrating wounds, rupture of viscera, injuries on vulva, penis, Vagina, scrotum, genital injuries are very fatal. Injuries of rectum and anal canal are also common.

7. Injuries on Limbs:

These may be bruises, abrasions, incised wounds, laceration, fractures and also amputations.

SPECIAL TRAUMA:

1. Blast Injury:

Blas injury is a special form of trauma resulting from explosion commonly referred to as bomb blast. Understanding of mechanism of these injuries requires knowledge of bomb design and physics of the explosive forces. Design of a bomb has three main elements; explosive material, a container and a detonation device. The choice of explosive material varies. It may be solid, liquid or gaseous. The most commonly used materials are commercial gelignite or sugar-sodium chlorate mixtures. The container may be of any material such as plastic, glass or metal, which can be scaled airtight. Usually a pipe, a bottle or a gas cylinder is used. The detonation devices can be time-delayed or remote controlled.

The detonated explosive material releases energy of an extremely high magnitude in the form of hot and expanding gases, raising the atmospheric pressure in the region of explosion instantaneously, generating pressure waves. This pressure waves travel concentrically in all directions at very high speeds (about 21,000 km/h). Like sound waves, these pressure waves can flow around barriers and get reflected by them. (Fig. 6.32)

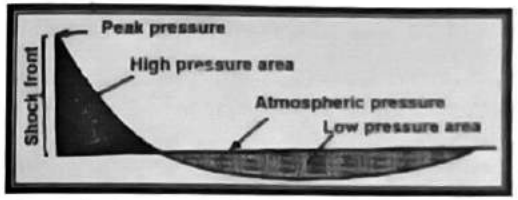


Fig: Atmospheric pressure changes in the region of explosion.

The pressure is very high at the front of the wave and the maximum differential between the pressure in the region of explosion and the normal atmospheric pressure is called peak over-pressure. It is measured in pounds per square inch. A partial vacuum is formed behind these waves of the peak over-pressure lowering the atmospheric pressure to below normal. Length of time between the passage of soack waves and return to the normal pressure is known as positive pressure duration.

Water is 800 times denser and 1000 times less compressible than air. It transmits blast waves more efficiently. Injuries produced from the same blast are far more serious and severe for victims under water than those in the open. (Figure)

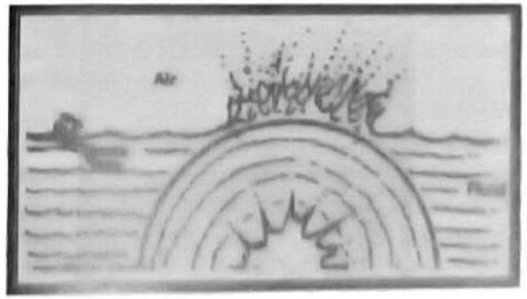


Fig: Pattern of transmission of blast waves in water

Besides blast waves, explosion produce flame of very short duration and solid fragments. Sum-total effect is conversion of bomb and the surrounding atmosphere into a violently expanding cloud of hot gas, flame and solid fragments. The factors influencing the outcome are:

- Physical characteristics of the bomb
- Distance between point of detonation and the victim
- Protecting or reflecting effect of adjacent structures

These elements are responsible to cause injuries to the victims of blast in the following four ways:

*1. **Primary effect*** is a direct impact of steep pressure wave front traveling at a very high speed. Further, because of the property of pressure waves to be reflected by and flow laterally around barriers, these reflected waves join and reinforce the original enhancing the damage more severely. This pressure wave front causes injuries like those of blunt force. Air over-pressure above 100 lb./in^2 is necessary to endanger a human being. If the victim is in contact with the bomb at the time of detonation, he is literally blown into pieces which fly in all directions for a variable distance which may go upto about 200 yards. In other cases, when the distance between the victim and the bomb is about one meter, the torso is grossly damaged and limbs get blown off. Beyond this range, the body may receive injuries but is not mutilated.

Pressure waves can pass through the body tissues depending on their resistance, type and architectural design. They may pass differentially through the coverings of the body, muscles and organs. The passage through the solid organs is relatively smooth producing less damage. Organs containing air like lungs and middle ear are more susceptible. They are subjected to shredding effect at the tissue-air interface as the waves crosses it and produce shearing movement in the other portion causing it to be bruised. Lungs show patchy alveolar hemorrhages throughout and death may occur due to respiratory embarrassment. Tympanic membrane shows reddening, bruising and perforation. (Figure)

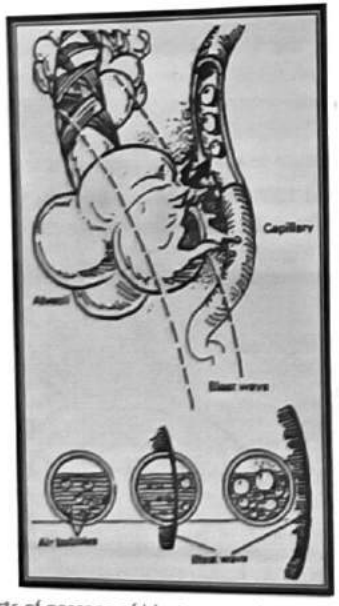


Fig: Effects of passage of blast waves through soft tissues.

*2. **Secondary effect*** is an indirect consequence in the form of injuries received due to impact of debris energized by the blast. This debris consists of primary missiles, originating from the components of the bomb itself and secondary missiles, which are nearby articles thrown into flight by the blast. Distance from the point of detonation and nature and velocity of these fragments are important factors determining the outcome. Resultant damage is both to worn clothes and the body of the victim. Clothes may get extensively torn, limbs amputated and body surface injuries spread over a wide portion within few meters from the point of detonation. Injury characteristics are either in the form of dirt tattooing or triad of punctate bruises, abrasions and small lacerations. The bruises and abrasions are circular, 2-10 mm in diameter and in some cases, may coalesce together to give the skin a purple discoloration. The size of the lacerations is slightly larger upto 3 cm in diameter. In cases where victims are beyond few meters of the blast, tattooing effect disappears. Only large fragments may get impacted in various parts of the body or pass into or through body cavities. (Figure)

Fig: Secondary effect to both clothes and body of the victim – tearing of clothes and injury characteristics in the form of trial of punctate bruises, abrasions increations.

*3. **Tertiary effect*** is an indirect injury caused to the victim by striking against a wall or other barrier under the effect of pressure waves. On most occasions the victim is lifted off the ground and propelled against the barrier precipitating indirect impact to the body and deceleration effect to the contents of the body cavities.

*4. **Other effect*** on the victim is due to the explosion atmosphere in the form of flame, hot gases etc due to combustion of clothes and surrounding items; inhalation of noxious gases and falling masonry structures. Ionizing radiation effects are only present in cases of nuclear blasts.

The original flame due to detonation is so momentary that secondary fire masks its effects. Those caught inside collapsing buildings sustain bruises, abrasions and lacerations of nonspecific kinds, which must be differentiated from those due to blast effect. These victims die mostly either due to multiple injuries of demolition or crush asphyxia.

Autopsy examination of the victims of explosions is guided by three principles that are necessary for the proper investigations of such cases:

- Identification of marker or trace evidence in the body of the victim of trace the source of its origin
- In case more than one bodies are mutilated, allocation of parts to each to determine their number
- Reconstruction of mutilated remains of the victims to locate and recognize the type, site, and distribution of injuries.

Besides determination of cause of death, which in most of cases is obvious, it is largely an anatomical exercise similar to sorting of skeletal remains. The task may be simple if the victim is relatively intact or may get very difficult, even impossible, when the victims are more than one and are badly mutilated in small fragments. The exercise can become extremely complicated when the smaller fragments of human origin get mixed with disintegrating masonry structures or when they are not available. First, non-human tissue, if any, should be identified, and discarded. It is followed by isolation and labeling of various parts and organs of the human origin.

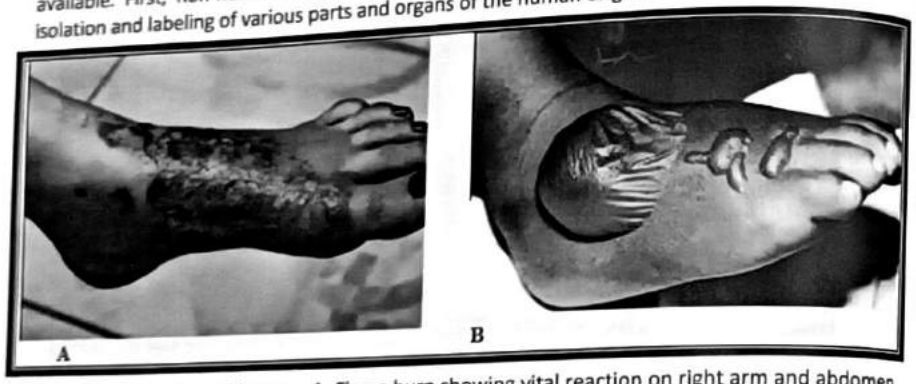


Fig: Ante-mortem thermal burns. **A.** Flame burn showing vital reaction on right arm and abdomen.
B. Hot liquid burn showing scalding.

Finally, allocation of these human parts is done to the individual bodies to determine their number. Radiology is useful and assists in identifying the trace evidence and matching of contained skeletal structures.

2. **Transportation Accidents - Road Traffic Accidents:**

Number of all sorts of transportation accidents is increasing these days specially road traffic accidents, railway accidents and air traffic accidents.

Causation of Accidents:

1. Mechanical defects: faulty breaks, fault in steering wheel column, sudden bursting of tyre, number of vehicles, speed
2. Environmental factors: poor visibility, advertisement boards hurdle, poor road conditions
3. Human factors: fault of users of road, drivers and pedestrians, age group (very young or very old drivers), disability (color blindness) personality trait,

Medical Fitness Certificate: following considerations are important for driving license:-

1. Age: People at extreme of age are not fit for driving
   For private vehicle age limit is 18 years
   For public vehicle age limit is 21 years
   After 60 years of age one should renew driving license each year

2. Sex: females are safe drivers as compared to males (as they do not take unnecessary risks). In U.K. for ambulance female drivers are preferred.
3. Physical Health: integrity of body parts, limbs, vision and hearing is required.
4. Physical Ill Health: IHD, hypertension, color blindness etc call precipitate an acute disability at any time.
5. Functional Ability: over fatigued and retardation effect the reaction time. Reaction time is time interval between cause of action and action or it is the time taken for 1st materialization of intention. Normally it is 0.3 second. If vehicle is going at a speed of 30 MPH it will travel 13.5 feet in 0.3 second. So always keep a distance of at least 14 feet from the vehicle in front. In fatigued states this time interval is increased.
6. Mental Health: delirium, hallucination etc all effect the power of decision. Hence insanity has to be ruled out. Use of sedative, hypnotic is also prohibited for driving.

Pattern of Injury: 1st of all see the victim, vehicle and scene of incidence. During examination look for trace evidence and examine the clothes. Injuries to the pedestrians include:

1. Primary impact: these are caused by direct impact between vehicle and pedestrian. Parts of the vehicle coming in contact with victim are bumpers, lights, radiator and bonnet. Bumper injury is typical and you can find the vehicle from its bumper imprint. Characteristic wedge shaped fracture of upper end of tibia is seen by the impact of bumper. If victim is a child then primary impact injuries may be on head, if adult these injuries may be on legs.' Sometimes primary impact injuries are on 2 different levels on the 2 legs; it means that the victim was walking or ?????
2. Secondary impact: these injuries are due to fall of the victim on road after impact. Injuries include bruises, abrasions, lacerations, and fractures etc. coup and counter-coup brain injuries etc.
3. Tertiary impact: or run over injuries occur when the victim on the ground is run over by another or the same vehicle. Characteristic of this is the tyre mark. No two tyre marks are same.

Injuries to the driver include ***(1) Deceleration Injuries:*** Forward Throw = steering wheel imprints, fractures of ribs, fractures of leg bones, fracture of wrist; Upward and Forward Throw = injuries on forehead, whiplash injuries and coup and counter-coup injuries of brain. ***(2) Acceleration Injuries:*** when vehicle is hit from back by another vehicle there is forward throw, body remains stable but head is thrown forward. If driver was leaning forward and head is not supported in case of back seators so there is over extension or backward movement of the head resulting in damaging injury to spinal cord; Jack-Knife injury. ***Whiplash Injury:*** combination of Hyper-Extension and Hyper Flexions of Neck.

Definition: In accidents where a vehicle by another vehicle from back. There is a Sudden Hyperextension at the Neck Joints Suffered by the people. Not having back Rest for head. Due to sudden push when the Driver applies breaks or vehicle strikes some heavy object like a wall there will be a sudden hyperflexion of Neck. This Hyper Extension and Hyperflexion causes fracture of Neck at C4 – C6 level. The person suffers severe damage to his spinal cord Resulting in paralysis or even Death.

Injuries to the co-passengers include fractures of ribs, fractures of leg bones, fracture of wrist, injuries on forehead, whiplash injuries and coup and counter-coup injuries of brain.

Injuries to the rear seat passengers: there are variety of injuries from head injuries lo long bone fractures and mostly are hyperflexion and hyperextension injuries.

Seat Belt Syndrome: If seat belts are tied following injuries occur: -

1. Due to shoulder strap: bruising of chest, ribs fracture, laceration of viscera
2. Lap belt: injuries to pelvic and abdominal organs and lumbar spine
3. Head strap: bruises on forehead etc

Identification of Drivers

- The only person in vehicle
- Person on the driving seat
- Specific injuries
- Identification by the witness
- If body is into pieces then identify the shoe or foot etc on the brakes paddle

Suicidal Road Traffic Accident:

- Vehicle stuck against a fixed object like a wall, pole etc or vehicle dropped from the turn over a mountain road etc
- Witness tells about over-speeding absence of brakes application
- No sign of brakes application like tyre marks on mad
- If weather is clear then chances of accidents are low
- Suicidal note
- Carry out psychological autopsy

Presumption of Survivorship:

1. Younger survive elders
2. Healthier survive diseased
3. Male survives females

Motorcycle Accidents:

Helmet can protect most of the injuries to the motorcyclist. Most of the accidents occur due to over-speeding. Head injuries are the most common injuries in case the motor cycle hits a firm object in front either stationary or moving towards the motor cyclist. Motorcycle can be struck from back by a vehicle like truck and in this case run over injuries can also occur.

3. **Transportation Accidents - Railway Injuries:**

These are either suicidal or accidental or homicidal injuries. Always keep in mind that person can be killed by some other means for removing the evidence of crime placed over the railway track. Accidental injuries are caused when collision occurs between the trains, dropped down electric wire touches the train, when some one is leaning out of window or door, while person is walking over the track or along the track and is hit from back or from the side.

4. **Transportation Accidents - Air Traffic Accidents:**

Aircraft accidents are increasing in number these days due to increase in the air traffic. Mostly the hijackers thinking it as a safe route for them selves are increasingly using now a day. Common injuries are seat belt injuries while landing or taking off. In a crash bodies are either burnt or scattered into pieces so a great problem can occur in identification.

THERMAL INJURIES

These are injuries by increased temperature (heat injuries) or injuries by decreased injuries (cold injuries)by Heat: Burns

Heat exhaustion

Heat stroke

Dehydration

Injuries by Cold: Local ——— Frost bite, Trench Foot, Emersion Foot
Generalized —— Hypothermia

Burns are: Thermal burns
Radiant heat burns (X-rays, UV-rays, laser etc)
Chemical burns (discussed latter)
Microwave burns
Electric burns (discussed later)

Burns

1. **Thermal Burns:**

Causative agent is heat. Heat causes damage to capillaries, exudation of large amount of fluid from circulation via these damaged capillaries. There is local tissue damage, hypoxia and tissue necrosis. Sources of heat are fire, flame, hot object, electricity, chemicals etc. In thermal burns the heat source is heat flame, Hash, hot objects and liquids. Heat is of 2 types:

Dry Heat: It is heat of flame, flash, hot objects (like iron, hot steel bars) and friction between two objects (when 2 objects come in contact with speed heat is produced, specially in road side accidents and in mechanical works).

Wet Heat: Heat is given by the hot liquids. Temperature of liquids determines the severity of burns. In dry heat maximum temperature is provided but in wet heat maximum temperature is equal to the boiling point of the liquids.

Thermal burns are either dry burns or wet burns:-

a. Dry Burns:

Flame Burns: when tissues comes in contact with a flame it is burnt - called flame burn. Site of burning is at or above the application of flame. If there is cloth in between, then cloth either will catch fire or will adhere to skin (as it is woolen or synthetic). Sometimes contact with flame is for short duration so burning is only of superficial tissues. As the duration of contact prolongs, deeper tissues are involved more. Hair gets curly and sticky called singeing of hair. In flame burn there is no blister formation and laceration, only burning, scorching and coagulation of proteins, live bone may burn and gets fractured if contact is for long duration.

Hot Article Contact Burns: any hot article, object or weapon may leave an imprint on body surface. This imprint may show shape of weapon. It may be accidental or self inflicted. Degree of severity of burn depends upon degree of hotness of object and time of contact.

Flash Burns: it occurs by igniting, lightening or flashing (of flame). Burnt tissue is only erythematous - red. If heat is received for longer periods deeper tissues are also involved. Sometimes there are abrasions with burns (like hot ligature causes burning and abrasions).

b. Wet Burns:

Emersion: there is emersion of body in hot liquids. Features may vary from simple blisters to roasting and also vary with intervening cloth. Tissue is dry, coagulated and hard. Blisters contain fluid. In antemortem burning blisters contain albumin and chloride rich fluid. There is no singeing of hair no burning of cloth.

Splash of Fluid: Local damage occurs at exposed parts. Blisters are formed but no hair singeing.
Steam burns: steam causes very severe burns may even cause laceration. Inhalation of steam causes damage to respiratory tract edema, choking and even death. Steam damages the alveoli in the lungs. Steam causes blisters formation on the exposed body parts.

2. Radiant Heat Burns:

These are due to electromagnetic heat waves. There is no actual contact between hot object and flame. These are seen when body parts are exposed in near vicinity of hot objects. There is only redness of skin. Hairs are also intact. If body is exposed for long duration to heat waves charring is seen.

3. Microwave Burns:

Microwaves produce heat by molecular agitation. The greater the water contents of a particular tissue the greater is heat produced. A particular thing about microwaves is that these heat up inside of tissues so it is opposite to the normal heat, which damages the external surface.

Classification of Burns: according to Dupuytren : It is pathological classification;

1. 1st degree
   - Erythema
   - Singeing of hair
   - No skin destruction
   - No scar formation
   - Disappears in few hours
2. 2nd degree
   - Vesication
   - Singeing of hair
   - Scorching
   - No scar formation
   - Confined to epidermis
3. 3rd degree
   - Destruction of cuticle and true skin
   - Very painful
   - Scar is formed
   - Skin contracture at scar
4. 4th degree
   - Destruction of whole skin (hair follicles, sweat glands, sebaceous glands, subcutaneous tissue)
   - Less painful
   - Scar is formed with contracture and deformity
5. 5th degree
   - Charring and burning of skin, subcutaneous tissue, soft tissue and muscles
   - Scar is formed with deformity
6. 6th degree
   - Charring of whole part including bone and cartilage

Wilson's Classification:

1. Epidermal Burns: 1st and 2nd degree burns of Dupuytren's classification
2. Dermo-epidermal Burns: 3rd and 4th degree Dupuytren's classification

3. Deep Burns: 5th and 6th degree Dupuytren's classification

Willace's Rule of Nine: by this we can estimate the burnt area

1. 9% for head and neck
2. 9% for each arm
3. 9% for front of each leg
4. 9% for back of each leg
5. 9% for front of chest
6. 9% for back of chest
7. 9% for front of abdomen
8. 9% for back of abdomen
9. 1% for perineum

This rule is not applicable to infants due to relatively large size of head.

Age of Burns:

Redness	- Immediate
Vesication	- 1-3 hours
Pus formation	- 2-3 days
Superficial sloughs separation	- 4-6 days
Deep sloughs separation	- 2 weeks
Granulation tissue seen	- 2-3 weeks
Scar formation	- at 3 week

Heat Injuries (other than burns)

Heat Exhaustion: It occur in any climate, building and also in mines. It occurs during physical exercises associated with prolonged sweating and salt depletion.

Signs: are muscle cramps, nausea, vomiting, dizziness, and drowsiness. It occurs in July and August. It depends on 2 factors Humidity and Temperature.

Following conditions are fatal: -

32°C	and	100% humidity
38°C	and	90% humidity
45°C	and	40% humidity
60°C	and	15% humidity

Condition becomes comfortable by air movement. Heat exhaustion is also known as heat collapse, heat syncope, heat prostration etc.

Heat Stroke: In this condition heat regulation mechanisms fail and hyperthermia occurs. It can occur anywhere in the world but it is very common in tropical areas in summer. Normally when temperature increases there is vasodilatation and increased sweating. But in summer small blisters are formed which block the openings of sweat glands and there is decreased sweating. It is common in athletes and persons working in open during summer. It is systemic hyperthermia, thermic fever and heat hyperpyrexia. Generally it is a fatal condition; on autopsy following findings are observed:-

- Degeneration of brain, heart and kidney

- If survival period is prolonged then biliary stasis, cholangitis and intramural myocardial infarction can be seen
- DIG
- Pulmonary edema but not incase of dehydration

Stationary air and humidity worsen all the conditions.

Dehydration: it is a condition characterized by decreased water contents of body due to excessive loss or reduced intake. This condition is commonly seen in summer seasons in athletes and those who work outside in sun. There is excessive sweating, headache, dizziness, drowsiness etc. It may lead to heat stroke if not treated.

Pulgistic Attitude: extensive burning causes muscle rupture and bone fractures. Legs and arms get flexed. Arms are flexed at elbow and come on chest, while legs flexed at knees and hips and come on abdomen - thus a specific attitude develops called pulgistic attitude.

Cold Injuries

Cold injuries result from

- Too much cold environment
- Exposure to ice or solid cold medium
- Cold water emersion

1. ***Local Cold Injuries***
   a. **Frost Bite:** occurs due to cold environment. Most exposed and tapered parts get necrosed e.g., tip of nose, ear lobule, fingers, toes. Frost is cold environment, moisture and dry icy material. Frost causes thrombosis in vessels. Blood vessels get blocked and blood supply is cut off and tissue necrosis occurs.
   b. **Trench Foot:** it was first seen in the soldiers on long stay in trenches. Feet are too cold, swollen, pooled with cold blood and are num, parasthesized and even paralyzed due to compression on nerves. It can also occur in other persons not specially the soldiers.
   c. **Emersion Foot:** when foot or feet are emersed in cold for long time there can occur erythema, swelling, inflammation, vascular congestion, gangrene formation in some tissues as blood supply is decreased tissue may become necrotic and dead. Gangrene is either dry or wet. There is no role of bacteria. It is only due to decreased temperature. Epidermis and dermis get separated. Epidermis is necrosed and avascular and hollow blisters are formed. These blisters should never be opened. Blisters formed due to heat injury are fluid filled. Sometimes whole of the limb is gangrened.
2. ***General Cold Injuries***

   State of body is hypothermic. It occurs due to continuous placement of body in low temperature environment without adequate precautions. Many diseases cause hypothermia and those should be ruled out, like:

   - Shock
   - Epilepsy
   - Diabetes
   - Ketoacidosis
   - Skin is icy cold to touch, pale or red (depending on protective measures of person)
   - Generalized muscular stiffness

- Blisters are seen
- Frozen joints fluid, ice cracking sounds are heard from joints
- Person is lethargic, fatigued and drowsy and may die

Normal body temperature is 37°C, 21°C body temperature is fatal and causes death; it depends upon age, built, physical state and duration of exposure.

Signs and Symptoms:

1. Decreased metabolic rate
2. Decreased respiratory rate
3. Decreased heart rate and peripheral circulation falls
4. Decreased oxygen dissociation from Hb anoxia death
5. Muscular stiffness
6. Paralysis of VMC
7. Vasodilatation stasis of blood thrombosis blockade of vessels tissue necrosis
8. Cerebral convulsions, drowsiness death
9. Person may be in the state of suspended animation

Treatment:

1. Gradual dry warming by exercise and rubbing
2. Administer stimulants
3. Avoid friction and compression
4. Do not open the blisters
5. Move joints in water bath of 37° C
6. Avoid alcohol and tobacco

Autopsy Findings:

1. Hypostasis is red or cherry red in color
2. Rigor remains for long period
3. Cooling delays putrefaction
4. Edema is more marked on face
5. All organs are congested
6. Heart is filled with cold, red (bright) blood
7. Lungs are edematous, red frothy blood oozes out on section
8. Superficial ulceration of gut is seen
9. Fatty necrosis of pancreas can occur
10. Ventricles of brain are full with serum

Medicolegal Aspects:

1. Mostly homicidal
2. Homicidal in case of infants
3. If a decomposed body is found in snow, it means that death is not by cold as cold prevents decomposition (putrefaction)
4. Person remains conscious till death

CHEMICAL INJURIES

These are injuries produced by the action of chemicals on body like acids and alkalies. These also include vitriolage (throwing of acid on face). There is damage at the site of application and below (as fluid flows down). Chemicals may cause ulceration, may eat up the tissues and form cavities. Color of the affected part may tell us about the used chemical.

Black	-	H_2SO_4
Yellow	-	HNO_3
White to Yellow	-	HCl

By the action of acids or alkalies tissues may be coagulated, dried, shrunken hard, shriveled necrosed etc. Alkalies mostly cause liquefaction of tissues. Other chemicals like castor oil seeds are vesicants they cause vesication. If contact duration is deeper tissues are also involved.

Chemicals Burns: burns by the chemicals are:

1. Superficial Burns: only superficial tissues are involved and contact is short
2. Deep Burns: contact time is prolonged and deeper tissues are involved

Effects of the Burns are dependent upon:

- Type of the chemical used
- Extent of the surface involved
- Contact time
- Site
- Age (in child 33% of burns are fatal)

Death in Burns occurs due to:

- Shock
  - Pain - Neurogenic shock
  - Fear - Psychogenic shock
  - Complications Hypovolemic shock
- Suffocation by gases like carbon mono-oxide, carbon di oxide and fumes of the chemicals
- Inflammation
- Toxemia

Fatal Period; we cannot give clear-cut view about fatal period. It varies with the involvement of different states and complications like septicemia, toxemia, peritonitis, meningitis etc.

Objectives to be attained are

1. Identification of person
2. Burns are either antemortem or postmortem. In case of antemortem vital reaction is seen, red line at the base of blister, repair signs, scar, scab, granulation etc.
3. Determine cause of death is it burns or something else
4. Mode of death
5. Look at the clothes and identify the smell
6. Look for the levels of CO CO_2 in the blood

7. Have a look at the state of heart
8. Look at the color of hypostasis
9. Types of burns
10. Age of burn Immediate: Red 1 hour: Vesication 2-3Days: Pus 4-6Days: Slough / Week. Scab

ELECTRICAL INJURIES

In this modern era electricity is in very common use. Users are from children to adults. The most dangerous place is the bathroom - water is in abundance - person is not wearing rubber slippers or if he / she is wearing those are also wet - so electric shock is lethal.

Supply of voltages is:-

Domestic	220-240 volts
Industrial	av.600-1200 volts
In lightening	4000000 volts and even more

Factors that influence the shock are:-

Earthing	better contact, worse effects
Duration of contact	there are 3 situations as given below
	Number one: by the domestic voltages there is often spasm of hands and wire is grasped called hold on phenomenon. Number two: high industrial voltages cause repelling of person. Number three: very high voltages attract the body from a distance: 5000 volts: 1mm, 100000 volts: 35mm
Resistance offered by the body	
Sleep	

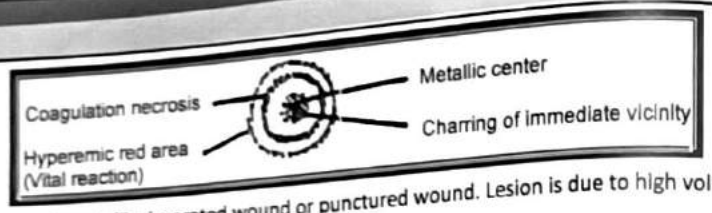
Path of the cur rent

From right hand to	Right foot	
" "	Left foot	
" "	Left hand	
From left hand to	Right hand	
From head to	Foot	this is the worst one

Resistance of tissue plays an important role in the conduction of current. Mainly current is conducted in the body via the blood vessels. Dry palms are most resistant and inner aspect of the thighs are least resistant. Alternate: current (AC) is more dangerous at 50-60cycles / sec than the Direct Current (DC). If body is exposed to electricity for some time the cardiac muscle is set into flutter and fibrillation.

Electric Burns: Electric burns include lesions of exit and entry. There may not be visible lesions but burning and charring of body. Lesions also depend on the time of contact.

1. **Entry Lesions:**
   a. Loose or intermediate contact. causes spark lesions, which are best seen by magnifying glass.
   b. Firm contact: there is blister formation, which may contain gas or liquid, surrounding area is red. There is well-developed electrical mark (like shape of conductor) on the skin. Rim of skin is 1-3mm elevated. Also there is hyperemia of immediate surroundings.
   c. Prolong contact: it causes special burns Joule Burn, skin has brown or biscuit color and there may be charring of tissue.



2. **Exit Lesions:** tissue is like lacerated wound or punctured wound. Lesion is due to high voltage.

Important Things are

- If clothes get fire damage is increased due to increased area of exposure
- Brownish discoloration of skin is seen
- Crocodile skin
- Area of coagulation is seen
- Arborescent marking is seen
- Ecchymosis is seen along the track

Knock Down Phenomenon: Sometimes a person is working at some height say 20-40 feet and gets a shock of electricity, he may fall down and now the injuries are due to fall from height and also by the electric shock.

Mode of Death:

1. Ventricular fibrillation
2. Respiratory muscle paralysis
3. Respiratory center paralysis

Mechanism of Death:

- Syncope — fibrillation of heart
- Asphyxia — spasm of respiratory muscles
- Cerebral anoxia — decreased blood supply to the brain and cessation of respiration
- Direct brain damage — shriveling of brain substance

Autopsy Findings:

1. In case of children and old age people always keep in mind the suspicion of foul play. Also collect trace evidence
2. Always see clothes of the dead person
3. External findings are non-specific asphyxial findings
4. Internal examination (if mode of death is syncope findings are
   Congestion of organs
   Pulmonary and brain edema
   Fracture of skull in head injury
   Disruption of brain
   Shrinkage of nervous system
   Hemorrhage from blood vessels

Medicolegal Aspects: Mainly electric shocks are accidental. In case of child and old age persons these are homicidal commonly. These may be iatrogenic during ECG recording and electrical convulsions therapy.

FIREARMS

Definition:

Any Instrument or device with which it is possible to propel a projectile by means of expansive gases generated by combustion of explosive substances.

Ballistics is the knowledge of all physical forces that act on a projectile.

We will study Firearms under 3 division:

1. Interior Ballistics
2. Exterior Ballistics
3. Terminal Ballistics

1. Interior Ballistics:

This Division is under following criteria:

i) Firearms Design
ii) Ammunition
iii) Cycle of Fire.

Design:

Following are the parts of a firearm.

Barrel: It is the steel tube that guides the projectile.

Bore: (Caliber of a Gun)

It is the diameter of interior of barrel and usually measured in Millimeter.

Muzzle: The open end of the barrel, from where a projectile exits gun is called as Muzzle.

Breech: The other end of barrel is called as Breech.

Classification

Firearms are classified in to following clauses:

A: Rifled Firearms
B: Smooth Bored Firearms
C: Air Pistols or Guns

A: Rifled Firearms:

In these Weapons inside of the bore is rifled i.e., cut longitudinally with number of spiral grooves (4-7) which run parallel but spirally from end of chamber to muzzle.

It includes Rifles, Revolvers and Pistols etc.

Due to rifling bullet gets more Gyroscopic stability, more power and slow loss of energy.

B: Smooth Bored Firearms:

These firearms have a perfectly smooth barrel. These include shotguns, Muskets etc. They are further divided into long barrel guns, short barrel, single barrel, double barrel, choked barrel and unchecked barrel. (Chocking is the degree of constriction at the muzzle end. Its advantages are:

1. Compactness of shot.
2. Reduce Area of spread of shot at target.

C. **Air Pistols:**

These release lead shots or pellets (small lead Non-spherical projectile), which are propelled by air compressed in a cylinder. Range for killing squirrels, rats etc.

Ammunition:

Commonly used Ammunitions are:

(i) **Cartridge:**

It is used in smooth bored firearms. It consists of:

- Cartridge case: It is the outer shell of the cartridge. A cylinder made of plastic or brass.
- Gun powder: filled inside the lower portion of case.
- Wad: A plastic or wooden wad to separate powder from pellets.
- Pellets: Small lead balls round in shape.
- Primer: At the base of cartridge, A small part which when struck with enough force, reacts chemically to produce heat, which ignites the main propellant charge / powder.

Primer may contain:

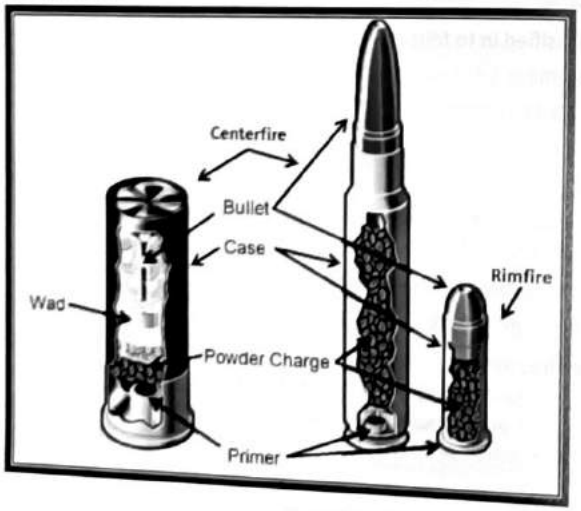
- Mercury Fulminate
- Potassium Fulminate
- Antimony Sulphide
- Lead Styphnate
- Barium Nitrate

(ii) **Bullets:**

These are used in Rifled Firearms:

It comprises of:

1. Bullet case. Made of cupro-Nickle Alloy.
2. Nose: A pin point tip. (Projectile)
3. Primer: At the base
4. Propellant: Gunpowder.



Commonly used ammunitions are cartridges in smooth bored firearms and bullets in rifled firearms. Bullets can be fully Jacketed or partially Jacketed (Dum Dum bullets). Fragile bullets are used in training purposes these contain no projectiles. There are also rubber bullets used by police and are called as Baton Roun. Incendiary bullets are used to ignite the target.

Propellant charge: It is of three types:

1. Black Powder:

15% charcoal 10% sulphur, 75% potassium nitrate. It produces a lot of smoke. Some powder is burnt some is not.

2. Smokeless Powder:

It contains Nitrocellulose (single base) or Nitroglycerine (double base). 1 gm of this powder (12-60% Nitrocellulose) produces 900 ml of gas with 100% conversion into gases. It produces no (smoke) and Tatooing.

3. Semi Smokeless Powder:

It is 85% black and 15% Smokeless powder.

$\Rightarrow$ By the combustion of powder following gases are produced.

CO_2 50% CO 3%

N_2 35% H_2, H_2S, O_2 and CH_4 in traces. In the chamber of revolver pressure rises up to 4 tons and in case of rifle up to 60 tons.

Cycle of Fire:

As the Trigger is pulled firing pin strikes the percussion cup.
↓
Primer is fired
↓
Powder is converted into gases
↓
Increased chamber pressure
↓
Projectile moves down the bore with increasing velocity
↓
Projectile leaves the Muzzle
↓
Chamber pressure returns to zero.

2. **Exterior Ballistics:**

Exterior Ballistics: it is the study of forces acting on bullet (projectile) as it leaves the barrel. These are following forces:

1. Forces in bullet or projectile i.e. the velocity of projectile = forward velocity + rotational velocity
2. Air resistance
3. Gravitational pull

Trajectory: it is the path of bullet or projectile. It is not a straight line due to air resistance and gravitational pull. As the projectile strikes the target it causes damage. Study of damages and impact of

projectile with target is terminal ballistics. If the target is human then wound is formed which is called Wound Ballistics.

Trajectory of Bullet

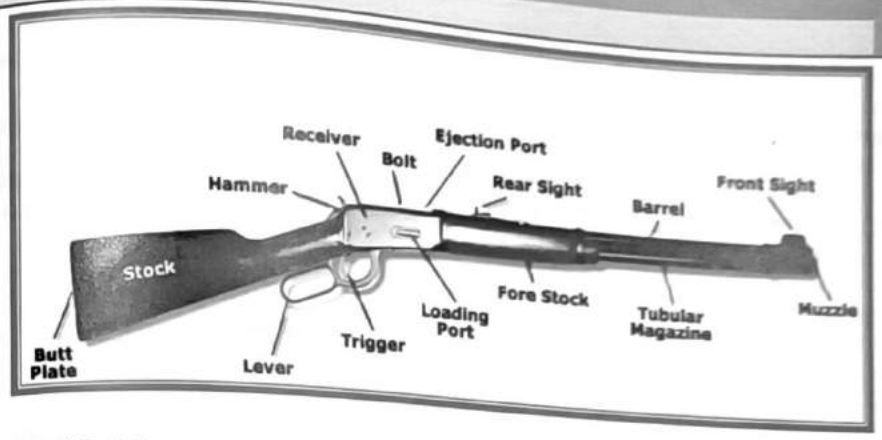
Tail wag Effect: when bullet is inside the barrel it is supported from all sides but as it comes out side there is no lateral support. Now it has 2 velocities:

1. Forward velocity
2. Rotating along its own axis

As the bullet is outside the barrel due to loss of lateral support, it becomes unstable but stability is gained by the rotation of the tail of the bullet along its own axis as tip follows the trajectory. After wagging; rotational movement the bullet gains stability. It is initial tail-wag effect. At the site of impact velocity of bullet suddenly falls and bullet is unstable again, it is terminal tail-wag effect. It is present in bullets fired from Pistol for 60 yards, Rifle for 200 yards. It's significance is:

- Increased gyroscopic stability
- Decreased air resistance
- Due to terminal tail-wag effect more damage is caused than what is suspected

As the bullet strikes the target it causes burning of hair, gas burns on skin, un-burnt powder causes tattooing and there is greasy spots and grease collar around entry wound. After entering in the body bullet forms a tract and then mostly wound of exit. Sometimes bullet does not comes out of body.



3. Terminal Ballistics:

Terminal Ballistics / Wound Production/ Wound Ballistics: When bullet impacts the target it transmits energy $K.E.= I/2mv^2$, that causes local direct damage and bullet passes ahead forming a tract. Infront of bullet waves are compressed in circular form called shock waves, these produce a cavity along original tract called primary or temporary cavity which is 30-40 times the size of bullet. After 5-10 milliseconds primary cavity disappears and only original track is left behind, called secondary cavity, as the elastic tissue recoils back. Along the original tract there is permanent tissue loss and due to distension by shock waves on the sides of the original track there is more tissue loss. Cavitation or canalization is produced when the bullet velocity is more than 1500ft/sec at the target. Factors, which modify the damages, include:

1. Terminal velocity
2. Weight of bullet
3. Rigidity of bullet
4. Architecture of bullet
5. Tissues:
   - If the bullet is in lungs; pneumostatic forces are set into motion, which enhance damage
   - If the bullet is in stomach, hydrostatic forces are set into motion, which cause more damage
   - In the soft tissue damage is less as bullet easily passes through and through

Flame of fire can only produce its effects at the distance of 6 inches, as flame cannot travel more than 6 inches from the barrel end. In case of a gun flame can travel the distance of a foot. Blackening caused by the smoke is present upto 12 inches, it can be differentiated from burning with the help of a swab. If u rub the swab over the blackened part in case of effect of smoke it will become gray. Gases produced can also travel a distance of 12 inches. Tattooing caused by the gun powder is seen within a range of 18 inches of fire.

Shotgun injuries; these are characterized by:

- Multiplicity of projectile (pellets and wads)
- Dispersion of projectile
- Wounds are caused by pellets and also wads

1. *Wound of Entry:* of shotgun is by its projectiles, which are multiple, non-spinning, round or oval pellets and also wads. These are aerodynamically of inferior quality than bullets. These have less gyroscopic stability so fall of energy is quite rapid,

   a. Contact Wound: injuries produced by contact wound and near contact wound of shotgun are more fatal than contact or near contact wound of rifled firearm. In case of shotgun contact wound, high gas pressure is generated which enters the wound, if wound is in the skull, increased pressure may cause bursting of skull. Soot (smoke) and wad is always in the skull.

   Contact wound or tear

   - Margins are torn
   - There is burning effect
   - Gases are always inside
   - There may be a bruise due to muzzle imprint

   b. Few Inches Distance: also called near contact wound. Wound is circular nearly one inch in diameter.

   - Burning is on the surface
   - Tattooing is also seen
   - Case and wad are inside the wound

   c. One-Yard Away: there is single oval hole.

   - Area around wound is burnt
   - Clubbing of hair is there
   - Tattooing is-there
   - Wad is found inside the body

   d. Two-Yard Away: there is irregular center with satellite pellets. Tattooing may or may not be present and wad is found in the body.

   e. 6-Yard Away: spread of pellets is increased, found in an area of 6-7inch.

   f. 12-Yard Away: area of spread increases more. It is about 12-14 inches.

Rule of Thumb: count areas of spread of pellets in inches count it in yards - it is the distance of fire. This is valid upto 5 yards. Away from 5 yards count spread of pellets in inches minus one, make it yards - it is the distance of fire in yards. The distant wounds by shotgun are rarely fatal, as there is rapid loss of energy of projectiles.

2. *Wound of Exit:* of shotgun shows greater disruption of tissues. Number of exit wounds are seen. Occasionally the projectiles remain in the body and there is no exit wound. It is larger and irregular than entry wound. There is no tattooing and no collar of abrasion etc. It has everted margins - except shored firearm wound - when person is sitting firmly against wall Bullet passes and strikes the hard wall then the everted margins are pushed back, so the margins get inverted.

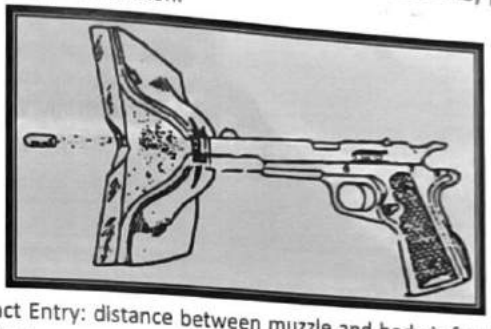
Rifled Firearm Injuries; these are more fatal than non-rifled firearm wounds as bullets are gyroscopically stable and have terminal railway effect, the axial spin of bullet causes increased damage. Bullets also have a wound of entry, wound of exit and a track in between. When there is no wound of exit then it means that:

- Bullet is inside the body
- Bullet is coughed out, vomited out or defecated
- Dropped out from wound of entry

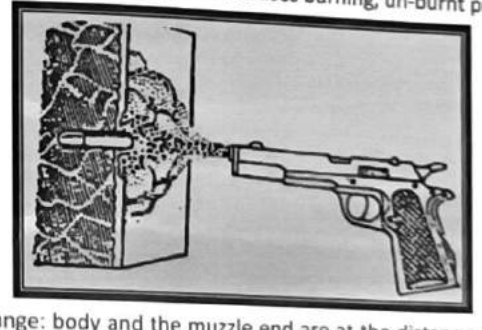
1. ***Wound of Entry:*** of rifled firearms has following three characters:

   - Smaller in size
   - Edges are inverted
   - Abrasions and grease collar are present
   - Burning, blackening and tattooing may be seen at wound of entry, depending upon distance between muzzle and body

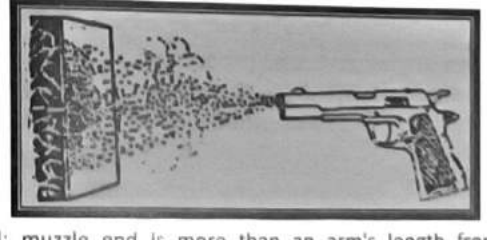
   a. Contact Entry: muzzle is placed on the body, all the things coming out of barrel like gases, bullet etc. enter n the body, as all the gases enter inside they give a push back to which muzzle form imprint abrasion.

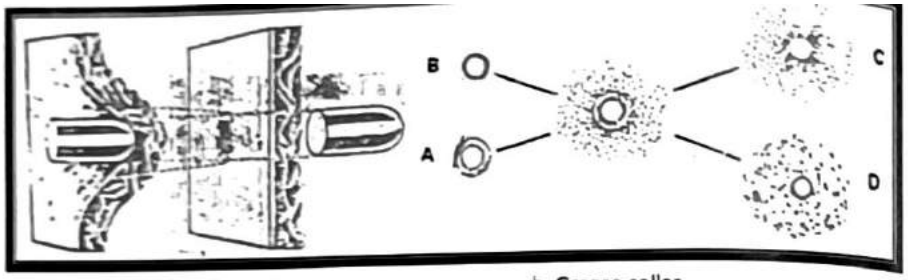
   b. Near Contact Entry: distance between muzzle and body is few inches. Smoke coming out gets deposited concentrically, flame causes burning, un-burnt powder causes tattooing.

   c. Intermediate Range: body and the muzzle end are at the distance of an arm's length. There is typical tattoo mark of un-burnt powder, no flame effect, no gas effect and no smoke effect. Only un-burnt powder particles form tattooing.

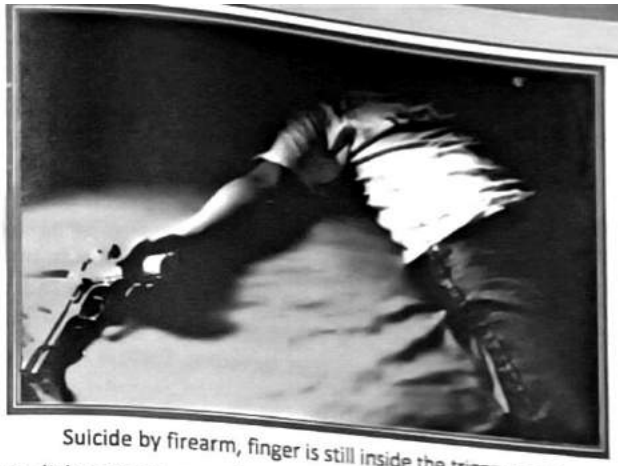
   d. Distant Wound: muzzle end is more than an arm's length from body, there is hole or perforation. There is collar of abrasion due to rotation of bullet. Hot bullet causes redness. There is no blackening and no tattooing.



a. Collar of abrasion
b. Grease collar
c. Un-burnt powder tattooing
d. Smoke blackening

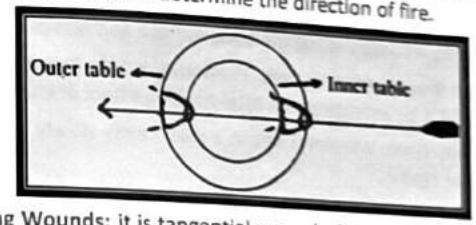
2. *Wound of Exit:* Shape of exit wound is very variable. Bullet has lost kinetic energy. So it becomes unstable and wound is irregular. It is larger than entry wound with no collar of abrasion, no tattooing, no blackening etc. its margins are everted except - shored firearm injury.

Exit Wound	Entry Wound.
It is bigger in size	It is smaller in size
Everted edges (except shored firearm injury)	Inverted edges
Abrasions and grease collar is not present	Abrasions and grease collar are present
No burning, blackening or tattooing	All are seen
Fibers of clothes turned outside	Fibers are turned inside
Profuse bleeding is seen	Slight bleeding
Irregular in shape	Regular in shape
Suicidal Firearm Wound	**Homicidal / Accidental**
Generally adult male	Anyone
Isolated bolted room and suicidal note	Not so
Side of temple, center of forehead, roof of mouth, under chin, front or left side of chest, epigastrium	Not so, it can be anywhere
Gun is in the right hand of the right handed person and in the left hand of left handed person and cadaveric spasm is also seen	Not so
Direction is consistent with self-firing	Not so
Contact or close contact shot	Mainly distant shot
Generally one fire	One to any number
Chemical examination of firing of hands is positive	It is negative
No evidence of disorder	Evidence of disorder and struggle
Psychological autopsy is carried out and tells us about:- Social status Marital status Economic status History of depression Previous attempts Any psychiatric treatment	Psychological autopsy is not helpful



Suicide by firearm, finger is still inside the trigger guard

Beveling Phenomena: it is seen in case of skull firearm wounds. When bullets hit skull, outer table is cleanly cut with oval or round hole but inner table is irregularly cut with -punched out margins, at entry hole. At exit hole opposite to this is seen that inner table is cleanly cut but outer is irregularly cut with punched out margins. Significance: we can determine the direction of fire.



Gutter Wounds or Glancing Wounds: it is tangential wound of skull with entry hole and open deep track. It is of 3 degrees:

1st Degree: only outer table is involved

2nd Degree: inner table is also involved

3rd Degree: bullet even enters skull cavity

Puppe's Rule: when 2 bullets enter the skull one after the other, fractures produced by first are arrested by the bullet entering second to it.

Corona: in case of loose contact with skin, gases will escape with resultant scattering of muzzle blast and an unusual arrangement of soot is seen on the skin, a circular zone of soot deposit around wound of entry separated from it by a zone of normal skin.

Back Spatter: blood, fragments of tissues, hair and fibers etc may come out from the contact entry wound and may be present over the hands or the firearm.

Firearm Wounds of Concealed Areas: it is referred to those wounds in which bullet or area of wound is not found in autopsy:

- A bullet in axilla, which is missed in usual autopsy
- At time of fire, mouth is open - bullet is in oral cavity and is missed during autopsy

Tandem Bullets: means 2 bullets in one wound. Due to mechanical defect in firearm 1st bullet cannot come out and when 2nd is fired both enter in target.

Ricochiate Phenomena: when bullet strikes a hard object it changes its path e.g. when bullet strikes the wall it changes its path. Pellets are fired from a distance of 3 feet, they may strike with each other and spread more and on the target the area of spread is more and they give a look as if they are fired from a distance more than 3 feet. In the body when a slow speed bullet strikes against a rigid bone it may change its path.

Kennedy Phenomena: when during autopsy it is difficult to distinguish between a firearm entry wound and exit wound. American president PJF Kennedy sustained injury on neck, bullet entered from back of neck and exit was from the front through trachea. The exit wound was of small size difficult to say that was it entry or exit or another entry from front. In fact the exit wound was small as the tight collar supported the neck tissue. As he was taken to hospital, attempts were made to save his life and during surgical manipulation it further became difficult to distinguish between entry and exit wound.

Rat Hole Phenomenon: beyond 3 feet the pellets start spreading. There is a central hole surrounded by few perforations.

Odd and Even Rule: suppose there are 3 injuries on the body, 2 are entry wound and one exit wound. It means 2 bullets entered the body from different wounds and come out from one wound or only one bullet came out and second is inside the body. Sometimes there is one entry wound and many exit wounds, it means that one bullet entered the body and struck against the bone shattered it into pieces and pieces came out from different exit wounds. But this rule is not applicable in ease of tandem bullets; 2 bullets moving end to end entering through one hole and exit through one hole also.

Foot - Mat - Rubbing Effect: Bullet wipes along the body surface and leaves a grease mark.

Collar of Abrasion: it is seen around entry wound. Previously it was thought that it is due to rotation of bullet. But now it is said that it is by indenting and total rubbing effect of the bullet.

Lead Poisoning! it is very rare. When a bullet is left in a joint cavity slowly it dissolves and causes chronic lead absorption from the joint cavity

Medicolegal Certification: first thing to be decided is that is it a firearm injury or not. If firearm then rifled or non-rifled. Then tell the time of injury, type, encircle holes on clothes and preserve them. If court of law asks about distance of fire then tell about it otherwise not.

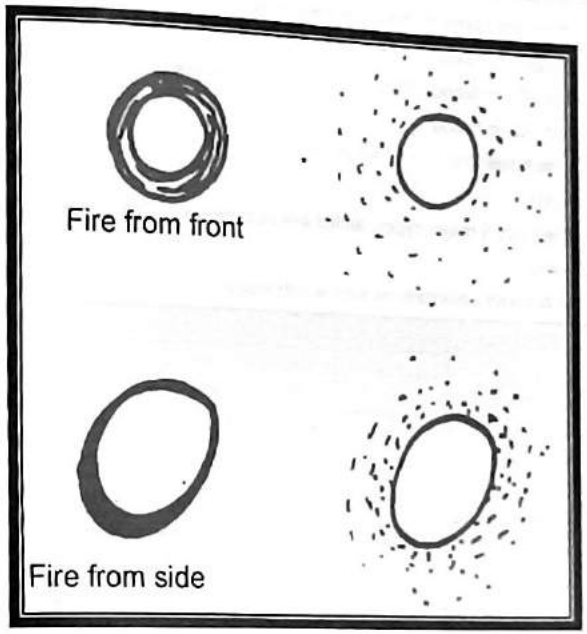
Autopsy: special considerations while conducting the autopsy of victim of firearm injury:-

1. *Scene of Crime:* describe scene concisely, take photographs look for position of body and firearm
2. *Clothing:*
   - Collect trace evidence
   - Bullets may be in clothing (trapped there in)
   - We can determine distance of fire by looking smoking effect and tattooing
   - Number of bullets can be determined
   - Determine entry and exit wounds
   - Determine the direction of fire
   - Holes are cut and sealed
   - Make clothing dry and get them preserved
   - Clothing are sent to lab for subsequent examination
3. *Complete External Examination:*
4. *Firearm Injuries:* these should be numbered and described fully with the help of a diagram
5. *Cause of Death:* it may be fear, shock, hemorrhage, injury to vital organs etc.

6. *Chemical Analysis:* it includes complete blood and urine examination. Also chemical tests of hands of victim for gun powder

Direction of Bullet: it can be ascertained by examining:

1. Entry and exit wound relation
2. By the beveling phenomenon (if skull is involved)
3. Fragments of clothing driven in the wound
4. Tracing the course of projectile
5. On skiagram small metal particles may be seen along the track
6. Fragments of one tissue driven into other if pieces of liver are found in intestines - direction is from right to left slightly downwards.



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Chapter-8

Asphyxial Deaths

Word Asphyxia is derived from 2 Greek words: A = no and Spliyxia = pulse
so we can say that it is condition of Pulselessness.

Asphyxia: Means interference with oxygenation process of blood.

Terms asphyxia, suboxia, hypoxia, anoxia may be taken in same meanings but all are different terms.

Anoxia: Total lack of oxygen in body

Hypoxia: Decreased oxygen concentration in body.

In forensic Medicine both are taken in the same meanings.

Hypoxemia: Lack of oxygen in blood

Hypercapnia: Increased CO_2 in blood

Hypocapnia: Decreased CO_2 in blood

Acapnia: No CO2 in body fluids

Classification of Asphyxia!

Asphyxia is classified into 5 major types, which are as follows:

1. Mechanical Asphyxia

in this airways are blocked externally as well as internally.

Mechanical Asphyxia	Suffocation	Smothering	Closing nose and mouth
		Gagging	Introducing some articles via mouth or nose for preventing air exchange
		Choking	Obstruction at the level of glottis
		Traumatic	Immobilizing abdomen and chest
		Autoerotic	Suffocation during sex adventures
	Strangulation	Hanging	Constriction of neck by a ligature around neck and force is applied indirectly (weight of body)
		Garroting	It is constriction of neck by ligature. Constricting forces are directly applied to ligature.
		Throttling	It is manual strangulation, or force is applied to neck of person by pressure from hands or forearms of another person.
		Mugging	It is type of strangulation in which pressure is applied by elbows
		Bans Dola	It is type of strangulation in which pressure is applied by hard sticks.

2. Environment Asphyxia

There is oxygen deficiency in the environment or some other gas in environment, like CH_4. CO_2, CO, SO, or H_2S, etc replace O_2. CO, CO_2, SO_2 are produced from combustion and CO_2, CH_4, H_2S from

fermentation. Such kind of asphyxia is mostly seen in mines, smoky and congested houses and house bomb factories etc.

3. Pathological Asphyxia

Diseases of upper larynx may cause obstruction in air exchange e.g. tumors of larynx and trachea, spasm of laryngeal muscles, edema of larynx etc.

4. Iatrogenic Asphyxia

It occurs due to negligence of doctors or anesthetists e.g. choking caused by endotracheal tube.

5. Toxic Asphyxia

It occurs due to disturbances at the level of lungs in oxygen transport.

Classification of Anoxia:

Anoxia or hypoxia means lack of tissue oxygenation. Tissue oxygenation is disturbed due to disturbances at

1. Blood level
2. Cellular level

Anoxia or Hypoxia is of 3 types due to disturbances at blood level.

1. Anoxic Anoxia

Oxygen cannot reach in lungs (due to mechanical asphyxia or environment asphyxia etc)

2. Anemic

It is insufficiency of blood to carry oxygen due to anemia

3. Circulatory Anoxia

In circulatory failure and hemorrhage oxygen transport from lungs to tissues is decreased.

Anoxia or Hypoxia is of 4 types due to disturbances at cellular level.

i. Extracellular Histotoxic Anoxia

Tissue enzyme system is disturbed and poisoned. So O_2 cannot enter into the cells from ECF.

ii. Pericellular Histotoxic Anoxia

Cell permeability for O_2 is decreased it is seen in case of anesthetic over dose.

iii. Substrate Histotoxic Anoxia

When foodstuff is deficient O_2 cannot be utilized.

iv. Metabolic Histotoxic Anoxia

There is toxicity of metabolic cad products, CO_2 and urea (due to excess metabolism or failure of excretory mechanism) so further metabolism is prevented.

BIOCHEMISTRY OF ASPHYXIA

- There is no gas exchange during asphyxia
- O_2 concentration in body fluids
- CO_2 concentration in body fluids
- Hyperglycemia is there as a stress response
- CO_2 ↓ pH and ↓ O_2 concentration causes cell membrane damage leading of Na^+ inward movement and K^+ outwards
- Disturbances occur in fluid electrolyte balance

PATHOLOGY OF ASPHYXIA

It is accompanied with two types of findings.

a. Nonspecific pathological

b. Specific pathological findings

Specific findings vary with types of asphyxia so are discussed when we discuss the particular type. Only non-specific findings are discussed here:-

1. Cyanosis

   It occurs due to ↑ CO_2 and $HbCO_2$ giving bluish coloration internally as well as externally. It becomes very prominent few hours after death.

2. Congestion

   There is damage to blood vessel walls and these injuries to blood vessel causes vasodilatation causing blood accumulation in all organs, liver, heart, kidney and brain.

3. Edema

   Damage to blood vessel walls causes shifting of Hind in extra cellular Hind in interstitial spaces leading to edema formation in brain and lungs.

4. Petechial Hemorrhage

   It occurs due to coming out of RBCs from blood vessel walls, which are damaged due changed blood biochemistry. It is seen on under surface of scalp, subcapsular surfaces of liver etc.

5. Fluidity of Blood

   Due to damage to blood vessel wall there is release of fibrinolysin, which keeps the blood in fluid form.

PHYSIOLOGY OF ASPHYXIA

There are 3 stages of asphyxia (these are formed after experiments on animals and volunteers.)

1. Stage of Suboxia

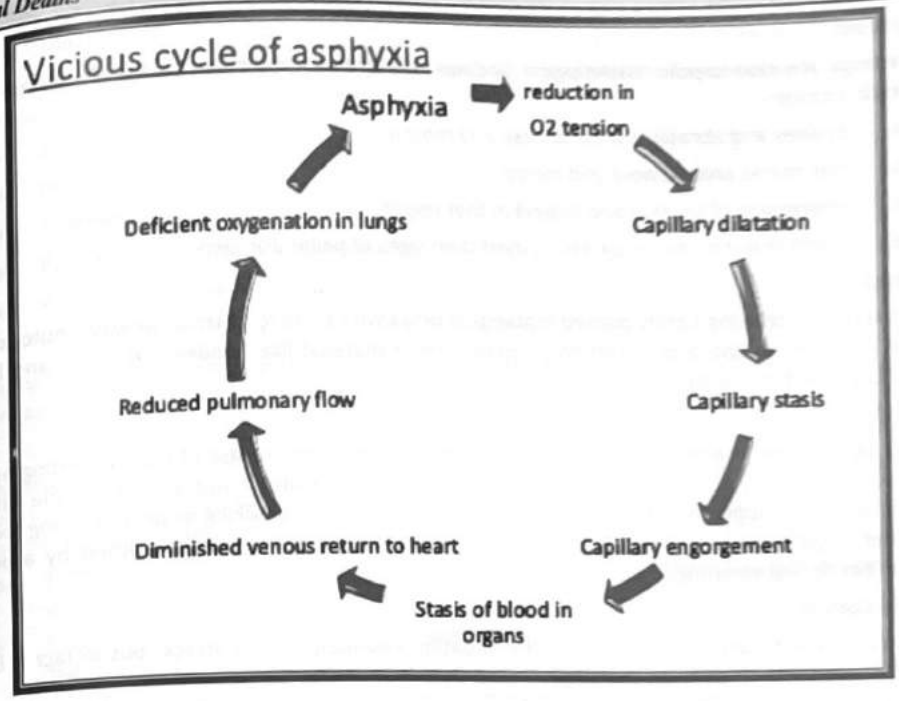
   1/4th to 1 minute obstruction results in suboxia and CO_2 accumulation - Cyanosis is also seen. ↑ CO_2 concentration stimulates respiratory center, there is increased respiratory rate and amplitude of respiration blood pressure is not effected.

2. Expiratory Dyspnoea

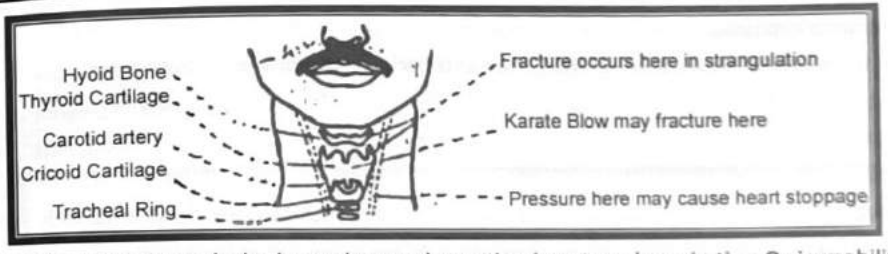
   It rests for 30 sec. There is trouble to breathe. Expiration is more pronounced. Cyanosis deepens; there is engorgement of neck veins, organs. Unconsciousness in seen, one may go into coma and convulsion can occur.

3. Exhaustion

   Coma deepens, respiratory rate is slow, inspiratory dyspnoea occurs, there is gasping, pupils are dilated, conjunctiva is insensitive, terminal vomiting may be seen, heart beat slops in 5-10 min. One may die before heart stops.



ANATOMY OF ASPHYXIA



It is failure of oxygen to reach the lungs due to obstruction in external respiration Or immobilization of chest and abdomen.

Types:

1. **Smothering**

   It is closing of nose and mouth by mechanical means. Most common example is placing plastic bags over heads of children. Plastic bag sticks to nose and mouth, this is called "Spaceman syndrome". A tired mother lying on the side of her child may cause his death by suffocation. Another example is causing suffocation of infant during breast-feeding as he is pressed against breast.

   Burking

   Burke and Hare ware two murderers. One of them used to sit on chest of victim and forcibly close the mouth and nose. Thus suffocation is caused by smothering and traumatic asphyxia. This combination is called burking.

Autopsy Findings in Smothering

Findings are non-specific pathological findings of asphyxia, (discussed already) and specific ones, which include:-

a. Bruises and abrasions around nose and mouth.
b. Nail marks around nose and mouth.
c. Impression of thumbs and fingers in that region
d. If soft material like pillow etc. is used then signs of pallor are seen.

2. Gagging

It means introducing tightly packed material in oral cavity so as to obstruct airways. Autopsy findings are all same, as those of smoothing except foreign material like handkerchief, sari, and bed sheet parts present in oral cavity.

3. Choking

It is obstruction in airways at the level of glottis. It is best seen in case of children eating breads etc, which completely obstructs larynx. These are sudden cardiac arrest and person may die without cry. This can also happen, when a bolus of food is swallowed during talking or person eating food who is under large dose of tranquilizers in mental institutions. Choking is also caused by aspiration of vomitus during vomiting.

Café Coronary

When death occurs due to choking, the situation resembles heart attack, but in fact it is case of suffocation and reflex heart stoppage.

Autopsy Findings

All nonspecific pathological sings of asphyxia are seen. A foreign body obstructing the airways at the level of glottis is also found.

4. Traumatic Asphyxia

It is traumatic immobilization of chest from anteriorly, posteriorly or on both sides.

Mode of death

Anoxic anoxia

Autopsy Findings

Nonspecific General Pathological findings are there other include (Specific for traumatic asphyxia)

- Clear-cut line on chest, bluish area and pale areas separated by this line. If blood is pushed up towards head in superior vena cava, then bluish area is up, also hemorrhages in neck, face, ear nose, and area of abdomen is somewhat pale.
- If blood is pushed down bluish color is seen in legs and abdomen due to congestion of lower extremity veins with, $HbCO_2$ In this case blood is pushed in inferior vena cava.
- Bruises and abrasion are seen on chest.
- Ribs are fracture.
- Trauma to pleura is also seen.

Medicolegal Importance

It is always accidental as old people dying in Haj. It is homicidal as burking. It is also seen in females sedative sex adventures.

5. Autoerotic Asphyxia

It is also called "sex hanging" or "sexual asphyxia". A little is known about it. Death occurs in sexual fantasies or masturbation. Findings are

- Adult or post adult male
- Nude partly or fully
- Isolated
- Pornographic material in surrounding
- Pattern of ligature or asphyxia is complex

Strangulation

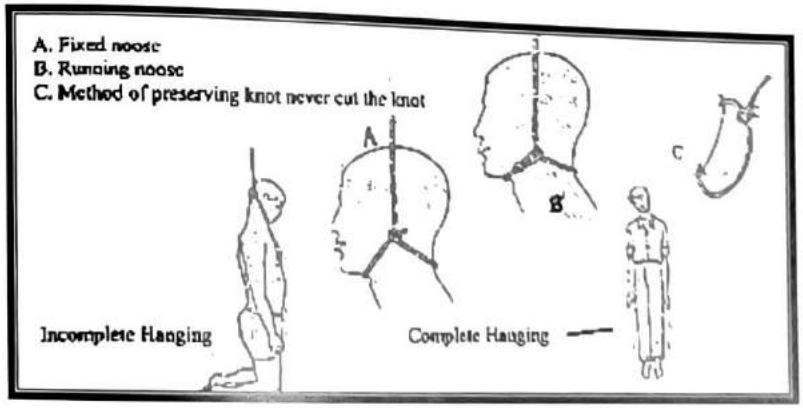
It is asphyxial death caused by interference with respiration due to application of pressure on neck by some means.

Types:

1. Hanging: It is constriction of neck by a ligature around neck and force is applied indirectly (weight of body). If a person is hanged and no body part is touching any supporting object hanging is complete. If some body part is touching any supporting object hanging is incomplete. Hanging is of 2 types:
   a. Typical Hanging: When knot is in the middle at occiput; in oilier words when occiput is point of suspension.
   b. Atypical Hanging: When point of suspension is some other area not occiput. Knot is not in the line.

Judicial hanging is typical hanging. It is practiced in some countries including Pakistan. Knots are of 2 types fixed and running noose. When it is Running noose; loop is formed already and person is hanged in it. Then loop is constricted and fits totally around neck. In this situation ligature around neck contact impression of knot, but when there is fixed noose and person is hanged in it the loop is wider so ligature mark around neck misses the impression of knot. Before Death these are:

- Flashes of light before eye
- Ringing of ear
- Unconsciousness



Mode of Death

Due to ligature pressure is on the under surface of tongue and tongue is pushed upwards and blocks airways so results in:-

- Anoxic anoxia
- Reflex cardiac arrest
- Fracture dislocation of cervical vertebrae in judicial hanging also destruction of medulla at C_2 level.
- Coma due to cerebral anoxia.
- Syncope due to vagal inhibition.
- All these lead towards death.

Fatal Period

5-8 minutes

Autopsy Findings

There are 3 lines of inquiry, which demand special consideration.

1. External Features
   - Nonspecific general pathological findings, others are
   - Neck is stretched due to upwards pull
   - Pale face (drainage of blood via vertebral veins)
   - Clenched hands
   - Purple nails
   - Prominent eye-balls due to congestion
   - Protruded tongue
   - Dribbling of saliva
   - Marked postmortem lividity
2. Ligature Mark
   - Appears as Depression
   - Abrasions and bruises of skin in bed of depression
   - Hyperemia and ecchymosis along edges
3. Hyperemia appearance
   - Injury to spinal cord and medulla
   - Extensive laceration, bruising, rupture of underlying tissue
   - Fracture of hyoid bone
   - Hyperemia of trachea and epiglottis

Medicolegal Importance

Whether death was due to strangulation or not?

- Ligature mark with petechial hemorrhage
- Dribbling of saliva
- Tear of intima of carotid arteries

- Congestion and hemorrhages in lymph node above ligature mark
- Fracture/dislocation of cervical vertebrae
- Absence of fatal injuries and poisoning

Suicidal hanging is common amongst females. Psychological autopsy is needed. Homicidal hanging is common but accidental is rare e.g. female falling down stairs hanged by duppatta and a male by turban.

1. Lynching

When more than 2 person over power an individual and hang him it is called lynching.

Antemortem Hanging	Postmortem Homicide
1. Autopsy signs coincide with cause of death.	1. Autopsy sings do not confirm that death is by hanging.
2. Ligature mark, oblique and non-continuous high up on the neck.	2. Ligature mark continuous, circular, low down on the neck.
3. Knot is single not on front	3. Knots are more than one and on front of neck.
4. Ecchymosis is well marked on either side of ligature. P.M. staining is marked above ligature and in lower extremities.	4. Ecchymosis is mostly absent. P.M. staining is according to position after death.
5. Parchmentization under ligature is well marked.	5. Parchmentization is absent.
6. Cyanosis of face, lips and ears etc is very well marked.	6. Cyanosis depends upon cause of death.
7. Face bloated, eyes congested, neck veins are engorged.	7. It depends upon cause of death; death may be due to suffocation.
8. Tongue is protruded.	8. Not so
9. Discharge of semen in males.	9. Not so
10. Defecation occurs.	10. Not so
11. There is dribbling of saliva	11. Not so

Antemortem Hanging	Postmortem Homicide
1. Age: adult, (child below 10 years, and adult of age above fifties rarely commit, suicide)	1. Age: any
2. Ligature mark is oblique, non-continuous	2. Ligature mark is transverse, continuous, circular
3. There may be previous history of unsuccessful attempts of suicide	3. Not so
4. No defense wound on body	4. Defense wounds may be present
5. Hands and legs may not be tied	5. Hands and legs may be tied
6. Body must be found hanging from a point accessible to the victim	6. Not so
7. Room is isolated, closed-door and closed windows	7. Not so
8. Mainly a suicidal note is found	8. Not so
9. Signs of struggle as a rule are absent in case of suicidal hanging	9. When signs of struggle are found, except when victim was sleeping, unconscious or a mere child.

2. **Garroting**

It is constriction of neck by ligature. Constricting forces are directly applied to ligature.

Mechanism

Or mode of death is

- Anoxic anoxia
- Syncopal
- Cerebral hypoxia (rare)

Autopsy Finding

These are non-specific general pathologic findings of asphyxia and specific ones, which are:-

a. Externally
   - On face are congestion, cyanosis, and conjunctional hemorrhage, petechial hemorrhages, bleeding from car, nose and mouth.
   - External findings at locus arc, ligature mark note its features, its level, type of material, direction of ligature, no of turns, ligature material may not be there. Then collect trace evidence fibers of ligature material (if is deep mark, then ligature is given by hard material if diffused then given by cloth etc.)
   - External findings away from locus include sings of struggle, defense wounds, also take swabs _ this may be case of a sexual offence.

b. Internally
   - At locus: there may be bruising of soft tissues, carotid sheath, and fracture of hyoid bone, fracture of laryngeal cartilage
   - Away from locus: there may be fracture of ribs, other abdominal injuries are also seen

Medicolegal Importance

Mainly it is homicidal, never suicidal, it may be accidental such as umbilical cord around fetus, and this may be used for infanticide.

3. **Throttling**

It is manual strangulation, or force is applied to neck of person by pressure from hands or forearms of another person.

Mechanism

Or mode

- Anoxic anoxia
- Syncopal (as ANS is involved)
  i. Pressure is on carotid sinus or above sinus ↑ pressure in sinus leading to parasympathetic or vagal stimulation this cause cardiac inhibition.
  ii. Pressure on carotid artery below sinus ↓ pressure in sinus sympathetic stimulation fibrillation death
  iii. Blockage of cerebral artery or vein cerebral hypoxia (rare)

Autopsy Findings

Vary with mode of death, if it is syncopal there is no finding at all. Even slight pressure on carotid sinus can cause death during intense emotional state e.g. A dancing boy puts hands over the neck of a girl she can die on spot if she is in intense emotional state. Findings are

- Non specific general pathological findings
- Specific ones include

a. External
   - At locus: congestion of face, petechial hemorrhages, bleeding from big nose, ear, subconjunctival hemorrhage, if one hand is used for throttling one bid bruise of thumb with nail mark and 4 small bruises on other side. If 2 hands are used then 2 big bruises and 8 or so on small bruises. Findings are modified by intervening cloth.
   - Away from locus: hands for legs may be tied, for other sings and features over rest of body.

b. Internal
   - At locus: see bruising of soft tissues, carotid sheath, retro-pharyngeal karate-chop tissue fractured hyoid bone may be there, Body of hyoid bone is fractured only by Karata chap.
   - Away from locus: there may be fracture of, ribs and also blunt injury of abdomen.

Medicolegal Importance

Generally it is homicidal accompanied by sexual offences. Rarely it is accidental, as is the case of dancing boy. It is never suicidal.

4. **Mugging**

It is type of strangulation in which pressure is applied by elbows. Rest of the findings is same as those of throttling.

5. **Bansdola**

It is type of strangulation in which pressure is applied by hard sticks.

	Hanging		Strangulation
1.	Ligature mark is oblique, incomplete above	1.	Ligature mark is transverse, complete and blow thyroid cartilage.
2.	Clear cut ligature mark margins.	2.	No clear cut
3.	Bruising of neck muscle is less.	3.	More bruising.
4.	Tissues beneath ligature mark are white, hard and glistening.	4.	Soft and read area beneath ligature mark.
5.	Hyoid bone is commonly fractured.	5.	Not fractured
6.	Bleeding from nose, mouth and ears are not common.	6.	Bleeding from these orifices is common.
7.	Face is congested with less petechial hemorrhages.	7.	Petechial hemorrhages are common.
8.	Neck is stretched	8.	Not so
9.	Dribbling of saliva is seen	9.	Not so
10	Urine incontinence less common	10.	Urine incontinence is common.

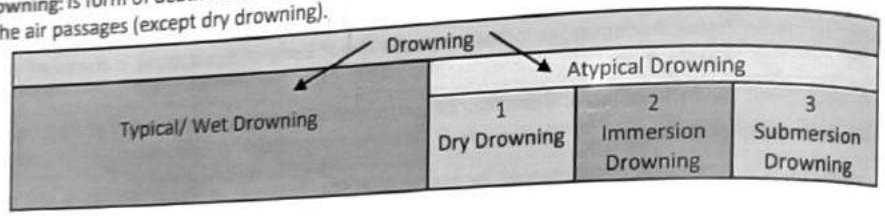
☆☆☆☆☆☆☆

Chapter-9

Deaths by Drowning, Starvation and Lightening

DROWNING

Drowning: is form of death resulting from defective oxygenation of blood in lungs due to presence of fluid in the air passages (except dry drowning).



a) **Typical Drowning:** in this case water goes into airways, resulting in obstruction of airways. Victim gets severe chest pain. Typical drowning is of 2 types:

- **Primary:-**
  Time is very short between insertion into water and death. Death occurs in few minutes. Vagal stimulation causes cardiac inhibition.
- **Secondary:-**
  Survival period varies from 1/2 hour to weeks. Victim is taken out of water. Death occurs due to metabolic acidosis, pulmonary oedema, chemical pneumonitis and severe chest infection.

b) **Atypical Drowning:** in this type there is very little or inhalation of water. It includes:

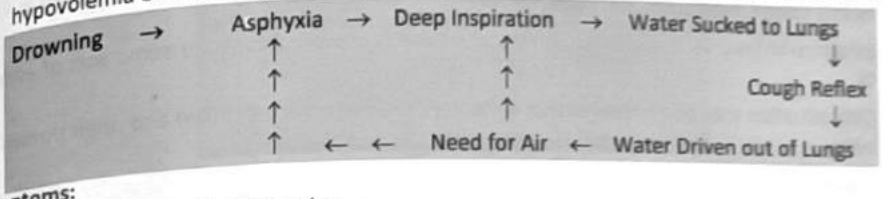
- Dry Drowning:-
  There is sudden rush of water in nose or mouth - thrust of water against nasopharynx or larynx causes intense laryngospasm so suffocation occurs. There is also stimulation of vagus hence cardiac inhibition is there. Predisposing factors include:
  1. Emotional tension
  2. Fear (feet entering 1st in Water)
  3. Hypersensitivity

  Its findings include the following:
  1. Clenched hands in sand and bushes etc. - instant rigor
  2. Contraction of erector pilli in ante-mortem drowning- it is called cutis anserina
- **Immersion Drowning:-**
  Sudden impact of alcoholics with water causes vagal stimulation and cardiac arrest – death
- **Submersion Drowning:-**
  It is seen in case of epileptic, drunken victim or a person having head injury becomes unconscious and falls in shallow water and gets drowned

Mode of Death:

- For Fresh Water Drowning:
  Water in blood Hemodilution Hypervolumic Rupture of Cells K^+, Hb, Ca^+, Na^+, Cl^- and Proteins causing ventricular fibrillation and death in 4-5 minutes

  For salt Water Drowning:
  Na^+ concentration rises 3% Hemoconcentration Fluid comes in lungs there is pulmonary edema and hypovolemia both leading to O_2 carrying capacity of blood and death occurs, in 8-12 minutes.



Symptoms:

- Auditory and visual hallucination
- Memory of past
- Mental confusion in some cases

Causes of Death:

- Asphyxia
- Ventricular Fibrillation (fresh water)
- Cardiac Arrest (salt water)
- Vagal inhibition
- Death due to complications: cardiac failure, renal failure, pulmonary edema, severe infections

Fatal Period:

- On average 5 minutes
- Fresh water 4-5 minutes
- Salt water 8-1 2 minutes

Autopsy Findings;

a. **Non-Putrid Bodies**

1. External Examination: first of all take a thorough history of the case:-

   Clothes: Person might be wearing swimming dress; clothes are wet, smeared with mud or sand. Presence of frank blood gives the suspicion of foul play. Skin: is wet cold, clammy and pale due to vasoconstriction

   Cadaveric Spasm: is seen in most of the cases. Hands are clenched very tightly. Eyes half opened, conjunctiva congested, pupils are dilated

   Post-mortem Staining: Confined to head, neck, face, front of chest, abdomen, thighs and legs (front side) - as body is floating up side down. Staining is pink due to hypothermia and un-dissociated hemoglobin.

   Air Passages: Foamy froth at nose and mouth.

   Goose Skin: as erector pilli contract due to cold water, skin is granular and puckered. There may be injuries produced by the water animals.

2. Internal Examination:

   Respiratory Tract: lungs are congested and heavy. On section fine froth with blood comes out and airways are also filled with fine froth.

Blood: Fresh Water = Water in blood Hemodilution Hypervolumic Rupture of Cells K^+, Hb, Ca^+, Na^+, Cl^- and Proteins. In Salt Water = Na^+ concentration rises 3%. Hemoconcentration Fluid comes in lungs there is pulmonary edema and hypovolemia

GIT: drowned fluid is seen in stomach and small gut.

Middle Ear: in case of ante-mortem drowning, hemorrhages and fluid is seen in middle ear cavity.

Diatoms: these are microscopic unicellular fungi. In ante-mortem drowning it is seen in lungs, blood, spleen, liver, brain and bone marrow.

Evidence of trauma: if during swimming someone is drowned consider some sort of epileptic fit,

CVA: situation may be of postmortem drowning; the person is first killed and .then thrown into water.

b. Putrid Bodies

Chances of putrefaction are more in polluted, warm, stagnant water. If temperature of water is 5-6°C putrefaction is delayed liquified for weeks.

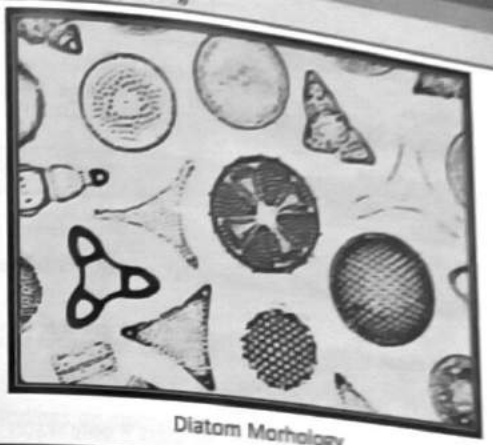
Lungs: softened and liquified with gas and froth formation.

Chemical Tests: in case of a death by drowning: difference between right and left ventricle blood Cl^- concentration is 25mg - left ventricular Cl^- contents are diluted in fresh water drowning and concentrated in salt water drowning. Mg^{++} level rises in brain.

Medicolegal Aspects:

1. Identification of body
2. Determine cause of death/type of drowning
3. Was death due to drowning or not? i.e. it is ante-mortem or postmortem drowning.
4. Factors contributing drowning include, sustained head injuries, epileptic fits, MI, IHD, intoxication.
5. Where the body was immersed?
6. Drowning is common by suicide in women.
7. Homicidal drowning is seen in case of infants and children commonly.
8. Accidental drowning is seen in children, swimmers, and fishermen and dock workers, intoxicated and epileptic subjects.
9. If the drowned person is wearing a non water-proof watch it will stop in water and indicate time and date of drowning.

	Antemortem Drowning		Postmortem Drowning
1.	If drowned media is present upto ileum it is antemortem drowning	1.	Drowned media is not upto jejunum or ileum
2.	Middle ear cavity is filled with fluid and show hemorrhages.	2.	Not so
3.	Diatoms are found in blood organs (lungs, spleen, liver, brain etc)	3.	Diatoms are not found



Diatom Morhology

STARVATION

Starvation:

It results from deprivation of food or by use of unsuitable food i.e. with lack of proteins, lack of water, lack of vitamins etc. Starvation is still a major problem in many countries. An adult person needs 2000 calories each day. If so much food is not available then weight loss starts. Some diseases also cause weight loss. 1st exclude these, cancer, metabolic disorders autoimmune disease and AIDS. Starvation is of 2 types acute and chronic. Their signs and symptoms are:-

Acute Starvation:

In 1st 30-48 hours

- Intense thirst
- Hunger pangs relieved by pressure
- Pale face, dry mouth
- Thick, white saliva
- Scanty urine
- Dry furrowed tongue

In next 48 hrs.

- Dehydration and emaciation
- Loss of body weight, 40% loss causes death
- Foul offensive breath
- ↑ Skin pigmentation
- ↓ Body temperature
- ↓ BP
- Feeble pulse
- Fatigue
- Weak voice
- Pallor and cadaveric look

- Hypoproteinemia may cause slight edema
- Brittle hair and nails
- Sunken, bright eyes with dilated pupils
- Constipation, dry stony feces
- Scanty, turbid urine
- ↓ Body sugar and protein
- Intellect remains normal till end.

Chronic Starvation:

Signs and symptoms are all those of acute starvation but with greater emaciation. Individual may die of infections.

Fatal Period

On average 10-12 days without food and water; 50-60 days if only water is given. Fatal Period varies with age, sex, health and clothing.

Treatment

- Restore body temperature
- Give sips of warm fluids
- Administer stimulants by mouth
- After few days administer predigested food.

Autopsy Findings

a. External Findings

- Dry shriveled body with hyper-pigmented skin
- No subcutaneous fat
- Foul smell from body
- Ulceration and bedsores
- Soft, pale, atrophied muscle
- Hollow cheeks and temple
- Dry coated tongue
- Brittle nails and hair
- Early decomposition

b. Internal Findings

- Reduced organ size and weight except brain.
- Organs are pale and shrunken
- Heart is small, pale, empty
- No body fat, shrunken
- Empty bladder
- Full and distended gall bladder
- Empty paper like intestines
- De-mineralized bones
- Lungs pale and collapsed

Medico-legal Aspects

It is common suicidal method amongst prisoners and lunatics and also common homicidal for infants, week and feeble old aged person. It is accidental in famines, mine disasters, ship wreck and stricture of esophagus.

LIGHTENING

Lightening:

Deaths by lightening are seen is rainy season. These are rarely seen.

Diagnosis;

- Always take history of circumstantial evidence.
- Look for burning of areas all around.
- See for findings on clothes, these may be from none to maximum, clothes may be torn, blood stained and burned etc.
- Look for Findings on dead body due to lightening and blast effect.

Injuries:

There is 2 type of wounds, wound of entry and exit, wound of entry is near head, neck, shoulder, and wound of exit is on the body part near or touching the ground. Exit wound is more marked by excessive tissue burning. There is a tract from entry to exit wound, along the tract following 3 types of burns are seen:

a. Surface Burns:

These are seen at the site of metallic objects; like zippers, (if they are in contract with skin). Due to generation of increased heart clothes and body surface is burnt and metal objects can melt.

b. Linear Burns:

All are along wet areas like, folds of axilla, folds of groin, folds of abdomen, and genitalia.

c. Arborizing Wound:

These are due to passage of current in blood vessels and pattern is arborising like branches of the tree (branches of blood vessels)

Sludge Hammer Effect;

When there are high voltages near body surface, body surface also gets that charge same charges repel each other and body is pushed ratner thrown away from the place, getting.

- Bruises and lacerations
- Fracture of skull and tearing of brain
- Rupture of muscles

Deaths by lightening are very uncertain it is clear by the 2 following cases.

1. Two persons were riding on same horse in rain, when one died of lightening but other survived. The person who died was wearing rubber shoes and who was saved, was bare footed and feet touching horse.
2. Two brothers were sitting aside in a room when one was burnt and died on the spot but other was thrown away from the place due to sludge hammer effect and survived.

Chapter-10

Infanticide

INFANTICIDE

Infanticide: means destruction of a newly born child and it is punishable by law. Motives are:-

- To get rid of an illegitimate infant of a widow or an unmarried woman.
- To kill a female child, to escape stigma of having a son-in-law e.g. in pre-Islamic Arabs.
- Extreme poverty

Examination;

In case of infanticide is as

a. Examine mother for recent delivery
b. Examine child for:-
   1. Was he born alive?
   2. Was child mature or immature?
   3. If born alive, time interval b/w birth and death.
   4. Case of death?

Signs of Maturity of Fetus:

Following are the signs of a child who is born mature:

1. Length 47 cm - 50 cm
2. Weight 2.5 __ 3.5kg
3. 4cm long thick hair on head
4. Nails project beyond fingertips
5. Eye brows and eyelashes are separate
6. No papillary membrane is there
7. Umbilicus midway b/w xiphisternum and pubic symphysis
8. In male child testis in scrotum
9. Center of ossification at lower end of femur

Signs of Still Born Child:

A stillborn child is one who died in uterus and shows anyone of following signs after delivery:

1. Rigor mortis at delivery
2. Signs of maceration
3. Signs of mummification
4. No signs of ossification center at lower end of femur.

Signs of Live Birth:

Evidence of life is drawn from following things:

- Air in lungs
- Air in bowel
- Crying
- Muscular movements
- Circulation: color of skin is reddish not pale
- Changes in Hb: HbF level starts decreasing shape of chest, arches rounded or dome shaped after respiration, it is flat before respiration.
- Diaphragm is at 4^{th} or 5^{th} rib level if respiration has not taken place and if respiration has taken place it is below 6^{th} rib
- Changes in lungs are very important:-

	Untreated (Still Born)		Breathed (Live Born)
1	Volume is small and closely placed along spine	1.	4 to 6 times larger and heart is covered by lungs
2.	It is solid like liver	2.	Spongy in consistency
3.	It is uniformly dark	3.	Color is red or pinkish grey
4.	No blood vessel is seen on surface	4.	Blood vessels are seen ramifying on the surface
5.	No ribs making	5.	Clear ribs marking
6.	On squeezing lungs under water larger irregular bubbles of gaseous decomposition are seen	6.	Small uniform air bubbles are seen
7.	No air vesicles are seen on surface	7.	Sometimes seen
8.	Weight of lung is 1 1/70 of body weight	8.	Weight of lungs is 1/35 of body weight
9.	Lung Sinks in water	9.	Lungs float on water

How Long the Child Survive?

Assessment of duration of life can be done by a careful. Consideration of the following points.

1. Skin
   - Bright red with vernex caseosa - fresh birth
   - Vernex removed - 2 to 3 days after birth
   - Brick red to yellow color - at 3rd day
   - Normal color - in a week
2. Caput Succedaneum

   It is the swelling formed on forehead during delivery. It disappears between 2-3 days after birth.
3. Umbilical Cord
   - Clotting at cut ends _____ 2 hours
   - Cord attached to child dries off _____ 12-14 hrs.
   - Ring of inflammation at base _____ 36-48 hrs.
   - Falling of cord due to sloughing _____ 5-8 days.
   - Healed wound and scar formation _____ 8-12 days.

4. **Circulation**
   - Nucleated RBCs in circulation _____ 24 hrs after birth.
   - HbF is 80% at birth gradually its concentration falls
   - Umbilical artery contracts 10 hrs after birth.
   - Contraction of ductus arteriosus is complete at 10th day.
   - Closure of foramen ovale occurs at 2nd-3rd month.

Causes of Death:

Causes of death of an infant are divided into following 3 groups.

1. **Natural**
   i. Immaturity
   ii. Congenital diseases e.g. syphilis, diseases of lungs and circulation.
   iii. Malformations
   iv. Debility
   v. Placental diseases
   vi. Erythroblastosis foetalis
   vii. Head injury in labor, these are mainly fissured fractures and injuries by forceps.
2. **Accidental**
   i. Prolonged labor
   ii. Cord prolapse
   iii. Twisting of cord around neck and head
   iv. Injuries to abdomen of mother
   v. Death of mother
   vi. Suffocation of child by blood, meconium, liquor amnii
3. **Criminal**
   i. Strangulation (by umbilical cord etc.)
   ii. Suffocation
   iii. Drowning
   iv. Starvation
   v. Poisoning
   vi. Blunt weapon injuries on scalp

BATTERED BABY SYNDROME

Also called "Caffey syndrome" or "Non Accidental Trauma in children". Step children and economic problems produce situations like battered baby syndrome. It is condition of trauma to child in home environment either by parents or guardian. Usually child is under 3 years of age with injuries of non-accidental violence. It is less common above age of 3 years as child become wiser and escapes from scene.

Important Features Include:

- Child is always under 3 years of age
- Story told to the doctor not confirms the injury

- Unexplained delay in reporting to doctor
- Child is youngest and unwanted

Common Injuries:

- Skin abrasions and bruises
- Subdural hemorrhages and fracture of skull
- Multiple fractures of long bones
- X-rays of whole body reveal multiple fractures in different body areas in different stages of healing.
- Injuries to lips, mouth, torn frenulum, whipping signs
- Injuries to eyes and even retina
- One constant feature is "it is repetitious".

Parents of Battered Baby:

- Usually young couples with unwanted child
- Isolated family will; dominant father (unhappy experiences in his own childhood)
- Poor family

Management:

- Safety of child is 1st priority
- Advice the family
- Hospitalize the child
- Try to know problems of parents give them proper advice and send the child with them
- Warning can be given
- If hurt is fatal report to the areas police

Hurdles in Investigations: are as follows

- Sufferer cannot complaint
- Parents always tell a lie.
- Doctors are not suspicious generally and rely on story of patient.
- Lawyers favour their clients as they are paid for this.
- Courts are difficult to be convinced, as it is child of parents.

Autopsy Findings:

a. **External Examination**
   Look at clothes, nutritional status: measure weight, height and take x-rays of whole body It may be a death from starvation not by physical violence

b. **Internal Examination**
   These include
   - Skull fractures, petechial hemorrhages under scalp, subdural hematoma
   - Injuries to hyoid bones
   - Traumatic changes in retina

- Fractures of ribs
- Injuries on abdomen
- Fractures and trauma to long bones

Whole body must be x-rayed.

SUDDEN INFANT DEATH SYNDROME

(SIDS) also called cot death syndrome, crib death syndrome. In 1940 few forensic researchers saw that some children died with asphyxial mode but cause was not known. These were non-suspicious deaths. Its etiology was not known, majority of infants died in beds or cots in 1st 6 months. There was no sign of pathology and in 98% cases cause of death was also not found.

Features:

1. Age is between 2-7 months.
2. Males are prone to females.
3. Death occurs in most of cases in winter.
4. Death occurs during sleeping.
5. There is increased risk amongst the members of twin pair
6. Prematurity increases the risk
7. Common in low class families
8. Seen all over the world.

Etiology:

Not well known, following factors may be responsible:-

1. Hypersensitivity to cow's milk
2. Respiratory infections
3. Hypo-parathyroidism
4. GIT infections
5. Spinal hemorrhages
6. Cardiac arrhythmia

Autopsy Finding:

You may not find any +ve autopsy finding. Autopsies are carried out to know cause of death and prevent further deaths. Some findings are:-

1. Pulmonary edema, heavy lungs
2. Purple patches on pulmonary surface of lungs firm in consistency
3. Collapsed alveoli and with thickened walls
4. Petechial hemorrhages on surface of lungs, heart and thymus
5. Presence of pathogens in lungs tissue cultures

S.I.D.S

Is unexpected unexplained death of a baby whose cause is not known

Chapter-11

Medicolegal Aspects of Sexual Activity

IMPOTENCE & STERILITY

Impotence is defined as physical incapacity to perform the act of sexual intercourse. It refers to the physical inability of the male sex to perform the sexual act. It may be complete or partial; temporary or permanent; curable or incurable. Out some schools of thought also say that females may also be impotent. Females are passive agents in sexual activity, so she cannot be impotent. Impotency is bar to marriage and a cause for divorce.

Sterility is inability to procreate; i.e., inability to impregnate in case of males and to conceive in case of female.

Impotence is the term that is mainly confined to males but sterility is the term, which can be in male as well as in females. Sterility refers to the condition of agametogenesis. In male both of these conditions (impotence and sterility) can be present together or exist separately. Fertility is opposite to sterility. Sterility is not a cause for divorce or a bar to marriage.

Medicolegal importance:

A doctor is asked to give an opinion in following circumstances

Civil Cases: 1- Disputed paternity and legitimacy
2- In case of divorce on plea of impotence; for the purpose of divorce impotence must be permanent, incurable, and present at the time- of marriage and marriage was constructed without full knowledge
3- Claim for money from a wife on the grounds that she has passed the child bearing age

Criminal Cases: 1- Alleged adultery
2- **Rape**
3- **Unnatural sexual** offences
4- **Claims of loss of** sexual power due to injury or accident

Causes of Impotence in Mates:

1- **Before puberty and at** very old age
2- **Absence or non-development** of penis or state of intersexuality
3- **Local diseases: large hydrocoele,** scrotal hernias, gonorrhea, and syphilis, TB of penis, cancer of **genitalia, elephantiasis**
4- **General diseases:** acute fever, tabes dorsalis, tumour of cauda equina and hypopituitarism
5- **Addiction: chronic alcoholism,** addiction to narcotics, bromides and cocaine
6- **Injuries: trauma to head,** spinal cord or cauda equina
7- **Psychological: fear, emotional upsets,** sexual perversions and dislike for partner
8- **Operations: amputation of penis** (complete or partial)

Causes of Impotence in Females:

1- Absent or rudimentary vagina
2- Local diseases: imperforate hymen, adhesions of labia, vaginismus, gonorrhea, TB, vaginal diphtheria, carcinoma etc
3- Psychological: fear, emotional upsets, sexual perversions and dislike for partner

Causes of Sterility in Males:

1- Before puberty
2- Malformations (hypospadias and epispadias) a person with undescended testes may or may not be sterile
3- Local diseases like testicular atrophy, diseases of testes and epididymis and after mumps
4- Injuries to testes or injuries to the sexual organs during operations etc
5- Psychological causes like emotional distress, sexual perversions, dislike for partner etc
6- Vasectomy

Causes of Sterility in Females:

1- Before menarche and after menopause
2- Malformations like conical cervix, absence of uterus, ovaries or fallopian tubes
3- Local or general diseases causing harm to ovaries, fallopian tubes etc e.g., chronic salpingitis, tuberculosis of the area, menstrual disorders
4- Chronic exposure to X-rays, chronic alcoholism, abuse of narcotics
5- Hysterectomy, tubal ligation

Proof of Potency and Non-sterility in Males:

It is by

1- Normal genitalia
2- Erection of penis
3- Ejaculation
4- Motile sperms in semen

Male should abstain from sexual activity for a week. After masturbation semen sample is collected and examined for any evidence of sterility within 2 hours. In case of a female

Proof of Non-sterility in Females:

It is by

1- Developed ovaries
2- Ovulation
3- Normally developed uterus
4- Patent fallopian tubes
5- Absence of any local disease

- Examining the case of impotence in case of male, first one must take an informed consent
- Complete physical examination should be carried out. Specially the CNS and the genital reflexes. One must exclude any organic cause for impotence. Doctor should say, "there is nothing to suggest that person is impotent".

- Prostatic massage per rectum should be carried out and urethral discharge should be examined for spermatozoa, pus cells, AFB etc.
- In order to rule out psychological impotence prostatic massage can be carried out under sedation and if no erection is seen or no urethral discharge is seen then there can be an organic cause for impotence. Penile plethysmography is also a useful tool to differentiate between psychological or organic impotence. It has a silicon rubber sleeve which fits around the penis and measures the frequency and extent of sleep erections (normal is 4-5 times a night during deep sleep). An impotent person will have no erection during night.

STERILIZATION

Sterilization: it is a procedure carried out deliberately to render a person incapable of reproduction without affecting the potency. Mostly it is carried out as a family planning measure. Sometimes it is carried out in good faith to avoid any danger to the life of mother due to pregnancy or delivery.

Pre-requisite: a written consent should be obtained from both the husband and the wife. For family planning purposes restrict the operation to those who are over 30 years of age and who have at least 2 children, one is male.

Common Procedures:

1- Vasectomy (in males)
2- Tubal ligation (in females)

In case of male semen is examined. Semen sample should be obtained after masturbation and examined within 2 hours. Person must abstain from sexual intercourse for a week. In case of female development of ovaries, patent fallopian tubes normal uterus and evidence of ovulation should be confirmed.

VIRGINITY

Virginity: a woman is a virgin who has had no coitus.

Medicolegal Aspects of Virginity the question that a woman is virgin or not arises in cases of:

1- Divorce on the plea of impotence of husband
2- Defamation of woman
3- Rape

Signs of Virginity:

1- Breast Signs: Firm, elastic, hemispherical breasts with small nipples usually surrounded by pink areola (these are of little value)
2- Genital Signs:
   - Firm elastic labia majora fully covering labia minora
   - Labia minora is small, thin, pink not hang down
   - Clitoris is small, vagina is narrow and tight
   - Intact posterior commissure, crescent in shape
   - Hymen is thin elastic and semilunar admits tip of little finger only and notches in the hymen are intact.

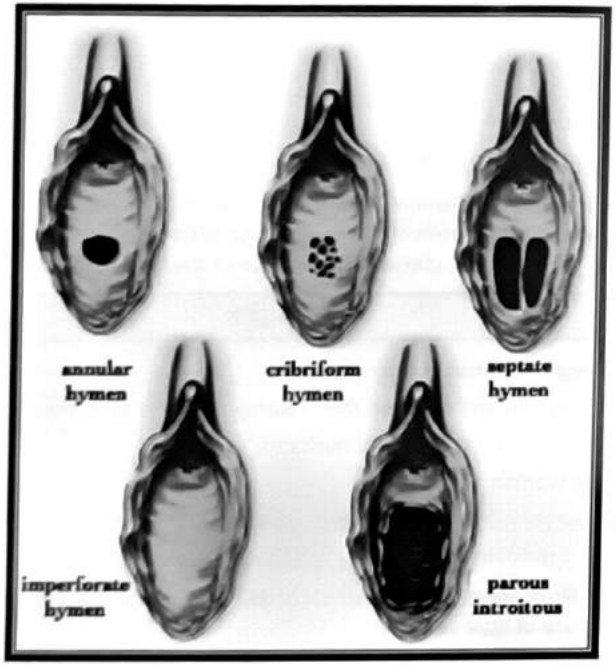
True Virgin: the hymen is intact and woman had no sexual intercourse

False Virgin: the hymen is intact and the women had sexual intercourse

HYMEN

Hymen: it is a membranous fold partially or fully covering the external vaginal orifice. Its thickness is about 1 mm. Its structure varies from thin membrane to a tough cartilaginous or fleshy mass.

Age	Character of Hymen
Child	Hymen is like a taut membrane
Small girls	It is situated deeply due to presence of excessive fat in labia majora
At puberty	It is like a fold of mucous membrane when thighs are separated
After puberty	Situated at orifice of vagina
After child birth	Hymen is lost, its presence being represented by the presence of several called Carunculae myrtiformes



Hymen Gets Ruptured By:

1. Sexual intercourse
2. Falling on a pointed object
3. Masturbation
4. Forceful separation of thighs
5. Excessive jumping, riding and dancing
6. Introduction of foreign bodies (medical instruments etc.)
7. Diphtherial infections
8. Constant scratching

Defloration: Loss of virginity is called defloration

After a sexual intercourse tears in the hymen are complete and extend up to the vaginal wall and there is some element of inflammation.

SEXUAL ACTIVITY

Sexual Offence: or sexual activity is the act of sexual intercourse with another person or an animal to obtain sexual gratification. Sexual activity may be in:

1. Natural Ways
   - Legal sex (after marriage)
   - Illegal sex (Zina and Zina-bil-jabr)
   - Sex with prohibited relatives (incest)
2. Unnatural Ways sexual intercourse against the order of nature with any man, woman or animal
   - Homosexuality; sodomy, lesbianism, buccal coitus
   - Bestiality (with animals)
3. Perversions

Coitus: is sexual connection between male and female per vaginum; with or without emission of semen

Legal Sex

It is:-

- Heterosexual
- After consent
- Partners are adult
- Registration and pronouncement of marriage
- Within permissible relationship

Sex outside these situations is illegal.

Hadood Ordinance 1979

There are 5 important sections of Hadood Ordinance, which include section 2, 4, 6, 15, 16

SECTION: 2

Adult: means a person who has attained, being male age of 18 years and being female age of 16 years or has attained puberty.

Hadd: means punishment ordained by Holy Quran and Sunnah

Tazir: punishment other than Hadd

Marriage: means marriage that is not void according to personal law of parties and "married" shall be constructed accordingly

Muhsan:

1- A Muslim adult man who is not insane and has sexual intercourse with a Muslim adult woman, who at the time he had sexual intercourse with her was married to him and was not insane

2- A Muslim adult woman who is not insane and has sexual intercourse with a Muslim adult man, who at the time she had sexual intercourse with him was married to her and was not insane

——— Muhsan is a married person

——— Non-Muhsan is a non-married person

SECTION: 4

Offence of Zina: a man and a woman are said to commit-zina if they willfully have sexual intercourse without being validly married to each other.

For the offence of zina just penetration of organ is sufficient, ejaculation is not required. But still swabs are taken and sent to the lab.

Punishment of zina according to Hadd is:-

- If Muhsan: Stone till death
- If Non-Muhsan: 100 strikes by number at public place

Offence of Zina-bil-jabr: a person is said to commit zina-bil-jabr if he or she has sexual intercourse with a man or woman to whom he or she is not validly married in any of the following case:

- Against the will of victim
- Against the consent of victim
- With consent of victim by putting him or her in fear of death or hurt
- With the consent of victim when offender is not validly married to the victim and consent is given because victim believes that offender is the person to whom victim is or believes to be validly married

Punishment of offender of zina-bil-jabr is:-

- If Muhsan: Stone till death at public place
- If Non-Muhsan: 100 strikes by number at public place

SECTION: 15

Caused by a man Including a belief of lawful marriage

SECTION: 16

Enticing a taking away or detaining with criminal intent a woman

Rape

It is unlawful sexual intercourse by a man of a woman:

- Even with his wife, if she is under 13 years of age and even with her consent
- With any woman not his wife under 14 years of age even with her consent
- With a woman not his wife above 14 years of age, against her will and without her consent or when consent is obtained by unlawful means

Punishment for rape is -376PPC:

1- Life imprisonment or imprisonment of any description up to 10 years and also unlimited fine
2- If woman is his own wife above 12 years of age and below 13 years then 2 years imprisonment or fine or both

After a rape following complications may arise:

1- Multiple injuries
2- Death due to fear or fight
3- Suffocation
4- Mental torture leading to personality derangement
5- Death of the victim by the assailant

Incest

It is sexual knowledge between a man and a woman who are related to each other by blood and society do not permit marriage e.g., father brother and uncle of a woman

Sodomy

It is anal intercourse between a man and a man or man and woman. It is also called Buggery. In sodomy there is a passive agent on whom the act is done and an active agent who performs the act.

Homosexual Sodomy: between man and a man

Heterosexual Sodomy: between man and a woman

Pederasty: here the passive agent is a young boy

Eunuchs: male prostitutes; they earn by passive pederasty. There are 2 groups Hijras and Zenanas (they have intact male genitals)

Tribadism

It is gratification of the sexual desires of a female by another female. Also called Lesbianism, Lesbian Love, Female homosexuality

Buccal Coitus

It is intercourse through the mouth also called Sin of Gomorrah.

Bestiality

It is sexual intercourse with lower animals. It is common in villages. Usually man uses goats and sheep and females use dogs.

SECTION: 337 PPC

Whoever voluntarily has sexual intercourse against the order of nature with any man, woman or animal shall be punished:

- Transportation for life or imprisonment up to 10 years
- Or fine
- Or both

Perversions

Sadism	Offenders gets pleasure by inflicting pain on opposite sex mainly done by males
Masochism	Offenders feel pain by inflicting pain on own self. It can lead to autoerotic asphyxial deaths as such persons like lonely places
Pedophilia	It is sexual abuse of children
Transvestism	Person enjoys by wearing clothes of opposite sex
Transsexuals	Person enjoys by acting like a member of opposite sex
Necrophilia	Sex with dead
Necrophagia	Cutting sex organs of dead and keeping them

Fetichism	Sexual gratification obtained by contact, sight of female body parts, clothes etc
Exhibitionism	Sexual gratification obtained by exposing genitalia to public with or without masturbation
Uranism	Sexual pleasure obtained by fingering, fondling, liking the genitalia etc
Voyeurism	Peeping Toms: watching others involved in sex. Such people peep into the bed rooms at night through key holes
Frotteurism	Pleasure is obtained by rubbing genitalia against other persons in lifts and crowds
Urolagnia	Pleasure is obtained by sight and odor of urine or faeces

Persons who perform the act of sexual perversions are called sexual perverts.

Examination of Female Victim of Zina-bil-jabr

Requirement:

1- **Authority to Examine:** Police presents the victim before magistrate who gives order for examination of female. But magistrate cannot force the lady. Always keep photocopy of order with you.

2- **Identity:** the one who brings the victim must establish her identity and at least give 2 identification marks

3- **Consent of Victim:** It should be before magistrate but practically it is not possible so take it on medicolegal register. It should be freely fully informed.

- Before consent tell the procedure, findings and consequences of examination
- Consent should be in front of third party
- Examination should be done by a male doctor in front of third party
- Examination should be done in adequate light with proper instrumentation
- Examination should be done in privacy in lithotomy position
- Preserve the specimens of findings i.e., trace evidence

Steps in Examination:

1- **Recording of Bio-data** and history allegation (time, date, day, site, who and how removed the clothes, any use of force if yes then where and how, number of individuals, victim's behavior, relative position of the victim and assailant, pain experienced or not during or after the act ejaculation occurred inside or outside vagina, any use of contraceptive method, did she injured the assailant and what happened after wards washing of clothes or body parts by her or by victim), complete medical history of the patient is required.

2- **General Impression:** Note physical health, psychology, gait, and logical status, look for injuries on forearms, lower part of thighs, external genitalia, on buttocks. Also look for stains of biological material on body, nail scrapings are very important

3- **Examination of Clothes for:-**

- Signs of struggle
- Trace evidence (blood, semen, hair, fiber etc.)
- Foreign material
- Examinations of specimen in UV lamp

Then preserve the clothes in total, air-dry them if wet so as to prevent putrefaction

4- **Local Examination:**

- **Inspection:** Look/or injuries, bruises, abrasions around genitalia, look for stains of blood, hair. Hymen cannot be examined on inspection.
- **Bilateral Traction:** bilaterally retract the tissue with 2 thumbs, see vaginal orifice and hymen whether it is present or not, tear or not, tear fresh or old. Pre-hymen area examination, hymen examination and post hymen area examination. Female with intact hymen is called Virgo Intacta.
- **Specimen Collection:** if hymen is intact further examination is not allowed ethically. But swabs are taken generally and sent to lab.
- **Digital Examination:** try to find features of vaginal orifice by digital examination.
- **Instrumental Examination:** once examination is complete take the help of instruments and confirm all the findings.

Modification of Findings by Some Factors:

1- **Age:-** In minor girls hymen is situated high up so it escapes injury and remains intact

2- **Time Interval:** important findings are lost if time interval between act and examination is very long

3- **Other Activities:** like taking bath may result in loss of findings and also changing the clothes may result in loss of more than half of findings

Examination of Catamite

Points of examination are same as in case of medical examination of female victim of zina but differ at local examination. Local examination of a victim of sodomy is as:-

- It is at knee elbow position
- Inspection for local injuries
- Collection of specimens
- Digitally examine tone and tenderness of external anal sphincter
- Take swabs in and out of anal canal
- In case of a non-habitual catamite anal orifice is dilated, irritable and tender to touch, zone of bruising may be present and mostly a triangular bruised area in- posterior part of anus with base on external side is seen. Gait and defecation may be painful.
- In case of a habitual catamite; anal skin is smooth and thick, anal orifice is deeply situated and depression is funnel shaped. An anal fissure scar may be present.

Examination of Accused in Zina-bil-jabr or Sodomy Case

Accused is examined as: -

- Proper authorization letter is required
- Identity of the accused must be established
- Consent should be taken
- Recording of bio-data
- Look for general physical health
- Look for mental health

- Look for nail marks, bite marks and condition of clothes
- Local examination for potency
- Presence or absence of any disease causing impotency
- Secondary sex characters
- Stains on clothes
- Carry out psychological interview as far-as possible

After sexual intercourse vaginal epithelium cells are transferred on the glans penis. Mop the glans penis with filter paper and then place that paper on Lugol's iodine vapors. Brownish discoloration is suggestive of presence of vaginal epithelium - ***Lugol's Iodine Test.***

Opinion

If all the above signs are positive, then there is nothing to suggest[1] that the person is impotent. In case of sodomy there are two agents an active agent and a passive agent. Passive agent is called catamite. If passive agent is a young boy then sodomy is called pederasty. Eunuchs are male prostitutes who earn then living by pederasty.

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Chapter-12
Pregnancy & Abortion

PREGNANCY

Condition of having a developing embryo or fetus in the body after union of an ovum and sperm is called pregnancy.

Duration of pregnancy:

1. On Average: it is 280 days (time between conception and delivery). Date of conception cannot be fixed, if date of insemination is known, then it is possible to ascertain the approximate date of conception.
2. Maximum Duration: of pregnancy reported is 359 days. Child shows signs of post-maturity.
3. Minimum Duration: observed is 210 days and child shows signs of pre-maturity.

Superfecundation:

It is fertilization of 2 ova of same cycle by more than one act of coitus.

Superfetation:

It is fertilization of an ovum during an already pregnancy. It is possible up to 3 months of 1st pregnancy.

Signs of Pregnancy in Living Women:

There are 2 approaches subjective and objective.

1. **Subjective Method**
   a. Amenorrhea: it can also be there in anemia, TB, emotional disturbances, lactation. Occasionally menses can occur in pregnancy. So amenorrhea is not reliable.
   b. Motion Sickness: it is nausea and vomiting in the morning (also not very reliable)
   c. Urinary Disturbances: in early weeks of pregnancy and few weeks before delivery
   d. Quickening: these are fetal movements felt by mother.
2. **Objective Method**
   a. *Changes in Breast:* increase in size, slight tenderness, nipples become prominent, appearance of secondary areola, venous engorgement over breast, expression of clear secretion from breast usually at 3rd month, stria over are usually seen in 3rd trimester
   b. *Changes in Vagina:* softening and bluing of vagina (Jacquemier's sign Sign) pulsations may be felt in vagina
   c. *Changes in Cervix:* non-pregnant cervix is felt like tip of nose (firm) Ad pregnant one is like lips (soft). Left hand is kept on abdomen and fingertips are inserted into vagina (of right hand), fingers of the 2 hands meet due to softening of tissues
   d. *Changes in Uterus:* uterus is palpable per abdomen at 12 weeks. It is midway between umbilicus and pubic symphysis at 16 weeks. Uterus may enlarge due to any cyst or tumour.

   At 20 wk uterus is one finger below umbilicus

At 22 week uterus is at umbilicus
At 25 week it is one finger above umbilicus
At 30 week it is midway between umbilicus and xiphisternum

e. *Uterine Contractions:* Braxton Hick's contractions occur throughout pregnancy
f. *Pigmentation of Skin:* hyperpigmentation occurs at axilla, abdomen, linea nigra (midline from pubic symphysis and xiphisternum)
g. *Fetal Heart Sounds:* these can be heard by ordinary fetoscope after 18-20 weeks
h. *Urine Examination:* note progesterone levels

Conclusive tests are Ultrasonography abdomen and detection of fetal heart sounds.

Signs of pregnancy in dead are:-

1. Presence of fetus in uterus
2. Uterine changes
3. Corpus luteum

Medicolegal Aspects of Pregnancy:

1. A woman in advanced pregnancy may avoid attending the court as a witness
2. A pregnant woman is entitled to the estate left by her husband on behalf of prospective heir
3. When a convicted woman pleads to be pregnant, as a bar to hard labour or execution
4. When a woman blackmails a person and accuses him that she is pregnant because of him
5. When a woman asks for termination of pregnancy after rape
6. When a woman claims for more money after divorce on account of being pregnant

Medicolcgal Aspects of Delivery:

After deliver:-

- Vagina is wide roomy and lochia is seen
- Vagina is lacerated
- Signs of episiotomy etc.

MISCARRIAGE OR ABORTION

It is defined as termination of pregnancy. It is classified as:-

- Natural (spontaneous)
- Artificial - Therapeutic
  - Criminal

Therapeutic abortion is legal done to save the life of woman by a doctor. It is justifiable done in good faith to save the life of mother.

Precautions for Therapeutic Abortions:

1. Always try to prolong pregnancy as much as possible
2. Consult senior colleague
3. Consent for abortion is taken from mother and husband
4. Indication should be clearly mentioned

Indications for Therapeutic Abortion:

1. Sever haemorrhage
2. Hydatiform mole
3. Infected uterus
4. Malignancy of genital tract
5. Prolapse of gravid uterus
6. Repeated caesarean sections
7. Heart failure, hypertension, nephritis, TB, severe diabetes
8. Epilepsy
9. Mental ill health

Complications of Abortion:

Complications produced by the process of abortion are:-

1. Sterility
2. Premature births
3. Displacement of uterus
4. Shock due to reflux vagal inhibition death
5. Haemorrhage shock death
6. Air or fat embolism death
7. Sepsis
8. Tetanus
9. Renal failure

During advanced pregnancy simply a blow over abdomen or hard work or even stress during defecation can induce abortion.

Isqat-I-Hamal:

(S.338-B.PPQ) whoever causes a woman with child whose organs have not been formed to miscarry; if such a miscarriage is not caused in good faith for purpose of saving life of woman or providing her necessary treatment it is said to cause Isqat-I-Hamal.

- **A woman herself causing Isqat-1-Hamal is also punishable**
- **(S.338-A) Punishment for Isqat-I-Hamal is, imprisonment for 3 years if with consent of woman and if without consent punishment is imprisonment for 10 years**

Isqat-I-Janin:

(S.338-B.PPC) whoever causes a woman with child whose organs have developed to miscarry; if such a miscarriage is not caused in good faith for purpose of saving life of woman or providing her necessary treatment it is said to cause Isqat-I-Janin.

- **A woman herself causing Isqat-I-Janin is also punishable**
- **(S.338-C) Punishment**

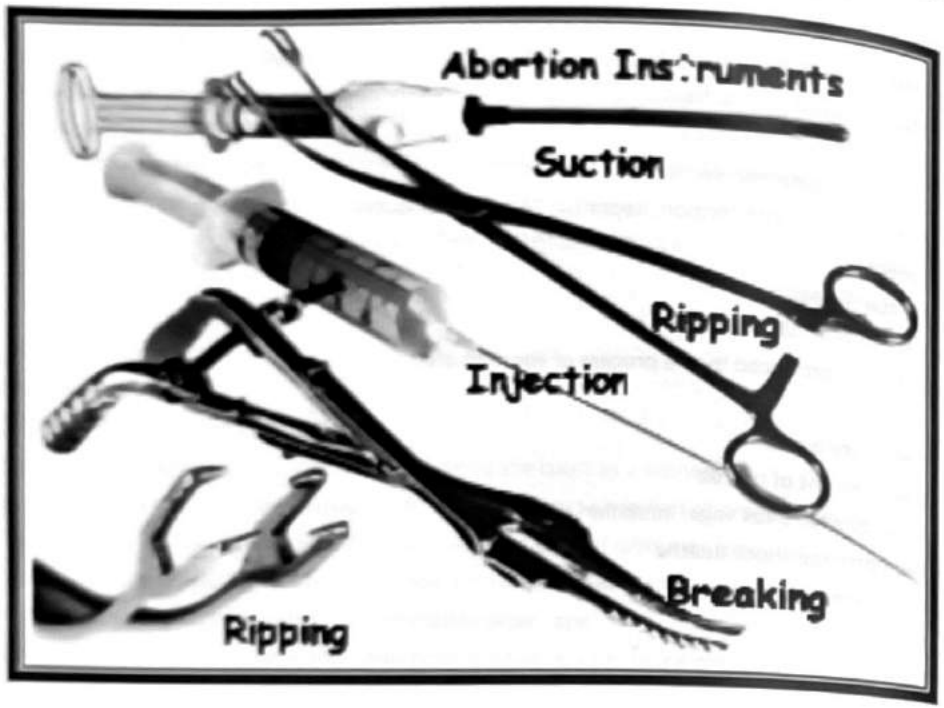
  1/20th of diyat if child was born dead

  Full diyat if child was live born and died by an act of offender

  Imprisonment for 7 years

  If there are more than one child separate diyat for each

If during this hurt is caused to woman (as it is without consent) separate punishment is for this



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Chapter-13
Medicolegal Aspects of Insanity

Delusion: It is false but firm belief in something, which is not a fact. It is not an isolated disorder but indicate deep-seated widespread disorder such as

- Schizophrenia
- GPI

It is very important from medicolegal point of view as delusion may affect the conduct and actions of sufferer and may lead him to commit suicide, murder or other crime. Common types of delusions are:-

- Hypochondrial delusions
- Delusions of poverty
- Nihilistic delusions
- Delusions of infidelity
- Delusions of grandeur
- Delusions of persecution

Illusion: It means a false interpretation of an external object or stimulus, which has a real existence.

- Mistaking stick as snake
- A dog as lion
- Tree as ghost

Illusions of sight, hearing and other senses may occur.

Hallucinations: Fake perception without sensory stimulus (or) it means seeing hearing, smelling, tasting or touching something which is not actually present. Various types are

- Visual hallucinations
- Auditory
- Olfactory/gustatory
- Tactile

Obsession; This is thought, image, feeling, or movement which an individual feels and compelled to carry out, usually repetitively, in spite of a strong urge to resist.

- Fear of open or closed spaces
- Animals such as dogs and cats.

Lucid Interval: This is period in course of mental disease during which there is complete cessation of symptoms of insanity. During this period an insane can make a valid and can give evidence, which is valid. He can also judge his acts soundly and legally responsible for his deeds.

Non-Compos Mentis: Means person of unsound mind. According to sec. 464, 465 of C.P.C, any magistrate or district judge may probe into whether the person before court is of sound or unsound mind. He can order for psychiatric examination.

Automatism: Conduct is automatic when consciousness of an actor is impaired to such a degree that he is unaware of what he is doing. Automatism may be 'product of

- Diseases (epilepsy)
- External factors (concussion, when head strikes a solid thing)
- Psychological stress (hysteria)
- Intake of drugs / chemicals (Barbiturates, alcohol)

Legal Insanity: It is serious mental disorder sufficient to warrant legal restrain of the sufferer as provided under mental health act (certifiable mental illness - legal insanity)

CLASSIFICATION OF MENTAL DISORDERS

1. Functional Disorders

a. Psychosis

This is disorder, which is characterized by withdrawal from reality, as if living in another world, a world of fantasy. It can be classified as:-

- Organic psychosis - Acute Chronic
- Functional psychosis

Examples are

- Schizophrenia; in it there is delusion, illusion, hallucination. It is due to disturbed biochemical metabolism of cerebrum.
- Psychosis of epilepsy

b. Psychoneurosis

These are disorders-which are mild and characterized by fact that the patient though suffering from emotional or psychological disorder does not lose touch of reality, it consist of

- Anxiety neurosis
- Obsession
- Hysteria

c. Personality Disorder

Psychopath: this term is applied to a person -who is neither insane nor mentally defective but does not confirm to normal social standards of behavior.

d. Mood Disorders

Mania: in this patient is excited, restless, talkative, violent and dangerous.

Melancholia: (depression) loss of interest in normal activities, refusal of food, lack of personal attention and suicidal tendencies may be present- Hallucinations and delusions are common and patient constantly feels the presence of imaginary evil or danger.

2. Organic Disorders

Brain tissue is physically involved as

- Arteriosclerosis
- Neuropathy
- Neoplasm
- Injury

- Scarring
- Hemorrhage

3. Toxic or Metabolic Group

Insanity associated with

- Cannabis indicia
- Alcohol

TESTAMENTARY CAPACITY

This means the capacity of a person to make a valid will law defines it as "composmentis", which must be certified by a doctor. A will to become valid must fulfill the following conditions.

1. Testator must be major
2. He must have a sound disposing mind at time of making will
3. Me must understand nature and consequences of his act
4. He must know what property he has, to whom he is giving, and has good reason for this action
5. He is executing it voluntarily and without any undue influence by any other person
6. He must sign it in the presence of 2 witnesses of which one should be a medical man
   Both witnesses should also sign in the presence of each other and of testator
7. None of witnesses should be beneficiary from the will

To invalidate a will on the ground of insanity of the testator, it must be proved that at the time of making of will person was mentally in capacitated to a certain extent so that:-

- He did not know nature of his act
- Was not fully aware of consequences
- Had made the disposal of his property which he would not have made, had his mind been sound

SECTION 59 OF SUCCESSION ACT

Every person of sound mind not a minor may dispose his property by will. An insane person may make a will during interval when his mind is sound. That interval is called lucid interval Presence of sound mind usually depends upon the following.

1. Mental perception about his property
2. Ability of mind to formal rational judgment.
3. Ability to exercise the will power in accordance with rational thinking.
4. Individual should not be-under any influence.

Following question can be asked from the individual

- What is your name?
- Where do you live?
- What is your property?
- Who are legal heirs?
- How he proposes to dispose his property?

Role of Doctor:

To tell that person is in sense or not, or her is not under effect of drug.

CRIMINAL RESPONSIBILITY

A criminal act has 2 parts

- Mens rea (evil thought)
- Actus reus (Evil action)

Both are incomplete without each other.

MC NAUGHTEN'S RULE

Mc Naugthen's Case:

Mc Naughten was an accused in a criminal case, lie while laboring under a delusion of persecution, shot Mr. Drummond, the private secretary of Prime Minister Sir Robert Feel, at charring cross London in mistake for latter. Evidence of insanity was led and a verdict of "not guilty by reason of insanity" was given. Public reacted adversely. Discussion started in parliament. The House of Lords put certain questions to all the 14 judges in connection with this case. From answers given by those judges, some rules were formed for criminal responsibility of insane.

Mc Naugthen's Rule:

According to these rules, to establish defense on the ground of insanity, it must be shown clearly that at time of committing act, the accused was laboring under such defect of reason from disease of mind as not to know the nature and quality of he was doing, or if he did know this, he did not know that what he was doing was wrong or right.

Limitations or Rules / Criticism:

Psychiatrist thought that emphasis is on reason as the main factor in determining an individual behavior while ignoring the potent effect of emotions, delusion, belief and hallucinations.

DURHAM'S FORMULA

(1954) Accused is not criminally responsible if his unlawful act was product of mental disease or mental defect. Mental diseases or defects have never been defined by law.

IRRESISTIBLE IMPULSE

(Impulsive insanity) This means sudden and irresistible force compelling the person to the conscious performance of acts without motive or forethought.

Example:

A normal person knows that finger is burnt when put in fire so he does not put at in fire. But an insane may have irresistible impulse and may put it in Fire.

Clinical Types:

- Kleptomania (stealing articles of little value)
- Pyromania (setting fire to things)
- Mutilomonia (maiming animals (lame)
- Sexual impulses

Legal Value:

When an unlawful act is committed by a person who at time of committing that act was unable to resist it, because of desire of mind, he should not be held responsible for that act, (police man at shoulder test) e.g., "sneezer should not be held responsible for sneeze"

LUNACY ACT (1912)

This deals with lunatics with inherent prerogative of the courts acting as prudent natural parents. It has got 4 parts and 100 sections but we will discuss only which are related to forensic medicine.

Procedure of Admission in Mental Hospital:

1. **Sec. 4** - **Voluntary Reception**

   Requirements are

   a. Written application by person himself.
   b. Consent of 2 visitors (one should be R.M.I'.)
   c. Patient cannot be retained more than 24 hrs. If the desires to leave.

2. **Sec. 4-A** - **Temporary Reception**

   (Without reception orders) requirements are:-

   a. Written application on prescribed form by relative (by blood/marriage/adoption) to in charge of asylum, having statement of connection / circumstances.
   b. 2 medical certificates on prescribed form, from 2 RMPs,
      i. One RMP should be his usual medical attendant. .
      ii. Examination should be commenced either separately or in conjunction, indicating date of examination.
      iii. When examination is done separately maximum interval should be 5 days.
      iv. Recommendations of 2 RMPs are valid up to 14 days. After which re-examination has to be done.
   c. Notice of Reception / Departing / Death of lunatic to visitors before expiry of 2nd day.

      Visitation should be by 2 visitors (one-RMP) within one month,
   d. Max. Period of stay is 6 months, when patient is capable of expressing himself as willing / unwilling he should not be retained for more than 28 days.

3. **Section 5-11** - **Reception with Order**

   Requirements are:-

   a. Petition to magistrate (indicate if there is any previous petition by the near relative),
   b. 2 medical certificates (one of be Govt. Medical Officer)
      i. Both doctors should examine separately
      ii. If one RMP is relative, indicate it in certificate
   c. Reception order - Magistrate may dismiss the petition by recording in writing reason of dismissal - subject to magistrate's satisfaction about:-
      i. Genuineness of petition
      ii. Person responsible ready to pay the cost of treatment / maintenance in asylum.
      iii. In charge of asylum willing to have the lunatic

4. **Section 13-15 - Arrest of Wandering**

Dangerous, cruelly treated lunatic

1. In charge of police station S.H.O may arrest wondering, dangerous, cruelly treated lunatic.
2. Produce him before magistrate who
   - i. Orders his examination, by Govt. RMP
   - ii. Makes other inquires
   - iii. Hands him over to - his relatives (who under take to take care) or pending reception order, authorized retention for a period (10 days) Magistrate sends 3 such orders to relatives with 10 days interval (3 in a month).

5. **Section 28-30 - Care / Treatment**

a. i. Appointment of visitors (minimum 3- one of RMP) monthly inspection.
   ii. Inspection by I G (for criminal lunatic) once every 6 months.

b. Discharge from asylum
   i. By in charge
   ii. On undertaking by relatives.

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Chapter-14

General Toxicology

In Latin - Toxicum = poison

In Greek - Toxilonom = arrow poison

Toxicology means a study to poison on living organ

Toxicology / General / Clinical / Environmental / Forensic

FORENSIC TOXICOLOGY

- It is a branch of medical science, which deals with poisons with reference to their sources, characteristics, properties, sign and symptoms produced, fatal results and remedial measure to combat their effects or actions.
- It also concerned with laws regarding their sale and prescription and analytical techniques employed for detection of poisons.
- Mr. Matthew Joseph Bonawnturu Qrfial (1787-1853) is father of modern toxicology. Traite described the poison and did first systemic approach - according to study of chemical and physiological nature of poison and devised analytical procedures.

Poison:

According to law poison is a substance when applied topically or administered internally as ingested, inhaled or injected cause harm or ill health or death.

Poisoning:

Harmful effects of a poison on an individual are called poisoning. Poisoning is of 2 types:-

1. **Endogenous**

   Endogenous poisoning is from within the body due to retention of waste products of metabolism, which are harmful and toxic to the body e.g. Uremia

2. **Exogenous**

   It is by poison administered into the body-from outside via any route. It is important from forensic point of view.

   - Exogenous poisons effecting community include
   - Environmental
   - Industrial

Its control and check is responsibility of legislation. Certificate or compensation in case of poisoning is work of forensic man.

Poisoning affecting the individuals include:

- Homicidal
- Suicidal
- Accidental
- Iatrogenic (any adverse condition resulting from treatment of any doctor)

SOME LEGAL ASPECTS OF TOXICOLOGY

All the poisoning has legal significance and all are immediately related to forensic man.

- Intention is very important in case of poisoning - poisons may be used to save some one's life – so used as medicine.
- Poison is also used to kill someone.
- Some dispenser wrongly dispenses medicines that leads to poisoning __ this comes under negligence conduct.

Smallest quantity of poison that can cause death is called fatal dose.

Fatal Period:

Time interval during which an average healthy person is killed with an average fatal dose of a poison.

Active Principle:

An alkaloid or any substance in plant causing toxic effects on CNS or any other system of body, e.g., In tobacco active principle is nicotine.

Route of Administration:

These are the following

1. Oral (sublingual - month)
2. Inhalation (via air passages)
3. Injection (I/v, I/m, I/F, s/c, I/P, I/art)
4. Natural orifices (nose, eyes, rectum, vagina, urethra)
5. External application (via skin, broken skin etc.)

Fate of Poison:

Poison is lost via following ways after its administration

- Vomiting (if irritants are presents)-
- Diarrhea (unless given is small amount or in liquid form)
- Excreted unchanged in urine.

Bio-Transformation:

These are reactions by which body converts a foreign chemical to structurally different chemicals e.g.,

1. Heroin ____ into morphine
2. Methanol into formaldehyde
3. Cocaine ____ into benzyleconine

New compounds formed are called metabolites, which may be

- Active
- Inactive
- Nontoxic
- Toxic (less)
- More toxic

e.g.

1. Methanol → formaldehyde (latter is more toxic).
2. Morphine → morphine glucoronide (latter is inactive).
3. Phenylbutazone → oxyphenylbutazone (both have similar effect).
4. Parathion → paraxon (latter is active while former is inactive.)

Liver is important organ that saves body against poisons.

From liver metabolites pass into circulation___ shows effects___ then it is excreted from body via various routes.

Routes of Elimination:

Of poisons include , urine, breath, feces, saliva, sweat, mucous, serous out flows, breast milk, bile, poisons also get deposited into bone hair, nail, epidermis, that is arsenic and lead (in bones)

CLASSIFICATION OF POISONS

Poisons are classified according to their features.

1. Medical classification
2. According to availability of poison
3. According to mode of action.

1. Medicolegal Classification

1. Suicidal Poisons: Barbiturate, HCN, corrosives (oxalic acid, carbolic acid)
2. Homicidal Poisons: Aconite, arsenic, mercury, and antimony
3. Accidental Poisons: Kerosene oil. Insecticides, snake venom, household drugs.

2. According to Availability

1. **Industrial:** Heavy metals - arsenic etc.
2. **Agricultural:** Insecticides, pesticides - parathion etc.
3. **Iatrogenic:** Cumulative effects of drugs, adverse drug reaction during intoxication, food and diet articles.
4. **Lab:** Reagents, disinfectants

3. According To Mode of Action

Corrosives

Strong acids

- Mineral acids __ H_2SO_4, HCl, HNO_3
- Organic acids __ oxalic acid, carbolic acid, acetic acid, salicylic acid
- Vegetable acids __ HCN

Strong Alkalies

- Caustic soda, caustic potash, carbonates of Na^+, K^+, NH_4^+

b. Irritant

Inorganic irritants

- Metallic — (compounds of Pb. Ar, Hg Antimony, Cu, Thallium, Zn, Mn, Ba, Radioactive substances).
- Nonmetallic -\C\', Br, 1, Boron, Phosphorous)

Organic irritants

- Vegetable poisons (castor oil, ergot, madar, abrus precatorius)

- Animal poisons __ (snake venom, in-sects bite (Scorpio)
- Mechanical poisons __ (powder glass, dried sponges, diamond dust)

c. **Neurotropic**

Cerebral depressants

- Somniferous__ (opium)
- Inebrients - (alcohol, anesthetics, sedatives, fuels, insecticides)
- Delirients - (Dhatura, belladonna, cannabis indica, cocaine)

Spinal

- Nuxvomica and its alkaloids and gclsimion

Peripheral

- Curare - conium

d. **Myotoxics**

Excitators

- Cardiac __ (adrenaline and digitalis)
- Smooth muscle __ (ergot, barium)

Depressants

- Cardiac __ (aconite)
- Smooth muscles __ (nitrates, papaverine)
- Voluntary muscles __ (curare)

e. **Asphyxiants**

- CO, CO_2, coal gas (SO_2) war gases, H_2S

f. **Miscellaneous**

- Analgesics, antihistamine, tranquilizers, stimulants, antidepressants, hallucinogens.

ACTIONS OF POISONS

These include

1. Local actions a. Specific b. Non-specific
2. Remote actions
3. Delayed actions
4. Generalized actions

1. Local Actions

These result from application of poison on that part for example:

- Corrosion __ by strong mineral acids.
- Irritation and inflammatory by __ cantharides
- Dilation of pupil __ by atropine.

These local actions are gross naked eye changes.

2. Remote Actions

Actions appear at site away from site of application of poison. These occur after absorption of poison. After absorption poison shows specific or nonspecific actions.

a. **Specific Actions**

Certain organs have specific affinity for poisons for example,

- Brain __ opium, narcotics, barbiturates, and alcoholic agents.
- Spinal cord __ strychnine.
- Peripheral nerves __ alcoholic agents.
- Kidneys __ HgCl
- Heart, blood vessel, + blood __ arsenic, ergot etc.

b. **Non Specific Actions**

Certain poisons, like corrosives, produce nonspecific actions in remote areas such as shock. Some poisons show both local and remote reactions. We can dilute them on the area of impact (so prevent local actions) but can kill a person by remote actions, for example oxalic acid.

3. Generalized Actions

These are actions; which are shown by many tissues alter absorption of poisons, (in more than 2 systems) for example, arsenic, mercury, U.D.T etc.

4. Delayed Action

These appear due to complications by poisons; such as action of barbiturates and corrosive on circulation.

FACTORS AFFECTING ACTIONS OF POISONS

These include following 6 factors:-

1. Composition and Form of Agents Producing Toxicity

Mild acids cause gastric initiation and can be thrown out by vomiting. Strong acids corrosive effects cause quick absorption and produce toxic effects.

Form of poison Physical Chemical Mechanical

- Physical -

  Gases act quickly

  Liquids act less quickly than gases

  Solids less than liquids

- Chemical -

  Some substances (poisons) when combined chemically become either inert or more toxic. For example lead, carbonate and copper arsenite both are insoluble in water put in stomach in the presence of HCl they are sufficiently soluble and produce toxic effects. Some chemical form of poisons is ↓ soluble and some are ↑ soluble such as mercuric form is ↑ soluble but mercurous from is ↓ soluble.

- Mechanical actions of poisons are altered when combined with inert substances. Such as arsenic in water and gets precipitated or attaches to walls of glass. So for homicidal purpose arsenic is mixed with milk, tea, coffee or coca which have nearly the same specific gravity as that of arsenic.

2. Dose or Quantity of Poison

↑ Dose ___ ↑ effects and vice versa but considerable variations are there in relation to age and weight.

$$\text{Dose} = \frac{\text{Age in years}}{\text{Age +12}}$$

$CuCSO_4$ is emetic in small doses but toxic in high doses. Ill health __ in diseases the same dose produce more toxic effects.

3. **Route of Administration**

Methods of introduction of toxic substances can influence

- Time of onset
- Intensity of effects
- Duration of toxic effects
- Degree of toxicity and possibility of target system affected
- Routes in order of toxicity are iv/inhalation/oral/topical

4. **Condition of Body**

In this we take into account age/maturity

- Infant ____ chloramphenicol
- Child ___ accidental poisoning
- Old age ___ toxic effects are reduced due to reduction in blood supply.

5. **State of Health and Disease**

- Acidosis ___ potentiate action of tubocurarine
- Hypertension ___ ↑ response to sympathomimetic
- Head injury ___ ↑ response to opiate
- Coma ___ narcotic cause fatal effect.
- Diarrhea and constipation ___ may ↑ or ↓ the absorption of drugs (poisons)

6. **Environmental Factors**

If environmental temp falls response decreased but duration of response may prolong due to ↓ temperature ___ absorption ↓ and hence response is ↓. But along with this metabolic degradation, excretion of poison is also ↓ and hence response is prolonged,

- Atropine toxicity ↑ in warm environment,
- Occupation: Industrial workers who work in chlorinated hydrocarbons or volatile compounds they have ↑ activity to metabolize such compounds. Liver microsomal activity is ↑ and toxicity is decreased,
- Living conditions: crowding, noise, and social pressure. All these also effect to toxic effect of drugs. Idiosyncrasy: it is abnormal response due to personal hypersensitivity to that during resulting due to genetic variations e.g., different personal responses to Quinine and Atropine.
- Allergic reaction occurs due to - person is exposed to that poison already,
- Tolerance occurs when (drugs) or toxic agent is used repeatedly in small doses, ↑ Doses are required to produce the desired effect,
- Synergism: combined effect of 2 drugs. One potentiate the other e.g., alcohol + barbiturate,
- Antagonisms: neutralization of the effect of 2 poisons (toxic agent) by each other, e.g. naloxone + morphine,

- Cumulative effect: poisons after absorption accumulate in the body tissues. Rate of absorption is ↑ than excretion rate. As, Hg, Pb and barbiturates,
- Automatism: some drags causes menial confusion individual think that he has short taken drug and he takes more dug so toxicity can occur. In CO-poisoning, alcohol or barbiturates this occurs, also in head injury and epilepsy.

7. **Condition of Stomach**

- Full stomach __ ↓ absorption of toxic agent __ ↓ response.
- Drug given by meal __ 4 absorption.
- Apply stomach __ ↑ absorption __ ↑ response
- Diseases of stomach __ ↓ absorption __ and so response is ↓
- If ionic agent cause initiation of gastric mucosa __ vomit out.

DIAGNOSIS OF POISONS

A forensic man faces 2 types of situations:

1. Poisoning in living: it can be — Chronic / Acute

2. Poisoning in dead

(1). In Living Cases	(2) In bead Cases
a. Circumstantial evidence/ history	a. Circumstantial evidence
b. Clinical exam	b. Postmortem exam
c. Investigation	c. Investigation

1. Living

Aim is

1. To keep individual alive
2. Prevent occurrence of serious damage
3. Help court of low

i. Circumstantial Evidence

- Response of relative and friends
- Environment around patient, e.g., chairs and tables, etc.
- Conduct of persons looking after the case.

Onset is sudden in acute poisoning. After taking food etc., onset is delayed and also in bacteria food poising. If a person is healthy and suddenly develops coma there must be suspicion of taking some narcotic drug. Note course, cause and condition. It is finalized by various analysis techniques. Many individuals may fall in the same condition at a time - may indicate epidemic origin but it is rarely seen. If someone vomit out after poisoning he will recover earlier than the other.

Course: Course is either downhill to death or uphill to recovery.

Relation with Meal: Symptoms after having meal may be accelerated mainly in planed homicidal poisoning. These may be withdrawal effect of the tranquilizers.

ii. Clinical Examination

1st we do general physical examination in which we see the following. General appearance and behavior of Patient:

- Aggressive _____ alcohol poisoning
- Restlessness_____ amphetamine, withdrawal of barbiturates, heroine
- Thick slurred speech _____ barbiturates
- Slowed drowsy speech _____ heroin (Final diagnosis is by thorough examination) Temperature, pulse, BP, Respiration:
- Hyperthermia: Dhatura, infection with un-sterilized needle
- Hypothermia: acute barbiturate poisoning
- Rapid pulse: nonspecific response found in some acute poisoning
- Fast irregular pulse: volatile substances, amphetamine and alcohol poisoning
- ↑ BP: amphetamine poisoning
- ↓ BP: shock, alcohol and barbiturate poisoning
- ↓ Respiratory; alcohol, opium and tranquilizer poisoning
- Nasal cavity: red and inflamed

Clothes, Body, Breath and Vomitus - **May Have Smell:**

- Burned martuquand: peculiar odor
- Cyanide: bitter almond
- Phenol: peculiar smell - stress phenolic
- Ammonia: ether smell
- Acetic acid: vinegar like smell

Vomitus:

- Phosphorous: coffee brown color / garlic smell
- H_2SO_4: black vomitus
- $CuSO_4$: Bluish green
- Silver salt: white or black vomitus
- HNO_3: yellow

Skin:

- Perspiration: nonspecific stress response
- Dry flushed skin: anti-cholinergic drug poisoning
- Goose flesh skin: withdrawal symptom
- Hot flushed skin: Organophosphate compound poisoning
- Needle tracts: narcotic, amphetamine poisoning
- Staining and discoloration: H_2SO_4, HCl

Oral Cavity: mouth, gums, lips and tongue is stained in $CuSO_4$ and $KmnO_4$ poisoning. Inflammation occurs in irritant and corrosive poisoning cases. Blue line on gums is seen in -Hg, Pb, Bi, Fe, Ag salt poisoning.

Eye: Pupil size / Response to light

- Dim light - (Pinpoint pupil) Opiate, organophosphorous and morphine poisoning.
- Dilated pupil responses to changes in light in LSD and withdrawal symptoms.

- Sluggish responding and dilated pupil - amphetamine poisoning.
- Red conjunctiva: marijuana; in case of barbiturates.
- Red tear: organophosphorous compound poisoning.
- Exacerbated limb reflex: barbiturate withdrawal
- Convulsions: amphetamine and depressant toxicity.

Coma:

- In age group of 15-35 yr. Suspicious of deliberate poisoning is always there careful examination exclude CVS accidents, meningitis and head injury - (by differential diagnosis).

Polyneuritis:

Occurs in case of acute and chronic poisoning of Arsenic, alcohol, CS_2, organophosphorous compounds. Thallium. It must be differentiated from diabetic polyneuritis.

iii. Investigations:

For this we collect skin washes, stomach washes, feces and other specimens of choice from body and poison is detected by chemical analysis. This was all about acute poisoning.

Chronic Poisoning

- Repetition of symptoms after interval.
- Exacerbated symptoms after suspected meal or medicine.
- Poison is present in body fluids, urine, feces, hair, nail etc.

2. In Dead

Aim

1. Determination of poison
2. Amount of poison
3. Help the court of law

In case of adult we examine externally as well as internally to determine:-

- Altitude of dead
- Postmortem staining
- Presence or absence of poisoning

External Exam

Corrosive: lips and mouth

HCl	black
H_2SO_2	brownish black
Alkalis	whitish grey

There may be peculiar smell of poison near body due to vitamins like HCN froth. Froth is blood tinged.

Internal Exam

All contents are noted specially note, GIT, bladder; and other viscera. Many times poisons are administered via vagina, urethra. Also sec oral cavity any inflammation and any other evidence of disease and also collect data for any and symptom in life for chronic poisoning.

GENERAL PRINCIPALS OF POISONING

Aims and Objectives:

- To prevent further damage to occurs
- To save life
- To prevent complications to occur
- To manage complications

In Case of Suspected Know Poisoning:

- Immediately start antidote therapy
- Treatment should be aggressive

In Case of Unknown Poisoning:

- Treatment should be on general lines
- Always consider toxic poison

Support vital sings

Maintain consciousness

Keep airways open

Maintain BP

General Lines of Treatment:

1. Support vital function
2. Remove patient from source
3. Remove unabsorbed poison
4. If absorbed use antidotes.
5. Eliminate absorbed poison

Treatment of General Symptoms:

1. Maintenance of patient general condition
2. Treatment of complications
3. Removal of unabsorbed poison
4. Removal of source

Poison is administered by Many Ways:

Injected Poison

1st of all apply tourniquet about 2" above the site

Multiple incisions are given, such the blood or poison by suction pump or mouth

- Pack the area adequately

Inhaled Poison

- Remove the source
- Clear air way passages
- Artificial respiration is done (95% O_2 5% CO_2)

Ingested Poison

- Poison should be removed by vomiting or gastric evacuation
- For vomiting fluid should be introduced into stomach to serve as a carrier, for this water is preferred as it reduces gastric irritation. In ingested poisons carbonate beverages should be avoided as these are corrosives and also cause distention of stomach pre-opening of pyloric sphincter and causes ↑ absorption

A. Methods of Inducing Vomiting:

By Mechanical Stimulation

By stroking back of tongue of posterior pharyngeal wall with blunt object not by finger (as vomitus will come on to finger and hand)

Advantage ____ it is ready to perform

Disadvantage ____ lack of effectiveness

By Chemical Method by Using

a. **Ipecacuanha act by 2 ways**

Early phase of vomiting, with in 30 min due to stimulation of GIT

Late phase of vomiting after 30 min by stimulating medullary chemoreceptor trigger zone

Symptoms of Ipecacuanha toxicity are:-

i. CVS irregular ECG, Hypotension, vomiting

ii. GIT abdominal cramps, nausea, vomiting

iii. CNS Convulsions weakness, tremors, stiffness

iv. Miscellaneous: dehydration, shock, fever, dyspnoea, during induced emesis is less effective than gastric lavage.

b. **Apomorphine is morphine derivative**

It causes quick emesis in 1-3 min by direct stimulation of medullary CTZ its disadvantages

- It must be fresh.
- Only given in ingested poison.
- In presence of qualified personal.
- Not appropriate for domestic case.

c. **Soap Solutions is a liquid detergent** (in 6-8 ounces of water)

- Ashen rapid emesis is needed and syrup of Ipecacuanha is not available.
- Mechanism stimulation of GIT mucosa.
- Disadvantage: difficult to swallow
- Act as corrosive agent.

d. **Salt Solution are potentially dangerous mainly not advised**

- Mechanism: It causes stimulation of GIT mucosa. If emesis does not occurs. Salt is absorbed from GIT mucosa. T Toxicity of ECF-hyperosmolarity. Fluid from ICF compartment comes into ECF compartment. Cells shrink → intravascular pressure is increased → intracranial pressure is there → severe damage may occur.

Another chemical is cathartics saline and Mg

- Saline cathartic→ they interfere b/w poison and absorption site. When poison is corrosive cathartics are used.
- Mg^{++} cathartics are used → ↑ Mg^{++} in serum.

B. Use of Antidotes:

Objectives are

1. To counter act the effect of poison
2. If emesis is not so effective we use antidote immediately
3. If gastric lavage is contraindicated
4. If poison is absorbed already
5. Oral route is not used for poisoning __ that poison is administered by other routes

C. Types of Antidotes

1. Mechanical or physical antidotes
2. Chemical antidotes
3. Physiological or pharmacological antidotes
4. Universal antidotes

Dispositional AD: alteration in absorption, distribution, metabolism & excretion of poison

This classification if based on mode of action.

1. Mechanical or Physical Antidotes
   - Demulcents __ fat, oil, eggs help in corrosive, poisoning
   - Bulky foods __ like Banana, (remove glass particles)
   - Charcoal - adsorbs alkaline poisons

   Mechanism: of Action of activated charcoal, Poisons diffuse through pass or charcoal surface and form complex and are passed but of body as complex.

   Contraindicated: in absent bowl syndrome, corrosives, poisoning hydrocarbon, and convulsions.

   Not effective in Alkali poisoning; boric acid poisoning, cyanide and DOT poisoning

   Time interval: to be used in 30 min

2. Chemical Antidotes

   These act chemically by combining with poison and from non-toxic compounds

   Dilute Acids _____ to neutralize alkalis

   Dilute alkalis _____ to neutralize acids

   $MgSo_4$ _____ for carbolic acid

   Lime _____ for oxalic acid

3. Pharmacological or Physiological

   Opposite effects are produced by antidote by competing with poison for receptor sites

   Atropine _____ for organophosphorous compound.

   Atropine _____ for Pilocarpine, Datura, Alocarpine

   Chloroform _____ for strychnine

   Caffeine _____ for morphine

   Nalorphine, Naloxone _____ for morphine

Chelating Agent

Are special antidotes for heavy metals. These form firm non-ionizable cyclic complex with cations, which form soluble nontoxic stable complexes, e.g., with calcium and heavy metals. For example

EDTA

Ethylenediamine tetra acetate; it is given in Pb, As, Hg poisoning. It is superior to BAL. It is excreted in urine.

BAL

British Anti Lewisite. It is used in As and Mg poisoning. It has high affinity for -SH group of tissue enzymes. It forms stable compound excreted by kidney. It is given by 10% injection I/M. It is contra indicated in liver damage.

Pencillamine

It is derived from penicillin. It is used in

- Cu, As and I Ig poisoning.
- Disorders of Cu. metabolism – Wilson's disease
- Dose is 2 gm/day

D. Universal Antidotal

1. It is used in cases of unknown poisons.
2. It is used when suspicious of 2-3 poisons.
3. It is

Mg^{+2}:	1 part	-	Neutralizes acids
Tannic acid	1 part	-	Precipitates alkaloid and many metals
Activated charcoal	2 parts	-	Adsorbs alkaloid.

Mixture is taken one tablespoon (5ml) mixed with 500 ml of water - soon after ingestion of poison. Repeat once or twice.

E. Elimination of Absorbed

Forced Emesis

Removal of poison from blood a Tier absorption; principal is to increase flow in renal tubules so ↑ Urine formation and ↑ excretion of poison. Mannitol and flourosamide are used.

- **Precautions**

  Renal functions are assessed
- **Adverse effects**

  Fluid electrolyte imbalance Cerebral and pulmonary edema
- Barbiturates, alcohol, lithium are removed easily by Peritoneal Dialysis

F. Symptomatic Treatment

- Morphine for pain
- O_2 or artificial respiration
- Cardiac stimulant for cardiac failure
- Sedative for convulsions
- Saline for dehydration and for excessive diuresis - T excretion of poison

Gastric Lavage

Lavage __ to wash

It is process of washing of stomach with various solutions, (water, saline, sodium bicarbonate solution, calcium salt solution, tannic acid etc.

Objectives:

Removal of unabsorbed poison

Indication:

1. In 4-6 hours of poison intake
2. Where emesis is contraindicated
3. Where quick removal is required
4. Where lavage is not contra-indicated

Contraindications:

1. In corrosive poisoning
2. Coma
3. Petroleum poisoning - 1st use endotracheal tube, in children use small tube.
4. In strychnine poisoning

There is no specific contraindication but procedure must be carried out with care and precautions.

Pre-Cautions:

1. Reassurance of the patient
2. Removal of artificial denture
3. Lubrication of stomach tube with 10% glycerin
4. Ask patient to swallow tube - not push
5. In corrosive use of soft lube

Apparatus:

Stomach tube, mouth gag, $KmnO_4$ solution, water, endotracheal tube, chemically cleared glass container.

Position of Patient:

Prone left lateral position, with head lower than rest of body

Procedure:

- Stomach tube (flexible, rubber tube, about 12.7 mm in external diameter and about a meter and a half in length) is passed through mouth gag into mouth oropharynx then push it gently and if feel resistance withdraw and try again. Tube should be inserted upto 50-cm mark on the (Distance b/w stomach end and teeth).
- Bubbling sounds at epigastric region are head with stethoscope when air is pushed into tube.
- Now syringe out contents of stomach, lower down funnel end of tube. Introduce 500 ml of plain water and collect fluid and send for toxicological analysis. Add antidote and continue till the color of in going fluid is same as that out coming fluid.
- Fluid required is about 5-10 liters. $MgSO_4$ and $NaSO_4$ left inside the stomach may cause irritation. Activated charcoal is used in cases of alkaloid, dhatura, opium poisoning.

- When tube is withdrawn pinch it to prevent aspiration. In children Ryle's tube should be used.

Complication:

1. Perforation
2. Aspiration pneumonia
3. Bleeding ulcers
4. Gagging and choking
5. Cardiac arrest

H. Gastrectomy

When large size capsules and tablets are ingested or large amount of tablets form large mass which do not come out via nasogastric tube then gastrectomy is done.

DUTIES OF AN RMP IN POISONING CASES

1. Medical Duties - To save patient
2. Legal Duties - To save himself

Medical Duties:

1. To guard patient interest; he must save patient's life and start immediate treatment.
2. Indifferent and doubtful cases refer him to nearest hospital without delay.
3. Inform relatives of patient about serious conditions of patient.

Legal Duties:

1. Recording of preliminary particulars, name, age, sex, occupation, address, data and time. Identification marks (2 at least)
2. If danger to public health must notify public health authorities
3. If homicidal poisoning must inform police
4. Careful observation and recording of
   - Time of arrival
   - Symptoms
   - Smell and color of vomitus
   - Pulse
   - Respiratory rate
   - Treatment given
5. Recording of dying declaration.
6. If death occurs do not issue death certificate but inform police.
7. Collect, preserve and dispatch specimen in safe custody, seal properly and send to toxicological lab.
8. Suspicious articles and utensils are collected and preserved.
9. Prepare medicolegal report.
10. Preserve detailed record.

COLLECTION PRESERVATION AND DISPATCH OF SPECIMEN

In Living:

1. Vomitus: 300 ml. If less available
2. Stomach wash: 500 ml. If less available then whole quantity.
3. Urine: 100 ml. If less available then whole quantity.
4. Blood: 5-10 ml. from peripheral site.

In Dead:

1. Stomach contents: all available
2. Liver: 200 grams
3. Brain: 200 grams
4. Kidneys: one
5. CSF: 50 nil if blood is not available

In different poisons amounts are

- Alcohol poisoning
  - Blood: 5ml
  - Urine: 5 ml.
  - Liver: 10 gram
- CO Poisoning
  - Blood: 5 ml
- Hg poisoning
  - Urine: 30ml
  - Liver: 20 grams
  - Kidney: one

Unavailable Specimen:

If it is not possible to get what is indicated e.g., in advanced putrefaction it is impossible to get what is required, then you have to collect what is available. If brain is liquified, retain all of it and send for the analysis, conc. of poison in brain is detected and level approximately is equal to that of blood. If brain is not available then skeletal muscle and intraocular fluid should be collected - (2 ml).

Preservatives:

Are used to

- Prevent putrefaction
- Make chemical analysis easy

For Viscera

Saturated salt solutions are used in poisoning by acids including carbolic acid and except other acids and rectified spirit.

For Blood

- K-oxalate (anticoagulant)
- Na-fluoride (enzymatic inhibitor)

- Used for suspected poisoning cases (prevents glycolysis) and also used in alcohol poisoning excluding oxalic acid, ethylene glycol, fluoride, co poisoning.
- Na-citrate is used in fluoride, oxalic acid, and ethylene glycol. Heparin and EDTA are not used. In co poisoning 1-2 cm thick layer of liquid paraffin is used to avoid its exposure to air
- Is preserve for by urine adding equal amount NaCl (saturated solution) Rectified spirit and some grains of thymol-Na-benzoate.

Disposal of Specimen:

Specimen should be put in separate containers (cleaned chemically) sealed and attach a label containing:

- Name, age, sex of dead body
- Date and place of death
- Summary of circumstantial evidence of death
- Cross autopsy finding
- Identification of material
- Specification of analysis requested
- Name and designation of person who have collected specimen
- Date of collection

Chain of Custody;

Maintain chair of custody of the collected material.

- Shorter the chain better it is
- Written receipt obtained every time
- Mail specimen always by registered mail and take receipt

TOXICOLOGICAL INVESTIGATIONS

Objectives:

- Isolation of poison
- Identification of poison
- Conc. of poisons

Poisons are grouped according to method of isolation.

Croup I:

Gases: Specimen of blood or lung tissue is taken and spectroscopy is done. Characteristic bands are seen for various types of Hb.

Group II:

Volatile poisoning: Blood, urine and tissue homogenate is made acidic or basic and steam, is passed and volatile poisons are collected as aqueous distillate.

Poisons distillable from acidic medium: CCl_4 chloroform, cyanide and ethanol.

Poisons distillable from basic medium: nicotine, amphetamine, and methadone

Group III:

Metallic Poisoning: Metal is isolated from tissues by boiling in concentrated acid. Heat or concentrated acid → Dry Ashing

Strong oxidizing agent → Wet Ashing

In ash, poison is isolated

Group IV:

Nonvolatile Organic Poisons: e.g., barbiturates detected in tissue homogenate.

Group V:

Miscellaneous Poisons

- Inorganic ions
- Highly water soluble organic ions
- Organic compounds
- Insoluble in H_2O or alcohol

ANALYTICAL TECHNIQUES

1. **Spectroscopy:**

   For gas detection

   Light is allowed to pass through different types of Hb, certain bands are seen. There is specific band for OxyHb, Carboxy Hb, Met Hb and etc.

2. **Steam Distillation:**

   Volatile poisons are separated by boiling poisons from tissues and enter in steam. Various chemical test of distillate confirm the poison.

3. **Reinsch's Test**

   Is for separation of metals. Acid solution is made in which salts of metals are deposited.

Arsenic:	octahedral crystals
Hg:	globular
Antimony:	needle like crystals

4. **Stas Otto Process:**

   Separation of organic poison is done from animal tissue, ethyl alcohol, Acidic aqueous solution or alkaline aqueous solution is made and extraction is done in ether or chloroform.

   - Acid ether extract: Hypnotic, barbiturates, aconite and sulphonates.
   - Acid ether chloroform extract: Synthetic analysis of tranquilizer.
   - Acid chloroform extract: Ergot, Heroine, atropine, benzoic acid
   - Alkali chloroform extract: Morphine, caffeine

5. **Chromatography:**

   Any process where substances -are separated by a continuous redistribution b/w 2 phases, one stationary and other mobile adsorptive; forces are

   1. Vander Waal's forces: Short range force of attraction b/w molecules
   2. Hydrogen bonds: between H-atoms attached to electro negative atom F, O and N,
   3. Permanent Dipole: Sharing of electron pair b/w 2 atoms involved in covalent bond is unequal.

Types

- Paper chromatography
- Ion exchange chromatography
- Thin layer chromatography
- High pressure liquid chromatography
- Gas chromatography
- Gas liquid chromatography
- Gas solid chromatography

i. **Thin Layer Chromatography**

Thin layer of silica gel is spread over glass plate and sample extract (Conc.) are put as spots on gel and all this is dipped in solvent. Solvent moves .up due to capillary action. Plate is removed, solvent is evaporated and if the sample is colorless it is made colored by Ninhydrin solution and Iodopalmitate solution and then- Rf values are calculated.

$$\text{Rf value} = \frac{\text{Distance of sample}}{\text{Distance of solvent}}$$

ii. **Gas Liquid Chromatography**

In this mobile phase is inert gas like He or N which How in column. Stationary phase is liquid. And it is variable according to nature of compound. Samples are vaporized carried by gas to detection, which is connected, with amplifier and records signal. Rf value is detected, = detection time, (Time b/w injection of samples and detection of compound.) by this Rf we detect compound. Strength of electric signal gives cone, of compound, Vaporizable drugs are analyzed by this method, like barbiturates.

6. **UV Spectroscopy:**

   Absorption of UV light cause electron transition in organic molecule actual wavelength depends on solvent, pH and temperature.

7. **Mass Spectroscopy:**

   It is complex and costly. Sample is bombarded with electron and is shattered into fragments.

8. **Immuno - Assay:**

   In this antibody bind to drug of interest so we can find out desired compound and can perform quantitative and qualitative exam.

9. **Neutral Activator Analyzer:**

   It is a chemical method based on, detection and measurement of sample by radioisotope- Sample is bombarded with neutron and becomes radioactive. Detector measures radioactivity.

10. **Atomic Absorption Spectrometry:**

    It is analytical quantitative technique, used to detect small amount of metals. Sample is solution or suspension and by absorption technique we can measure amount of substance.

INTERPRETATION OF RESULTS

After the tests toxicologist have to interpret the results. Which are mainly

- Route of administration
- Conc. of toxin

Route:

- ↑ Amount of toxin is found .at site of administration, GIT, lungs and muscles
- From site of administration __ absorbed __ transported to organ __ fatal effect.
- Strong corrosives have direct effect.

Blood Levels:

Best indicators of toxicity. These are 4.

1. Normal Levels: it is the concentration of that compound found in general population shows no toxic effect. For example cyanide is required for vitamin B12 synthesis and also absorbed by cigarette smoke. As, Pb, Hg are environmental contaminants.
2. Therapeutic Levels: Amount sufficient to produce desired effects.
3. Toxic Levels: Are life threatening can cause coma, conclusions, liver and kidney damage.
4. Lethal Levels: Sufficient to cause death. These all depend on human and poison.

   Human: age, sex, body weight, nutritional status, health disease, tolerance etc.

   Poison: Nature, rate of absorption, nature of compound, structure, and bio-transformation.

Artifactual Circumstances:

- ↓ Extraction efficiency
- Selection of pH is wrong
- Determination of sample is wrong
- Putrefaction Certain toxic substances A in conc. due to bacteria action.
- Artifacts in embalming -Ve

Interpretation may be+Ve False +Ve

-Ve Results:

- Absence of poison
- Wrong detection
- Correction chart not available
- ↓ conc. __ not detectable
- Poison readily oxidized
- Early destruction of poison

+Ve Results:

- Correct identification
- Sufficient amount of sample
- Sufficient poison in sample

False +Ve Results:

- Alcohol less than 100 mg%
- Burning of tissues
- Carboxy hemoglobin
- Gas production NH3, CO, HCN, H2S, N, SO2 can give false +ve results.
- Contamination and embalming of body by formaldehyde and methyl alcohol
- Artifacts in sample collection.
- Artifacts in storage.

Preservatives, formalin, Heparin, EDTA, should be used

☆☆☆☆☆☆☆

Chapter-15

Special Toxicology

1. CORROSIVES

Definition:

Any substance that comes in contact with living tissue and causes its destruction by coagulation necrosis is corrosive.

Mechanism of Action:

- Extraction of water from tissue
- Coagulation of cellular proteins
- Converting Hb into hematin

As they cause coagulation of cellular protein so lysis of cell does not occur

Classification:

1. **Strong Acids**
   - Mineral acids: H_2SO_4, HNO_3, and HCl
   - Organic acids: Oxalic acid, carbolic acetic acid, and salicylic acid
   - Vegetable acids: HCN
2. **Strong Alkalis:**

   Caustic soda, caustic potash, sodium, carbonate, ammonium carbonate and potassium carbonate

General Uses of Corrosives;

- H_2SO_4: used in batteries, labs, industry, toilet bowel and pipe cleaners
- HCl: used for cleaning metals, toilet bowls, swimming pools
- HNO_3: used for cleaning ornaments
- Oxalic acid: used rust remover
- Alkalis: In paint emulsions and washing powders

By the action of corrosives cell lysis is blocked so cell morphology is not destroyed. Scab is formed at the site of action so further absorption of corrosive is decreased.

Factors Affecting Poisoning of Corrosives

These include the following factors:-

- Volume of corrosive
- Concentration of corrosive
- Time of contact
- Pre-morbid state of stomach

Clinical Sings and Symptoms of Corrosive Poisoning:

Here we will discuss the general or say common signs and symptoms of poisoning caused by corrosives.

1. Immediately after swallowing the poison there is burning sensation in mouth, throat, esophagus, and abdomen
2. Intense thirst and difficulty in swallowing
3. If during drinking the solution falls from mouth then corrosion of lips, checks, chin, neck is also seen
4. There is vomiting of dark colored matter. Blood + mucous + shreds of mucous membrane
5. Especially in acid ingestion when vomitus falls on ground it causes effervescence
6. There is edema of glottis; may cause choking
7. Acids generally cause constipation and alkalis cause loose stools with mucous and blood
8. There are signs of corrosion of GIT. Many a time esophagus is spared as it is vertical and corrosive solution passes quickly so stomach is more affected than esophagus
9. There is hoarseness of voice and pain in throat
10. Patient represents hypotension, week feeble pulse
11. Pupils are dilated and eyes are sunken
12. The fumes of very concentrated acids may cause conjunctivitis, and nasal irritation
13. By entry of corrosive into respiratory air ways there is edema of airways
14. Due to dehydration there is oliguria
15. Basic difference between alkalis and acids is that patient feels soapy taste in alkali ingestion

Causes of Death:

In case of poisoning by corrosives death occurs due to

- Edema of larynx: suffocation
- Loss of fluid: primary shock
- Perforation of stomach and hemorrhage
- Chemical peritonitis
- Hypostatic pneumonia
- Septic absorption

Treatment of Corrosive Poisoning:

During treatment of poisoning by corrosives following points are to be noted.

- Stomach wash and emetics are contraindicated
- In case of acid poisoning administer dilute alkalis with plentiful water then administer one table spoonful of calcium oxide, magnesium oxide or milk of magnesia and also give melted butter and olive oil
- In case of poisoning by alkalis administer dilute vegetable acid like acetic acid and then demulcent drinks should be followed
- Maintain I/V line for fluid and electrolyte balance
- Steroids should be given systemically
- In severe cases of edema of glottis or trachea or incases of laryngospasm tracheostomy is done
- Apply antibiotics on skin burns

- Give morphine for pain and ice to relieve thirst

1. H_2SO_4

It is colorless, odorless, heavy, viscous, non-fuming oily liquid. Very concentrated acid is darker in color. When mixed with water it evolves great heat. Commercial H_2SO_4 is black due to presence of impurities.

Mechanism of Action:

It causes dehydration of tissues and produces greasy white necrotic material on surface with swelling which turns into black or brown color (mainly by conversion of Hb into dark color Acid Hematin).

Specific Sign and Symptoms:

Burns on lips, cheeks, chin and neck etc., all are blackish or brownish in color

- Tongue is coated with whitish covering which latter on becomes black
- Teeth become chalky white as their polish has been deprived off
- Vomiting is violent, dark black or brown in color mixed with blood mucous and mucous membrane shreds
- Vomitus cause dark staining of clothing and fabrics
- Urine is of blue color

Fatal Dose:

On average 10-15 ml

Fatal Period:

May vary from 12-24 hours

Postmortem Appearance:

1. Clothes show brownish color stains also on body
2. Face is calm, eyes are sunken, and pupils dilated
3. Tongue coated with blackish material and appears as shapeless mass
4. Teeth chalky white
5. Edema of larynx
6. Corrosion of esophagus, stomach and intestines
7. Corroded areas are blackish or brownish, swollen and dried as water is extracted from them
8. Perforations and hemorrhages in GIT and signs of chemical peritonitis

Medicolegal Importance:

It is rarely-used for suicidal, homicidal purposes; its most common use is in throwing the acid with malafide intention to disfigure face (vitriolage). $BISO_4$ poisoning is mainly accidental in industrial workers and in children. Sulfuric acid produces severe burns, it may cause blindness if cornea is involved in a case of vitriolage, and also causes permanent disfigurement of face.

2. HNO_3 - Aqua Fortis - Red Spirit - Engraver's Acid - Red Spirit of Niter

Nitric acid is yellow liquid with irritating fumes, as it is volatile on room temperature.

Mechanism of Action:

It is an oxidizing agent reacts with organic matter to form NO_2 and picric acid. Picric acid stains yellow and this color gets deepens on addition of alkali HNO_3 causes coagulation of proteins. This yellow discoloration is called Xanthoproteic Reaction.

Specific Signs and Symptoms:

- Fumes of nitric acid cause irritation of eyes and air ways leading to conjunctivitis, lacrimation, rhinitis, edema of glottis, dyspnoea, pulmonary pneumonitis, bronchitis
- It stains tissues and fabrics yellow

Fatal Dose:

On average is 15-20 ml

Fatal Period:

3-24 hours

Postmortem Appearance;

1. Clothes and body parts may be stained with yellow spots.
2. Face is calm eyes sunken and pupils dilated
3. Tongue coated with yellow colored material
4. Skin of oral cavity is also stained yellow orange
5. Color of vomitus is yellow orange or brown
6. Vomitus stains yellow on skin and fabrics
7. Gut is also stained yellow; perforations are not common
8. Signs of respiratory tract inflammation are common

Medicolegal Aspects:

It is mainly an accidental poisoning. Death may also occur due to edema of airways in some vitriolage cases. (It is not much used for vitriolage purposes).

3. HCl - Muriatic Acid - Spirit of Salt

It is pale yellow watery, highly fume-able and irritating fluid not too much corrosive.

Mechanism of Action:

It causes increased secretion, redness, swelling and slight corrosion at the site of application.

Specific Signs and Symptoms:

- Being highly fume-able it causes irritation of eyes, throat and airways. There is increased salivation, lacrimation, and rhinitis, leading to suffocation, cough, dyspnoea, and cyanosis.
- Inflammation of gums, loosening of teeth.
- Vomiting is somewhat coffee ground.
- Perforations are not common.

Fatal Dose:

5-18 ml on average

Fatal Period:

24-30 hours

Postmortem Appearance:

1. Skin and clothes are stained whiter or darker
2. Face is calm with sunken eyes and dilated pupils
3. If conc. of acid is high tongue is coated darker material other wise wish whiter material

4. Tissues are also stained whiter or darker according to concentrations
5. Vomitus is coffee ground
6. Perforation of gut is not common
7. Signs of pulmonary infections are seen

Medicolegal Aspects:

Generally its poisoning is rare. Some accidental and suicidal cases are seen.

4. Oxalic Acid - Acid of Sugar

It is sparingly soluble in water, its crystals resemble with sugar, magn..sium and zinc sulfate. It is easily obtained. Its taste is sour.

Mode of Action;

It combines with serum Ca^{++} to form insoluble calcium-oxalate causing reduction in Ca^{+} availability leading to violent muscular contraction, convulsions and collapse.

Specific Signs and Symptoms:

- Repeated recurrent vomiting, vomitus is dark green in color
- Whitening of skin and fabrics if it falls out of mouth
- 1st constipation latter on diarrhea
- 1st albuminuria then anuria and coma
- Numbness, spasmodic twitching and convulsions are seen
- Vomiting persists till coma then death occurs
- Deposition or calcium oxalate in nephrons leading to nephrotoxicity

Fatal Dose:

15-20 grams on average

Fatal Period:

1-2 hours

Postmortem Appearance:

1. Mucous membranes are white as bleached
2. Stomach contains dark brown gelatinous material
3. Perforations are rare mucous membranes are corroded with white patchy deposits of calcium oxalate
4. Blood vessels are seen distinctly as dark lines due to formation of acid hematin
5. Inflamed kidneys and intestines are seen
6. Congestion of lungs and airways is also seen if it is inhaled

Medicolegal Importance:

It is rarely used for suicidal purposes. Its homicidal poisoning cases are seen mainly. Accidental oxalic acid poisoning is common in children of washer-men who use it as a cleansing agent and bleaching agent.

Chris ton's Saying:

If a person immediately after swallowing solution of crystalline salt with strong acidic taste is attacked by burning throat, stomach pain, bloody profuse vomiting, imperceptible pulse and dies in half an hour - it is nothing but oxalic acid poisoning.

Treatment:

Specific antidote of oxalic acid is I.V. Ca^{++} gluconate, orally Ca^{++} lactate or chalk. (30 grains chalk neutralizes 20 grams oxalic acid).

5. Carbolic acid - Phenol

It is coat-tar derivative. Its liquid is dark brown in color. Its pure crystals are long, colorless, prismatic needles, with intensely penetrating (phenol) odor. It is more soluble in alcohol than water; Its color changes to pink on exposure to air and light.

Mechanism of Action:

It is coagulant of proteins. It has penetrating qualities causing necrosis of tissues and sloughing.

Specific Signs and Symptoms:

- Burns of carbolic acid are white, bleached and hardened sometimes brownish
- There is giddiness, cold, clammy skin, feeble pulse, constricted pupils; after ingestion
- Smell of phenol in breathing
- Urine is smoky green (carboluria), scanty and contains albumin
- It is nephrotoxic

Fatal

20 drops of phenol, 10-15gm carbolic acid

Fatal Period:

3-4 hours

Postmortem Findings:

1. Burns by carbolic acid are grayish white with phenolic odor
2. Rugae of stomach are prominent, thickened, less brownish and leathery
3. Signs of irritation are well marked
4. There is corrosion of intestines and vessels are very prominent
5. Liver and spleen are hardened and whitish
6. Kidneys show degenerative changes

Mechanism of Action:

It is used as antiseptic, disinfectant, germicidal, surface anesthetic, preservatives, and abortifacient. As it is easily available so its homicidal and suicidal poisoning are common. Accidental poisoning is rare. Carbolic acid poisoning is called ***Carbolism***. Its distinguishing feature is phenolic odor. Its specific antidote is 10% solution of glycerin + water + $MgSO_4$ orally followed by 2 ounces of liquid paraffin. Rest of treatment is discussed already.

6. Acetic Acid

It is colorless liquid with vinegar smell. Its dilute form is called vinegar and used in eating, and cooking food.

Mechanism of Action:

Its concentrated form acts as strong irritant with corrosive actions.

Specific Signs and Symptoms:

- Yellowish white color of mucous membranes.

- Irritable cough and laryngeal complications.
- Hemoglobinuria and nephrotoxicity leading to renal failure.

Fatal Dose:

60 ml on average

Fatal Period:

4-48 hours

Postmortem Findings:

1. Yellowish-white burns on cheeks, lips, chin, neck and same color spots on clothes
2. Mucosa of mouth, esophagus, stomach and intestines show yellowish white color staining; signs of inflammation
3. Kidneys are inflamed
4. Odour of vinegar is also present

Medicolegal Importance:

Its poisoning is accidental and very rarely reported.

7. Salicylic Acid

It is odorless, crystalline solid with sweetish-acrid taste. Its important preparations include sodium salicylate, methyl salicylate and salicylic acid.

Mechanism of Action:

It causes marked gastric mucosal corrosion but its fatal effects are seen after absorption.

Specific and Symptoms:

- It causes irritation of GIT.
- Pain may not be there.
- Other symptoms include giddiness, profuse perspiration, dehydration, acidosis, confusion, delirium, coma

Fatal Dose:

On average 5-10 grams

Fatal Period:

It varies from 4-7 days.

Postmortem Appearance:

1. Gastroenteritis and submucosal hemorrhages
2. Congestion of viscera
3. Inflammation of kidneys
4. Edematous lungs
5. Petechial hemorrhages in renal cortex and brain

Medicolegal

Acetyl salicylic acid (Aspirin) is an analgesic, its poisoning is mainly accidental and suicidal (only in U.S.A)

Treatment:

It includes emetics, gastric lavage, sodium bicarbonate, MgO_2, iv glucose administration also urine alkalinizers.

8. Hydrocyanic Acid - HCN - Cyanogen - Prussic Acid

Its solution is colorless, volatile with bitter almond like smell.

Mechanism of Action:

It inhibits $CytP_{450}$ oxidase system, so CO_2 cannot be utilized and cell death occurs due to internal asphyxia. This effect is seen after absorption, this locally acts as a corrosive.

Specific Signs and Symptoms:

- If HCN is. Inhaled it causes sudden death within a minute, may be without a cry
- If death is delayed there may be dyspnoea, convulsions, and dilated pupils __ for few minutes
- When it is ingested it causes giddiness, dyspnoea, dilated pupils, seizures, loss of muscle power, within minutes
- Corrosion of mouth, throat, and stomach causes pain
- Vomiting is not profuse
- Respiration is spasmodic, and face is cyanosed
- In case of chronic poisoning there are, headache, vomiting, diarrhea, chronic, cachexia, mental disturbances

Fatal Dose:

50mg of pure acid (10-15 bitter almonds)

Fatal Period:

1-20 minutes; its treatment is of any value if immediate.

Postmortem Appearance:

1. Smell of bitter almonds from body
2. Face is cyanosed
3. Eyes sunken and pupils dilated
4. Fine froth from mouth
5. Nails arc-blue
6. Rigor mortis is early
7. P.M. Staining is pink
8. Bitter almond smell from body cavities
9. Signs of irritation in GIT with pink mucosa
10. Petechial hemorrhages in pleura, peritoneum, meninges and brain
11. Blood stained froth in airways

Medicolegal Aspects:

It is common suicidal and homicidal poison. It is also seen in cattle eating linseed, called cattle poisoning

Treatment:

Artificial respiration; IV injection of nikethamide; IV injection of sodium nitrate and sodium thiosulfate

9. Alkalies

Alkalis are chemicals with high pH (11.5 or above). These include NaOH, KOH, $Ca(OH)_2$, NH_4OH, $KmnO_4$, NH_3.

Medicolegal of Action:

Alkalis cause liquefaction necrosis, of not only surface epithelium but also of whole tissue. These also cause, systemic complications.

Specific Signs and Symptoms:

- Taste of alkalis is acred and soapy
- Vomitus is alkaline in reaction with dark altered blood and shreds of GIT mucosa
- There is diarrhea, not constipation
- Tongue and lips are brown and swollen (caustic soda)
- Dyspnoea
- Sneezing, coughing, cyanosis (ammonia)

Fatal Dose:

5 grams (caustic soda) 30 ml (NH_4GH)

Fatal Period:

Within 24 hours

Postmortem Appearance:

There is corrosion of stomach, mucosa of mouth, throat, and esophagus. Mucous and blood are present in stomach. Vapors of NH_3 cause inflammation of airways.

Medicolegal Importance:

- It is mainly accidental and suicidal
- Never homicidal

2. IRRITANTS

Definition:

These are the poisons when applied on skin cause reduces and swelling, on mucous-membranes cause ↑ secretion (nose: rhinorrhea, eyes: lacrimation, mouth: salivation) when ingested cause irritation of gut, nausea, vomiting and diarrhea.

Mechanism of Action:

These poisons on local area produces sever irritation and inflammatory actions. Corrosives when used in dilute forms, act as irritants.

Classification:

Irritants are classified in 3 major groups; inorganic, organic and mechanical

Factors Affecting Irritant Poisoning:

These include the following factors:-

1. Amount of poison
2. Concentration of irritant
3. Duration of contact
4. Pre-morbid state of stomach

General Signs and Symptoms of Irritant Poisoning:

These include the following

1. Burning pain in mouth, throat, esophagus, stomachs abdomen.
2. Intense thirst
3. Dysphagia and dyspepsia
4. Nausea
5. Continuous painful vomiting
6. Diarrhea
7. Vomitus 1st contains normal stomach contents then contains altered blood and mucous.
8. Diarrhea is severe, urgent 1st loose stools latter on contains blood and mucous.
9. Rapid, week pulse
10. Dysuria
11. Anxious look, cold clammy skin and sighing respiration.
12. Cramps in muscles and coma may follow

Causes of Death:

Incase of poisoning by irritants death occurs due to:

1. Shock: in 24 hours
2. Exhaustion: in few days.
3. Complications: in month: complications include damage to liver, kidneys and other vital organs.

1. Arsenic Poisoning - Capillary Poison

It is insoluble in water as metallic form and also in metallic form it is nonpoisonous, as it is not absorbed from GIT. Its oxides are poisons, which are not given by water as they float on water and are colored so easily distinguished. Oxides of arsenic and also metallic arsenic get attached to vessel wails. For homicidal purpose it is mixed with milk or coffee etc. Other fatal arsenic compounds are sulfides of arsenic As_2S_3, (yellow) As_2S_2 (red-sandoor).

Mode of Action:

- It combines with -SH group of cellular enzymes and inactivates them so disturbs cell metabolism.
- It causes capillary dilation, hence called capillary poison.

Routes of Administration:

1. Orally: for suicide, homicide or as drug (aphrodisiac)
2. Application on mucous membranes, absorbed from vaginal mucous when used as love- philters in contraceptive plugs
3. By inhalation
4. By injection

Specific Symptoms of Acute Poisoning;

The symptoms of poisoning start after 1/2 hour of oral, general sings and symptoms we have already discussed now only specific one are given.

1. When very large does is taken then only following symptoms results which are of cerebrospinal type i.e. narcotic symptoms like, vertigo, headache, spasm, stupor, profound hypotension, circulatory collapse and death.

2. When does is less than narcotic does, i.e. dose of GIT symptoms is administered then problems of GIT are profound, (general) we have discussed already, specific are
   - Coffee ground vomiting: 1st vomitus contains stomach contents then it becomes blackish .or greenish due to presence of bile than by mucous, blood and shreds of mucous membrane are present in vomitus which is a dark brown color vomitus, it is called coffee ground vomiting of Arsenic.
   - Rice water stools: 1st diarrhea is of loose stools then the mucous, blood and shreds of mucous membrane give colorless, odorless, watery stools called Rice water stools (like cholera).
   - Drinking of water increases vomiting.
   - Painful cramps in legs due to dehydration
   - Hepato and Nephrotoxicity

Acute Arsenic Poisoning	Cholera
i. Pain in throat before vomiting.	i. Pain after vomiting.
ii. Vomiting before diarrhea.	ii. Vomiting after diarrhea.
iii. Vomitus contains blood.	iii. Not so
iv. Stools 1st rice water then bloody	iv. Through out Rice water stools
v. Congestion of eyes	v. Not so
vi. Hoarse voice	vi. Not effected voice

Acute Arsenic Poisoning	Food Poisoning
Symptoms appear after 20-30 min. of ingestion of food	Symptoms appear after few hours of ingestion of food It is due to micro-organisms taken in by food-(gastroenteritis.)

Treatment of Acute Arsenic PoisoningL

1. Maintain vital sings like B.P, pulse, temperature, respiratory rate
2. Stomach wash is alone
3. Maintain IV line to treat shock and electrolyte imbalance
4. i/v sodium thiosulfate 1gm in 10cc water 4-6 hourly for 24 hours sodium thiosulfate forms harmless compound with Arsenic which is excreted out in urine
5. 1/v give BAL. 3 mg/kg of body weight 3 hourly for 2 days, .6 hourly for next one day and 12 hourly for next 10 days. BAL also binds with arsenic forming harmless complex, which is excreted out in urine
6. Give low dose of analgesic

Acute Arsenic Poisoning:

Autopsy Findings. In Case Of Acute Arsenic Poisoning

These depend on amount of Arsenic given and include.

- Signs of dehydration, sunken eyes, wrinkling of skin, prominent cheek bones
- Jaundiced skin
- Cyanosis
- Red velvety stomach, Arsenic particles with blood, mucous and sheds of mucous membrane are present, scattered areas of erosions and hemorrhage
- Petechial hemorrhages on sub-endocardial surface

- Congestion of liver. Kidneys and other viscera, fatty degeneration starts

Sub-Acute Arsenic Poisoning:

Symptoms are same as in case of acute arsenic poisoning but appear after long interval. One thing is important that jaundice appears in latter stages.

Chronic Arsenic Poisoning:

Sings and Symptoms of Chronic Poisoning

These are discussed in 4 stages, which are:

1. Stage of Nutritional. G.I.T. Disturbances: There is weight loss, anorexia, diarrhea, fatigue, vomiting.
2. Stage of Catarrhal Changes: Feeling of common cold, running, nose, sense of fullness of headache, running eyes, conjunctivitis, cough, fatigue, hoarse voice, eruptions of skin, inflammation of mucous membranes. .
3. Stage of Skin Rashes: Patchy brown pigmentation of skin, (Rain drop appearance) skin rashes, irritation, vesication, Mee's line (white line crossing the nails showing periods of arrested growth).
4. Stage of Nervous Disturbances: Tingling and numbers of hands and feet. Tenderness of muscles, neuritis, headache, drowsiness, impaired vision and mental activity. Kidney, liver and heart enlarge. Bone marrow is depressed.

Treatment of Chronic Poisoning

1. Take the patient away from the source (located by careful history)
2. Provide good food
3. I/v administration of sodium thiosulfate
4. I/v administration of BAL
5. Continue treatment at low doses for 6-12 months

Medicolegal Aspects:

It is common homicidal and suicidal poison. It is mixed in water sources for mass homicide or mixed with food article, as it fits in the criteria; it is cheap, available, colorless, odorless, easy to administer. It is also commonly used as cattle poison. Its accidental poisoning occurs in

- Children
- In adults by love-filters and drugs (aphrodisiac __ as quacks give it for increasing libido)
- Among industrial workers
- Cases when it is used as abortifacient

Fatal Dose:

120-200 mg it depends on age, sex, nature of compound, state of health, disease.

Fatal Period:

In Narcotic:	few hours
By GIT disturbances:	12-48 hours
In subacute poisoning:	4-5 days

2. Mercury - Para - Quicksilver

It is liquid metal with silver luster. It is nonpoisonous as metallic from is ingested in the form of big particles, as it is not absorbed. It is poisonous when fine particles are inhaled, rubbed or ingested. Salts of

mercury are also poisonous. It is commonly used in industry and also as a drug (diuretics) and Anti-fungal (for cereals and grain diseases)

Mode of Action;

- It combines with SH group of cellular enzymes and cause their inhibition.
- It locally acts as corrosive.

Routes of Administration:

- Given orally
- By inhalation

Acute Mercury Poisoning:

Specific signs and symptoms of acute mercury poisoning include

1. If mercury is ingested in high doses it acts as corrosive and causes corrosion of GIT, marked injuries to liver, spleen, heart, skeletal muscle and lungs
2. If mercury is ingested in low concentrations it acts are an irritant poison, it has metallic taste, constriction of throat, mucous membranes are corroded and appear grayish white, bloody vomiting and blood stools, profuse purging, damage to kidneys. Renal Failure, Circulatory Collapse and Death. If by some treatment circulation is maintained then death may occur in 3-5 days by nephrotoxicity
3. If mercury is inhaled only following signs are seen in 1-2 days, stomatitis, salivation, metallic taste, pneumonitis, kidney damage, renal shut down, uremia and death

Treatment of Acute Poisoning

1. Maintain vital sings like BP, pulses, temperature, respiratory rate
2. Stomach wash with sodium thiosulfonate
3. Administer charcoal and penicillamine
4. Maintain IV line to control fluid and electrolyte balance
5. Then give egg albumin

Autopsy Findings in Acute Poisoning

1. Tongue is white and mucosa of upper G.I.T. shows signs of corrosion and diffuse grayish-white escharotic appearance! More marked in stomach and small intestine
2. Ulceration is common, grayish deposits of mercury or black deposits of sulphides of mercury are there
3. Inflammation of small intestine
4. Inflammation, ulceration and gangrene of caecum and colon
5. Kidneys are congested
6. Liver and heart show fatty degeneration

Chronic Mercury Poisoning:

Signs and Symptoms of Chronic Poisoning

- Inflammation of gums and loosening of teeth and formation of blue black line on gum as with lead poisoning
- There is hyper-salivation (ptaylism)
- Discoloration of lens capsule
- Ulceration of back of hands

- Tremors of hands, arms, legs which aggravate by voluntary work and disappear in sleep (called Hatter's shake; are seen in workers of felt hat industry)
- Mercuric erethism causes, insanity, shy, irritability, insomnia, tremors, hallucinations and delusions (Disturbances of Personality)

Treatment of Chronic Poisoning

1. Always locate the cause and remove the source
2. Give symptomatic treatment
3. Administer BAL and penicillamine in low doses for long time

Autopsy Appearance in Chronic Poisoning

All the findings are same in acute poisoning except

1. Massive necrosis of intestines
2. Massive damage to kidneys, liver and heart

Fatal Dose

1-2 Grams

Fatal Period

- Very high doses: few hours
- Low doses: few hours - 3-5 days
- In inhalation: few days
- Chronic poisoning: depends on dose, age and health

Medicolegal Aspects:

Rarely homicidal and suicidal, its poisoning is commonly accidental. Chronic Mercury Poisoning is called Hydragyrism. Poisonous compounds of mercury include Mercuric Chloride, Mercurous Chloride, Mercuric Sulfide (vermilion) and Mercuric Oxide.

3. Lead - Sesa

It is very toxic, two times more toxic, when inhaled than when ingested. Toxic lead compounds are Lead acetate, lead oxide, lead chromate and lead is also found in petroleum.

Mode of Action:

- It combines with -SH group of enzymes and cause their inhibition
- It inhibits haem synthesis
- It cause spasm of capillaries and arterioles
- It gets deposited in CNS and destroys myelin sheaths, neurons also causes cerebral edema
- It also causes nephritis and infertility

Routes of Administration:

- Orally given
- Inhaled (very toxic)

Acute Lead Poisoning:

Specific signs and symptoms include the following:-

- Metallic taste in mouth, swollen gums, loose teeth, blue black lines on gums (like arsenic)
- Stomatitis, foul smell from mouth

- Colic pain relieved by pressure
- Lead encephalopathy causes, insomnia, headache, tremors of eyes, mouth and fingers, loss of vision, paralysis, hallucination, excitement, delirium convulsions, and permanent insanity

Treatment of Acute Lead Poisoning:

1. Maintain vital signs like B.P, pulse, temperature, respiratory rate
2. Stomach wash with sodium sulfate
3. Administer B.A.L. and penicillamine
4. Maintain IV line to maintain fluid balance lost in vomiting and diarrhea
5. Administer Ca^{++} and vitamin D supplements as Ca^{++} favours lead deposition

Autopsy Appearance in Acute Poisoning:

These mostly resemble with acute arsenic poisoning and include feature of gastroenteritis with congested gut mucosa, eroded patches, stomatitis, blue black line on gums, black color feces in large intestine.

Plumbism (Chronic Lead Poisoning):

1. Weakness, anorexia, dyspepsia, metallic taste, foul smell from mouth
2. Facial pallor due to vasospasm
3. Hypochromic microcytic anemia.
4. RBCs are with punctate basophilia due to altered porphyrin metabolism
5. Lead colic (spasmodic, intermittent, at night) relieved by pressure
6. Lead line, bluish black on gums only on diseased teeth (called Burtonian line). This line is subepithelial
7. Lead palsy, wrist drop and foot drop due to degeneration of nerves and muscles atrophy
8. Lead encephalopathy; headache, insomnia, loss of vision, hallucination, excitement, ataxia, and insanity
9. Renal damage
10. Degeneration of sperms, amenorrhea

Acute lead poisoning is rare but chronic is common. It mainly occurs drinking water obtained via old lead pipes.

Treatment of Chronic Lead Poisoning:

1. Administer BAL and EDTA for 5-6 days
2. Then give penicillamine for 2 months
3. For severe colic give injections of morphine
4. After this when acute symptoms are gone "deleading" is carried out. Produce –ve Ca^{++} balance in body by ↓ Ca^{++} in diet or giving parathormone or NH_4Cl –ve Ca^{++} balance causes out coming of lead from tissues

Autopsy Findings of Chronic Lead Poisoning:

These are mainly same as discussed in acute poisoning.

Medicolegal

Its acute poisoning is rare. Chronic poisoning occurs in factory workers and in using household old lead pipes.

4. Copper - Tamba

It is non-poisonous in metallic state but salts are poisonous. Its toxic most salt is cooper sulfate and other is copper sub-acetate ($CuSO_4$ is called blue vitriol (Nila thotha) and copper sub-acetate is called Zangal). Its fatal docs is 30 gram and fatal period is 12-24 hours.

Mode of Action:

It is powerful inhibitor enzymes.

Acute Copper Poisoning:

Symptoms appear 20-30 minutes after ingestion. Specific ones are:

1. Blue colored vomiting. If it is not distinguished by green color bile vomitus add NH_4OH, $CuSO_4$, vomitus will turn deep blue
2. Cold perspiration: collapse of circulation
3. Convulsions and coma
4. Urine is of inky color contalning albumin and casts
5. Jaundice appears in some cases
6. Spasms of extremities is noted

Treatment of Acute Poisoning:

1. Maintain vital sings
2. Stomach wash with potassium ferrocyanide
3. Administer pencilamine, BAL or EDTA
4. Administer demulcent fluids
5. Maintain IV into to balance fluid loss

Autopsy Findings in Acute Copper Poisoning:

1. Jaundiced skin
2. Greenish blue froth coming out from mouth
3. Greenish blue coloration of gastric mucosa
4. Mucosa of gut is congested and eroded
5. Inflammation of kidneys is also seen

Chronic Poisoning

Signs and Symptoms of Chronic Poisoning

These include metallic taste in mouth, green line of gums, features of gastroenteritis nausea, vomiting, colic, diarrhea and all other general signs. Specific are

- Peripheral neuritis
- Wilson's disease
- Bronzed diabetes

Treatment of Chronic Poisoning:

1. Always locate the cause and remove the source.
2. Give symptomatic treatment.
3. Administer penicillamine, EDTA for long duration in low doses.

Fatal

2-30 grams of $CuSO_4$

Fatal period:

12-24 hours

Autopsy Appearance in Chronic Poisoning:

All features are same as in case of chronic poisoning include also parenchymatous injury to heart, liver and kidneys.

Medicolegal Aspects:

Copper is not used for homicidal purposes its poisoning is chronic by cooking and eating food in copper utensils.

5. Phosphorous - Liver Poison

It is inorganic and nonmetallic. It is in 2 forms:-

a. White crystalline phosphorous, on exposure to air it changes its color to yellow. It is insoluble in water, soluble in ether and alcohol, highly soluble in CS2. When it comes in contact with water it forms tense white fumes and garlic smell (P_2O_5). It is used in gunpowder, fireworks and as rodenticide.

b. Red Phosphorous, It is inactive until impurities of white or yellow phosphorous are present. It is insoluble in either, alcohol and CS_2. It is used in safety matches.

Mode of Action:

- It interferes metabolic sequences occurring in liver
- It impairs blood circulation in bones

Acute Phosphorous Poisoning:

Features Specific for Acute Phosphorous Poisoning

Signs and symptoms are divided in 3 stages

1. Primary Stage (Few Min to Few Hours)
   - Burning pain in mouth, throat, esophagus and stomach
   - Vomiting and diarrhea
   - Garlic taste in mouth, vomitus and stools, and also in breath
2. Remission Stage (2-3 Days)

   Patient feels better for 2-3 days, as if he is recovering
3. Secondary Stage
   - Necrosis of liver, hepatomegaly, jaundice
   - Purpura
   - Urine contains glucose, albumin, amino acid, bile and blood
   - Insomnia
   - Renal insufficiency

Phosphorous inhibits glycogen deposition in liver and t fat deposition. Thus liver enlarges 1st. becomes uniformly yellow soft and greasy. Then necrosis and shrinkage is seen. It is called necrobiosis.

Treatment of Acute Poisoning

1. Never give fatty substances, which increase phosphorous absorption
2. Stomach wash with $KMnO_4$
3. Administer 0.2% sol. of $CuSO_4$
4. Maintain i/v line to compensate fluid loss

Autopsy Findings

1. Inflammation of GIT, ulceration of mucosa
2. Garlic odour from lungs and stomach
3. Fatty changes in kidney, liver and heart
4. Petechial hemorrhage on skin

Chronic Phosphorous Poisoning:

It mainly occurs in factory workers by inhalation. It features are:-

1. Bone formation in bone marrow and haversian canal
2. Phossy Jaw: after months and even year victim complaints of toothache, swelling of jaw, loosening of teeth, necrosis of gums, death of bone in mandible. Multiple discharging sinuses in jaw bone with foul smell.
3. Spontaneous fractures
4. Hepatic necrosis, jaundice and hepatomegaly

Treatment of Chronic Poisoning

Save the patient from further exposure, and give him 0.2% solution of $KMnO_4$ twice weekly, for some weeks. Apply antibiotics on discharging sinuses.

Fatal Dose:

120.mg

Fatal Period:

20-24 hours

Medicolegal Aspects:

Accidental in factory workers forming bombs, fire works, safety matches, also in children playing with fire crackers, paints and dyes. It is rarely suicidal and rarely homicidal.

6. Castor Oil Seed - Ricinus Communis - Arandi

Caster seeds are oval, mottled, glassy brown. The residue after extraction of oil, is poisonous. Oil is not poisonous and causes severe purging. Seeds are nonpoisonous if swallowed entire or after cooking.

Active Principle:

It is "Ricin" a toxalbumin: toxic protein

Mode of Action:

- Ricin causes agglutination and lysis of RBCs
- It is antigenic in nature
- It also causes some degree of nephritis and cell destruction

Signs and Symptoms:

1. When applied to mucous membranes and skin it causes dermatitis, rhinitis and conjunctivitis

2. If inhaled causes asthma and allergy
3. If ingested causes burning in throat, mouth, pain in abdomen, nausea, profuse vomiting, bloody purging, hemolysis, renal failure, dehydration and cramps in muscles, coma, and convulsions may lead to death

Fatal Dose:

6 mg of Ricin (10 raw seeds)

Fatal Period:

2-6 days

Treatment:

- Stomach wash with warm water
- Administer charcoal
- Give demulcents
- IV glucose and saline for fluid loss

Autopsy Findings:

Inflamed bowel with corrosion, hemorrhage is seen. Seeds may be found in stomach. Renal congestion is also noted.

Medicolegal Aspect

Its poisoning is accidental in factory workers. Criminal administration is in food it is used as

- Abortifacient
- Purgative
- Lubricant

Castor oil seeds

Croton seeds.

7. Coroton Oil - Jamalghota - Nepala - Coroton Tiglium

Seeds and oil both are poisonous. Seeds are oval, black brown with longitudinal lines, its kernel is white oily. Oil is browning viscid with unpleasant smell.

Active Principle:

"Coroton" it is also a toxalbumin.

Mode of Action:

It acts as an irritant and vesicant

Signs and Symptoms:

1. By topical application it causes blistering.
2. On ingestion it causes severe GIT irritation, burning pain in abdomen, profuse vomiting, powerful purging, burning pain at anus, dehydration, circulatory collapse, nephrotoxicity, coma Death.

Fatal Dose:

20 drops of oil = 4 seeds

Fatal Period:

4-6 hours, if delayed 3-6 days

Same as castor oil seed poisoning. Stomach wash with warm water, administer charcoal and demulcents also maintain IV line for fluid balance.

Autopsy Findings:

Same as in castor oil seed poisoning. Inflamed bowel with corrosions and hemorrhages, Seeds may be present in stomach. Renal congestion is seen.

Medicolegal Aspects:

Mainly its poisoning is accidental taken mistakenly as castor oil seed. Suicidal poisoning is also seen. It is mixed in food for homicidal purposes. It is used as abortifacient and also as arrow poison.

8. Abrus Precatorius - Rati - Jaquirity - Indian Liquorice - Gunchi - Sui Poison

All plant is poisonous with beautiful red seeds, which have black spot on one end. It is commonly used "Cattle Poison" or "Sui Poison".

Active Principle:

"Abrin" a toxalbumin

Mode of Action:

It acts as an irritant ' Oil and seed also contain some fat splitting enzymes, hemoglutinins and urease.

Signs and Symptoms:

1. If injected under skin or in a wound it causes, swelling, pain, ecchymosis followed by necrosis, vertigo, cardiac arrhythmia, and convulsions.
2. If ingested it causes nausea vomiting, abdominal pain, and diarrhea then circulatory collapse.

Fatal Dose:

1-2 seeds

Fatal Period:

3-5 days

Treatment:

1. Administer anti-abrin
2. 10 gram sodium bicarbonate
3. Rest of treatment is symptomatic

Autopsy Findings:

There is swelling, inflammation, and necrosis at the site of application. Haemorrhagic patches are seen under mucous membranes. Stomach and intestines are congested.

Medicolegal Importance:

Its poisoning is accidental. It is used as:

- Oral contraceptive
- Arrow poison
- Goldsmith use for weighing
- Cattle poisoning

Rati seeds crushed mixed with opium or dhatura, and a paste is made from which spikes are formed which are dried and small needles are formed which are introduced into the skin of animals. It is mistaken as "pit-viper bite". Death occurs in 3-4 days.

9. Ergot - Mother of Rye

Ergot is compact parasitic fungus, which grows on Rye.

Active Principle:

Ergotoxine, Ergotamine, Ergometrine (alkaloids)

Mode of Action:

These cause contraction of

Uterus:	cause abortion
Arterioles:	cause gangrene
Intestines:	diarrhea

Signs and Symptoms:

Its acute poisoning is never seen; but chronic poisoning is seen. It occurs mainly due to endemic ergotism (by eating ergot-contaminated flour in some areas).

- These alkaloids cause symptoms of gastrointestinal catarrh
- It also causes convulsions, madness, numbness, cutaneous creeping sensations and psychiatric disturbances
- It causes swelling of feet, pain, numbness and gangrene there is sloughing away of fingers and toes without bleeding

Fatal Poise:

1 gram

Fatal Period:

24 hours

Treatment:

1. Stomach wash
2. Vasodilators are given
3. Maintain vital sings
4. Provide good nutrition
5. Rest of treatment is symptomatic

Autopsy Findings:

1. There is congestion and inflammation of gastrointestinal tract and kidneys.
2. Particles may be found in stomach.
3. Gangrene of toes and fingers is also seen.

10. Capsicum-Chilies

Capsicum has pungent smell and taste. These are highly irritating.

Active Principle:

"Capsicin" are acrid, volatile and non-alkaloid

Mode of Action:

It is highly irritating and stimulates pain endings.

Signs and Symptoms:

1. On topical application causes irritation and vesication.
2. On ingestion it acts as an irritant poison, (only with high doses)
3. When applied to eyes it causes burning and lacrimation.

Death from capsicum is never known.

Treatment:

If applied to skin, wash the area with plentiful water. In case of eye, wash with water, apply cortisone and antibiotics and if ingested give ice to suck.

Medicolegal Aspects:

It is used for purpose of torture by putting it into eyes and vagina etc. It is thrown into eyes to facilitate robbery.

11. Semicarpus Anacardium-Marking Nut-Bhilawan

Juice of this nut is used by washer-men as marking ink on the clothes.

Active Principle:

"Semicarpol" and "Bhilawanol"

Mode of Action:

It acts as irritant and vesicant.

Sings and Symptoms:

1. When applied to skin, juice causes vesication, strongly raising blisters, itching, fever, and brown urine, dysuria, and painful stools.
2. Internally administered juice causes blisters in mouth, severe gastroenteritis, dyspnoea, cyanosis, tachycardia, coma and death.

Fatal Dose:

10 grams juice 75-150 grains

Fatal Period:

12-24 hours

Treatment:

It is symptomatic

Autopsy Findings:

If death is by ingestion of poison, there are cyanosis, body temperature is high, blisters in mouth, corrosion and hemorrhages of through out GIT.

Medicolegal Aspects:

- It is used for production of artificial bruise.
- Also commonly used for abortion by application on abortion sticks.
- Its accidental poisoning occurs when quacks give it for some diseases like syphilis.

12. Snakes-Ophidia

Most of the snakes are nonpoisonous. With exception of king cobra most of poisonous snakes do not attack man without provocation. Snakes more commonly attack men than women. Bites are generally found on peripheral parts of body. Snakebites are more dangerous immediately after winter season. Each year nearly 40, 000 deaths are reported from snakebites. Nearly there are 13 different families of snake, which can be distinguished out of nearly 2500 species of snakes. Snakes are classified as: -

Snakes	Nonpoisonous Poisonous	Colubridae	Elapidea.	These include Cobra, Krait, Coral Snakes, Mamba
			Crotalidae.	These include Rattles
			Hydrophidae	Sea Snakes
			Tree snakes	
		Vipers	Russell's Viper, Non-pit Viper, Saw scaled viper	

Mode of Action:

Snake venom contains mixture of toxic enzymes and proteins, which have diversified actions. These include neuro-toxins, cardio-toxins, hemolysin, thromboplastin. Cholinesterase. Phosphatases, hyalurondiase, and MFO inhibitors.

Features of Snake Bite:

On local examination, usually two fang marks are seen, they may be one even if snake is poisonous. Nonpoisonous snakebite is U shapes set of teeth.

- Poisonous snake bite  (2 big fang marks)
- Non poisonous snake bite  (U shaped teeth marks)

Factors Affecting Severity of Bite:

1. Age and Health
2. Location of bite: If peripheral ↓ Fatal and if near trunk ↑ Fatal
3. Size of snake
4. Season
5. Type of snake
6. Type of microorganism present in oral cavity of snake
7. Physical activity of victim: If victim starts running results are more fatal

Poisonous Snake	Non Poisonous Snake
Belly scales are large and cover entire breadth of belly	Belly scales are small and do not cover entire belly breadth
Head scales are small	Head scales are large
Long canalized fangs	Fangs are short and solid
Tail compressed	Tail not markedly compressed
General nocturnal	Not so
Only 2 fangs marks are seen at site of bite	U-shaped teeth impression at site of bite

1. **Elipidae**
- Width of head and neck is same
- Pupils are round
- Fangs are short, fixed and grooved

2. **Vipers**
- Pitless viper is more dangerous than pit-vipers
- Head is triangular and wider than neck.
- Pupils are vertical
- Fangs are long, moveable and canalized.
- In case of pit vipers a pit is present between nostrils and eye.

3. **Sea Snakes**
- Found near sea coasts
- Head is small
- Tail is flat
- Belly plates are not broad and have dull and tuberculated scales on their back
- Fangs are short and fixed

Snake Venom:

Venom is toxic saliva secreted by parotid glands of poisonous snakes. It id composed of:-

- Fibrinolysin
- Proteolysin
- Agglutinin
- Cardio-toxin
- Hyaluronidase
- Neuro-toxins - Predominant in Elipidae venom
- Cholinesterase - Predominant in Elipidae venom
- Haemolysins - Predominant in viper venom
- Thrombolpastin - Predominant in viper venom

1. **Neurotoxic Venom:**

This acts on motor neurons and effects resemble like curare. Resulting in muscular weakness and paralysis, e.g., venom of cobra and krait.

2. **Vasculotoxic Venom:**

   Causes enzymatic destruction of cell wall and coagulation disorders, e.g. venom of viper snakes.

3. **Myotoxic Venom:**

   It causes generalized muscle pain and myoglobinuria e.g. venom of sea snakes.

Symptoms of Snake Bite:

1. **Elipidae Bite**
   - Triple response, slight burning sensations
   - Giddiness, lethargy, muscle weakness, spreading paralysis
   - Vomiting
   - Ptosis
   - Slow laboured breathing
   - Patient is conscious but cannot speak
   - Respiratory and heart failure - Death
2. **Viper Bite**
   - Swelling, intense local pain, ecchymosis, blisters appear, severe hemolytic blood oozing
   - Hemoglobinuria
   - Petechial hemorrhage
   - Bleeding from gums and other body orifices
   - Hemoptysis
   - Circulatory Failure - Death
3. **Sea Snake Bite**
   - Sharp painless prick
   - After 1/2 hour generalized muscle stiffness, pain, starting in neck
   - Brown urine due to myoglobinuria
   - Hyperkalemia, Respiratory failure - Death

Prevention of Spread of Venom:

- Immobilization of part
- Application of tourniquet
- Clean the wound
- Give incision 1cm long, 1/2 cm deep suck the wound, remember that there should be no wound or injury in the mouth of sucker.

Treatment in Hospital:

- Give 24-30 ml polyvalent antivenom
- Administer steroids and analgesics
- Administer antibiotics
- Prophylactic measures of tetanus
- If disseminated IV coagulation has occurred administer heparin
- Antihistamines also should be given

Contra Indications:

- Morphine
- Alcohol

Postmortem Measures:

- Look for any mark all around wound by magnifying glass
- Look for marks of incisions and suction
- Collect specimen from wound area
- Collect specimen from blood

Postmortem Findings:

- Congestion of face - due to asphyxia
- Cyanosis
- Froth from mouth and nose
- Pulmonary and cerebral edema
- Blood in fluids
- Hemorrhage from wound and body orifices

Medicolegal Importance:

It is almost accidental. It may be homicidal and occasionally suicidal (it was done by Queen Cleopetra)

13. Scorpions

These are crab like, long, fleshy, five segmented with tail like post-abdomen end. In broad sac with a hollow sting. Scorpions venom contains toxalbumin with neuro-toxic and haemotoxic actions. It is more toxic than snake venom, but only a small amount is injected. Red scorpion's venom contains potent cardiotoxin. At site of sting is irritation, swelling, burning radiating pain; then headache, giddiness nausea, profuse sweating is seen then unconsciousness may persist upto one week. Always try to prevent spread of venom as discussed already give antivenom and wash the wound with $KMnO_4$.

14. Poisonous Insects

These include ants, wasps, bees, hornets, Spanish fly, etc. Bite of insect could result in a variation of symptoms ranging from minute pain, to hemolysis, anaphylactic shock and coma.

15. Poisoning by Glass Powder or Glass dust

Signs and Symptoms:

- Sharp burning pain in throat, stomach and abdomen
- Bloody vomiting
- Ulcers, hemorrhages and perforations in gut
- Glass pieces and diamond dust produce faint shadows on X-ray
- Shock may lead to death

Treatment:

- Give bulky foods, large amount of rice and banana
- Also administer emetics and laxatives
- Give other symptomatic treatment

Autopsy Findings:

There is inflammation of gut, erosions, ulceration, hemorrhages, perforation, glass pieces are also found in gut.

16. Food Poisoning

The illness results from ingestion of food containing bacterial or non-bacterial product. It is characterized by:-

1. History of ingestion of common food by all sufferers
2. Simultaneous attack of many persons
3. Similarity in signs and symptoms
4. Or there may be involvement of only one person

Types:

1. Bacterial food poisoning
2. Non-Bacterial food poisoning produced by poisons derived from plants, animals and inorganic chemicals.

In bacterial food poisoning symptoms appear from 2 hrs __ 6 days of ingestion of food depending upon organism.

Bacterial Food Poisoning:

1. **Infection Type**

   It results from ingestion of viable organisms that multiply in GIT and cause gastroenteritis. Common organisms are salmonella and Shigella. This is caused by twice-cooked meat dishes, fish dishes, custards, milk, cream, ice cream, signs and symptoms appear after 12 hrs, and are:

   - Chill, headache
   - Nausea, vomiting, severe abdominal pain, diarrhea and marked prostration

   Treatment is stomach wash, bed rest, warmth, give antibiotic, no solid food is given and also provide symptomatic treatment.

2. **Toxin Type**

   It is caused by toxins produced by the microorganisms present in food before ingestion. These are endotoxin produced by staphylococcus resistant to heat. It is caused by milk, custard, cream, previously prepared meat dishes. Signs and symptoms appear in 1-2 hours after taking food and are:

   - Hyper-salivation
   - Gastroenteritis

   Treatment includes stomach wash, antitoxin administration, give saline and provide symptomatic treatment.

3. **Botulism**

   It is caused by ingestion of preformed botulinum toxin in preserved food by "Clostridium botulinum". It is heat resistant and present in soil contaminated under cooked foods. It is found in meal, flesh and vegetables. Symptoms appear in 12-36 hrs after food ingestion and are:

   - Ocular muscle paralysis (diplopia), difficulty in swallowing and speech, respiratory failure - bulbar palsy
   - Patient remains conscious till end
   - Treatment include, stomach wash, administration of i/v line and anti-botulinum

3. NEUROTICS

Definition:

These are poisons, which mainly act on nervous system.

Classification:

Neurotic	Cerebral Somniferous	Inebrients	opium, pethidine alcohol, sedatives hypnotic, fuel anesthetics insecticides
		Deliriants	Dhatura, Atropa, Hyoiscyamus, Cannabis Indica, Cocaine
	Spinal Peripheral	Strychnine curare	

1. Opium and Morphine

It is (opium) dried juice obtained by incision of unripe capsules of white poppy. Poppy seeds (khaskhas) do not contain opium. Crude opium is dark brown in color when fresh; but old one is black.

Active Principle:

Morphine, codeine, thebaine, and heroine

Routes of Administrations

- Oral: smoking
- Hypodermic injection
- Absorption through wounds, vagina, rectum.

Mode of Action:

These occupy opiate receptors in brain and alter pain perception, these act as analgesic, CNS depressant and also depress respiration. Vomiting center is stimulated and cough center is also depressed.

Excreted:

It is excreted in urine as conjugate of glucoronide

Acute Poisoning:

Signs and symptoms appear 1/2 - hrs after ingestion and few minutes after the intravenous administration and include:

1. **Stage of Excitement**
   Euphoria, pleasurable mental excitement, laughter, hallucination and tachycardia; convulsion are also seen in children.
2. **Stage of Stupor**
   These is CNS depression, headache, dizziness, sense of heavy limbs, ↓ ed sensibility, sleep, contracted pupils, face and lips are cyanosed, itching all over body.
3. **Stage Of Narcosis**
   Coma, no reflexes, relaxed muscles, pin point pupils, no light reflex, ↓ ed BP, weak pulse, slow pulse, Chyne-Strokes Breathing, cyanosis, sweating, hypothermia, respiratory paralysis.

Marquis Test:

It is for diagnosis of morphine. 3cc conc. H_2SO_4 + 3 drops of formalin + (vomitus, tissue etc, sample). A purplish color develops that turns blue test is +ve.

Treatment:

1. Stomach wash
2. Give purgatives to clear intestines and treat constipation
3. Cause pressure diuresis to increase excretion
4. Catheterization (if necessary)
5. Administer antidote: NalorphineIV
6. Administer nikethamide: for stimulation for respiration and circulatory system-
7. Keep body warm
8. Give hot coffee or tea by mouth
9. Artificial respiration (if needed)
10. Administer antibiotics in prolonged unconsciousness

Chronic Poisoning:

Following signs are seen, there are dermal scars by repeated injections, pin point pupils, anorexia, amnesia, confusion, hallucination, constipation, impotence, lethargy.

Treatment:

In chronic poisoning progressively taper off the dose. At same time give methadone also gradually taper off its dose (it reduces withdrawal sings). Also administer antispasmodic, tranquilizers and also provide psychiatric treatment.

Fatal Dose:

200 mg morphine, 2 grams opium

Fatal Period:

45 minutes to 2 hours

Autopsy Findings:

Injection marks
Cyanosis
Forth from mouth and nose
Signs of starvation
Congestion and edema of lungs with froth in Airways __ heroine lung
Cerebral edema
Congestion of liver

Medicolegal Aspects:

- Poison of choice for suicide
- Used for infanticide
- It is also used as aphrodisiac
- Rarely is it used as cattle poison
- Accidental poisoning is also by over dosage.

2. Alcohol - Ethyl Alcohol

It is obtained by enzymatic fermentation of carbohydrates like sugar, starches and fruit juices. When taken orally it is absorbed from GIT enter portal circulation reaches live here gets metabolized, then enter systemic circulation cross blood brain barrier and acts on brain,

1st: stimulation
Then: depression
Ultimate effect: depression; depression of vital centers

Approximate %age of Alcohol in Social Beverages is as:

Rum: 50-60%
Whisky, Brandy: 40-45%
Wines: 10-15%
Beers: 4-10%

Acute Alcohol Poisoning:

Sings and symptoms are shown in 3 stages.

1. **Stage of Excitement**
   Euphoria, flushing of face, dilated pupils, alcohol smell in breath, rapid pulse.
2. **Stage of In-Coordination**
   In-coordination of thoughts and speech, impaired recent memory, slurred speech, staggering gate, impaired skill movements dilated pupils, blurred vision, dry mouth, alcoholic smell in breath, nausea, vomiting and diarrhea; In this stage offences are carried out.
3. **Stage of Narcosis**
   Coma, deep-sleep, dry-mouth, rapid pulse, decreased temperature, constricted pupils which dilate on pinching neck skin (Mc Ewan's sign), slow respiration, cold clammy skin, cyanosis, cardio-respiratory failure Death.

Fatal Dose:

It depends on
Is person drinker?
Is he social drinker?
Is he/she habitual?
Health of person?
For adults it is 150 for children 64 ml.

Fatal Period:

It depends on
Health of person
Condition of stomach
Condition of liver
Taking other drugs or not
It varies from 10-24 hours

Treatment of Acute Poisoning:

- Stomach wash
- Keep patient warm
- IV vitamin B_6, 5% glucose
- Artificial respiration __ if necessary

- Avoid emetics

Chronic Alcohol Poisoning:

It results in gradual

- Physical
- Moral

Mental, deterioration

Physical deterioration is characterized by lack of hygiene, loose of appetite, chronic gastritis, .peripheral neuropathy, impotency, sterility, impotency, Moral deterioration is characterized by sociological effects and mental one is characterized by Dementia.

Due to chronic alcohol poisoning 3 common syndromes may result.

1. Delirium Tremens

   There is cerebral edema characterized by insanity with symptoms of sleepiness, excitement, tremors and fear. It is seen in chronic alcoholics under:-

   - Exposure to cold
   - Shock
   - Withdrawal of alcohol
   - Acute infection

   Auditory and visual hallucinations are also there is latter stages. Treating infection, administering I/v hypertonic glucose, vitamin B complex.

2. Korsakoff's Syndrome

   It is characterized by hallucination, disorientation, multiple neuritis and loss of memory. Treatment involves I/v vitamin B administration.

3. Acute Hallucinosis

   There are auditory hallucinations and delusions; patient is homicidal and suicidal in response.

Treatment of Chronic Poisoning:

Gradually withdraw alcohol until patient can manager his life at his own.

Autopsy Findings:

1. Rigor sets in early
2. Decomposition is retarded
3. Alcohol odour from lungs, stomach, intestine
4. Acute inflammation of stomach
5. Cerebral edema, flatting of brain surface
6. Fatty liver

Medicolegal

It is the most widely abused drug. Poisoning with alcohol is common but mainly deaths occur due to head injuries and other crimes done by person in alcohol poisoning.

3. Barbiturates

These are salts of metals mainly used as sedative, hypnotic, anesthetic, anti-epileptic, strychnine antidote etc.

Classification:

1. Long acting I to 8 or 12 hours (Phenobarbitone and Barbituric) Fatal Dose is 3-4 grams
2. Intermediate acting half to 4 or 8 hrs (Pentabarbitone) Fatal Dose is 2-3 grams
3. Short acting 1/4 to 2 hours (Cyclobarbitonc) Fatal Dose is 1-2 grams
4. Ultra short Acting 1/2 hour to 45 minute (Pentathol) Fatal Dose is 1 gram

Mode of Action:

- CNS depression
- Anti-epileptic
- Analgesic
- Cumulative effects if liver and kidney functions are impaired

Acute Poisoning:

- Mental confusion, restlessness, delirium, giddiness, ataxia. Slurred speech, lose of immediate memory
- Stupor (deep sleep), no time and space orientation
- Cyanosis, flaccid limb, no reflexes, diplopia
- Hypothermia cannot be treated by warmth
- ↓ed BP, Cheyne Stokes breathing
- Coma and then Death

Barbiturate Automatism:

If a person takes barbiturate dose, he forgets about it after sometime, thinks us if he has not taken dose. so takes repeated doses and toxicity occurs.

Chronic Poisoning:

- Addiction
- Apathy, loss of concentration, sleeplessness
- Vertigo, tremors, ataxia, delirium, hallucination
- Albumin, sugar and casts in urine
- Bronchopneumonia, pulmonary edema and cyanosis

Treatment

- Stomach wash with $KMnO_4$
- Enema (saline purgative as enema)
- Keep warmth
- Give artificial respiration
- Administer analeptic, 5% I/v glucose
- Also carryout dialysis if necessary
- If person recovers from coma following complications are seen
- ↓ Bp
- Restlessness
- Weakness

- Anemia
- Blisters formation at friction site
- Bowel sounds are heard

Autopsy Findings:

- Cyanosis
- Froth from nose
- Congestion of lung/brain
- Stomach may contain tablets or capsules
- Damage to brain, stomach, lung, liver, kidneys

Medicolegal Aspects:

It is use for suicide and also for infanticide. Accidental poisoning is seen in case of automatism

4. Hydrocarbons

It is group of poisons major source is petroleum. Many processes separate hydrocarbons into oils, fumes, gases, mainly we take 2 groups:-

1. Gas
2. Oil

Toxicity depends on boiling point of liquid, greater the boiling point the lesser is its toxicity. Petroleum distillates are recovered from Earth with minerals, metals and 'w materials. In air standard of petroleum (pollution) is measured by PPM (parts per million) common household hydrocarbon is kerosene oil also used in industries, lubrication oil (poisonous) Vaseline and Paraffin (non-poisonous). Fumes and gases cause poisoning by inhalation.

Mechanism of Action:

These are CNS depressants and also act as irritants.

Signs and Symptoms:

1. By inhalation, dizziness, headache, irritation of airways, stuffiness of nose, respiratory distress (Shallow breathing), broncho-pneumonia
2. By ingestion burning pain in throat, esophagus, nausea, vomiting, colicky pain, diarrhea, smell of kerosene oil in breath, vomitus, diarrhea depression, dizziness, convulsions, coma. Respiratory failure death
3. Chronic Poisoning can also occur, seen in industry workers and is characterized by dizziness, drowsiness, headache, anemia and liver damage

Fatal Dose:

10-20 ml in children

200-250 ml in adult

Fatal Period:

Few hours to 24 hours

Treatment:

- Remove person from source
- Keep airways open
- Provide artificial respiration
- Give antibiotics and soda bicarbonate (for acidosis)

Autopsy Findings:

- Signs of asphyxia
- Cyanosis, congestion of viscera
- Brain edema, pulmonary edema
- Peculiar smell of petroleum is also found

Medicolegal Aspects:

Its common accidental and suicidal poisoning rarely homicidal

5. Organophosphorous Compounds

This is group of several dangerous poisonous used as insecticides for spraying crops

Classification:

These are divided into 2 groups:

1. Alkyl group: HETP, TEPP, TEPP, Metathion
2. Aryl Group: Parathion, Diazinon

Mode of Action:

These are powerful cholinesterase inhibitors so acctylcholine accumulates at neuromuscular junction and synapses, so hyper-excitation is seen.

Signs and Symptoms:

1. Headache, chest constriction, pin-point pupils
2. Abdominal cramps, vomiting, diarrhea
3. Sweating, salivation and muscular twitching
4. Pulmonary edema, convulsions, coma Death

Fatal Dose:

Parathion 175 mg

Malathion 1 grain

Fatal Period:

1/2 to 3 hours

Treatment:

1. Remove clothes of patient and wash skin and mucous membranes with water and soap, so as to remove any poison
2. If ingested carry out stomach wash with $KMnO_4$
3. Raise the Feet, so as to drain respiratory mucous
4. Artificial respiration is given
5. Use atropine as antidote
6. Administer diuretics and tranquilizers

Medicolegal Importance:

Accidental in agricultural and industrial areas also suicidal and homicidal poisoning is seen

6. Datura - Atropine - Atropa Belladona – Hyoscyamine

Datura plant is all poisonous but seeds and fruits are the most poisonous. There are 2 varieties of Datura.

1. Datura Alba

2. Datura niger
   - Seeds: are hard, flat, kidney shaped, double ridged and convex on inner border, surface is smooth, and color is yellow to brown
   - Fruit: it is green, less spherical, with spikes (thorn apple)
   - Active principle: Atropine, Hyoscine (alkaloids)
   - Mode of Action: These are competitive acetylcholine antagonists

Signs and Symptoms:

- Bitter taste, dry mouth and dysphagia
- Flushed face, dilated pupils, loss of accommodation
- Raised temperature, hot dry skin, no perspiration
- Delirium, giddiness, excitement, confusion, hallucination, staggering gait, drowsiness, coma death due to respiratory failure

Fatal Dose:

100-125 hours

Fatal Period:

Within 24 hours

Treatment:

1. Stomach wash with $KMnO_4$ tannic acid
2. Antidote is Physostigmine
3. Provides symptomatic treatment

Medicolegal

It is stupefying poison used for robbery, rape, kidnapping; Its accidental in children, also used as aphrodisiac.

7. Cannabis Indica

All parts of this plant are poisonous

Active Principle:

"cannabinol", tetrahydrocannabiols

Various Forms of Cannabis Indica:

These are as follows

1. **Bhang:** active principle 15%. It consists of dried leaves, fruits and shoots used as beverage. Person sings, dances, seeks sexual pleasure, followed by sleep.
2. **Majun:** It is sweat made of bhang, flour, milk and butter. It produces delusions and all effects of bhang.
3. **Ganja:** active principle 25%. It is dried flowering tops of female plant mixed with tobacco. Smoker feels drowsy and dreamy.
4. **Charas:** active principle 25-40%. It is resinous exudates from leaves and stems of plants. It is smoked with tobacco, pipe and hookah. It is very powerful.

Acute Poisoning:

Signs and symptoms of acute poisoning are described in 2 stages:

1. Stage of Excitement: euphoria, increased appetite, depression of higher centers, loss of orientation, sexual hallucination
2. State of Narcosis: Giddiness, confusion, drowsiness, dilated pupils, tingling, numbness, generalized anesthesia, deep sleep and victim may wake up without depression. Rarely death due to depression of respiration

Chronic Poisoning:

- Addiction
- Anorexia, weight-loss, weakness, tremors, moral deterioration, impotence
- Hashish Insanity: there are hallucinations, delusions, sexual jealousy and tendency to commit suicide and homicide

Fatal Dose:

Chars = 2 grams / kg of body weight

Ganja = 1 gm / kg of body wt

Bhang = 10 gm /kg of body wt

Fatal Period:

Within 12 hours

Treatment:

1. Stomach wash
2. Hypodermic injection of strychnine
3. Strong tea or Coffee
4. Saline purgatives
5. Artificial respiration

Medicolegal Aspects:

1. It is commonly used by Road Robbers to stupefy persons and facilitate robbery
2. Run Amok: By continuous use of cannabis person develops strong desire to commit murders. When a number of individuals are killed then person commit suicide of surrender himself to police

8. Cocaine Coke, Snow Cadillac - White Lady

It is an alkaloid derived from coca plant. Its derivative Xylocaine is used as local anesthetic.

Acute Poisoning:

It acts in 2 stages

1. Stimulation State: these is Dryness of mouth, bitter taste, euphoria, increased physical and mental activity, increased libido, excitement, delirium, flushed face, pupil dilated, blurred vision, increased heart rate, increased respiration raised temperature, ?????? vomiting, increased movements, in co-ordination, muscular twitches, convulsions.
2. Stage of Depression: Vital centers are depressed, feeble pulse, death from respiratory and circulatory failure.

Chronic Poisoning Cocainism:

Its symptoms are, anorexia,* weight loss, moral deterioration, ↑ed libido, cocaine insanity (Characterized by delusions, hallucination, e.g. grains of sand are living under skin Magnan's Symptoms, and feeling of small insects creeping on skin Cocaine Bugs)

Fatal Dose:

1 gram

Fatal Period:

2-3 hours

Treatment:

1. If cocaine is given by injection apply tourniquet
2. If applied on nose of throat, wash with water
3. If swallowed, perform stomach wash with $KMnO_4$ administer barbiturate to control excitement. Avoid morphine, administer cardio-respiratory stimulants and provide symptomatic treatment

9. Strychnine - Nuxvomica

It is an alkaloid obtained from seeds of Nuxvomica.

Seeds:

Seeds are hard, flat, ash-grey, 2 cm thick, slightly convex on side and concave on other side.

Active Principle:

Strychnine

Mode of Action:

It stimulates CNS particularly anterior horn cells of spinal cord

If seeds are swallowed as a whole they are nonpoisonous. Broken chewed seeds are poisonous

Symptoms:

1. Stiffness of muscles of face and neck
2. Muscle twitching
3. Tonic-clonic convulsions
4. Body is thrown into are only back of head and heels are touching the ground position is opisthotonous
5. Cyanosis
6. Blood stained Froth from mouth and nose
7. After minute muscle spasticity is gone and all the muscles are relaxed but after short duration another spasm occur
8. Asphyxia leads to death

Fatal Dose:

1 seed of Nuxvomica

Fatal Period:

1-2 hours

Treatment:

1. Keep patient in dark quiet room (no stimulus like light and noise should be there)
2. Anesthesia with chloroform
3. Antidote is IV barbiturates
4. Stomach wash with $KMnO_4$
5. Administer animal charcoal
6. Administer muscle relaxant
7. Provide artificial respiration

Medicolegal Importance

- It is commonly accidental
- Rarely homicidal and suicidal

Strychnine Poisoning

1. Person is fully conscious

Strychnine Poisoning

1. History of poisoning
2. Sudden onset
3. Generalized convulsions
4. Death in few hours
5. Chemical analysis reveals poison

Epilepsy

1. Person is unconscious

Tetanus

1. History of injury
2. Gradual onset
3. Lockjaw an early manifestation
4. Death in several days
5. Not so

4. CARDIAC

1. Cardiac poisons (Digitalis)
2. Oleander (Kaner)
3. Aconite (Mitha Zahar)
4. Tobacco (Nicotine)

- Aconite 1st stimulates and then depresses the myocardium, smooth muscles, CNS and peripheral nerves
- Nicotine 1st stimulates and then depresses and paralyzes the nervous system, skeletal muscles and cardiac muscles

5. ASPHYXIANTS

1. CO
2. CO_2
3. H_2S
4. War-gases

1. Carbon Monoxide

It is colorless, odorless, tasteless, nonirritating and insoluble in water and alcohol. It burns with blue flame and forms CO. It is produced due to incomplete combustion of carbonaceous material.

Source:

- Domestic, disused wells, sewerage gas and coal gas
- Industrial, petroleum device gas, exhaust of vehicles, gas from gun powder, dynamite explosion, (4% CO is in tobacco smoke)

It is very poisonous, absorbed 300 times more rapidly than O_2 from lungs causing anemic hypoxia and quickly forms carboxy Hb, which cannot CO_2-Hence it is called chemical asphyxiant.

Acute Poisoning:

Signs and symptoms depend on concentration of CO-Hb in blood

- 1-3% CO-Hb: always present in people of urban areas
- 3-5% CO-Hb: always in smokers
- 20% CO-Hb: no symptom
- 30% CO-Hb: dizziness, headache
- 40% CO-Hb: in-coordination, sleepiness and confusion
- 50% CO-Hb: slurred speech, wakefulness, vomiting, signs of drunkenness
- 60% CO-Hb: unconsciousness
- 70% CO-Hb: death

Person feels weakness due to sudden hypoxia so cannot escape from situation inhales more and more CO at lastly death occurs. While examining the drivers always keep on mind that 50% CO-Hb produce symptoms like drunkenness.

Chronic Poisoning:

It occurs in workshop workers, ill-ventilated rooms also produce such situations, causing headache and inability to walk.

Fatal Dose:

If concentration of CO is (1:500 CO: air ratio) symptoms appear simultaneously and in case concentration is as (1:5000 CO: air ratio) symptoms appear after 5-6 hrs. Death occurs with variable dosages.

On average	60-75%
As low	33-6%
As high	83.2%

It depends on conc. of Hb in blood.

Treatment:

- Remove the patient environment, provide artificial respiration and carryout blood transfusions
- Maintain body temperature, HP
- For edema administer diuretic
- Administer steroids, antibiotics and diazepam

Autopsy Findings:

1. Bright cherry red PM staining
2. Congestion of face and veins and lungs

3. Froth from nose and mouth
4. Hemorrhage-in meninges, cortex and basal nuclei
5. Bulla on skin
6. Hemorrhage and necrosis of myocardium

Specimens:

- In living: 10ml blood from peripheral vein add 1-2 ml liquid paraffin so as to avoid contact b/w blood gases and air.
- In dead: 25-30 ml blood from, both sides of heart, bone marrow from ends of long bones.

Toxicologies Tests:

- Spectroscopy for +ve test at least 10% CO-Hb is required
- Gas chromatography
- Electrophoresis

Medicolegal Aspects:

It is mainly accidental and also homicidal in cold weather coal gas poisoning. In fact CO-automatism leads to death. It is very rarely suicidal.

2. Carbon-dioxide

It is odorless, colorless, slight acidic in taste formed by complete combustion. It is present in air in traces 0.4% in conc. It is produced by

- Respiration
- Combustion
- Fermentation
- Putrefaction

It is heavy so accumulates at bottom of wells.

Signs and Symptoms:

- T rate and depth of respiration and dyspnoea
- Throbbing pulse of temporal artery
- 25-30% CO_2 in air causes direct neuronal death
- 50-80% CO_2 in air causes immediate spasm of glottis

Treatment:

- Remove person form environment
- Maintain pH and vital signs
- Other is symptomatic treatment

Autopsy Findings:

- Cyanosis, congestion of face, legs, blood fluidity, and pulmonary edema petechial hemorrhages
- Congestion of brain and lungs
- Dark color blood in heart

Medicolegal Importance:

It is mainly iatrogenic during anesthesia and also accidental

3. War Gases

These are agents filled to carry destruction mostly in war times but if need arises on other occasions it can also be used e.g. to disperse unruly mobs.

Term war gases in inappropriate as:-

1. These are not used in wartime only
2. These are not gases on all occasion; but gas is formed by reaction between 2 or more chemicals.

War Gases include:

1. Lacrimators or Tear Gas
   - Choloro acetophenone (CAP)
   - Bromobenzyl cyanide (BBC)
   - Ethyl iodo acetate (KSK)
2. Lung-Irritant or Asphyxiants or Choking Gases
   - Chlorine (Cl_2)
   - Phosgene ($COCl_2$)
3. Vesicants or Blister Gas
   - Mustard gas (Dicholorethyl sulfide)
4. Sternulators or Nasal Irritants or Vomiting Gases
   - Diphenyl chlorarsine (DA)
   - Diphenylamine chlorarsine (DM)
   - Diphenyl Cyanarsine (DC)
5. Nerve and Blood Poisons or Parralysants
   - CO
   - HCN
   - H_2S
6. Nerve Gas
   - Chemicals like acetylcholine
7. Miscellaneous
   - Methyl isocyanate

Qualities of War Gas:

1. It should be cheap
2. Definitely toxic in low concentrations
3. Heavier than air
4. Enough volatile
5. Must be stable

DIFFERENTIAL DIAGNOSIS OF POISONING CASES

H_2SO_4

1. Severe burning pain
2. Violent eructation and vomiting, vomitus is dark down or black
3. Vomitus stains the fabrics dark
4. Urine is of blue color

HNO_3

It stains the tissue and fabrics yellow in color and also has pungent smell

HCl

1. Does not stain skin or mucous membranes but stains dark cloth reddish brown (so does the vomitus)
2. Vomitus is coffee ground
3. It can be diagnosed by its pungent smell

Oxalic Acid

1. Vomiting is severe continuous
2. Vomiting is black in color due to altered blood
3. Spasmodic twitching is also seen

Carbolic Acid

1. Hot burning pain from mouth to stomach
2. Dark smoky green color urine
3. Smell of phenol in breath

Salicylic Acid

1. Giddiness
2. Profuse perspiration
3. Signs of hemorrhage from mucous membranes

HCN

1. Headache and giddiness then loss of muscle power
2. Bitter almond like smell from body
3. Fine froth from nose and mouth
4. P.M. staining in pink

Phosphorus

Acute Poisoning

1. Garlic taste in mouth,
2. Diarrhea of dark, luminous, offensive stools
3. Jaundice, purpura and epistaxis
4. Priapism is frequent

Chronic Poisoning

1. Necrosis of gums
2. Phossy jaw
3. Bone formation in Haverssion canals

Arsenic

Acute Poisoning

1. Vomiting after 1/2 hr of ingestion

2. Then diarrhea occurs
3. Pain in throat before vomiting
4. Earlier stools are Rice-water stools then bloody

Chronic Poisoning

1. Reinsch's Test:
   20 ml vomitus, stomach contents, urine or blood +4 ml HCl gently heat this after putting a copper coil in it Copper coil is removed and examined if deposit is
   Grey then: Arsenic, Bismuth
   Pink then: Antimony
   Black then: Mercury
   Its deposit gets dissolved in 2ml of 10% KCN then it surely arsenic
2. Marsh's Test:
   If suspected material is exposed to nascent hydrogen; if Arsine (arseniuretted hydrogen is formed presence of Arsenic is confirmed.

Mercury

Acute Poisoning

1. Strong metallic taste
2. Grayish color to mucous membranes
3. Vomitus is while mixed with blood
4. Bloody profuse diarrhea

Chronic Poisoning.

1. Nephritis
2. Abortion
3. Mercuria lentis (discoloration
4. Mercuric Erythism
5. Mailer's shake

Lead

Acute Poisoning

1. Constipation
2. Lead colic
3. Metallic taste in mouth
4. Lead encephalopathy

Chronic Poisoning

1. Facial Pallor
2. Lead line or Burtonian line
3. Damage to sex organs, menstrual abnormalities
4. Blood lead level is ↑35-ug/100 ml
5. ↑ALA level in urine
6. Lead level in urine ↑0.25 mg/L

7. Opacity in GIT seen on X-ray

Copper

Acute Poisoning

1. Green or blue color vomitus turning blue on addition of NH_4OH
2. Inky urine

Chronic Poisoning

1. Peripheral neuritis
2. Wilson's disease
3. Bronzed diabetes
4. Green line or gums

Opium

1. Marquis' Test
   3cc cone. H_2SO_4 +3 drops formalin to this add suspected tissue of fluid; Purplish color appear that turns blue.
2. Euphoria is important sign of morphine addicts

Alcohol

Acute Poisoning

1. Mc Ewan's sign
2. Hang over (signs) headache fatigue, abdominal discomfort

Chronic Poisoning

1. Delirium Tremens
2. Korsakoffs syndrome
3. Acute hallucinations
4. Beri Beri
5. Mallory - Weiss syndrome (Tear of mucosa of lower esophagus with hemorrhage)
6. ↓Vision (amblyopia)

Kerosene

There is finding of Double Gastric Fluid level in abdomen X-ray produced due to floating of kerosene (or other petroleum products) in between gastric juice and air bubble.

Dhatura

1. Dry mouth
2. Difficult speech
3. Dysphagia
4. Dilation of skin blood vessels
5. Dry hot skin
6. Drunken gait
7. Delirium
8. Dilated pupil
9. Drowsiness

Cannabis

Acute Poisoning

1. Euphoria
2. Disorientation
3. Laughter
4. Sexual hallucinations
5. Psychotic reactions ending in violence

Chronic Poisoning

1. Hashish insanity
2. Apathetic, lethargic, frustrated attitude
3. Run amok

Cocaine

Acute Poisoning

1. Lilliputian Hallucination, person perceives objects very much smaller than they really are
2. Cocaine fever
3. Cyanosis
4. Loss of reflexes

Chronic Poisoning

1. Physical exhaustion
2. Euphoria and rebound dysphoria
3. Nymphomania (sexual tension in women)
4. Sexual hallucination
5. Tactile hallucination
6. Cocaine bug

Strychnine

1. Convulsions
2. Opisthotonus. (Hyper-extended body resting on head and heel) or emprosthotonos (hyper-flexed body) or pleurosthotonus (side ways curving of body)
3. Risus sardonicus (grimacing expression on victims face due to facial muscle spasm)

COMMON USES OF POISONS

H_2SO_4

In Batteries, labs, toilet, bowel cleaners, pipe cleaners.

HNO_3

Extensively used in arts, cleansing nickel ornaments, separating gold from other metals, gun cotton, and coloring matter.

HCl

Commonly used in houses for cleaning purposes also in swimming pools, also used to erase writing.

Oxalic Acid

Extensively used as rust remover, bleaching agent for straw hats and vegetable fiber wood leather, ink stains etc and for discharging dyes in printing.

Carbolic Acid

Antiseptic, disinfectant, germicidal and preservative

Acetic Acid

Used in cooling foods as 'sirka'

Salicylic Acid

Used as analgesic. Methyl salicylate is used as abortifacient.

HCN

Used in veterinary practice, photography, electroplating, fertilizer

Phosphorous

Kodenlicide, insecticide

Arsenic

1. Arsenic trioxide - (Flower's sol. 1% arsenic dioxide) Arsenic trioxide also called white arsenic flower's sol. is used as rat poison and flypaper.
2. Arsenic sulfides
3. Copper arsenite (School's green,) copper acetoarsenite (Emerald green) used as coloring agent for wallpapers and toys.
4. Lead sodium, potassium compound of arsenic is used as weed killer insecticide, fungicide.
5. Organic arsenicals are used for trypanosomiasis
6. Arsine gas (Arsenic Trihydride) is used in industry and labs.

Mercury

It is used as disinfectant, diuretic, purgative, also used in thermometer, barometer, ceramics, explosives, fireworks, photography, finger print powder, embalming, painting.

Lead

1. Lead acetate (sugar of lead) previously used as astringent and local sedative.
2. Lead carbonate (white lead) for paints.
3. Lead oleate
4. Lead sodium, potassium compound of arsenic are used as weed killer insecticide, fungicide.
5. Organic arsenicals are used for trypanosomiasis.
6. Arsine gas (Arsenic Trihydride) is used in industry and labs.

Copper

It is used in coins, also as fungicides and antidote ($CuSO_4$) in phosphorous poisoning

Castor Oil

(Not contain Ricin) it is used as purgative, lubricant, and abortfacient

Croton Oil

It is used as abortifacient

Rati Seed

Used for abortifacient, migraine

Capsicum

Fruit and seeds used in food as flavoring agent

Marking Nut

Used as abortifacient. Its coating is used for hair washing as used in shampoos made locally.

Madar

1. Flower _____ as digestive stimulants
2. Powdered root as emetic
3. Milky juice as vesicant
4. Juice is also used for removing hair by tanners.

Opium

1. Seeds of poppy (khaskhas) used as food sprinkled over sweets contained no opium. Quacks give as treatment of cold
2. Opium is used as Narcotic and Sedative
3. Apomorphine prepared from morphine is used as emetic

Alcohol

It is used as beverages, solvent for perfumes, after shaves, colognes, in medicine preservation for viscera.

Absolute alcohol:	99% ethanol
Rectified spirit:	95% ethanol
Methylated spirit:	90.95% ethanol + 5-10% methanol
Surgical spirit:	methylated spirit + castor oil + oil of winter - green (methyl salicylate).
Distilled spirit:	alcohol separated by distillation (brandy, whiskey, gin, rum, arrack) not by fermentation (beer and wine)

Atropine and Hyoscyamine

1. Mydriatic
2. Antispasmodic
3. Antidote for organophosphorous compounds
4. Pre-anesthetic medication

Cannubis Indica

Used as Aphrodisiac, analgesic and anesthetic

Strychnine

Used as aphrodisiac, rodenticide and cattle poisoning

☆☆☆☆☆☆☆

Chapter-16

Poison Table

Name & Action	Average Fatal Dose & Fatal Period	Treatment	Medicolegal Points & Poison Sources
Abrus Precatorius Contains toxalbumin, Locally irritant	60-120 mg 1-2 Seeds 3-5 days	Removal of sui. Antiabrin if available. Hydrochloric acid pepsin mixture. 10 grams $NaHCO_3$ daily to alkalinize urine.	Cattle poison Homicidal use Malingerer in conjunctivitis. Decorative beads & used by goldsmith
Acetic acid	60 ml Upto 48 hours	Stomach wash with milk or lime-water. Egg while or milk of magnesia orally. 10-mg morphine IM for pain, Eye wash.	Accidental Suicidal Vinegar is antidote for caustic alkalis
Alcohol (ethyl) Cerebral inebriant Hepatatoxic	1 gram of root 250 mg of extract 1.5ml of tincture 4 mg of alkaloid 6 hors	Stomach wash with tannic acid (10 gms in 2 liters of water) or 0.2% KI solution. Stimulants, Atropine 2mg IM. Novocaine 50 ml 0.1% IV. Oxygen, artificial respiration. Digoxin 0.5 mg tablet, TDS.	Homicidal Accidental (use as medicine by quacks or mistaking it for edible food). Arrow poison. Cattle poison.
Alcohol (ethyl) Cerebral inebriant Hepatotoxic	0.4-0.5 mg percent in blood 150-180 ml of absolute alcohol. 12-24- hours	Very serious cases, hemodialaysis or peritoneal dialysis and Gastric lavage. Maintain body temperature, 2g $NaHCO_3$ orally 2 hourly to prevent acidosis. Vitamin B6 50-100 mg IV. Coramine 3-5 ml IV. Saline purge. Oxygen, artificial respiration. Fructose/glucose IV.	Accidental from overdrinking Addiction problems. Increased incidence of head injury.
Ammonia Irritant Corrosive if concentrated	30 m 1 of 25% concentration.	Neutralize by vinegar Give milk, white of egg, plenty of water. 10-mg morphine, ice sucking. Cortisone 1 mg per kg body weight, TDS Antibiotics, Eye wash.	Accidental Suicidal Vitriolage
Amphetamine CNS Stimulant	120-200 my Upto live days	Gastric lavage, sedation with chlorpromazine, cardio-respiratory resuscitation &	Accidental from over dosage. Addiction problems. Appetite

Name & Action	Average Fatal Dose & Fatal Period	Treatment	Medicolegal Points & Poison Sources
Hallucinogen		general measures. Haloperidol (5-10 mg) IV. Slowly to combat CNS effects, Forced diuresis in severe poisoning.	suppression, mood elevation & treatment of narcolepsy.
Antidepressants CNS Anti-depressant & sedation	1.2 gms Upto six days	Gastric lavage, treat arrhythmias, maintain blood pressure. ECG monitoring Artificial respiration. Physostigmine 2-4 mg IV Over two minutes to reverse CNS effects & to counteract some cardiac effects.	Accidental from over dosage. Suicidal. Treatment of endogenous depression.
Antimony Irritant Inhibits sulphydryl action Arrack	750 mg of tartar emetic, 100-200 mg of antimony butler 24 hors	Emesis: Tannic acid 4 ml Demulcents. Sodium sulphate 30 ml. BAL: 3 mg per kg body weight 4 tunes on first day & then twice daily for 10 days. 10 mg morphine. Ice sucking. Intravenous fluids.	Accidental, Homicidal. Use in alloys, type metal, foil, batteries, matches & Medicine
Arsenic Irritant Inhibits sulphydryl action	120-200 mg 24 hours	Stomach wash. Demulcents. Sodium sulphate 30 ml. 10% solution of UAL I/M Morphine. Ice sucking, Intravenous fluids	Homicidal. Accidental. Abortifacient Aphrodisiac Cattle poison. Used in weed killers & rat pastes
Aspirin Gastric irritant Non-narcotic analgesic & antipyretic	5-10 gms Few minutes to few hours	Gastric lavage, leave some dilute $NaHCO_3$ in stomach. Restoration of electrolyte normality & acid base balance. Vit K_1. Blood or platelet transfusion. Forced cocktail diuresis. General measures.	Accidental Idiosyncrasy Suicidal
Atropa Belladona Barbiturates Cerebral depressant Hypnotic	125 mg 24-48 hours 3 grams 24-48 hours	See dhatura. Stomach wash. Raise BP to 100 mmHg. Coramine IV. 5 ml 25% followed by 10 ml in 15 minutes & then 20 ml every 30 minutes till reflexes return. Forced diuresis. Haemodialysis. Exchange transfusion, Enema.	Accidental Stupefying Suicidal, accidental overdose from sleep from sleeping tables or treatment of epilepsy Automatism Addiction problems
Barium Locally irritant, Cardiac depressant	1 gram 12 hours	Give magnesium sulphate 15 gms. After some time was with magnesium sulphate 60 gms in 10 liters. 10ml 10% sodium sulphate	Accidental during use of barium sulphate in x-rays Suicidal occasionally

Name & Action	Average Fatal Dose & Fatal Period	Treatment	Medicolegal Points & Poison Sources
		IV. Morphine. Enema.	
Benzene (Benzol) CNS depressant Asphyxiant	10-15 ml Few minute, to three days	In inhalation remove patient from source, oxygen, artificial respiration and supportive treatment. In ingestion, gastric lavage, avoid aspiration, artificial respiration, and blood transfusion.	Accidental Suicidal
Bromides Cerebral depressant somniferous	Blood level above 50 mg% Average 6-12 hours	Sodium chloride 1 gram orally hourly. In unconscious patients, 1 liter normal saline IV daily for 4 days. Oxygen administration. Diuretics. Analeptics as required.	Accidental Idiosyncrasy
Calotropls Local, gastro-intestinal & cerebrospinal irritant	Uncertain 12 hours	Gastric lavage with warm water or $KMnO_4$ 1:5,000. Demulcents. Morphine. Stimulants & other drugs as indicated by symptoms.	Accidental from use in medicine & as depilatory. Abortificient, Infanticide. Cattle poison. Artificial bruises, Arrow poison
Cannabis Cerebral Delirieuts Hallucinagen	Not known	Gastric lavage, purgatives. IV fluids. Oxygen & artificial respiration. Tranquilizers.	Accidental Doping & robbery Running amok Addiction problems
Cantharides Vesicant Irritant	1.5 grams 24 hors	Stomach wash. White of egg. Liquid paraffin. Alkaline diuretics. Morphine for pain	Aphrodisiac Abortificient Accidental
Capsicum Irritant	Not fixed Not known	Nothing specific. Blunt scraping the tongue & ice sucking helps. Was the eyes with saline, apply antibiotics & cortisone drops.	Accidental Robbery. Torture Seeds resemble dhatura seeds
Carbolic acid Carossive Nephrolosic	10-15 gms 3-4 hours	Stomach wash with 10% glycerin. 60ml liquid paraffin orally White of egg. Alkaline saline IV. Castor oil orally followed by 30 gins sodium sulphate purgative.	Accidental Suicidal Abortifacient
Carbon dioxide	Concentration	Artificial respiration, oxygen.	Accidental
Respiratory depressant	30% Not fixed	Then if available. Stimulants.	
Carbon monoxide Chemical asphyxiant	50-70% saturation of blood Not fixed	Remove the patient from source. Artificial respiration, oxygen. Maintain body warmth. Blood transfusion. Stimulants. Cyto-chrome C intravenously. IV corticoids or IV. 500 ml 20%	Accidental Suicidal Automatic acts

Name & Action	Average Fatal Dose & Fatal Period	Treatment	Medicolegal Points & Poison Sources
		Mannitol for cerebral oedema.	
Carbon letra-chloride	2-4 ml (adults) 1 ml (children) 1-2 days	In inhalation, remove patient from source, oxygen, artificial respiration, and supportive treatment. In ingestion, gastric lavage, saline purgative, treatment for hepatic & renal damage. N-acetyl-cysteine is severe cases.	Accidental antihelmenthic over-dosage
Caustic potash & soda	5 grams 24 hours	Neutralize by vinegar. Demulcents ice sucking. Morphine for pain. Intravenous fluids.	Accidental Vitriolage Suicidal
Corrosive Irritant when diluted	5 grams 12hors	Stomach was with soda bicarb. Maintain body warmth. Artificial respiration, oxygen, stimulants. Haemodialysis.	Accidental Suicidal. Knock out drops for robbery or rape. Dry wine Addiction
Chlorine Irritant Asphyxiant	Uncertain 48 hors	Oxygen, artificial respiration, vene-section, stimulants. Antibiotics. Wash eyes with boric acid solution. Broncho-dilators, corticosteroids.	Accidental War gas Dispersing unruly mobs (Tear gas)
Chloroform Cerebral inebriant Respiratory depressant	30 ml by mouth Above 0.04 % in blood.	When inhaled, give artificial respiration, oxygen & cardiac stimulants. Maintain body warmth. When swallowed, wash stomach. Give demulcents & stimulants.	Accidental Delayed chloroform poisoning
Cocaine Narcotic Hallucinogen	1/2 hour 1 gram 2hors	Stomach was with $KMNO_4$ or tannic acid. If injected, ligate proximal to injection site. If applied locally, wash with water. Oxygen, artificial respiration, cardiac stimulants, amyl nitrite inhalation.	Accidental either from anesthesia or use as an aphrodisiac Addition problems
Colocynth Vegetable irritant	1-2 grams 24 hours	Stomach wash, demulcents. Stimulants. Intravenous fluids.	Suicidal Abortifacient
Conium Peripheral neural depressant nerve terminals	1 cm of plant 2 hours	Stomach was with tannic aid, artificial, respiration, oxygen inhalations, and stimulants.	Accidental
Copper sulphate Irritant	30 gms of copper sulphate	Stomach was with 1% potassium ferrocyanide. Egg while & milk.	Suicidal Antidote in phosphorus poisoning

Name & Action	Average Fatal Dose & Fatal Period	Treatment	Medicolegal Points & Poison Sources
	or of cooper sub-acetate. Upto 72 hours.	Morphine. BAL Cuprimine. Magnesium sulphate. Dialysis.	Emetic Accidental
Coroton Tiglium Vegetable irritant Contains toxalbumin	4 seeds or 20 drops of the oil 6 hours.	Stomach wash and demulcents such as cold porridge or custard. Intravenous fluids. Stimulants.	Accidental Suicidal Abortifacient Homicidal Arrow poison
Curare Paralysis of respiratory muscles	60 mg 1-2 hours	Artificial respiration, oxygen, ligate proximally, inject Prostigmine.	Accidental in anesthesia or shock therapy Arrow poison
Cyanides (potassium & sodium)	200 mg ½ hour		Suicidal Accidental
DDT CNS stimulant	20 grams Upto 6 hours	Gastric lavage, saline cathartics Atropine. Calcium gluconate IV. Diazepam 10 mg IV. Oxygen.	Accidental Suicidal
Dhatura Cerebral deliriant	Uncertain (100-125 seeds) 24 hours	Stomach wash with 5% tannic acid (2.5 mg IV. every 3 hours) or Physostigmine 1-4 mg repeated if necessary at 1-2 hours. Tepid sponging for raised temperature. Diazepam 10 mg IV to allay excitement. Warm enema.	Stupefying Roadside robbery Kidnapping & rape. Accidental Seeds resemble chili seeds
Digitalis cardiodoxin	15-30 mg of digitalis, 4mg of digitoxin Upto 24 hours	Gastric lavage with tannic acid, atropine 0.6 mg. Tri-sodium EDTA. Potassium chloride 1-2 gms, TDS Anti-glycoside antibodies. Glucose & insulin. Sedatives or stimulants ECG monitoring.	Accidental Karely suicidal
Di-nitra weed killers CNS depressant Inhibits cholinesterase	1-2 gms 4 days to 2. Weeks	Wash skin, cold sponging, general measures, sedatives, and absolute rest.	Accidental Suicidal
Endrin Neurotoxic Cholinergic	6 grams 2 hours	Gastric lavage, saline cathartics. Atropine. Calcium gluconate IV. Paraldehyde. Oxygen and Blood transfusion	Suicidal Homicidal Accidental Plant penicillin
Ergot Vasoconstrietor Smooth (uterine) muscle contractor	Uncertain Uncertain	Stomach wash with tannic acid. Magnesium sulphate. Intravenous fluids. Amyl nitrite inhalations. Sodium nicotinate 140 mg IV.	Abortifacient Accidental from contaminated food

Name & Action	Average Fatal Dose & Fatal Period	Treatment	Medicolegal Points & Poison Sources
Ether Anaesthetic	30 ml orally More than 0.15% in blood Uncertain	Gastric lavage, demulcents, stimulants. Oxygen, artificial respiration. Anliconvulsant. Maintain blood pressure.	Accidental Suicidal Addiction
Hallucinogens Mechanism of action on CNS not known	Uncertain Not known	Limit stimulation, tranquilizers, symptomatic measures, and psychotherapy.	Accidental Suicidal Homicidal Habit forming
Hemlock Hydrochloric acid Corrosive Irritant if diluted	2-30 ml 24 hours	Stomach wash (with soft rubber lube if possible). Give milk, lime water, egg white. Morphine for pain. Ice sucking. Cortisone.	Accidental Vitriolage Suicidal
Hydrocyanic acid Internal or cellular asphyxia (histo-toxic). Inhibits respiratory enzymes	60 mg of the anhydrous acid 10 minutes	Speed is essential. Inject two 20ml ampoules of 1.5% Dicobalt Tetracemate (Kelocyanor) IV followed by 20 ml 50% glucose. This treatment now replaces the old one. Methylene blue 50 ml 1% IV. PAPI > Artificial respiration with 100% oxygen. Coramine IV slowly.	Suicidal Accidental
Hydrogen sulphide Local irritant CNS depressant	0.2% in air Within few minutes	Oxygen, artificial respiration. Coramine 2ml 25% IV.	Accidental Exposure in sewers
Hyoscyamine Cerebrul Delirients	125 mg of hyoscyumine 1530 mg of Hyosine 24 hours	Stomach with 5% tannic acid. Prostigmine 0.5 mg or Pilocarpine-nitrate 15 mg stibeulanconsly. Tepid sponging for raised temperature. 10 mg diazepam IV and allay excitement. Warm enema.	Stupefying Homicidal Truth scrum Twilight sleep. Sedative in medicine
Iodine Corrosive if concentrated irritant	2 gms of iodine 10 ml of tincture 24 hours	Stomach wash with 1 -% starch solution 100 ml 55 sodium thiosulphate orally.	Accidental idiosyncrasy Suicidal Vitriolage
Iron salts Irritant	Uncertain	Gastric lavage, leave dilute $NaHCH_3$ in stomach Electrolyte correction. Desferioxamine-B	Accidental through overdose

Name & Action	Average Fatal Dose & Fatal Period	Treatment	Medicolegal Points & Poison Sources
Kaner cardiac depressant			
Kerosene Irritant	15 ml Uncertain	Stomach was with cure with warm water containing sodium bicarbonate. Steroids. Antibiotics. Glucose IV. Liquid paraffin 250 ml orally followed by saline cathartic.	Accidental Suicidal
Lead Irritant	Uncertain Uncertain	Stomach was with 1% magnesium or sodium sulphate. Give egg white milk. Calcium gluconate 1 gram IV. Morphine & atropine. EDTA 1 gram twice daily for 5 days in 5% glucose saline by drip. Penicillumine 1 gram daily for 4 or 5 days by mouth or slow IV. drip. Vitamin D 100 mg daily. Diazepam. IV. 10 mg or barbiturates IM 100-200 mg for convulsions.	Abortifacient Cattle poison Accidental (drug)
Manganese Corrosive locally Neurotoxic	10 gram as potassium permanganate 1/2 hour	Stomach wash with powdered charcoal. Milk & egg while. Calcium gluconate IV. In chronic poisoning. BAL & EDTA. Par-paint 25 mg IM	Accidental
Marking nut Mercury Corrosive & Irritant Nephrotonic	Metallic mercury not poisonous. 200-300 mg of corrosive sublimate 72 hours	Emetics or stomach wash with magnesium carbonate or sodium fomaldehyde sulphoxylate 250ml 55 & 100ml to be left in stomach. Egg white, Activated charcoal orally. Magnesium sulphate, BAL 200mg twice daily IM Sodium thiosulphate IV. Penicillumine orally.	Accidental Abortifacient Suicidal
Methyl alcohol	60-240 ml Upto 4 days	Ethyl alcohol prevents formation of toxic formic acid & formats & breakdown of glycol into toxic oxalic acid & oxalates. (Sec wood alcohol).	15 ml causes blindness
Morphine Cerebral somniferoux (respiratory depressant) Nareotic	200 mg as morphine. 2 grams as opium.	Stomach wash with potassium permanganate. Maintain body warmth. Naloxone 0.4. 0.8 mg IV. Amiphenazole 30 mg IV.	Suicidal Infantiedal Accidental Doping race horses Cattle poison Morphinism

Name & Action	Average Fatal Dose & Fatal Period	Treatment	Medicolegal Points & Poison Sources
analgesic	12 hours	Intravenous glucose drip. Oxygen & artificial respiration. Stimulation such as adrenaline, coramine, or strychnine may be given if necessary.	
Mushrooms Parasympathomimetic	½ to 1 mushroom 3-6 days	Gastric lavage, supportive treatment atropine, exchange transfusion is children, charcoal, haemoperfusion in adults.	Accidental
Naphthalene Irritant. Nephrotoxic, haemolytic & hepatotoxic	2 grams Uncertain	Stomach wash. Magnesium sulphate, Sodium bicarbonate orally to alkalinize urine. Blood transfusion, 25 mg hydrocortisone Hemisuccinate & IV Glucose.	Accidental Suicidal Moth balls
Nicotine Cardiac depressant	1 mg / kg body weight 15 gms of crude tobacco Uncertain	Stomach wash with warm water & activated charcoal. Atropine Parpanit 25 mg IM & nitrites. Cardiorespiratory stimulants. Oxygen & artificial respiration. Antihypertensive.	Accidental Malingering Suicidal Homicidal Infantiedal Abortifacient
Nitric acid Corrosive Irritant if diluted	15-20 ml 18 hours	Stomach was (with soft rubber tube if possible). Give milk, magnesium oxide, egg white or melted butter. Morphine, Intravenous fluids. Ice sucking. Corticosteroids.	Accidental Suicidal Abortifacient Vitriolage
Nitrons oxide Anaesthetic	Uncertain Uncertain	Inhalation of oxygen & carbon dioxide, artificial respiration, stimulants.	Accidental, Laughing gas
Nuxvomica Spinal irritant	15-30 mg of strychnine. 2 grams of powdered Nuxvomica. Whole un-damaged seeds not fatal.	Keep patient in dark quiet room. 600 mg pentobarbital or 10 mg diazepam IV. Succinylcholine chloride 50 mg IV. Stomach wash with tannic acid. Tubocurarine, Oxygen & artificial respiration.	Accidental (from prescription errors or eating fruit) Suicidal Homicidal Love-philter Aphrodisiac
Organophosphorous compounds CNS depressant Inhibits cholineslerase	1 gram of Tik-20 (variable for other compounds)	Remove clothing. Stomach wash, wash skin. 2 mg atropine IV. Half hourly till pupils. Dilate. PAM 1 gram 4 hourly. Oxygen. Intravenous. Charcoal haemo-	Accidental Suicidal Homicidal

Name & Action	Average Fatal Dose & Fatal Period	Treatment	Medicolegal Points & Poison Sources
	6 hours	perfusion.	
Oxalic acid Corrosive Narcotic Nephrotoxic	15-20gms 2 hours	Give chalk, calcium magnesia. 10 ml 10% calcium gluconate IV. Ice sucking. Oxygen.	Accidental Suicidal To erase ink writing
Paracetamol Non-narcotic analgesic & antipyretic	10gms Upto five days	Oral methionine 10 grams in 12 hours over 4 doses or IV cysteamine prevents hepatic damage if given within 10 hours. Gastric lavage, general measure. Cysteamine 2 gms IV. in 10 minutes & 400 mg in 55 dextrose over 4, 8 & 8 hours, Vit Kt. Charcoal haemo-perfusion, hypertonic glucose IV for cerebral oedema.	Accidental Suicidal
Paraldehyde Cerebral depressant	60-90 ml 12 hours	Gastric lavage, 205 acctyleysteine (mucolytic) 140 mg/kg orally followed by 70 mg/kg hourly for 3 days, general measures, respiratory stimulants. Maintain body warmth. Oxygen.	AccidentalSuicidal Addiction
Pethidine Narcotic analgesic	2 grams 24 hours	Gastric lavage, Coramine IV. General measures.	Accidental Addiction
Phenacelin Analgesic & antipyretic	5 grams Few hours to sonic days	Gastric lavage, 1% methylene blue 1 mg/kg body weight IV. Vit. C. IV. General measures. Maintain body warmth.	Accidental Idiosyncrasy Suicidal
Phosphorus (elemental) Proloplasmic poison	120 mg 24 hours	Stomach wash with 0.5% potassium permanganate or 0.2% copper sulphate. Liquid paraffin. Intravenous saline with calcium gluconate & glucose. Oxygen. Vit K, 200mg IV. Corticosteroids 100 mg IV for hepatic coma. Peritoneal or haemodialysis.	Suicidal Abortifacient Accidental from fireworks. Homicidal
Plumbaga Muscle irritant Respiratory depressant	Uncertain Uncertain	Wash the part with cold water. Wash the stomach with 1% tannic acid. Give corumine. Oxygen.	Abortifacient, Malingerer bruise Homicidal

Name & Action	Average Fatal Dose & Fatal Period	Treatment	Medicolegal Points & Poison Sources
Potassium Perninagunate	10 grams 1/2 hour	Stomach was with 10% sodium thiosulphate solution in warm water. Give milk, intravenous glucose.	Accidental Suicidal Abortifacient
Powdered glass Irritant	Not known Not Known	Bulky foods like rice, ripe banana & custard. Plenty of water. Give laxatives but no violent purgatives.	Accidental Homicidal Infanticidal Suicidal
Rati			
Ricinus Canununts	6 mg of rich (10 seeds)	Stomach was with warm water, Demulcent, Cold porridge or custard. Intravenous fluids.	Accident
Scorpion stinging Neural depressant Haemolysins	Uncertain Uncertain	The ligature proximally. Incise the part. Wash with dilute ammonia. Inject 1% novocaine or 0.5% Xylocaine locally. Give hot coffee. Cortisone, Scorpion antivenin if available.	Accidental
Semicarpus Anacardium (milking nut)Irritant	10 grams 24 hours	Wash the part with warm water. If taken orally, was the stomach with warm water, give milk, ice to suck & morphine for pain.	Accidental Torture Abortifacient Vitriolage Malingerer's conjunctivitis & bruise
Snake bite Neurotoxius in elapids. vasculotoxins in vipers, & myotoxinx in sea snakes	15 mg of cobra venom 40 mg of viper venom Few hours in bite from cobra & few days in bite from viper. Sea snake bite not fatal.	Apply ligature proximally. Wash the part & incise. Suck the blond by suction pump. Give specific antivenin when available or polyvalent antivenin 20 ml subcutaneously around bite, 20 ml IM & 20 nil intravenously. Repeat IV dose if collapse occurs or 6 hourly. Inject atropine 0.6 mg & Neostigmine 0.5 mg IV to combat fixed toxin of ciapids. Inject heparin & fibrinogen in viper bite cases. General measures.	Accidental Cattle poison
Sodium nitrite Cardiac depressant	2 grams Few hours to some days	Gastric lavage, 1% methylene blue 1 mg/kg. Body weight. Vit. C. General measures. Maintain body warmth.	Accidental Used as a mordant by weavers
Sulfuric acid	10-15 ml	Stomach wash (with soft rubber tube if possible). Give milk,	Suicidal Accidental Vitriolage Abortifacient

Name & Action	Average Fatal Dose & Fatal Period	Treatment	Medicolegal Points & Poison Sources
Corrosive Irritant if diluted	12 hours	magnesium oxide, egg white, melted butter. Morphine for pain. Intravenous fluids, oxygen, cortisone.	
Tear gas Irritant	Not fatal	Remove the patient to fresh air. Wash eyes with cold water. Put liquid paraffin drops in eyes & use dark glasses. In severe cases, instillation of cortisone eyes	Accidental; War gas To disperse unruly mob
Thallium Metallic irritant	1 gram 2 days to 2 weeks	Follow treatment of heavy metal poisoning. Gastric lavage activated charcoal. Saline cathartic, and demulcents, UAL Prussian blue. Maintain blood pressure.	Homicidal Accidental Rodenticide Depilatory
Tik 20			
Tranquilizers Anxiolytic & muscle relaxant	10 grams Uncertain	Gastric lavage, activated charcoal, general measures. Blood transfusion.	Accidental Suicidal Addiction problems
Turpentine	200 ml	Gastric lavage with bicarbonate solution, demulcents, alkaline diuretics, general measures.	Suicidal Abortifacient Counter-irritant
Wood alcohol (Methyl alcohol) Neurotoxic Respiratory depressant	15 ml causes blindness 60-20 ml Upto four days	Gastric lavage with 55 $NaHCO_3$. Ethyl alcohol 1 ml/kg body weight 4-6 hourly for 1-3 days. Combat acidosis with $NaHCO_3$ orally or 5% IV solution Protect eyes. Haemodialysis. General measures. Tranquilizers.	Accidental from use in place of ethyl alcohol Suicidal
Zinc Irritant	15 grams of zinc sulphate, 400 mg of zinc chloride24 hours	No emetics, stomach wash with warm water, Give milk, egg white, and black lea. EDTA. Morphine for pain.	Accidental (from food or wounds) Abortifacient Suicidal
Zinc Phosphate Irritant	Upto 24 hors	Remove contaminated clothing & wash with water. Emetics. Gastric lavage with 3-5% $NaHCHO_3$ General supportive measures, Vitamin K.	Suicidal Homicidal Dowry death Accidental Rodenticide

Chapter-17

Pakistan Penal Code (XLV of 1860)

PAKISTAN PENAL CODE (XLV OF 1860)	
SECTION	DESCRIPTION
10	The word "man" denotes a male human being of any age. The word "woman" denotes a female human being of any age
11	The word "person" includes any company or association, or body of persons, whether incorporated or not
12	The word "public" includes any class of the public or any community
14	The word "servant of the state" denote all officers or servants continued, appointed or employed in Pakistan by or under the authority of the central government or any provincial government
17	The word "government" denotes the person or persons authorized by law to administer executive government in Pakistan or in any part thereof
19.	The word "Judge" denotes not only every person who is officially designated as a Judge, but also every person. Who is empowered by law to give, in any legal proceeding, civil or criminal, a definitive judgment, or a judgment which, if not appealed against, would be definitive, or a judgment which, if confirmed by some other authority, would be definitive, or who is one of a body of persons, which body of persons is empowered by law to give such a judgment.
20.	Court of justice denotes a Judge who is empowered by law to act judicially alone or a body of Judges which is empowered by law to judicially as a body, when such Judge or body of Judges is acting judicially.
22.	The words "movable property" are intended to include corporeal property of every description, except land and thing attached to the earth or permanently fastened to anything which is attached to the earth.
23..	"Wrongful gain" is gain by unlawful means of property to which the person gaining is not legally entitled. "Wrongful loss" is the loss by unlawful means of property to which the person losing it is legally entitled.
24.	Whoever does anything with the intention of causing wrongful gain to one person or wrongful loss to another person, is said to do that thing "dishonestly".
31.	The words "a will" denote any testamentary document.
39.	A person is said to cause an effect "voluntarily" when he causes it by means whereby he intended to cause it, or by means which, at the time of employing those means, he knew or had reasons to believe to be likely to cause it.
40.	The word "offence" denotes a thing made punishable by this Code
41.	A "special law" is a law applicable to a particular subject.
42.	A "local law" is a law applicable only to a particular of the territories comprised in Pakistan.
43.	The word "illegal" is applicable to everything which is an offence or which is prohibited by law, or which furnishes ground for a civil action and a person is said to be "legally bound to do "whatever it is illegal in him to omit.
44.	The word "injury" denotes nay harm whatever illegally caused, to any person, in body,

PAKISTAN PENAL CODE (XLV OF 1860)	
SECTION	DESCRIPTION
	mind, reputation or property.
45.	The word "life" denotes the life of a human being unless th ontrary appears from the context.
47.	The word "animal" denotes any living creature, other than a human being.
51.	The word "oath" includes a solemn affirmation substituted by law for an oath, and any declaration required or authorized by law to be made before a public servant or to be used for the purpose of proof, whether in a Court of Justice or not.
52.	Nothing is said to done or believed in "good faith" which is done or believed without due care and intention.
53.	The punishments to which offenders are liable under the provision of this Code are. 1. Qisas, 2. Diyat; 3. Arsh; 4. Daman; 5. Tazir 6. Death 7. Imprisonment of life; 8. Imprisonment which is of two description i. Rigorous ii. Simple 9. Forfeiture of property; 10. Fine;
55.	In every case in which sentence of imprisonment for life shall have been sentenced may, without the consent of the offender, commute the punishment for imprisonment of either description for a term not exceeding fourteen years.
57.	In calculating fractions of terms of punishment, imprisonment for life shall be reckoned as equivalent to transportation for twenty-five years.
82.	Nothing is an offence, which is done by a child under seven years of age.
83.	Nothing is an offence sufficient maturity of understanding to judge the nature and consequences of his conduct on that occasion.
84.	Nothing is an offence, which is done by a person who, at the time of doing it, by reason of unsoundness of mind, is incapable of knowing the nature of the act, or that he is doing what is either wrong or contrary to law.
85.	Noting is an offence which is done by person who, at the time of doing, it, is by reason of intoxication, incapable of knowing the nature of act, or that he is doing what is either wrong or contrary to law; provided that the thing which intoxicated him was administered to him without his knowledge or against his will.
86.	In cases where act done is not an offence unless done with a particular knowledge or intent, a persons who does the act in a state of intoxication shall be liable to be dealt with as if he had the same knowledge as he would have had if he had not been intoxicated, unless the thing which intoxicated him was administered to him without his knowledge or against his will.
87.	Nothing which is not intended to cause death, or grievous hurt, and which is not known by the doer to likely to cause death, or grievous hurt, is offence by reason of any harm which it may cause, or be intended by the doer to cause, to any person, above eighteen years of age, who has given consent, whether express or implied, to suffer that harm, or by reason of any harm which it may be known by the doer to be likely to cause to" any such person who has consented to take the risk of that harm.
88.	Nothing, which is not intended to cause death, is an offence by reason of any harm which it may cause, or be intended by doer to cause, or be unknown by the doer to be likely to

PAKISTAN PENAL CODE (XLV OF 1860)	
SECTION	DESCRIPTION
	cause, to any person for whose benefit it is done in good faith, and who has given a consent, whether express or implied to suffer that harm, or to take the risk of that harm.
89.	Nothing which is done in good faith for the benefit, of a person under twelve years of age or of unsound mind, by consent, either express or implied, of the guardian or other person having lawful charge of that person, is an offence by reason of any harm which it may cause, or be intended by the doer to cause or be known by the doer to be likely to cause to that person.
90.	A consent is not such a consent as is intended by any section of this Code, if the consent is given by a person under of injury, or under a misconception of fact, and if the person doing the act knows, or has been reason to believe, that the consent was given in consequence of such fear or misconception; If the consent is given by a person who, from unsoundness of mind of intoxication is, unable to understand the nature and consequence of that to which he gives his consent; Unless to contrary appears from the context, if the consent is given by a person who is under twelve years of age.
93.	No communication made in good faith is an offence by reason of any harm to the person to whom it is made, if it is made for the benefit of that person.
191.	Whoever being legally bound by an oath or by an express provision of law to state the truth, or being bound by law to make a declaration upon any subject, makes any statement which is false, and which he either knows or believes to be false or does not believe to be true, is said to give false evidence.
269.	Whoever unlawfully or negligently does any act which is, and which he knows or has reason to believe to be, likely to spread the infection of any disease dangerous to life, shall be punished with imprisonment of either description for a term which may extend to six months or with fine, or with both
270.	Whoever malignantly does any act which is, and which he knows or has reason to believe to be. Likely to spread the infection of any disease dangerous to life, shall be punished with imprisonment of either description for a term which may extend to two years, or with fine, or with both.
272.	Whoever adulterates any article of food or drink, so as to make such article noxious as food or drink, intending to sell such articles as food or drink, or knowing it to be likely that the same will be sold as food or drink, shall be punished with imprisonment of either description for a term which may extend to six months, or with fine which may extend to one thousand rupees, or with both.
274.	Whoever adulterates any drug or medical preparation in such a manner as to lessen the efficacy or change the operation of such drug or medical preparation, or to make it noxious, intending that is shall be sold or used for, or knowing it to be likely that it will be sold or used for any medical purpose, as if it had not undergone such adulteration, shall be punished with imprisonment of either description for a term which may extend to six months, or with fine which may extend to one thousand rupees or with both.
277.	Whoever voluntarily corrupts or fouls the water of any public spring or reservoir, so as to render it less At for the purpose for which it is ordinarily used, shall be punished with imprisonment of either description for a term which may extend to five to three months, or with fine which may extend to five hundred rupees, or with both.
278.	Whoever voluntarily vitiates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the neighborhood or passing along public way, shall be punished with fine which may extend to five hundred

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	rupees.
279.	Whoever drives any vehicle, or rides, on any public way in a manner so rash or negligent as to endanger human life, or to be likely to cause hurt or injury other person, shall be punished with imprisonment of either description for a term which may extend to two years or with fine which may extend to one thousand rupees or with both.
293.	Whoever sells, lets to hire, distributes exhibits or circulates to any person under the age of twenty years any such obscene object or offers or attempts so to do, shall be punished with imprisonment of either description for a term which may extend to six months, or with fine or with both.
294	Whoever, to the annoyance of other:- (a) does any obscene act in any public place, or (b) sings, recites or utters any obscene songs, balled or words in or near any public place shall be punished with imprisonment of either description for a term which may extend to three months, or with fine, ____ or with both.
299.	(a) "adult" means a person who has attained the age of eighteen years; (b) "arsh" means the compensation specified in this Chapter to be paid to the victim or his heirs under this Chapter. (c) "authorized medical officer" means a medical officer or a Medical Board, howsoever designated, authorized by the Provincial Government. (d) "daman" means the compensation determined by the court to be paid by the offender to the victim for causing hurt not liable to arsh. (e) "diyat" means the compensation specified in section 323 payable to the heirs of the victim. (f) "ikrah-e-tam" means putting any person, his spouse or any of his blood relations within the prohibited degree of marriage in fear of instant death or instant permanent impairing of any organ of the body or instant fear of being subjected to sodomy or zina-bil-jabr, (g) "ikrah-e-naqis" means any from of duress which does not amount to ikrah-i-tam: (h) "minor" means a person who is not an adult. (i) "qatl" means causing death of a person. (j) "qisas" means punishment by causing similar hurt at the same part of the body of the convicts he has caused to the victim or by causing his death if he has committed qatil-i-amd in exercise of the right of the victim or a wali. (k) "tazir" means punishment other than qisas, diyat, arsh or daman; (l) "Wali" means punishment entitled to claim qisas.
300.	Whoever, with the intention of causing death or with the intention of causing bodily injury to a person, by doing an act which in the ordinary course of nature is likely to cause death, or with the knowledge that his act is so imminently dangerous that it must in all probability cause death, causes the death of such person, is said to commit qatil-i-amd.
301.	Where a person, by doing anything which he intends or knows to be likely to cause death, causes death of any person whose death he neither intends nor knows to be likely to cause death, cause death of any person whose death he neither intends not knows himself to be likely to cause, such an act committed by the offender shall be liable for qatil-i-amd.
302.	Whoever commits qatil-i-amd shall be punished with death or imprisonment for life as tazir.
305.	In case of qatl, the wali shall be:- (a) the heirs of the victim, according to his personal law, and

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	(b) the Government, if there is no heir.
315.	Whoever, with intent to cause harm to the body or mind of any person, causes, the death of that or of any other person by means of a weapon or an act, which in the ordinary course of nature is not likely to cause death is said to commit qatl-shibh-i-amd.
317.	Where a person committing qatl-i-amd or qatl-shibh-i-amd is an heir or a beneficiary under a will, he shall be debarred from succeeding to the estate of the victim as an heir or a beneficiary.
318.	Whoever, without any intention to cause death of or cause harm to, a person cause death of such person, either by mistake of act or by mistake of fact, is said to commit qatl-i-khata.
321.	Whoever, without any intention to cause death of or cause harm to any person, dose any unlawful act which becomes a cause for the death of another person, is said to commit qatl-bis-sabab.
323.	(1) The court shall, subject to the injunctions of Islam as laid down in the Holy Quran and Sunnah and keeping in view the financial position of the convict and the heirs thousand six hundred and thirty grams of silver. (2) For the purpose of sub-section (1), the Federal Government shall, by notification in the official Gazette, declare the value, of silver, on the first day of July each year or on such date as it may deem fit, which shall be the value payable during a financial year.
324.	Whoever does any act with such intention or knowledge an under such circumstances, that, if he by act caused qatl, he would be guilty of qatl-i-amd, shall be punished with imprisonment of either description for a term which may extend to ten years and shall also be liable to fine.
325.	Whoever attempts to commit suicide and does any act towards the commission of such offence, shall be punished with simple imprisonment for a term" which may extend to one year, or with fine, or with both.
328.	Whoever being the father or mother of a child under the age of twelve years or having the wholly abandoning such child, shall be punished with imprisonment of either description for a term, which may extend to seven years or with fine, or with both.
329.	Whoever, by secretly burying or otherwise disposing of the dead body of a child whether such child dies before or after or during its birth intentionally conceals or endeavors to conceal the birth of either description for a term which may extend to two years, or with fine, or with both.
330.	(1) The diyat may be made payable in lump sum or in installment spread over a period of three from the date of the final judgment. (2) Where a convict fails to pay diyat or any part thereof within the period specified in sub-section (1), the convict may be kept in jail and delt within the same manner as if sentence to simple imprisonment until the diyat \j paid full or may be released on bail if he furnished security equivalent to the amount of diyat to the satisfaction of the court. (3) Where a convict dies before the payment of diyat or may part thereof it shall be recovered from his estate.
331.	The diyat shall be disbursed among the heirs of the victim according .to their respective shares in inheritance; provided that, where a heir foregoes his share, the diyat shall not be recovered to the extent of his share.
332.	Whoever causes pain, harm disease infirmity or injury to any person or impairs, disables or dismembers any organ of the body, or the kind of hurt caused arid may also be punished with imprisonment of either description for a term which may extend to five years as tazir.

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333.	Whoever dismembers amputates, severs any limb or organ of the body of another person is said to cause italf-i-Udw.
337B.	Whoever causes on any part of the body of person, other than the head or face, a hurt which leaves a mark of the* wound, whether temporary or permanent, is said to cause jurh. Jurh is of two kinds namely: (a) Jaifah (b) Ghayr-jaifah
337c.	Whoever causes jurh in which the injury extends to the body cavity of the trunk, is said to cause jaifah.
337e.	(1) Whoever causes jurh which docs not amount to jaifah, is said to cause ghayr-jaifah. (2) The following are the kinds of ghay-jaifah, namely: (a) damihah (b) badiah (c) mutalahimah (d) mudihah (c) hashimah (d) munaqqilah (3) Whoever cause ghayr-jaifah— (i) In which the skin is ruptured and bleeding occurs, is said to cause damihah. (ii) by cutting or incising the flesh without exposing the bone, is said to cause badiah. (iii) by lacerating the flesh, is said to cause mutalahimah. (iv) by causing fracture of a bone without dislocating it is said to cause hashimah; and (v) by fracturing and dislocating the bone, is said to cause munaqqilah.
339.	Whoever voluntarily obstructs any person so as to prevent that person from proceeding in any direction in which that person has a right to proceed is said wrongfully to restrain that person.
340.	Whoever wrongfully restrains any person in such a manner as to prevent that person front proceeding beyond certain circumscribing limits, is said "wrongfully to confine" that person.
350.	Whoever intentionally uses force to any person, without that person's consent, in order to the coming of any offence, or intending by the use of such force to cause, or knowing it to be likely that by the use of such force he will cause injury, fear or annoyance to the person to whom the force is used, said to use criminal force to that order.
351.	Whoever make any gesture, or any preparation intending or knowing that such gesture or preparation will cause any person present to apprehend that he who makes that gesture or preparation is about to use criminal force to that person, is said to commit an assault.
354.	Whoever assaults or uses criminal force to any woman, intending to outrage or knowing it to be likely that he will thereby outrage here modesty, shall be punished with imprisonment of either description for a term which may extend to two years, or with fine or with both.
359.	Kidnapping is of two kinds; Kidnapping from Pakistan and kidnapping from lawful guardianship.
360.	Whoever conveys any person beyond the limits of Pakistan without the consent of that person or of some person legally authorized to consent on behalf of that person, is said to kidnap that person from Pakistan.
361.	Whoever takes or entices any minor under fourteen years of age if a male, or under sixteen

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	years of age if a female, or any person of unsound in dout of the keeping of the lawful guardian of such minor, or person from lawful guardianship.
362.	Whoever by force compels, or by any deceitful means induces, any person to go from any place, is said to abduct that person.
363.	Whoever kidnaps any person from Pakistan or form lawful guardianship, shall be punished with imprisonment of either for a term which may extend to several years, and shall also be liable to fine.
364A.	Whoever kidnaps or abducts any person under the age of fourteen in order that such person may be murdered or subjected to grievous hurt, or slavery or to the lust of any person or may be so disposed of as to put in danger of being murdered or subjected to grievous hurt, or slavery or to the lust of any person shall be punished with death or with imprisonment for life or with rigorous imprisonment for a term which may extend to fourteen years and shall not be less then seven years.
365.	Whoever kidnaps or abducts any person with intent to cause that person to be secretly and wrongfully confined, shall be punished with imprisonment of either description for term which may extend to seven years and shall also be liable to fine.
365A.	Whoever kidnaps or abducts any person for the purposes of extorting from the person kidnapped or abducted or from any person interested in the person kidnapped or compel any property, whether movable or immovable, or valuable security, or to compel any person to comply with any other demand, whether in cash or otherwise for obtaining release of the person kidnapped or abducted, shall be punished with imprisonment for life and shall also be liable to forfeiture of property.
366A.	Whoever, by any means whatsoever induces any minor girl under the age of eighteen years intent that such girl may be, or knowing that is likely that she-will be forced or seduced to illicit intercourse with another person shall be punishable with imprisonment which may extend to ten years and shall also be liable to fine.
366B.	Whoever imports into Pakistan from any country outside Pakistan any girl under the age of twenty-one years with intent that she may be, or knowing it to be likely that she will be, forced or seduced to illicit intercourse with another person, shall be punishable with imprisonment with may extent to then years and shall also be liable to fine.
377.	Whoever voluntarily has carnal intercourse against the order nature with any man, woman or animal, shall be punished with imprisonment for life or with imprisonment of either description for a term which shall not be less than then years and shall also be liable to fine.
494.	Whoever, having a husband or wife living marries in any case in which such marriage is void by reason of its taking place during the life of such husband or wife, shall be punished with imprisonment of either description for a term which may extend to seven years and shall also be liable to fine.
495.	Whoever commits the offence defined in the last preceding section having concealed from the person with whom the subsequent marriage is contracted the fact of the former marriage shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine.
499.	Whoever by words either spoken or intended to be read, or by signs or by visible representations makers or publishes any imputation concerning any person intending to harm, or knowing or having reasons to believe that such imputation will harm, the reputation of such person, is said, except in the cases here in after excepted to defame that person.

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500.	Whoever defames another shall be punished with rigorous imprisonment for a term which may extend to two years or with fine, or with both.
	SHARIAT CRIMINAL LAWS
SECTION	Offences Against Property (Enforcement of Hudood) Ordinance, 1979 Ordinance VI of 1979
2.	In this ordinance unless there is anything repugnant in the subject or context, a. "adult" means a person who has attained the age of eighteen years of puberty; b. "authorized medical officer" means-medical officer, howsoever designated authorized by Government c. "hadd" means punishment ordained by the Holy Quran or Sunnah d. "hirz" means and arrangement made for the custody of property e. "imprisonment for life" means imprisonment till death f. "nisab" means the nisab as laid down in section 6 g. "tazir" means any punishment other than had
4.	Theft may be either liable to hadd or theft liable lo tazir.
5.	Whoever, being an adult, surreptitiously commits, from any hire, theft of the value of the nisab or more, not being stolen property knowing that is or is likely to be of the value of the nisab or more is subject to the provision of this Ordinance, said to commit theft to hadd.
6.	The nisab for theft liable to hadd is four decimal four five seven (4.457) grams of gold or other property of equivalent value, at the time of theft.
7.	The proof of theft liable to hadd shall be in one of the following forms, namely; a. the accused pleads guilty of the commission of theft liable to hadd, and b. at least two Muslim adult male witnesses, other than the victim of the theft, about whom the Court is satisfied, having regard to the requirement of tazkiya Al-huhood, that they are truthful persons and abstain from major sins (kabair) give evidence as eye-witness of the occurrence. Provides that, if the accused is a non-Muslim the eye-witnesses may be non-Muslim Provided further that the statement of the victim of the theft or the person authorized by him shall be recorded before the statements of the eye-witnesses are recorded.
9.	(1) Whoever commits theft liable to hadd for the first time shall be punished with amputation of his right hand from the joint of the wrist. (2) Whoever commits theft liable to hadd for the second lime shall be punished with amputation of this left foot up to the ankle. (3) Whoever, commits theft liable to hadd for the third time or any time, subsequent thereto, shall be punished with imprisonment for life.
10.	Hadds shall not be imposed in the following cases, namely:- a. When the offender and victim of the theft are related to each other as b. When a guest has committed theft from the house of his host; or c. When a servant or employee has committed theft from the hirz of his master employers to which he is allowed access. d. When the stolen property is wild grass, fish, bird, dog, pig intoxicant. Musical instruments, or perishable foodstuffs, for the preservation of which provision does not exist. e. When the offender has a share in the stolen property the value of which, after deduction of his share, is less than the nisab; f. When a creditor steals his debtor's properly the value of which, after deduction of the

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	amount due to him, is less than the nisah; g. When the offender has committed theft under ikrali or iztirar, Explanation. In this clause. i. "ikrah" means putting any person in fear of injury to the person, property or honour of that or any other person and ii. "iztrar" means a situation in which a person is in apprehension of death due to extreme hunger or thirst.
13.	Whoever commits theft which is not liable to hadd, or for which proof in either of the forms mentioned in section 7 is not available or for which hadd may not be imposed or enforced under this Ordinance, shall be liable to tazir.
15.	When any one or more persons, whether equipped arms or not, make show offence for the purpose of taking away the property of another and attack him or cause wrongful restraint or put him in fear of death or hurt, such person or persons are said to commit haraabah.
21.	i. Whoever -extends patronage, protection or assistance in any form to, or harbors any person or group of persons engaged in the theft of cattle, on the understanding that he shall receive one or more of the cattle in respect of which the offence is committed, or a share in the proceeds thereof, is said to commit "rassagin" or" patharidari".
SECTION	Offences of Zina (Enforcement of Hudood) Ordinance, 1979 Ordinance VI of 1979
2.	a. "adult" means a person who has attained, being a male, the age of eighteen years or beings a female, the age of sixteen years, or has attained puberty b. "Hadd" means punishment ordained by the Holy Quran or Simnah c. "Marriage" means marriage, which is not void according to the personal law of the parties and married shall be construed accordingly, d. "Muhsan" means:- i) a Muslim adult man who is not insane and has had sexual intercourse with a Muslim adult woman who, at the time he had sexual intercourse with her, was married to him and was not insane, or. ii) a Muslim adult man who, at the time she had sexual intercourse with him, was married to her and was not insane; and e. "tazir" means any punishment other than hadd.
4.	A man and a women are said to commit 'zina' if they will fully have sexual intercourse without being validly married to each other. Explanation - Penetration is sufficient to constitute the sexual intercourse necessary to the offence of zine.
5.	1. Zina is liable to hadd if:- a. it is committed by a man who is an adult and is not insane with a woman to whom he is not, and does not suspect himself to be married; or b. it is committed by a woman who is an adult and is not insane with a man to whom she is not, and does not suspect herself to be married. 2. Whoever is guilty of zina liable to hadd shall, subject to the provisions of this Ordinance:- a. if he or she is a muhsan, be stored to death at a public place, or b. if he or she is not a muhsan, be punished, at a public place, with whipping numbering one hundred strips. 3. No punishment under subsection (2) shall be executed, until it has been confirmed by the court to which an appeal from the order of conviction lies; and if the punishment be of

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	whipping until its confirmed and executed, the convict shall be dealt with in the same manner as if sentenced to simple imprisonment.
6.	A person is said to commit zina-bil-jabr if he or she has sexual imprisonment with a woman or man, as the case may be to whom he or she is not validly married, in any of the following circumstances, namely:- a. against the will of the victim, b. without the consent of the victim c. with the consent of the victim, when the consent has been obtained by putting the victim in fear of death or of hurt, or d. with the consent of the victim, when the offender knows that the offender is not validly married to the victim and that, the consent is given because the victim believes that the offender is another person to whom the victim is or believes herself or himself to be validly married.
7.	A person guilty of zina or zina-bil-jabr shall if he is not an adult, be punished with imprisonment of either description for a term which may extend to five years, or with fine, or with both, and may also be awarded the punishment of whipping not exceeding thirty stripes.
8.	Proof of zina or zina-bil-jabr, liable to hadd shall be in one of the following forms namely a. the accused makes before a Court of competent jurisdiction a confession of the commission of the offence; or b. having regard to the requirement of tazkiyahal-shuhood, that they 'are thoughtful persons and abstain from major sins (kabair), give evidence eye-witnesses of the act of penetration necessary to the offence; Provided that, if the accused is a non-Muslim the eye-witnesses may be non-Muslim
10.	i. Subject to the provisions of section 7, whoever commits zina or zina-jabr which is not liable to hadd, or for which proof in either of the forms mentioned in section 8 is not available and the punishment of qazf liable to hadd has not been awarded to the complainant, or for which hadd may not be enforced under this Ordinance, shall be liable to tazir. ii. Whoever commits zina liable to tazir shall be punished with rigorous imprisonment for a term, which may extend to ten years and with whipping numbering thirty stripes, and shall also be liable to fine. iii. Whoever commits zina liable to tazir shall be punished with imprisonment for a term, which may extent to twenty-five years and shall also be awarded the punishment of whipping numbering thirty stripes.

MEDICAL CERTIFICATE

To be filled up by a registered medical practitioner

1. What is the applicant's apparent age?.....
2. Is the applicant subject to epilepsy, vertigo or any mental ailment likely to affect his efficiency?.....
3. Does the applicant suffer from any heart or lung disorder which might interfere with the performance of his duties as a driver?.....
   (a) Is there any defect of vision? If so, has it been corrected by suitable spectacles?.....
   (b) Can the applicant readily distinguish the pigmentary colours red and green?.....
   (c) Does the applicant suffer from night blindness?.....
   (d) Does the applicant suffer from a degree of deafness which would prevent his hearing ordinary sound signals?.....
5. Has the applicant any deformity or loss of members which would interfere with the efficient performance of his duties as a driver?.....
6. Does he show any evidence of being addicted to the excessive use of alcohol, tobacco or drugs?.....
7. Is he generally fit as regards (a) bodily health, and (b) eyesight?.....
8. Marks of identification .....

I certify that to the best of my knowledge and belief the applicant ..... is the person herein above described and that the attached photograph is a reasonably correct likeness of the applicant.

Signature: .....

Name: .....

Designation:.....

Space for Photograph	Name: Special attention should be directed to distant vision and to the condition of the arms and hands and joints of both extremeties.

Fig.: Specimen of the form of medical certificate

DEATH CERTIFICATE

Cause of death **1. Immediate cause.** Disease, injury or complication which caused death, not the mode of dying such as heart failure, asthenia. Etc. **Antecedent Cause:** Morbid conditions, if any, giving rise to above cause, stating underlying condition least. 2. Other significant conditions contributing to the death, but not related to the diseases or condition causing it.	a) Due to (or as a consequence of) b) due to (or as a consequence of) c)	Interval between onset & death approx.	
Accident / Suicide / Homicide (Specify): How did Injury occur?			
IF DECEASED WAS A FEMALE Was the death associated with pregnancy? Yes / No Was there delivery Yes / No			
Name or rubber stamp of institution	Sl. No. Institution	Date of report	
Allopathic/Ayurvedic/Homoeopathic/Unani	Signature & Address of Physician/Medical Officer		

(To be detached & handed over to the relative of the deceased)

Certificate that Sri/Smt/Kum ..... S.W/D of Sri ..... Resident of ..... was admitted to the hospital on ..... & expired on .....

Director (Medical Supt.)
Name of Hospital

WEIGHT & MEASUREMENTS OF ORGANIC IN ADULTS

Brain	1400 gm (male): 1275gm (female): 1.4% of body weight
Spinal Cord	27 to 28 gm; length 45 cm
Pituitary	0.5 to 0.6 gm; size 2.1 x 1.4 x 0.5 cm
Heart	300 gm (male); 250gm (female); 0.4 to 0.45% of body weight
Thickness of atrial wall	1 to 2 mm
Thickness of left ventricle	10 to 15 mm
Thickness of right ventricle	3 to 5 mm
Length Circumference	12.5 cm; width: 9 to 10 cm at atrioventricular groove 24 to 24 cm
Circumference of aortic valve	6 to 7.5 cm
Circumference of pulmonary valve	7 to 9 cm
Circumference of tricuspid valve	10 to 12.5 cm
Circumference of mitral valve	9.5 to 10.5 cm
Thyroid	20 to 40 gm: size: 5 to 7 x 3 to 4 x 1.5 to 2.5 cm
Parathyroid	0.12 to 0.18 gm: Thymus: 15 to 40 gm
Right Lung	360 to 570 gm
Left Lung	325 to 480 gm
Trachea	11 to 12 cm; right bronchus: 2.5 cm; left bronchus: 3.5 5 cm
Liver	1400 to 1500 gm; 1.8% of body weight
Spleen	150 to 200 gm; 0.16% of body weight
Kidney	120 to 220 gm (male); 120 to 175 gm (female)
Size	11 to 12 x 5 to 6 x 3 to 4 cm

POST MORTEM REPORT

Station: _____ P.M. No: _____

Date: _____

Name	Sex	Age	Case	Body Brought Form / by	Time & Date	Time & Date of P.M. Exam

Information Furnished by the Police	Case Sheet Particulars
	IP NO.
	Ward.
	DOA.
	DOE.

Body Identified by:

NB: Observe the state of all organs and when no disease or injury is found write intact or Healthy

i. External appearance.		
ii. External Injuries / Fractures		
III. Cranium & Spinal canal		
1. Skull & vertebrae		
2. Membranes		
3. Brain & Spinal cord		
IV. Thorax		
1. Walls, ribs, cartilages, sternum		
2. Pleura & Cavity		
3. Larynx & trachea		
4. Lungs	Rt	
	Lt	
5. Pericardium		
6. Heart	Coronaries	
7. Large vessels		
V. Abdomen		

1. Walls & peritonemum		
2. Letter from Police No.....dated ..... of ..... Police station. With reference the above, I am herewith furnishing particulars about the referred case.		
IP No	Ward: DOA	DOD
X-Ray Nos. with finding		
Final Diagnosis		

The wound certificate may be issued by you as you have been seen the case first.

Your faithfully,

( )

Copy to the concerned police.

(The doctor of higher center need not mentioned injuries in detail when the case is referred to him for further management. He should mention it as a referred case with name, age, sex, and brought by whom in the medicolegal register. The higher center doctor must not open the bandages / sutures of the wounds etc., put by the referring doctor to avoid agony and introduction of infection.