Toxicology

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poison

substance which when administered / inhaled or ingested, is capable of acting deleteriously on human body

POISON VS MEDICINE

Legally

⇒ With what intend the thing is given to a person

⇒ if u give a poison to save the life → its **medicine**

⇒ e.g. morphine (opium's active ingredient) alkaloid

(a poison)

can be given to a cardiac patient for pain (but in therapeutic doses)

Medically, it is the DOSE)

⇒ when same morphine is taken by the addicts, may cause toxicity to the body.

OR

may be given by another person with the intend to harm

↓

becomes "poison"

Toxicology

It is the science which deals with poisons with reference to their sources, properties, mode of action, symptoms which they produce, lethal dose, nature of fatal results, treatment, methods of their detection & estimation and autopsy findings.

Forensic toxicology

it deals with the medical & legal aspects of the harmful effects of poisonous substances on human body.

Paracelsus

considered to be the father of modern toxicology

said:

"It is the dose which decides
b/w medicine
& poison."

History

Toxon: تیر کمان (~~arrow~~)

bow (کمان)

Toxeuma:

arrow

Toxicon:

a poison which was applied on the tip of arrow to kill animals/humans

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Imp

Classification of Poisons

Based on

1) Nature of Poison

① Corrosives :- cause corrosion / ulceration (when come in contact with skin or mucous membranes)

- Mineral acids (sulphuric acid, nitric acid, HCl, HF)
- Mineral alkalis (Na, K, hydroxides, carbonates)
- Organic acids (carbonic acid, oxalic acid, acetic acid, vegetable acids, salycilic acid, hydro hydrocyanic acid)

② Irritants :- cause redness, irritation, inflammation of the tissues.

⇒ Inorganic — Metallic / Non-metallic

⇒ Organic — Animal / Plant

⇒ Mechanical — diamond dust, chopped hairs → to cause blockage of intestines, dried sponge

(even when body is decomposed, hairs are one of the organs that resist putrefaction, similarly nails, bones)

③ Neurotics :- act on the nervous system

- Cerebral ↓ inebriants alcohol, anaesthetics, sedatives, → deliriants (cause delirium)
- Peripheral (peripheral nerves)
- Spinal → nux vomica, strychnine

(4) Cardiac poisons :-

digitalis, oleander, aconite, nicotine

(5) Asphyxiants :- gases

CO_2, CO, war gases, tear gases, sewer gases

(6) Miscellaneous :-

pharmacological agents :- paracetamol, tranquillisers, anti-depressants

(2) Manner of use :-

(1) Stupefying poisons → for purpose of robbery... biscuits etc given on buses / stands → become unconscious

(2) For malingering (ڈرامے بازی) ← symptoms (ظاہر) produce karna (جسم پر چوٹ لگی ہو) for medical leave..

(3) Suicidal — opium, cardiac poisons, hydrocyanic acid, organophosphate

(4) Homicidal

(5) Accidental — storage..., animal bites..., chemicals in industry..

ideal suicidal poison: cheap, easily available, capable of being administered in any food / drink, pleasant taste, no repulsive smell, small lethal dose, short lethal period, preferably painless

(opium is ideal suicidal poison → v. painless death → become unconscious & death in that..)

ideal homicidal poison :-

cheap, easily available, colourless, odourless, tasteless, capable of being administered in any food, drink or drug without arousing any suspicion ..

PTO

hydrocyanic acid → v. small fatal period, in minutes

opium → addicts know kitni dose leni hai, use chronically, slightly more than therapeutic dose ~~to have euphoric~~ effects etc...

The symptoms should resemble any natural disease or serious illness. Lethal dose should be small, lethal period sufficiently long to permit the poisoner to escape safely.

There should be no antidote & no possibility of its detection either at autopsy or by laboratory methods.

(arsenic → v. common)

③ Source of Poison:

① Household poisoning (used for domestic purposes)
e.g. phenol
rat pills
aluminium phosphide pills in wheat
(سری)

② Industrial poisons

③ Agricultural poisons

④ Drugs & medicines

for treatment of obesity → causes diarrhea (doesn't make any suspicion) → pt. ↑ ho jai to death ho jati → ↑ no medicine's effective

Causes of Accidental Poisoning

(Domestically), industrially

① Carelessness in the storage, (keeping poisonous & nonpoisonous substances together)

② Greater use of chemicals in industry & for household purposes

③ quack remedies

TYPES OF POISONING

1) Acute poisoning:- → death is not necessary

when someone takes an excessive dose (first attempt pai hi poisoning ho gai)

or

small doses over short period of time (max. 2-3 days)

2) Chronic poisoning:-

repeated small doses, over long period of time

(months, years or years)

e.g. heroin

(at the end multisystem failure & death)

3) Subacute poisoning:-

It includes both types of poisoning symptoms (acute + chronic)

→ diff. types of poisons are there in which subacute type of poisoning is common

4) Fulminant poisoning:-

An excessive large dose of a poison that may result in death sometimes even without producing any symptoms

TOXICITY RATING:

Rating of poisons which is based on the quantity of poisons required to cause fatality / death.

(minimum quantity)

↳ upto 6

6 → super poison / supertoxic

5 → extremely toxic

4 → v. toxic

3 → moderately toxic

2 → slightly toxic

1 → non-toxic.

(½) → standard

eg. cyanides (when quantity of poison is less than 5 mg / kg body weight)

water intoxication: toxicity of water occurs when it is taken more than 15 g/kg body weight

↳ but relatively non-toxic

5 → extremely toxic
↓
5 to 50 mg/kg

4 → v. toxic
↓
50 to 500mg/kg

3 → moderately toxic (500 mg to 5g/kg)

2 → slightly toxic (5g to 15g/kg)

1 → non-toxic (more than 15g/kg)

Routes of Administration:

1) **Enteral:-** (mouth/anus)
expose to enteral mucosa

2) **Parenteral:-**
- by injection (IV/SC/intraarticular/intradermal)
- by inhalation (through resp. tract)
- by external application
- natural orifices (eyes, nose, vagina ....)
- sublingual route

Actions of the poisons

1) **Local action:-** e.g. (acids/corrosive alkalis) → wherever come in contact with body, cause damage, visible to naked eye examination

acids → local, non-specific, local & remote combined

(corrosion / ulceration / irritation / redness / erythema / hyperemia)

2) Remote action:-

but specific

"when the poison gets absorbed in the body / into the system, it then acts on various systems."

e.g. strychnine acts on the spinal cord (remote action)

- cardiac poisons
- opium — on brain
- asphyxiant (like gas)
- ~~irritants — not locally on GIT~~

(phosphorous acts specifically on the liver)

(various poisons have diff. affinity for diff. systems)

3) *(General action)* Non-specific action:

some poisons .. not specific action → non-specific effect.

e.g. do shock (generalized) acids

→ remote non-specific action of acids

4) Local & remote combined action:

(some poisons effect locally e.g. detoxification in liver .. so we have damage,

kidneys sai excretion .. " " "

e.g. carbonic acid, phenol, oxalic acid ... remote + local

(localized remote)

then infect locally damages skin, mucous memb., GIT.. then absorption — distant organs ko bhi involve .. blood, liver, kidneys etc.

5) General action:-

"when a poison acts on 2 or more systems (poori body ko target)"

e.g. arsenic, lead, phosphorus, antimony, mercury (metallic poisons)

(skin, GIT, liver, lungs, brain)

Pencil leads → 200 yrs back made of lead, now they are made of graphite → not poisonous

- chronic lead poisoning → skin, resp. system, excretory ", reproductive ", eyes

Factors Modifying Actions of Poisons:

1) Dose :-

"smaller the dose, the effect is therapeutic"

&

"larger dose will cause toxicity"

However, there are certain exceptions to this rule :-

① **Idiosyncrasy** (inherited intolerance)

e.g. mushrooms, eggs, milk, quinine, aspirin,

→ severe symptoms appear at once

→ severe diarrhea, fever, rigor, chills

② **Allergy / hypersensitivity rxn**

aik dafa exposure ho jai, next time phir ↑ hota

(bcuz of previous exposure of the substance)

on next exposure, more intense symptoms

~~Habit~~

③ **Habit** cigarette smoking

→ diminishes the effects of poison

(habit) vs (addiction) → physical + psychological dependence

habit → عادت ... نہ بھی کرے گزارہ رہتا (function kar sakta)

addiction → اگر نشہ نہیں کیا functions ni hoon gai, withdrawal symptoms appear

alcohol → addiction

1) **Synergism** — two things which potentiate / augment the effect of each other & produce toxic symptoms

↳ e.g. alcohol & barbiturates

↳ if taken in non-toxic doses simultaneously, they produce toxic effects

2) **Additive effect** — if total response is equal to the sum of individual actions

2+2=4

when the total response is more than the sum of individual actions (SYNERGISM)

e.g. 2+2=8

3) **Cumulative poisons** → some poisons are excreted from the body v. slowly, tend to accumulate inside the body & when reach up to a specific threshold, poisoning occurs.

↳ abrupt, adverse action

slow poisoning

↳ arsenic is v. common

↳ non-toxic doses mein thora thora detay

↳ thoray thoray symptoms delay, no suspicion arises

2) Form of poison :-

• Physical state :-

- Poisons are given in liquid / fluid form, gaseous (vapours)

IV etc... therapy kam slow

work v. early ... inhale & action shuru

- Solids (fine powders, coarse powders)

sub se slow

• Chemical combination :-

(Synergism) +

some poisons when chemically combined, effect is nullified

e.g. acids + alkalis ... neutralize

$AgNO_3 + HCl \rightarrow AgCl$ harmless

• Mechanical combination :-

(acids + alkal)

strong acids / alkalis diluted in water

now acid... irritant .. (ulceration / erosion karta)

dilute .. so only irritation / inflammation ...

- All alkaloidal poisons (strychnine, morphine)

when combined with activated charcoal become inert

3) Method of Administration :

⇒ most speedy route is inhalation / IV

↓

slower is IM, S/C, oral ingestion

↓

more slower → application on intact skin

⇒ some poisons when given through diff. routes, act differently

↓

Snake venom

↓

snake bite .. S/C inject → toxicity

if ingest → harmless .... GIT → acids digest it

↓

Cocaine → addicts snuff / inhale, apply on skin / eat, ingest → toxic effects (delerious, convulsions)

↓

if ingested for therapeutic purposes → works as local anaesthetic

4) Condition of the body :

1) Age :-

→ in children & old, effect of poison is more.

as children → not good immune system,
BBB not developed enough,
drug metabolizing enzymes not completely developed

2) State of health:-

eg. cardiac patient (CAD)
↓
cannot stand any suffocative environment
↓
agar 30% bhi CO hi conc. in blood
↓
causes death of the patient

healthy adult can tolerate upto 50-70% conc. of CO

Opium
↓
cause of death → resp failure

asthmatic patients mein bohat jaldi effect
↓
small amount can cause the death

~~melawy~~
↓
patients with kidney disease

3) Sleep:- (rest ... metabolism is at its lowest rate)

↓
if someone ingests poison & then sleeps ...
↓
as slow absorption
↓
effects will come slowly.
↓
toxicity will come a bit late

Fate of the Poisons in Body:

"Naturally, any poison (unless it is in very small amounts) (or given in diluted form)

NATURAL RESPONSE → majority of the poison is lost in the stools (diarrhea) or in vomiting."

some of the times

ONCE ABSORBED:

① **Excreted:** After absorption, it may also get lost from the body in diarrhea or through stools

② **Metabolized:** either partially or completely metabolized inside the body.

③ **Biotransformation:** poison gets converted into active form inside the body & then affects the body.

e.g. lead carbonate ∴ not poisonous

when ingested ∴ in stomach reacts with HCl

converted to active form & causes toxicity

or

AFTER ABSORPTION CHANGES COME

⇒ some is partly metabolized, some remains in original form

∴ intermediate products

√√ excretions in urine / bile can be detected

(4) **Stored in the bones:**

sometimes poisons e.g. arsenic

when they're eliminated from rest of the body

can be found in skin, nails, hairs (appendages) or In The Bones

(metallic poisons can be found longg time after the episode of poisoning)

Diagnosis of Poisoning

⇒ **LIVING**

- **Acute:**

⇒ **SYMPTOMS** appear sudden after the ingestion of suspected food / fluid / medicine.

e.g. nausea, vomiting, diarrhea, pain abdomen, flushing of the face, congestion in eyes,

pinpoint pupils / dilated pupils,
froth can come,
cyanosis,
unconsciousness,
delerium,
coma,
CNS affects ... wrist or foot drop

⇒ SEVERITY all symptoms may increase in severity & either the death of patient occurs or he recovers.

⇒ DETECTION when the patient is presented with poisoning symptoms in casualty, stomach wash is performed
↓
the fluid extracted is sent for the chemical examination to detect poison

⇒ Also in urine & blood & stools, poison can be detected.

• Chronic :

⇒ SYMPTOMS Slow, gradual symptoms
↓
e.g. GIT irritation,
whenever takes suspected food / fluid / medicine, episode of nausea, vomiting, diarrhea comes
abdominal pain
↓
if not given for sometime, symptoms disappear

undiagnosed episodes of nausea, vomiting, diarrhea, abdominal pain

↓

gradual deterioration of health

⇒ SEVERITY always exacerbation of severement of symptoms occurs when the suspected food is taken

&

in b/w the periods patient is completely healthy.

⇒ DETECTION can be detected in urine, blood, vomit

⇒ gastric lavage is not done in chronic poisoning.

⇒ DEAD

① Hx ② Examination ③ Investigation

① Hx: (circumstances in which poison was given or taken)

① was there any Hx of purchase of the poison by victim or not.

② was there any Hx of quarrel

③ any financial worries

② Autopsy / PM examination :

① SMELL most of poisons emit diff. types of smells.

e.g. organophosphorus → garlicy smell / kerosene like smell

potassium cyanide → bitter almond like smell
↓ deadly
bitter taste

H_2S → rotten egg like smell

alcohol → sweetish smell

paraldehyde → fishy smell

when the Dr. enters the mortuary where the body is lying, immediately he can feel that smell...
(especially on opening the body)

② ORIFICES

mouth, rectum, vagina... all these should be checked...
some poison may be detected.

③ FROTH (v. common symptom of poisoning)

↳ any poison which affects resp. tract, secretions ↑
↓
mucus ↑
↓
come out of mouth & nose

④ PM lividity → discoloration of skin after death

body after death fixed position mein pari rahay

Normal colour of lividity is bluish purple
(CO_2 ki wajah sai)

usually develops in 3-4 hrs after death

In poisonous cases, colour changes

e.g. opiate poisoning → black
phosphorus " → yellowish
cyanide " → pink
CO " → bright red

⇒ Internal examination:

① Smell

② - Changes in resp. tract
" GI tract ... ulceration
⇒ Stomach contents → sent to lab for examination

Colour of mucous membranes changes

usually acids ... greyish color then becomes black
nitric acid → orangish color

⇒ Chemical analysis:

Presence / detection of poison in the parenchyma of the organs of deceased

is

the MOST ROBUST INVESTIGATION THAT CONFIRMS THE DIAGNOSIS

Duties of Doctor In Case Of Poisoning

① **Preliminary Particulars:** ~v. imp~ (must be noted by the doctor)

- Name
- Age
- Sex
- Address
- Brought by whom
- Date & time of examination of victim/dead

② **Treat the patient** PRIVATE CLINIC

→ if came alive, & the Dr. is certain that it is suicidal/ accidental poisoning
↓
not required to inform the authorities (i.e. the police/ magistrate)
↓
(can treat)

↓ BUT AGAR POLICE → AA KAI POOCH LAI/ MAGISTRATE BULAI. THEN THE DR. HAS TO TELL

BUT "PROPER RECORD KEEPING"
+
"COLLECTION OF SAMPLES" (urine, stool, blood, stomach wash, vomit)
↓
for chemical examination.

jo us ki presence mein paas ho ghai sa na le hai aaj

→ if it is confirmed that it is a case of homicidal poisoning
↓
then the duty of the Dr. is to inform the police

Scanned with CamScanner

phir zyada tar doctors treat ni kartay

refer to tertiary care hospital for treatment

bcuz it becomes a police case

⇒ if the patient is dying

duty of Dr. is to record the

DYING DECLARATION

what the patient says about his cause of death, circumstances of his death

جس زبان میں کہے بیان
↳ note کریں

sealed & sent to the magistrate or police

⇒ if death occurs,

don't issue

DEATH CERTIFICATE

⇒ after the PM examination, if confirm report comes from lab ...

then cause of death "issued"

duty of Dr. is to inform police / magistrate.

⇒ IN PUBLIC HOSPITAL

each & every case
(suicide / homicide / accidental)
↓
police is informed,
to come & investigate & treat...

Usually
emergencies ko treat
kar letay... & police aa kar
investigations karti...

Law Sections:

① 284 PPC

Negligent conduct w.r.t. poisonous substance
(لاپرواہی)
↓
in storage of poison; may pose danger to human life
public ko expose

6 months imprisonment ~~with~~ OR fine
OR BOTH

② 336A PPC

Hurt caused by corrosive substance
↓
eg. acid throwing

~~LIFE~~
IMPRISONMENT
OR

336 B PPC → Punishment

14 years imprisonment & 1 million fine

② 337-J PPC

Causing hurt by mean of poison (disease/death/injury)

اس کی سزا الگ

poison دینے کی سزا

10 yrs. imprisonment