

TOXICOLOGY

PLANT POISONS

1.ABRUS PRECATORIUS

Identification: Seeds are scarlet coloured with black spot at one end.

Toxic principles:

- Abrin - toxalbumin
- Abrine - amino acid
- Abaline - glycoside
- Haemagglutinin - lipolytic enzyme

Action:

- Toxalbumin - cytotoxin

Inhibit assembling of AA into proteins



Inhibit protein synthesis by ribosomes



Severe cytotoxic effects in multiple organ systems



Destruction of cells, especially red cells & causes hemolysis & hemorrhage





Signs & symptoms

- GIT : GI irritation
N,V abd pain, diarrhoea
Prostrations, rectal bleeding
- CVS : circulatory collapse, weak & rapid pulse, hemorrhagic tendency
- CNS :convulsions
- Hepato renal : failure
- Local injection: local inflammation, viper bite like

TREATMENT

1. Gastric lavage
2. Activated charcoal
3. Sodium bicarbonate
4. ANTIABARIN
5. 5% glucose saline iv
6. Symptomatic Tx

MLI :

- Animal poison - sui
- Accidental poison- children
- Suicidal & homicidal
- Abortifacient
- Arrow poison

FATAL DOSE : 90- 120 mg powdered seed (1-2 seeds)

FATAL PERIOD : 3- 5 days



2. RICINUS COMMUNIS / castor seeds

- Smooth oval, mottled with light & dark brown markings

Toxic principle :

Ricin - toxalbumin

MOA :

Ricin - ribosome inactivating protein

↓
Prevent the assembling of various amino acids into proteins

↓
Block protein synthesis in the cell

- Toxin enters the ribosome of endoplasmic reticulum of GI cells & damage causes severe diarrhoea
- Agglutination of red cells lead to hemorrhage.



Signs & symptoms :

- On ingestion - burning sensation in mouth, oesophagus & stomach
- Thirst, salivation, nausea , vomiting, bloody diarrhoea, abdominal pain
- Muscular cramps, drowsiness, delirium, convulsions, coma, death.
- Hepato renal failure with jaundice, uraemia
- Hemorrhage so in internal organs
- Dust of seed - allergic conjunctivitis, sneezing, headache, allergic asthma

Treatment :

- Gastric lavage - warm water/ KMnO_4
- Demulcents
- Sodium bicarbonate
- Glucose saline iv
- Blood transfusion
- Symptomatic treatment

PM appearance

- stomach & intestinal mucosa - Hemorrhagic inflammation
- Stomach - seed particles
- All internal organs - congested

CROTON TIGLIUM

Active principles

Croton seed contain :

- Crotin - toxalbumin
- Crotonoside

croton oil contain :

- Crotonoleic acid
- Methyl crotonic acid

Signs & symptoms :

- On ingestion - hot burning pain from mouth to stomach
- Salivation, vomiting, abdominal pain, watery diarrhoea
- Vertigo, prostration
- Circulatory collapse, death
- Jaundice, renal failure

Treatment :

- Stomach wash- warm water/ KMnO_4
- Demulcents
- Sodium bicarbonate
- Glucose saline iv
- Symptomatic treatment

MLI

- Accidental ingestion of seed
- Homicide & suicide - rare
- Root/oil - abortifacient
- Oil - arrow poison, vesicant

PM appearance :

- Inflammation & necrosis of GI mucosa
- Fatty changes in liver
- Jaundice
- Cloudy swelling of kidney
- All internal organs congested & edematous





Calotropis

Active principles :

- Calotropin
- Calotoxin
- Calactin
- Gigatin
- Usharin

Signs & symptoms :

- Milky juice of plant - madar juice : Local irritation
Inflammation
Vesication
- On ingestion - burning pain from mouth to esophagus
Salivation
Abdominal pain, nausea, vomiting, diarrhoea
- Dilated pupils
- Tetanic convulsions
- Circulatory collapse
- Coma & death
- Arrhythmia & A-V block

Treatment :

- Stomach wash with warm water
- Demulcents
- Glucose saline iv
- Symptomatic management

MLI

- Abortion stick - quakes
- Infanticide - juice
- Artificial bruise
- Arrow poison
- Cattle poison
- snake repellent- root



SEMICARPUS ANACARDIUM

Active principles:

- Semecarpol
- Bhilawanol

Signs & symptoms

- Juice contact with skin: irritation, inflammation, blisters
- Ingestion- burning pain from mouth to oesophagus & stomach
- GI irritation, vomiting, diarrhoea
- Dyspnea, cyanosis, fall of BP
- Delirium, coma, death

Treatment:

- Skin - wash with soap & water
- Demulcent drink
- Activated charcoal
- Iv fluids
- Symptomatic management

PM appearance

- Erythema & blisters at angles of mouth & lips
- Inflammation & blister formation in pharynx & oesophagus
- Stomach mucosa- congested
- All other internal organs - congested

ML aspects

- Quackery medicine
- Abortifacient
- Artificial bruise - false charge
- Sexual jealousy - vitriolage
- Rarely - homicide & suicide

Fatal dose : 6 - 8 seeds

Fatal period : 12 to 24hrs



CERBERA ODOLLAM

Active principles:

- Cerberin
- Cerberocide
- Odollin
- Odolotoxin

Signs & symptoms

- GI irritation- nausea, vomiting, abdominal pain, diarrhoea
- General weakness, blurring of vision, respiratory distress
- Hyperkalaemia
- ECG : AV block, SA block
combination of AV & SA block
ventricular arrhythmia
atrial fibrillation
Atrial tachycardia
Sinus bradycardia

Treatment:

- Stomach wash
- Atropine 0.5mg iv every 15-30 min
- Propranolol 1 mg iv
- Correct Hyperkalaemia
- Digoxin immune Fab - specific antidote

MLI

- Suicide- common - grinded seed kernel mix with honey or sugar
- Homicide - powdered seed add to alcohol
- Accidental - mistaken as unripe mango
- Purgative



Nerium odorum

Active principles

- Nerin
- Oleandrin
- Odorin

Action

- Digitalis like action
- Inhibit $\text{Na}^+\text{-K}^+$ ATPase
- All plant parts are poisonous
- Oleandromycin - antibiotic- extracted



Signs & symptoms

- Nausea, vomiting, dysphagia, frothy salivation, abdominal pain, diarrhoea
- Atrial & ventricular fibrillation, A-V block, BP fall, cardiac failure
- Headache, dizziness, ataxia, muscular twitching, tetanic convulsions, drowsiness, coma

Treatment

- Stomach wash
- Sodium molar lactate solution, atropine & propranolol 1mg iv
- Atropine 1mg, adrenaline 2cc, 2mg nor adrenaline in 5% glucose as iv
- Digoxin immune Fab
- Symptomatic management



ACONITE ROOT

Root is conical with wringling & dark brown in colour

Toxic principles:

- Aconitine
- Aconine
- Pseudoaconitine
- Mesoaconitine
- Indaconitine

MOA : neurotoxic & cardiotoxic

Open tetrodotoxin sensitive Na⁺ channel



Increase influx of Na⁺ & delays repolarisation



Increase excitability of skeletal muscles & smooth muscles



Ventricular arrhythmia

- 1st stimulate sensory nerves → tingling
- then depress → numbness

Signs & symptoms

- Skin contact : tingling & numbness
- Ingestion : bitter sweet taste
 - Burning sensation from mouth to stomach
 - Tingling of mouth, tongue & lips
 - Then numbness & anaesthesia
 - Salivation, nausea, vomiting, diarrhoea
 - Severe thirst & dysphagia
- CVS : ventricular arrhythmia
- ECG : nodal rhythm
 - Ventricular tachycardia
 - Multiple ectopics
 - A-V block

- CNS : impairment of hearing, vision
Loss of speech
Tingling & numbness spread all over body
Convulsions
- Muscular system: weakness of muscles, muscular spasm & twitching
- Eye : Hippus → pupils show alternate constriction & dilatation
- Resp : shallow, deep & laboured
- Death due to ventricular fibrillation, cardiac or respiratory failure

FATAL DOSE : 1gm of root

FATAL PERIOD : 45 min - 24 hr

Treatment :

- Stomach wash with warm water & then with KMnO_4
- Milk or activated charcoal
- Atropine - 1-2mg
- Digoxin
- Airway should be maintained
- iv fluids & oxygen inhalation
- Hemoperfusion

Ideal homicidal poison

- Cheap & easy availability
- Lethal dose small & fatal period less
- Extremely unstable - Cannot be detected in usual chemical tests
- Bitter sweet taste can be masked by mixing it with pan or drink
- Accidental poison - mistaken as horse radish
- Abortifacient
- Cattle poison
- Arrow poison



DATURA

Active principles

- Atropine
- Hyoscine
- Hyoscyamine

Action

- First stimulate the higher centres of brain, then the motor centres & finally cause depression & paralysis of vital centres of medulla.
- Stimulation of respiration & then depression

Differences between datura & chilli seeds

Datura seed	Chilli seed
Dark brown	Pale yellow
Comparatively larger	Smaller
Double edged	Singled edge
Kidney-shaped	Round shaped
Embryo is '9' shaped	Embryo '6' shaped
No smell	Pungent smell



Datura seed



Capsicum seed

Signs & symptoms

- Dryness of mouth, burning pain in stomach
- Dysarthria
- Dysphagia
- Dry hot skin
- Dilatation of cutaneous vessels
- Dilatation of pupil- corn picker's pupil
- Diplopia, temporary blindness
- Dysuria
- Drunken gait
- Delirium- muttering , pillrolling movements
- Drowsiness leading to coma, death
- Diminished bowel movement & constipation
- Distention of urinary bladder due to urinary retention

Treatment

- Stomach wash
- Physostigmine 0.5 mg iv or im hourly
- Pilocarpine nitrate 5 mg s/c
- Sedatives for delirium
- Diazepam for convulsion
- Supportive measures : to maintain airway
iv fluids
Catheter for urinary retention
Tepid sponging to control hyperthermia

PM appearance

- Froth at nostrils
- All internal organs congested & edematous
- Stomach mucosa - seed particles stuck

MLI

Road poison or railway poison

STRICHNOS NUX VOMICA

MOA :

- Glycine - inhibitory neurotransmitter in post synaptic

Prevent the effect of glycine in the post synaptic receptor of spinal cord



Excitation (particularly in anterior horn cells)



Spasm of muscles

Signs & symptoms :

- Conscious seizure
- Twitching of muscles of face, neck, trunk, extremities
- Followed by tetanic convulsions
- Face : cyanosed, anxious look, eye balls will be prominent & pupils dilated
- Risus sardonicus - contraction of jaw muscles & facial muscles
- Opisthotonus - contraction of paravertebral muscles
- Emprosthotonus - spasm of abdominal muscles
- Pleurosthotonus - body bent to the sides
- Convulsions persist for half to 2 min
- In between convulsions, muscles completely relaxed
- After 5-15 min next convulsion occur
- Breathing hindered- due to spasms of diaphragm & thoracic muscles
- Cyanosis, hypoxia
- Lactic acidosis, rhabdomyolysis, renal failure

Differential diagnosis : tetanus

Differences Between Strychnine Poisoning and Tetanus

Trait	Strychnine poisoning	Tetanus
1. History	No history of injury, history of poisoning present	History of injury
2. Onset	Sudden	Gradual
3. Site of action	Postsynaptic membrane	Presynaptic membrane
4. Lower jaw (risus sardonicus)	Not affected early	Starts with risus sardonicus
5. Muscles affected	All muscles are affected at a time	All the muscles are not affected at a time
6. Muscular condition	Completely relaxed between the convulsions	No relaxation of muscles in between the convulsions
7. Fatal period	1 to 2 hrs	More than 24 hrs
8. Chemical analysis	Strychnine is found	No poison is found
9. Culture	No growth	<i>Clostridium tetani</i> are found

Treatment :

- Transfer the patient to dark room
- Diazepam or barbiturates iv
Pentobarbital sodium 0.3-0.6 gm iv
- Stomach wash
- Animal charcoal
- Symptomatic treatment
- Tracheostomy

PM appearance :

- Rigor mortis - appear early, passes off slowly
- Signs of hypoxia
- Stomach mucosa - congested
- Internal organs- congested & edematous
- Strychnine detected even in decomposed bodies



Opium

1. Phenanthrene derivatives

- . Morphine
- . Codeine
- . Thebaine
- . Heroin or brown sugar and diacetylmorphine their synthetic derivatives

2. Benzylisoquinoline derivatives

- . Papaverine
- . Narcotine

All the above are derivatives of opium called opiates.

There are certain drugs which are not derivatives of opium but have similar action. They are called opioids, e.g. pethidine, methadone, pentazocine, fentanyl etc.

Action :

Act at 4 receptors

- 1) μ 1&2 - analgesia, miosis, respiratory depression, euphoria
- 2) κ 1&2 - analgesia, miosis, dysphoria
- 3) δ - supraspinal analgesia
- 4) OFQ/N

- These receptors contain endorphins (inhibitory peptide)
- The opioids inhibit endorphins & activate these receptors
- 1st stimulate & then depress the CNS

Opium poisoning *(to remember easily)*

Stage of excitement: Euphoria, restlessness, talkativeness.

Stage of stupor: Headache, drowsiness, sleep, constricted pupil.

Stage of coma: Respiratory depression, Cheyne-stokes respiration, hypotension, hypothermia, absence of reflexes, constricted pupil, irregular pulse.

Premortal dilation of pupil, respiratory failure, death.

Differential Diagnosis

1. Intracranial hemorrhage: Cerebrovascular accidents and brain trauma.

2. Poisoning: Alcohol, barbiturates, benzodiazepine, carbolic acid, carbon monoxide and organophosphates.

3. Metabolic conditions: Diabetic and uremic coma.

4. CNS infections: Meningitis, encephalitis, encephalopathy and cerebral malaria.

5. Others: Epileptic and hysterical coma, and heat hyperpyrexia.

Treatment

- Naloxone 2 mg iv repeatedly every 20-30 min — physiological antidote
Alternative : Naltrexone & Nalfemene
- Airway should be maintained & endotracheal intubation
- Stomach wash
- Magnesium sulphate 20 gm - to keep the bowel clear
- Activated charcoal
- Symptomatic treatment

PM appearance

- Face - cyanosed
- Froth at mouth & nostrils
- PM staining- black
- Smell of opium on opening the viscera
- Trachea & bronchi, brain - congested & edematous
- Stomach- small soft brownish lump of opium

Morphinism/ morphinomania

- Dry skin with puncture marks
- Masked by tattooing
- Abscess & thrombosed vein
- Pigmentation & scars in front of elbow - railroad tracks

ANIMAL POISONING



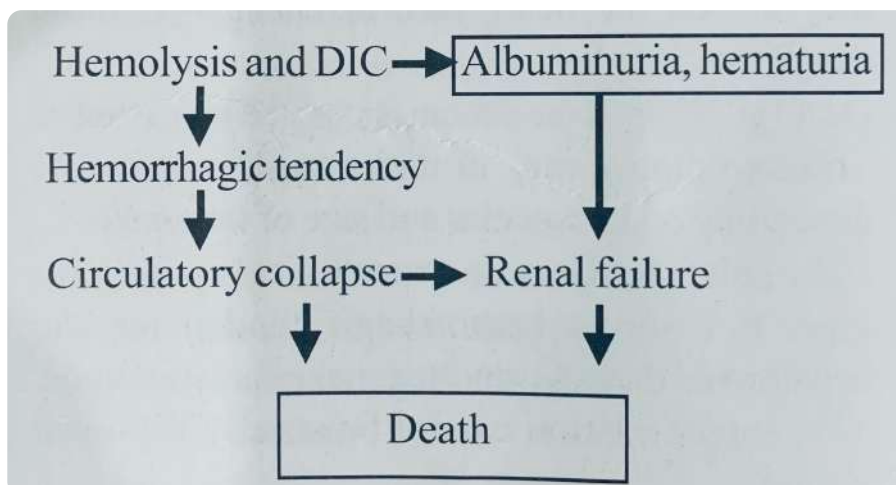
1. RUSSELLS VIPER

Identification :

- Flat triangular head with a 'V' mark
- Head scales : small
- On the back : 3 rows of brown diamond shaped marks with black rings around.
- 2 Fangs - canalised
- Broad undivided scales on the belly
- Caudal scales divided into 2 rows
- Viviparous

Venom - Hemotoxic

- 1) Phospholipase-A,B,C & D - hydrolysis of lipids & causes lysis of RBC
- 2) Hyaluronidase
- 3) Lecithinase - act on lipid layer of endothelium by producing lysolecithin & Help in increase of fragility & permeability for leakage of blood cells & plasma into ECS
- 5) Protease - trypsin like action - tissue damage
Destruction of fibrinogen - anticoagulant effect
Local changes - edema, bruising, blistering, necrosis
- 5) Cytolysin
- 6) Proteinase
- 7) Histamine - lysis of platelets, increase vascular permeability
- 8) Thromboplastin
- 9) 5- hydroxytryptamine - pain



Treatment :

Low dose infusion therapy:

- 10 vials ASV stat as infusion over 30 min
- Followed by 2 vial every 2 hr as infusion in 100ml normal saline till clotting time normalizes

High dose intermittent bolus therapy :

- 10 vials ASV stat as infusion over 30 min
- 6 vials 6 hourly as bolus therapy by infusion till clotting time normalizes.

First aid

Do's:

- Assure the patient & avoid exertion
- Immobilization of bitten limb with a splint or sling
- Limb should be kept below the level of heart.
(Do not elevate the limb)
- Let the wound ooze out
- Pressure immobilization technique

Do nots :

- Do not incise the wound
- Do not try to suck out the venom
- Do not apply a tourniquet
- Do not apply ice or alcohol
- Cryotherapy is not advised
- Do not wash

Diagnosis :

- History
- Clinical manifestations
- Identification of reptile
- Bleeding time & clotting time
- 20-min whole blood clotting time(WBCT)



2.COBRA

Identification :

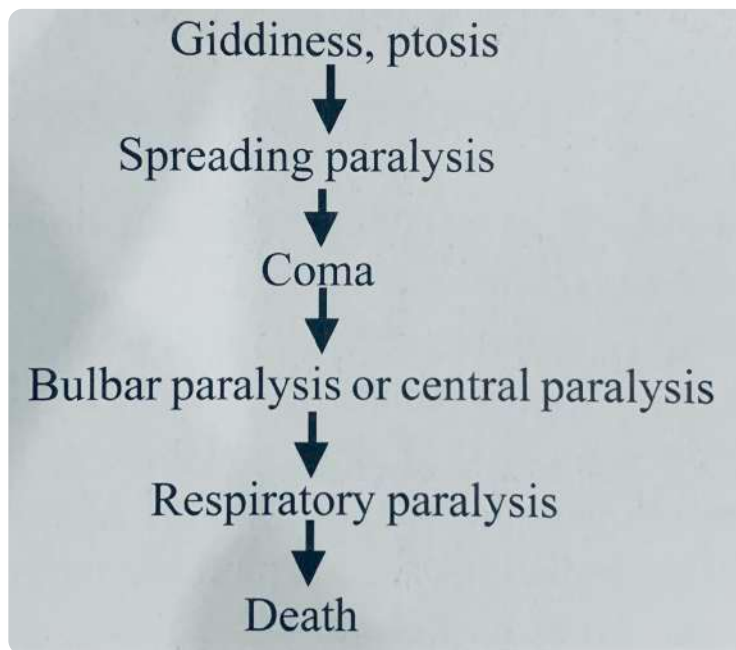
- Hood
- Dorsum of hood - spectacle/ monocle mark
- White band - b/w hood & body
- 2 poisonous fangs - grooved
- Head scale - 3rd supralabial scale large & touches nasal plate
- Belly scale - single upto genital pore & doubles thereafter
- Elapidae

Venom - predominantly neurotoxic & slightly hemotoxic

- Neurotoxin - curare like effect & paralysis
direct action on cardiac & respiration centre
- Cardiotoxin - direct effect on heart
- Cholinesterase - hydrolysis of AChE → Impair neuromuscular transmission
- Phospholipase -A - destroy phospholipid in nervous tissue Alter NM conduction
- Hyaluronidase - break tissue barriers → Help in spreading venom
- Protease
- Histamine

Signs & symptoms

- Local reaction minimal
- No swelling
- Slight radiating pain —————> Numbness due to paralysis of nerve
- Sleepy, weakness of legs, reluctant to stand or move
- Weakness increase —————> Spastic paralysis of lower limbs
- Paralysis spread to trunk & head
- Extra ocular muscles weakness , strabismus, ptosis, ataxia
- Difficulty in speech & swallowing
- Respiration become slower & heart rate increases
- Coma



Treatment:

- ASV 10 vials stat as infusion over 30 min
- 2nd dose - 10 vials after 1 hour
- Repeat till symptoms subside

Krait

Identification :

- Steel blue or black in colour
- Single or double white bands across the back & has creamy white belly
- Bands extend upto tip of tail
- Head - large scales & 4 infra labial shields
- 4th infra labial shield - largest
- Plates under belly & tail are not divided
- Central row of large hexagonal scales on back

Venom - neurotoxic

- Constituents similar to cobra venom

Signs & symptoms :

- Resemble cobra bite
- But, there will be no swelling or pain at the site of bite
- Feeling of drowsiness & intoxication are more intense

Treatment:

- ASV 10 vials stat as infusion over 30 min
- 2nd dose - 10 vials after 1 hour
- Repeat till symptoms subside

Non poisonous snakes :

- Rat snake
- Indian rock python
- Tree snake
- Golden tree snake
- Green vine snake
- Blind snake
- Sand boa







Scorpion

Identification :

- 8 legged arthropod
- End part of tail has a bulbous projection which contain 2 poisonous glands & a sting

Venom- hemotoxic & neurotoxic

- Neurotoxin
- Hemolysin
- Agglutinin
- Hemorrhagin
- Coagulin
- Proteinases
- Lecithinase



Signs and symptoms of scorpion bite

Neurotoxic

Parasthesia, anesthesia



Weakness, paralysis



Muscular spasm, cramps



Convulsions, coma



Respiratory paralysis



Death

Hemotoxic

Swelling at site



Hemolysis, fever



Hematuria, aneuria



DIC



Renal failure



Myocarditis



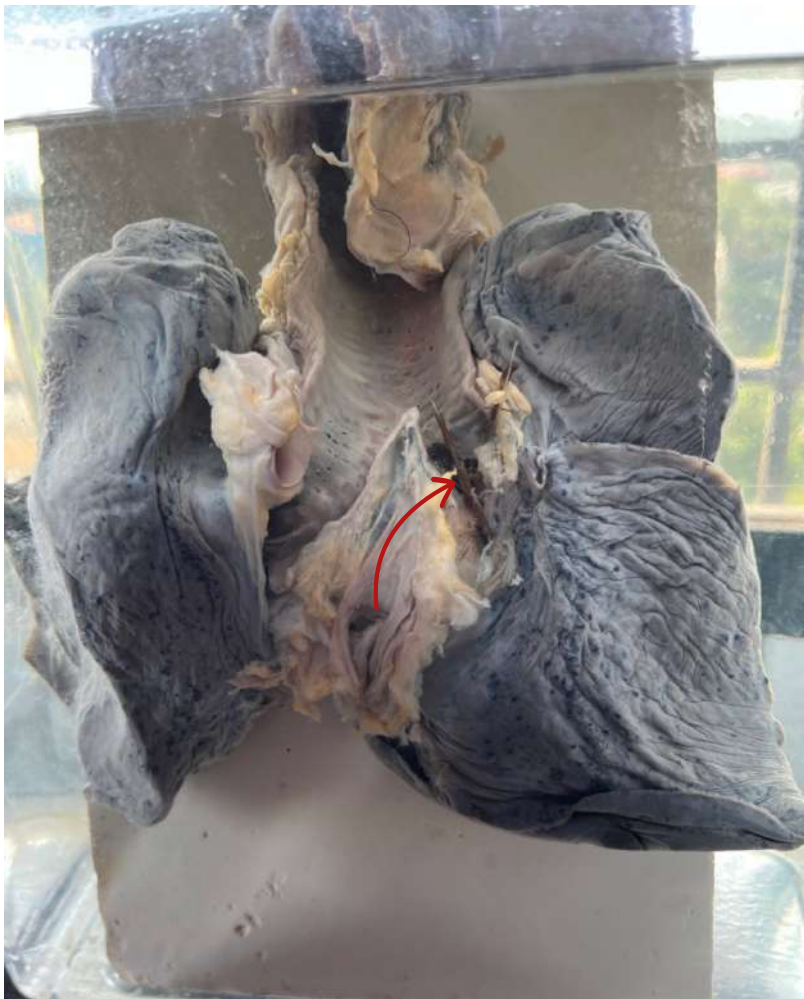
Treatment:

- Wash the area with soap & water
- If specific anti venom available it should be given.
- Calcium gluconate iv
- Atropine - to reduce pulmonary edema
- Prazosine - to block ca^{+} ion influx
- Symptomatic treatment

PM finding:

- Affected site - swollen
- Pulmonary edema
- Heart & brain - petechiae
- All the internal organs congested





Foreign body in air passage

Types of Drowning

I. Wet Drowning (Typical drowning)

- a) Fresh water drowning
- b) Salt water drowning

II. Atypical Drowning

- a) Dry Drowning
- b) Immersion Syndrome
- c) Secondary Drowning
- d) Submersion of the unconscious (Shallow water drowning)

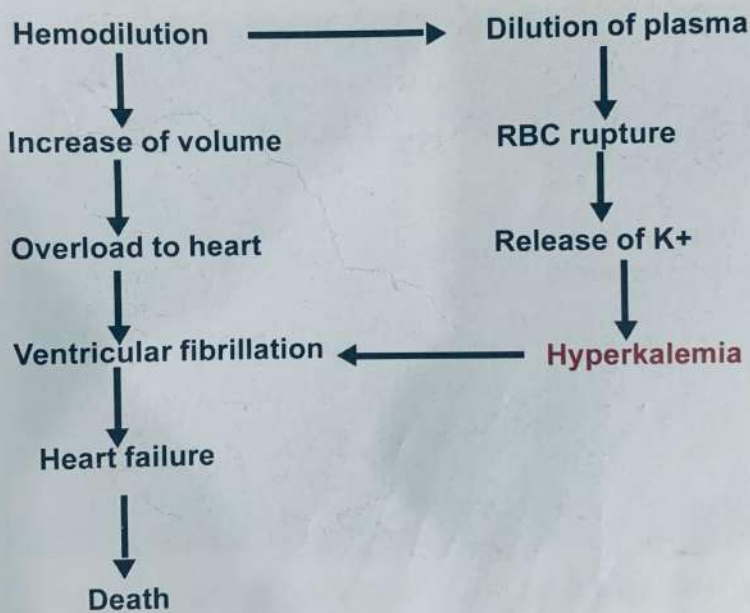
Features of antemortem drowning

Differences Between Drowning and Postmortem Submersion

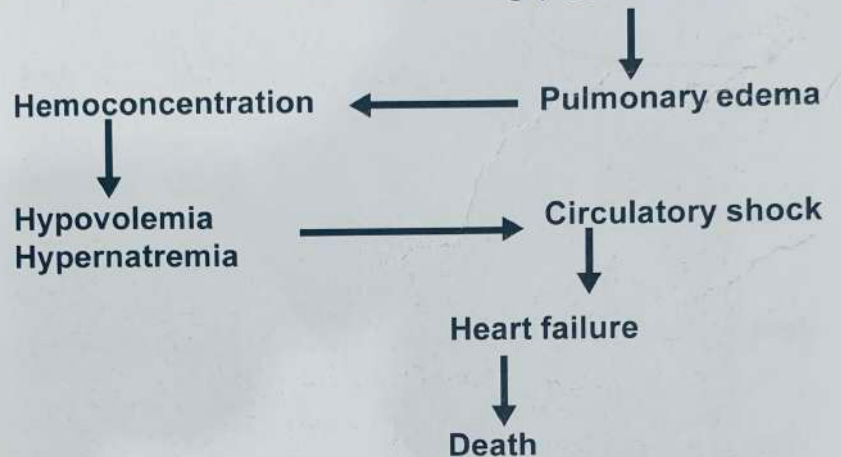
Characteristics	Drowning	Postmortem submersion
1. Froth over mouth and nostrils	Copious amount of leathery fine froth	Absent
2. Cadaveric spasm	Cadaveric spasm, weed particles in hand	Absent
3. Air passages	Weed, Mud or sand	Absent
4. Lungs	Congested edematous, ballooned up and crepitant	Congested or pale
5. Mud, weed in stomach	May be present	Absent
6. Diatom test, Gettler's test	Positive	Negative
7. Injuries	Consistent with a fall into the well or pond or river	Injuries not consistent
8. Other signs	Water seen in the middle ear, sphenoid and ethmoid air cells	Not present

Mechanism

Fresh water Drowning (Hypotonic)



Salt water drowning (Hypertonic)



Differentiate Between Lungs in Fresh Water and Sea Water Drowning

Characteristics	Fresh water drowning	Salt water drowning
1. Size and weight	Ballooned up, light weight	Edematous, heavy
2. Color	Pinkish	Purplish or bluish
3. Consistency	Emphysematous (emphysema aquosum)	Water logged lung (edema aquosum)
4. Shape on placing on the table	Shape is retained	Lung flattens out
5. Cut section	Froth, little fluid	More fluid, little froth
6. Crepitus	Crepitus felt	No crepitus

PM finding

External:

- Clothes - wet
- Face & eye congested
- Postmortem staining - face, shoulder & front of upper part of chest
- Fine white leathery froth at nostrils & mouth in copious amount
- Cutis anserina
- Cadaveric spasm - weed particles, leaves etc firmly grasped
- Washerwoman's hand & feet - bleaching & soddening

Internal :

- Lungs
- Foreign body in trachea & bronchi
- Water content in stomach
- Ueno's sign
- Sveshnikov sign
- Brain - SAH

Fracture of alae of thyroid - Manual strangulation



Mechanism

Antero posterior compression force

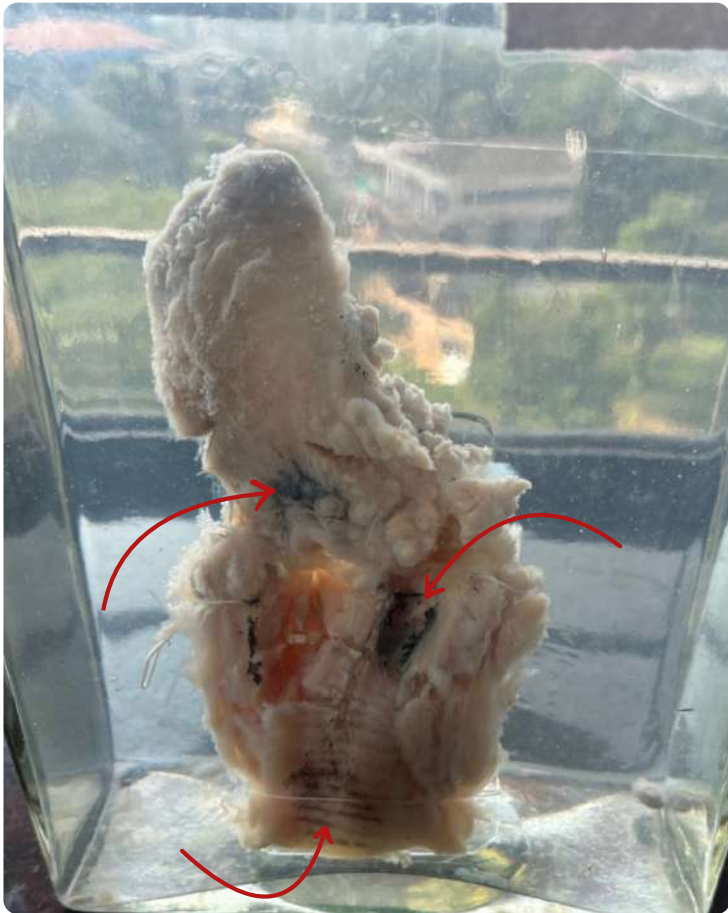
Traction force

Inward compression force

Burns & soot particles in Respiratory passages

Features of antemortem burning :

- Vital reaction at the burnt margins
 - Soot particles in the trachea & bronchi
 - Cherry red discolouration to blood
 - Line of redness present
 - Blisters contain leukocytes
 - Increased enzymes reaction in peripheral zone.
-
- Heat hematoma
 - Burn V/s scald



Differences between Heat Rupture and Lacerated wound

Feature	Heat Rupture	Lacerated Wound
1. Cause	Exposure to heat	Blunt force
2. Site	Fleshy areas and extensor surfaces	Anywhere
3. Vessels and nerves	Intact and stretching across the floor	Torn
4. Infiltration and bruising at the margins	Absent	Present
5. Bleeding or clotted blood	Absent	May be present

Differences Between Antemortem and Postmortem Burns

Feature	Ante-mortem burns	Post-mortem burns
1. Line of redness	Present	Absent
2. Blister	Contain leukocytes	Contain no leukocytes
3. Vital reaction	Cellular infiltration present	Absent
4. Enzyme	Peripheral zone shows increased enzyme reaction; <u>leucine amino-peptidase</u> detected by 2 hrs, <u>acid phosphatase</u> by 3 hrs and <u>esterases</u> by 3 – 4 hrs	Peripheral zone does not show increase in enzyme reaction
5. Color of blood	Cherry red due to COHb	No cherry-red color
6. Soot particles	Present in trachea and bronchi	Absent
7. Evidence of fat embolism	May be seen	Absent



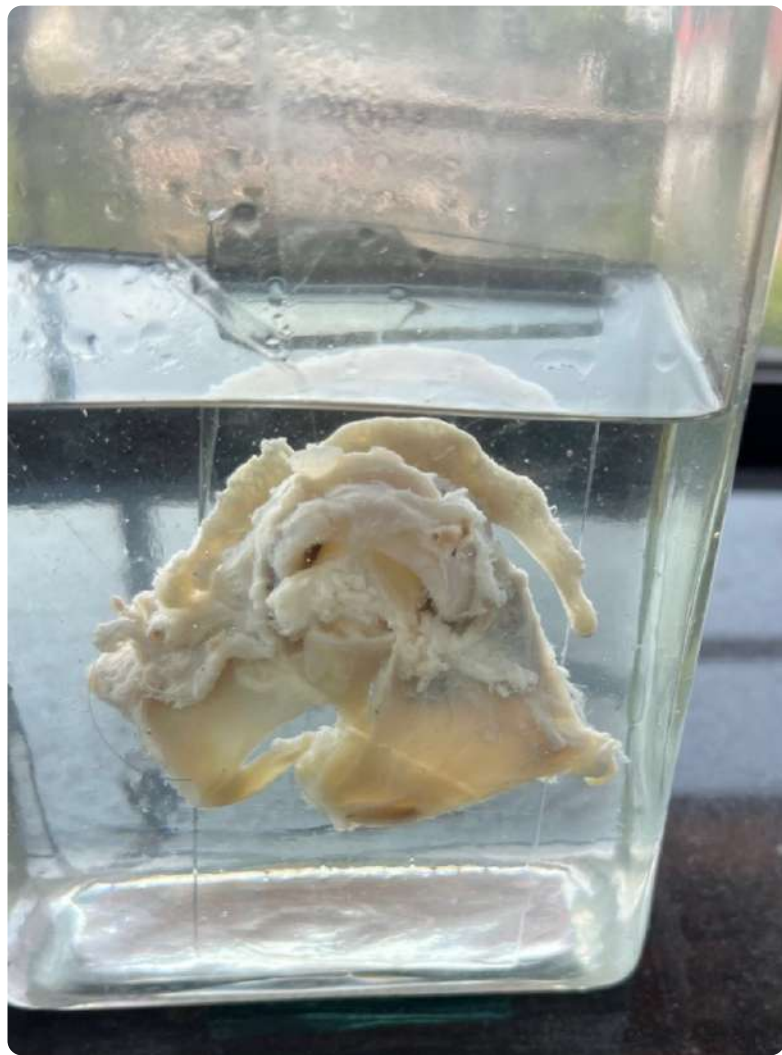
Joule burn

- The electric burn at the point of entry of electricity
- Mechanism :
The current when pass through skin, produces heat which causes heating of tissue which is called endogenous burns.

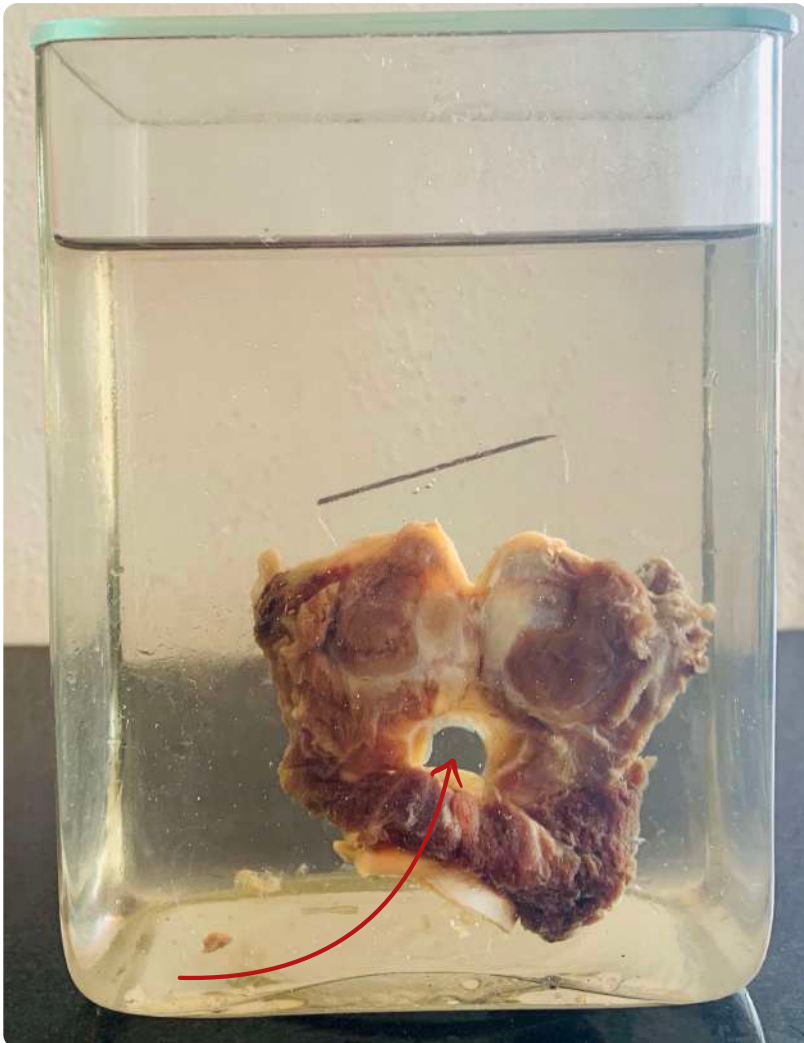
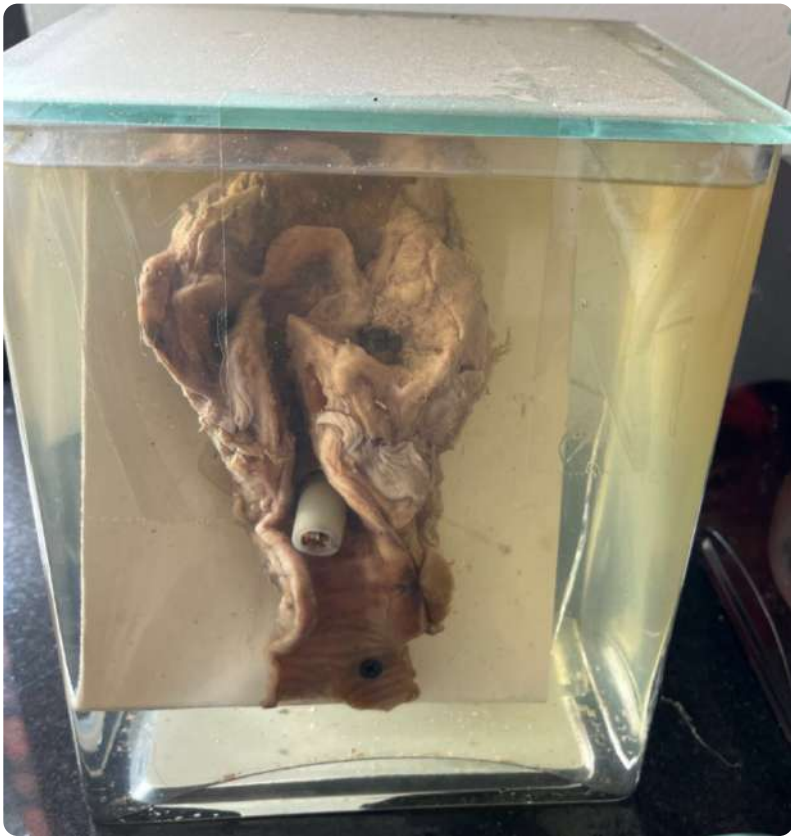


Stab wound

Hyoid & thyroid fractures



Tracheostomy tube





Pyelonephritis

Aorta

Aortic aneurysm:

1) saccular

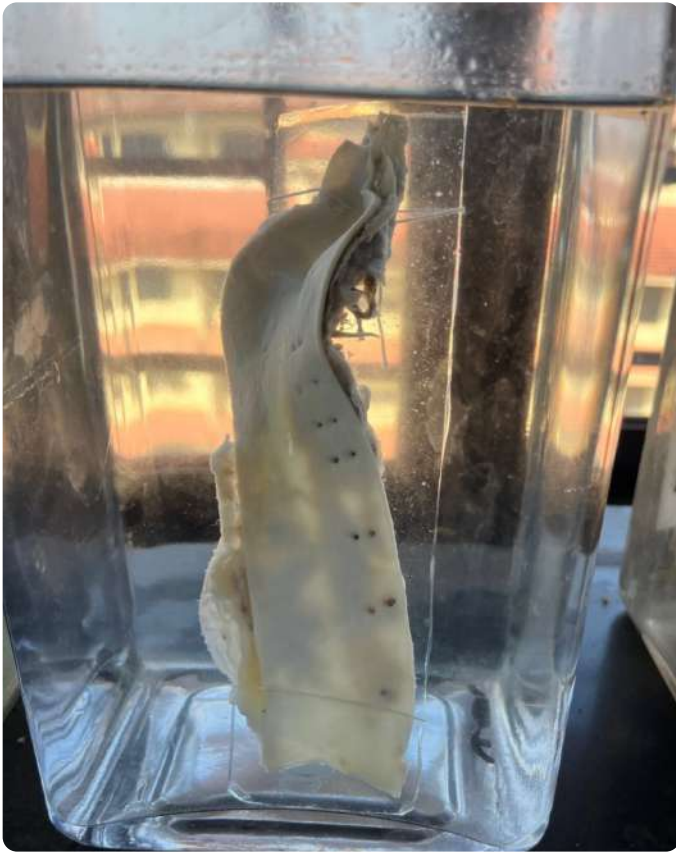
- Seen in : syphilitic aortic aneurysm
- Location : ascending, arch or descending aorta

2) fusiform

- Seen in : Atheromatous aneurysm
- Location : abdominal aorta

3) dissecting

- Seen in in association with :
 - coarctation of aorta
 - Marfan's syndrome
 - lathyrism
 - hypertension
- Location: ascending aorta



Atheromatous calcified aorta





Cardiac (LV) hypertrophy & mural thrombus

- Seen in : hypertension
Valvular disease

Mechanism

Coronary atherosclerosis



Thickening of coronary arteries & narrowing of lumen



Reduced blood supply to myocardium



Hypertrophy



Occluded Left Anterior Descending artery

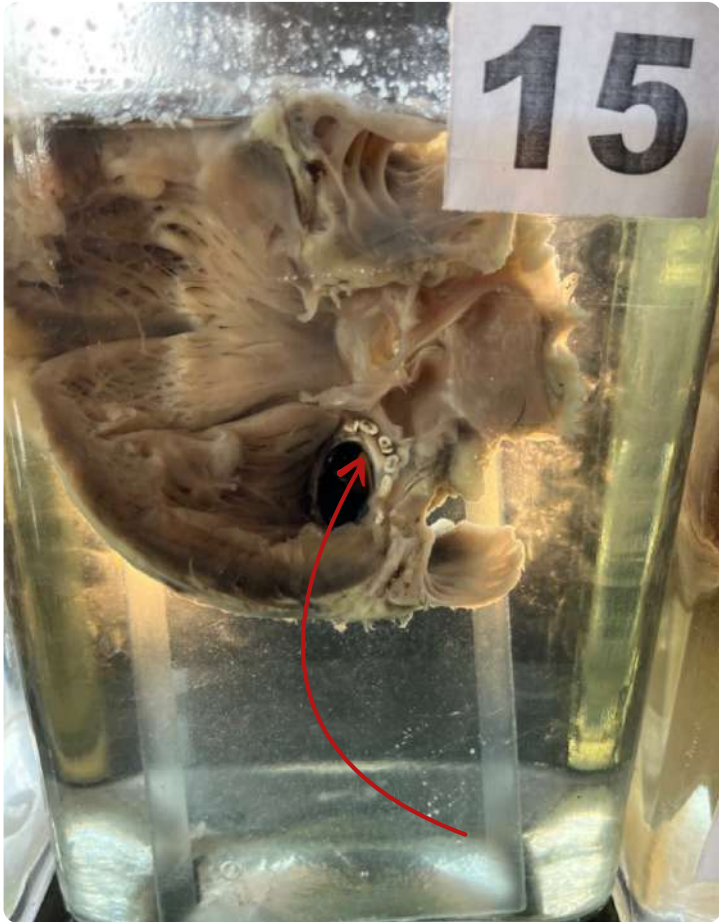
- Most commonly involved in coronary atherosclerosis
- Occlusion- Leads to MI
- Infarction of anterior & apical portion of LV & adjacent interventricular septum

Fibrosis of heart



Heart fibrosis & mural thrombus

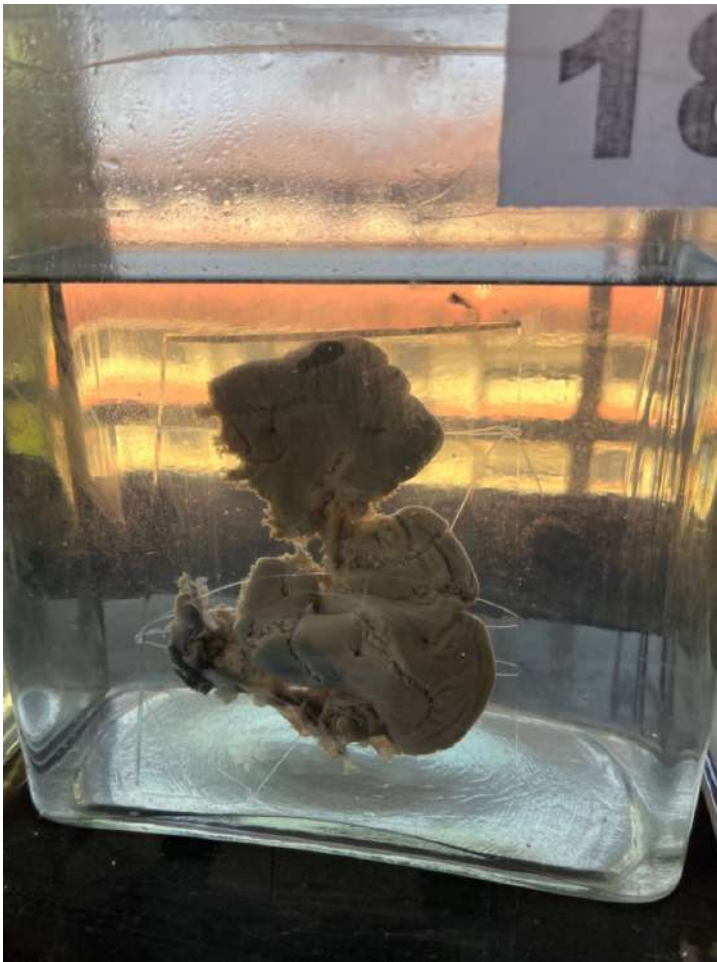




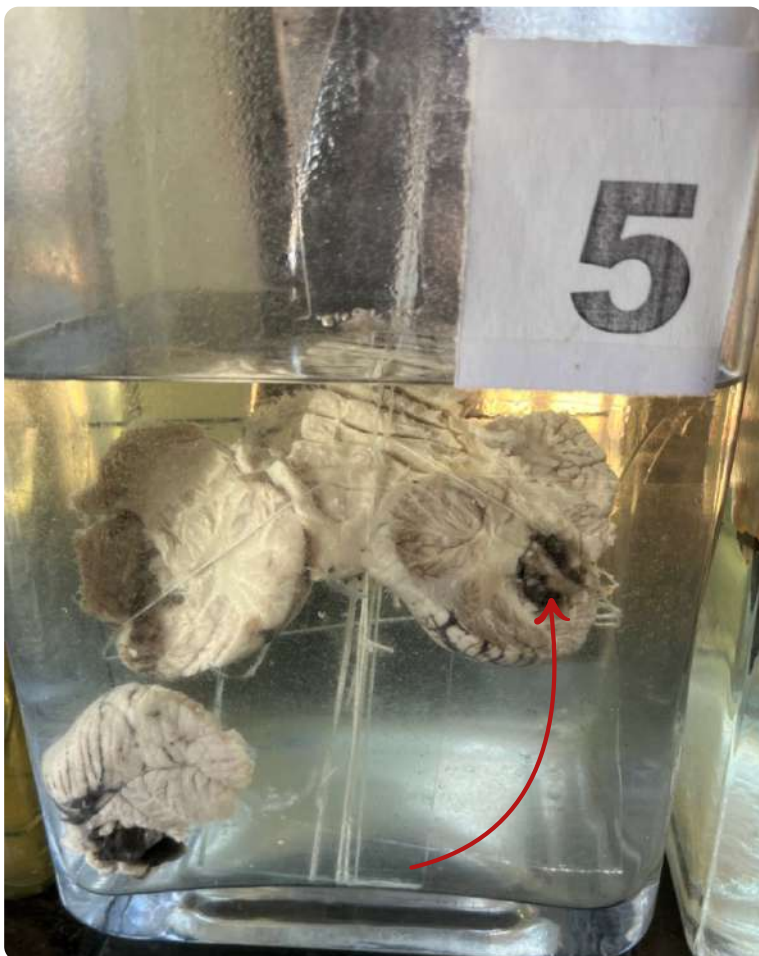
Prosthetic valve



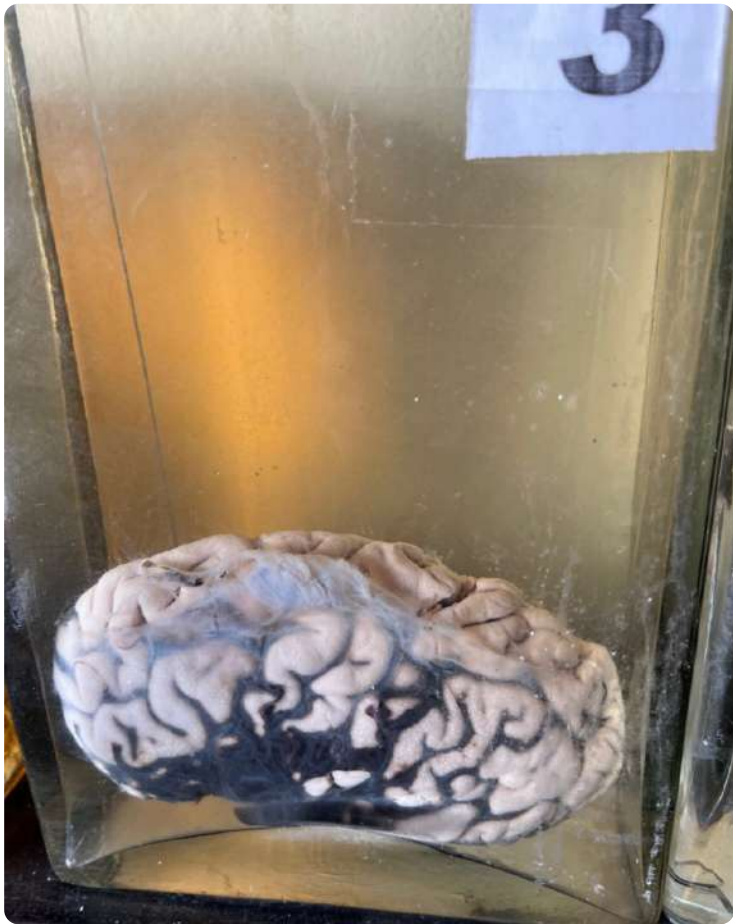
**Aneurysmal sac in
the left ventricle**



Lacerated spleen



Intra cerebellar haemorrhage



Basal Subarachnoid hemorrhage

- Most common traumatic Intracranial hemorrhage
- Most commonly involved vessel

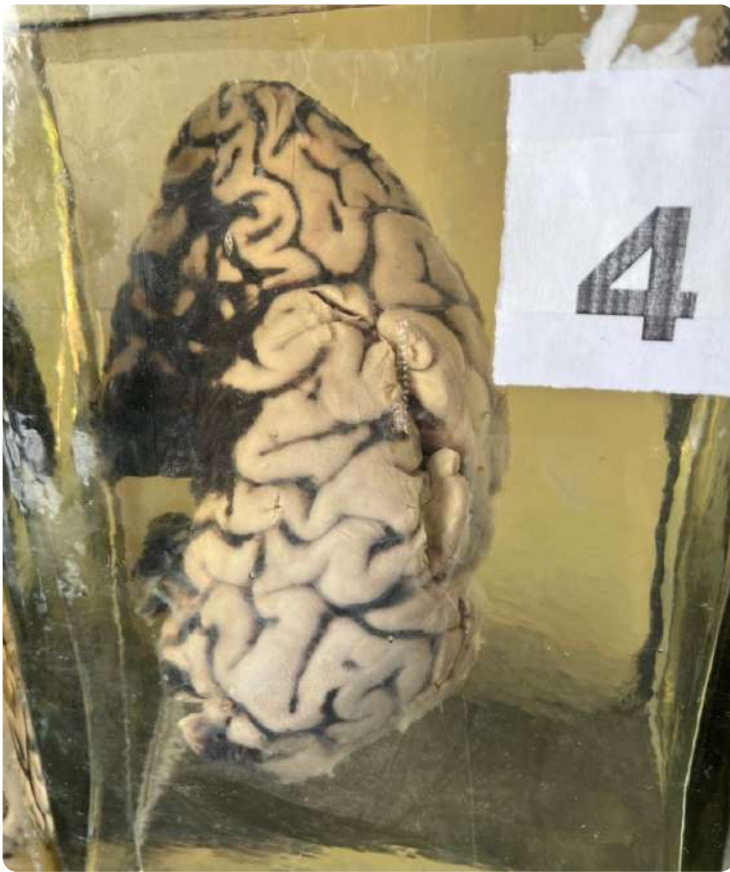
Causes :

Traumatic

- 1) leakage of vessels on the surface of brain
- 2) leakage from intracerebral hemorrhage to SA space
- 3) injury to vertebral artery in trauma to neck
- 4) traumatic asphyxia, strangulation, drowning
- 5) associated with lacerations & contusions of brain in head injury

Natural

- 1) rupture of berry aneurysm located in circle of Willis
- 2) A-V malformations, angioma
- 3) blood dyscrasias, leukemia, sickle cell anemia
- 4) anticoagulant therapy
- 5) malignant hypertension & arteriosclerosis in old age



Sub dural & sub arachnoid hemorrhage

Clinical features :

- Sudden onset of severe unusual headache - thunderclap headache
- Nausea, vomiting
- Neck stiffness, photophobia, drowsiness, agitation
- Disturbance of consciousness
- Meningism & kernig's sign - positive

Diagnosis :

CT scan - no shape, diffuse

Situation: focal, diffuse or bilateral

Not a space occupying - no distortion of brain surface

Lumbar puncture - CSF stained with blood - Xanthochromia



Intracerebral hemorrhage

Causes :

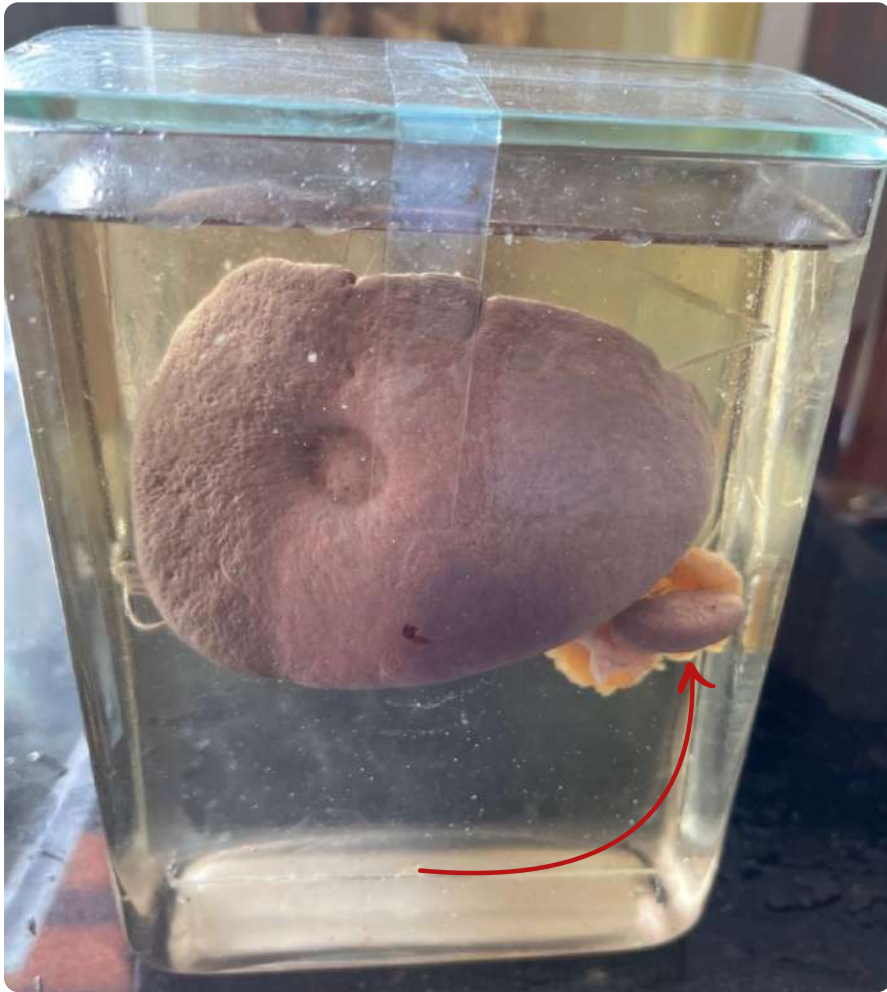
Natural

- Capillary hemorrhages seen in :
 - Blood dyscrasias
 - Fat/air embolism
 - DIC
 - Anticoagulant therapy
- spontaneous rupture of charcot's artery [lenticulostriate branch of middle cerebral artery] in :
 - Hypertension
 - Arteriosclerosis in old age
 - Eclampsia of pregnancy
- Angioma, tumors of brain & cerebral malaria
- Drugs of abuse - cocaine & Amphetamine

Traumatic

- Associated with laceration of brain
- Blunt injury head with or without skull fracture in :
 - Traffic accidents
 - Fall from height
 - Blows on head
- Rupture of branches of anterior choroid artery due to blow on vertex

Accessory spleen



Lacerated spleen





Micro nodular liver



Micro nodular liver



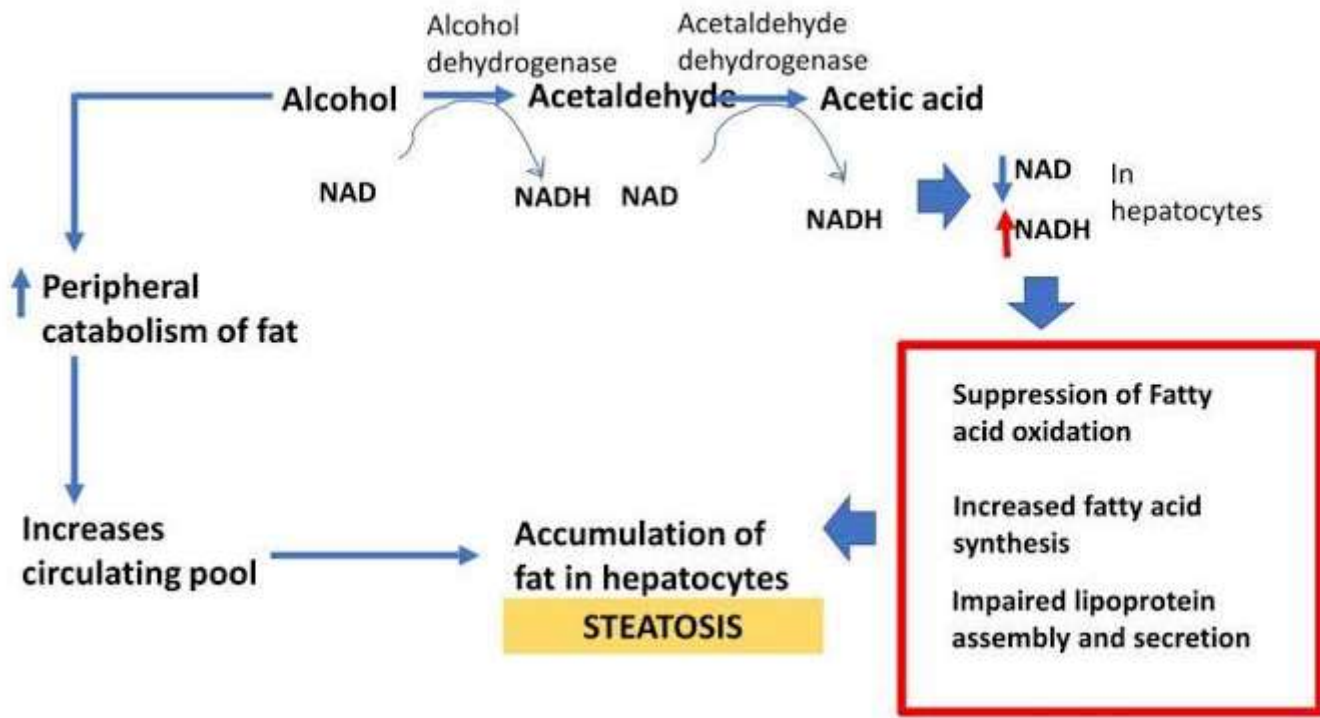
Macro nodular liver cirrhosis



Lacerated liver

Alcoholic fatty liver / cirrhotic liver

Pathophysiology:



Causes of death

Following are the causes of alcohol related deaths^{11,12}

- Cirrhosis
- Fatty liver
- Hepatic failure
- Ruptured esophageal varices
- Alcoholic cardiomyopathy
- Pancreatitis

Pathology:

Mallory Denk bodies



Foetus showing ossification centres

- Calcaneum - 5 months
- Talus - 7 months
- Cuboid - 9 months

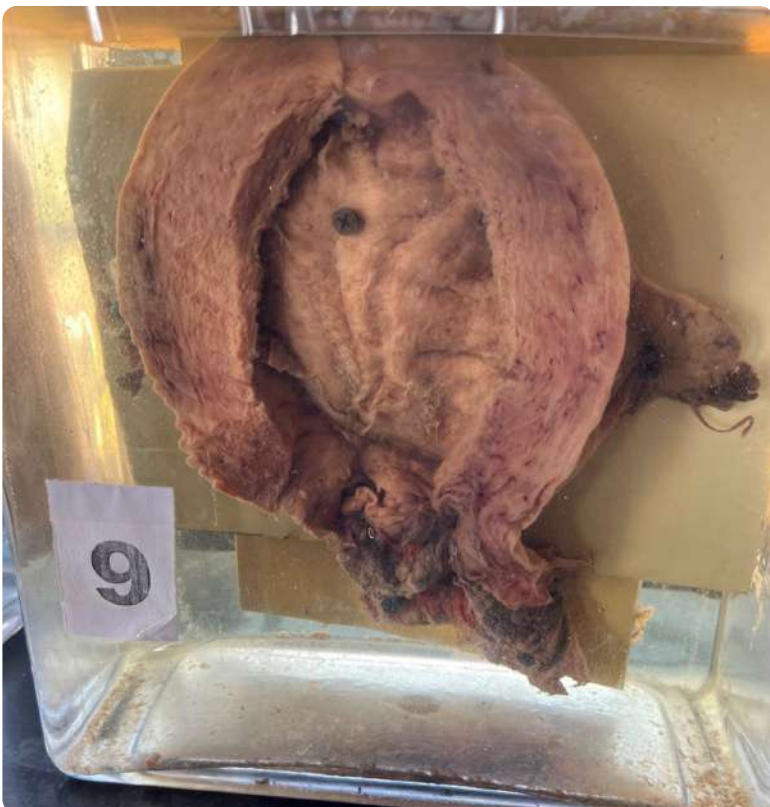
Gestational age = 9 months



Retained placenta & umbilical cord with uterus



Adenomyoma



Multi gravid uterus



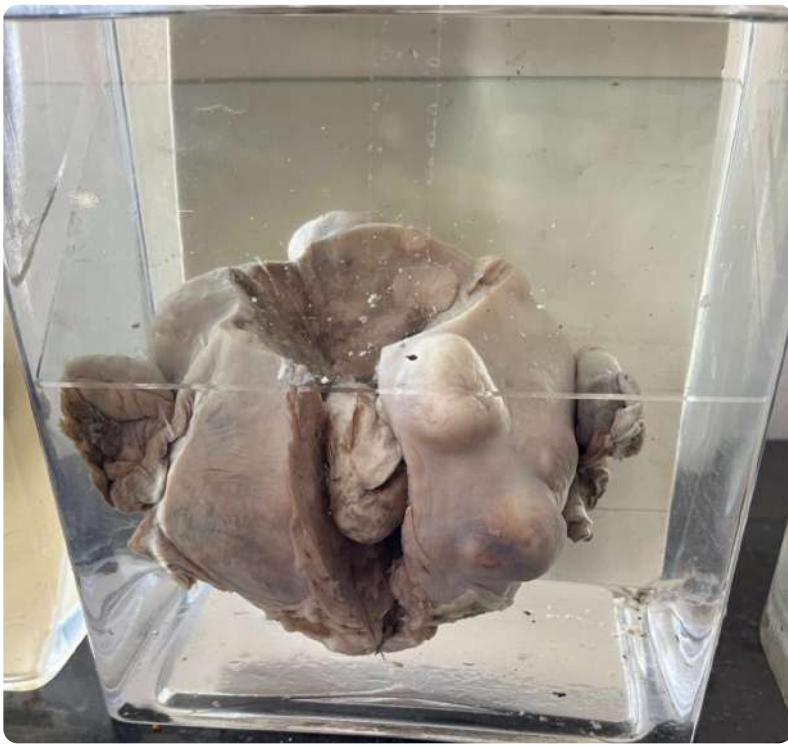
Cu- T

- Abortifacients used by quacks
- MTP indications
- i pill components
- criminal abortion complications



Ectopic pregnancy (tubal pregnancy) rupture

- Causes



Fibroid uterus

MECHANICAL INJURIES



Hesitation cuts

- Multiple superficial parallel incised cuts
- MLI : self inflicted

Light sharp cutting weapons

Indicates hesitant mind of

suicide

Indicate direction of cut



Multiple superficial incised wound
due to sharp edged weapon

- Features of incised wound
- Margins - clean cut & well defined
- Width of wound > thickness of blade
- Length > width & depth
- Depth - variable [deeper at beginning & shallower at end]
- Hemorrhage - more



Chop wound

Incised wound by heavy cutting weapon like chopper, sword.

Features

- Margins- infiltrated with blood
- Depth - almost same throughout the wound
- Bone underneath usually cut
- Tangential cut - bevelling of margin [homicidal]



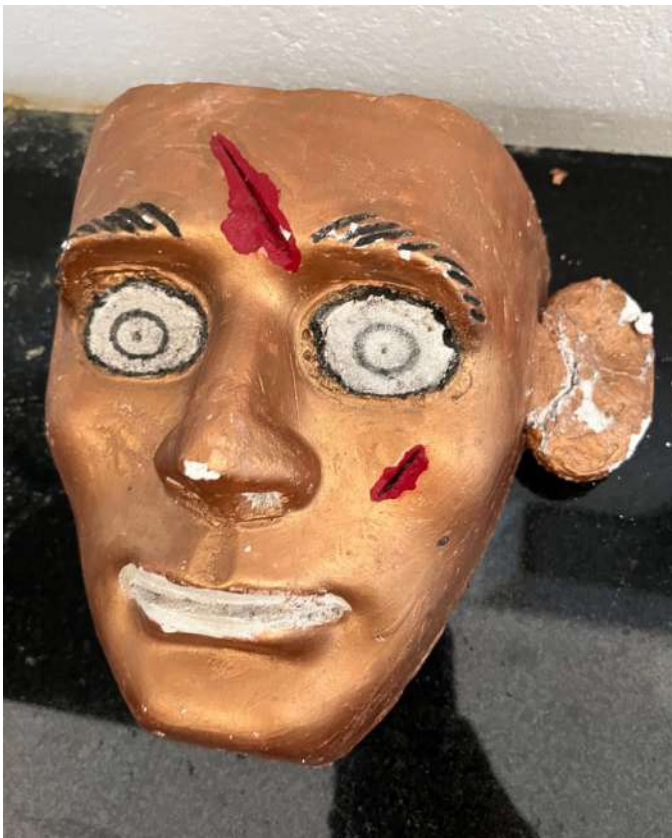
Circular penetrating lacerated bullet entry wound

Abrasion collar present

No burning, blackening or tattooing seen => distant shot



Lacerated wound in scalp



Incised wound on the forehead & the cheek

ASPHYXIA

Hanging
pressure abrasion of ligature

Strangulation

Oblique pressure abrasion of
ligature





Smothering

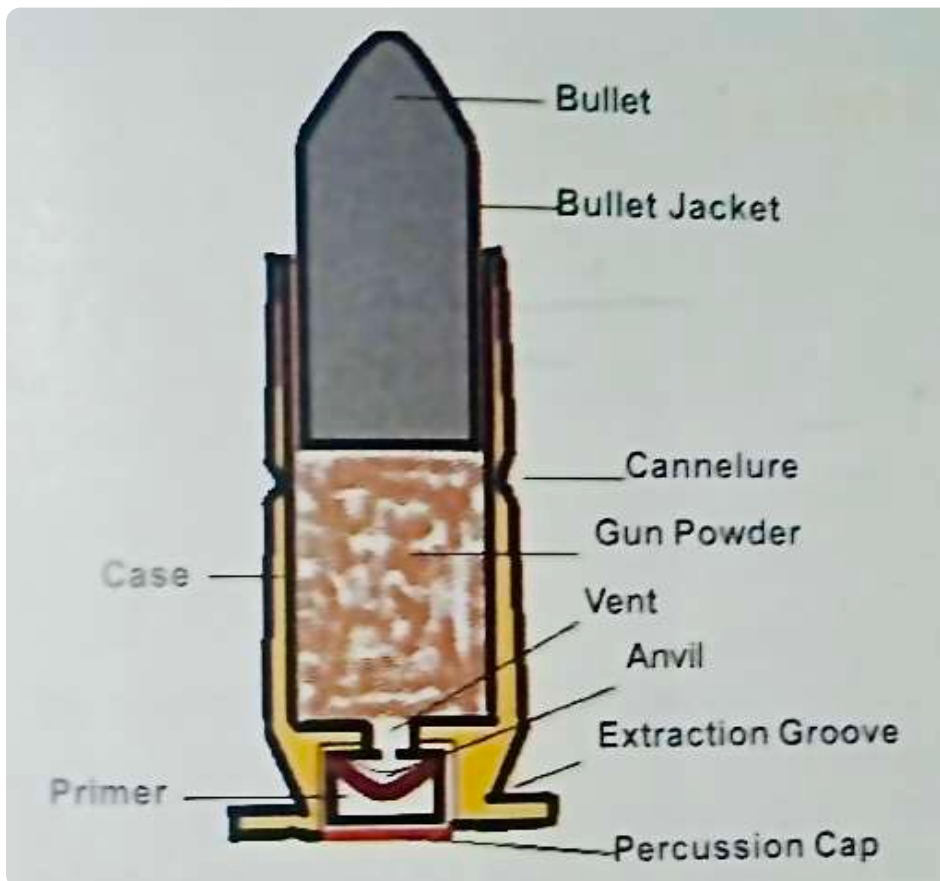
Multiple circular contusions
around mouth

Multiple curvilinear abrasions
around mouth

Subconjunctival Haemorrhage

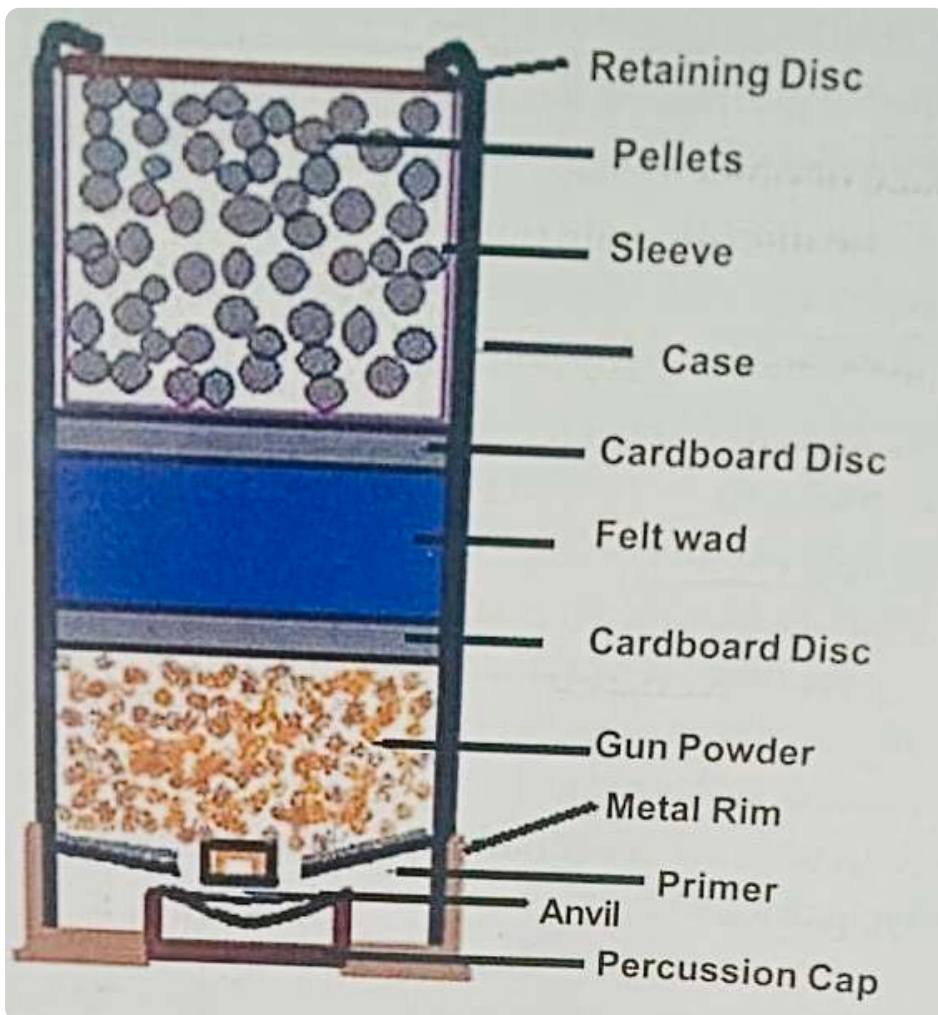
WEAPONS

Bullet of rifled firearm





Shot gun cartridge





1. ROPE

Type of Weapon : Patterned and Twisted nylon rope.

Criminal Uses : Strangulation
Hanging
Garroting
Auto-Erotic Asphyxia

Ligature Mark - Patterned.
Pressure Abrasion

Ante Mortem

Parchmentised

Margin-contusion

SC Hemorrhage & Contusion

Post Mortem

Not Parchmentised

No contusion

Not present







Hand axe

Type of weapon: Heavy cutting with sharp edge

Parts :

Toe end

Head end

Handle

Type of injuries :

Chop wood

Fractures of bone

Features of chop wound :

- Incised wound with contused margin
- Deep & wedge shaped
- Usually lower end (heel) of the axe touches the body first - deeper wound

11.AXE

Type of Weapon: "Heavy cutting" weapon with sharp edge.

Type of Injuries:

- Chop Wound
- Fractures

Features of chop wound:

- Deep gaping wound with sharp margins.
- Abrasions and contusion around the wound.

Medico Legal Importance:

- 1. Suicidal - Rare
- Homicidal - Common
- Accidental - Not uncommon
- 2. A dimension of Wound corresponds to cross section of weapon.
- Dangerous weapon Sec. 326 IPC





Chopper

Type of weapon:

Heavy cutting with sharp edge



Rubber tapper's knife

Type of weapon :

Type of injuries :

Stab wound - boat shaped injury with a long horizontal limb & two small vertical limbs on either side.



Metallic rod

Hard & blunt, non flexible
Tram line contusion

2.IRON ROD

Type of Weapon:

"Long", "Blunt", moderately heavy patterned metallic weapon.

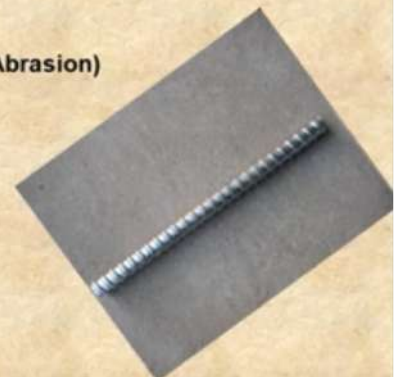
Types of Injuries:

- Patterned Abrasion (Impact Abrasion)
- Patterned Contusion
- Lacerations
- Fractures
- Lacerated Stab Wounds.

Nature of Weapon: Dangerous.

Medico Legal Importance:

- Accidental (Common)
- Homicidal
- Suicidal - Rare





Stone

Type of weapon :

Moderately heavy, hard & blunt

Types of injuries:

Contusion

Laceration

Fractures

Skull - depressed & comminuted fracture

Concussion

Intracranial hemorrhage



Hammer

Moderately heavy, hard & blunt

Head

Handle - metallic /wooden

Laceration

Fractures - signature fracture

Abrasion & contusion

10.HAMMER

Type of weapon: "Moderately heavy blunt weapon"

Types of Injuries:

- Contusions
- Lacerations
- Fractures
- Signature #



Significance of Signature Fracture:

- Type of depressed #
- Suggests type of weapon used and
- Size of fracture
- Corresponds with diameter of contact surface.

Nature of weapon: Dangerous U/s 326 IPC

Other Medico Legal Significance:

- Can suggest "Relative positions of assailant and victim."



Sickle

8.CYCLE CHAIN

- Type of weapon: Flexible patterned metallic chain.
- Type of Injuries:
 - Patterned (Imprint) Abrasions
 - Patterned contusions
 - Lacerations
 - Fractures
- Nature of Injuries:

• Homicidal (Common)	
• Strangulation	
• Assault Injuries	
• Suicidal	- Rare
• Accidental	- Uncommon
- Nature of Weapon: Dangerous







Kitchen knife

Type of weapon :

Light single edged sharp weapon

Type of injuries

Linear abrasion - with tip

Stab wound

Incised wound

Contusion - with handle







FIG. 13.12: Hard and blunt—moderately heavy



FIG. 13.15: Hard and blunt—smooth surface



FIG. 13.13: Hard and blunt—moderately heavy



FIG. 13.16: Hard and blunt—irregular surface



FIG. 13.14: Hard and blunt weapon—heavy (e.g. stone)



FIG. 13.17: Hard and blunt—flexible (e.g. rope)



FIG. 13.24: Sharp cutting edge (single) with pointed weapon



FIG. 13.18: Hard and blunt-non-flexible (e.g. rod)



FIG. 13.21: Sharp cutting weapons—moderately heavy



FIG. 13.25: Sharp cutting edges (double edged) with pointed weapon



FIG. 13.19: Various types of sharp cutting weapons



FIG. 13.22: Sharp cutting—heavy weapon



FIG. 13.26: Sharp cutting edge with pointed weapon



FIG. 13.27: Cutting edge with blunt end



Ossification of Bones

Bones	Appearance	Fusion
Upper Limb		
Shoulder		
Head of Humerus	1 st Year	Composite epiphysis forms at 6 years which fuses with the shaft at 16-18 years
Greater tuberosity	2 nd Year	
Lesser tuberosity	5 th Year	
Tip of Acromion and Coracoid process	14 years	
Medial end of clavicle	18-20 years	22-23 years
Elbow		
Capitulum	2 nd year	The capitulum, trochlea and lateral epicondyle fuse to form a composite epiphysis by 14 years which fuses with the shaft by 15-16 yrs
Trochlea	11 Years	
Lateral epicondyle	13 years	
Medial Epicondyle	5-8 years	
Head of radius	6 th Year	14-17 years
Proximal ulna (olecranon)	10 years	14-17 years
Wrist and Hand		
Distal ulna	6 th year	16-18 years
Distal Radius	2 nd Year	16-18 Years
Carpal Bones		
Capitate	1 st year	
Hamate	2 nd Year	
Triquetrum	3 rd Year	
Lunate	4 th Year	
Scaphoid	5 th Year	
Trapezium	6 th Year	
Trapezoid	7 th Year	
Pisiform	11 th year	
Metacarpals		
Head of metacarpals(2-5)	2-4 years	14-17 years
Base of 1 st Metacarpal	4 years	16 years
Bones of Lower Limbs		
Pelvis		
Head of femur	1 st year	15 years
Greater trochanter	4 th year	14-17 years
Lesser trochanter	11 years	14-17 years
Iliac crest	14 years	18 years
Ischio-pubic ramus		7-8 years
Tri-radiate cartilage	Obliterates by	11-14 years
Ischial Tuberosity	16 years	19 yrs (f), 21yrs(m)
Distal Femur	9 th Month of IUL	16-18 years
Calcaneum	5 th month of IUL	
Talus	7 th Month of IUL	
Cuboid	10 th month of IUL	