

DEFINITIONS IN FORENSIC MEDICINE

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Common Terminologies

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Forensic medicine :

- Application of medical knowledge to legal purposes, to aid the administration of justice.
- AKA state medicine/legal medicine.

medical jurisprudence :

Application of knowledge of law in the practice of medicine.

medical ethics :

- Set of moral principles.
- Guiding the members : Doctor-doctor/Doctor-patient/Doctor-state relationship.
- Self imposed conduct (National medical council).
- Violation is **punishable**.

medical etiquette :

Conventional laws of courtesy in dealing with colleagues.

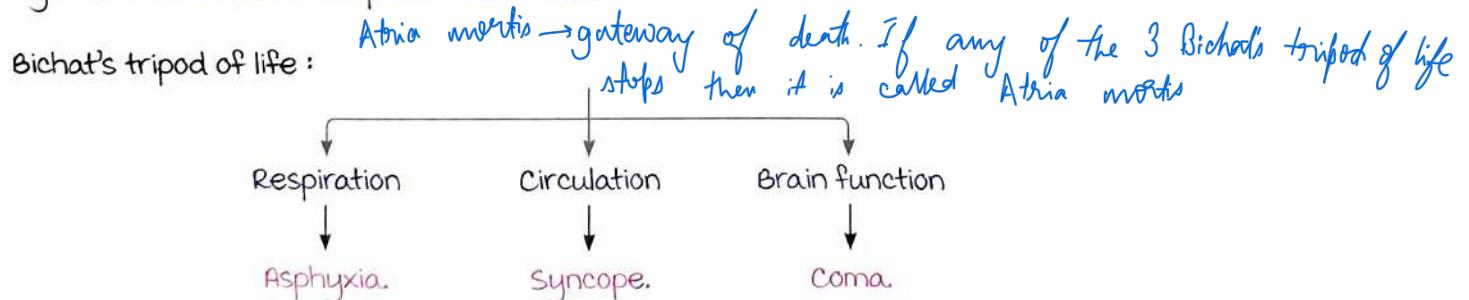
DEATH

Cause :

Any injury/disease resulting in death.

mode :

System that initiates the process of death.



manner :

How the death occurred.

- Natural.
- Homicidal.
- Accidental.
- Suicidal.
- Undetermined.

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Legal Procedures

New laws :

To come into force from July 1, 2024.

Indian Penal code (IPC) → Bharatiya Nyaya Sanhita (BNS).

- Describing offences/punishments.
- 358 sections.

Criminal Procedure Codes (CrPCs) → Bharatiya Nagarik Suraksha Sanhita (BNS).

- Describes procedure in cases of crime.
- 531 sections.

Indian Evidence Act (IEA) → Bharatiya Sakshya Adhiniyam (BSA).

- Admissibility of evidences/recording of evidences in court.
- 170 sections.

TYPES OF OFFENCES

Based on arrest :

Type	cognizable offence	Non-cognizable offence
Section	a(g) BNS	a(e) BNS
Procedure	Police can arrest without warrant from magistrate. eg : murder, dowry death, rape, dacoity.	Police cannot arrest without a warrant.

M D R D

Based on punishment :

Summons cases	Warrant cases
<ul style="list-style-type: none"> • Imprisonment < 2 years. • a(x) BNS. 	<ul style="list-style-type: none"> • Imprisonment > 2 years. • a(z) BNS.

Based on compromise :

Compoundable offence	Non-compoundable offence
<ul style="list-style-type: none"> • minor offences. • Victim can compromise with accused & drop the case. 	<ul style="list-style-type: none"> • Serious crimes. • No compromise permitted between victim and accused.

CIVIL AND CRIMINAL CASES

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Features	Civil cases	Criminal cases
Conditions	Dispute b/w two parties.	Life-threatening injury/assault.
Various terminologies	Plaintiff : Person filing complaint. Defendant : Person defending themselves.	Assailant : Person committing crime. Victim : Person suffering injury/assault. State/prosecution : Files the complaint. Defendant : Party who needs to defend.
Burden of proof (Onus of proof)	Plaintiff (Reasonable evidence).	Prosecutor (Beyond reasonable doubt).
Verdict	Compensation/direction.	Fine/imprisonment.

JUDICIAL AND EXECUTIVE MAGISTRATE

Non-judicial magistrate

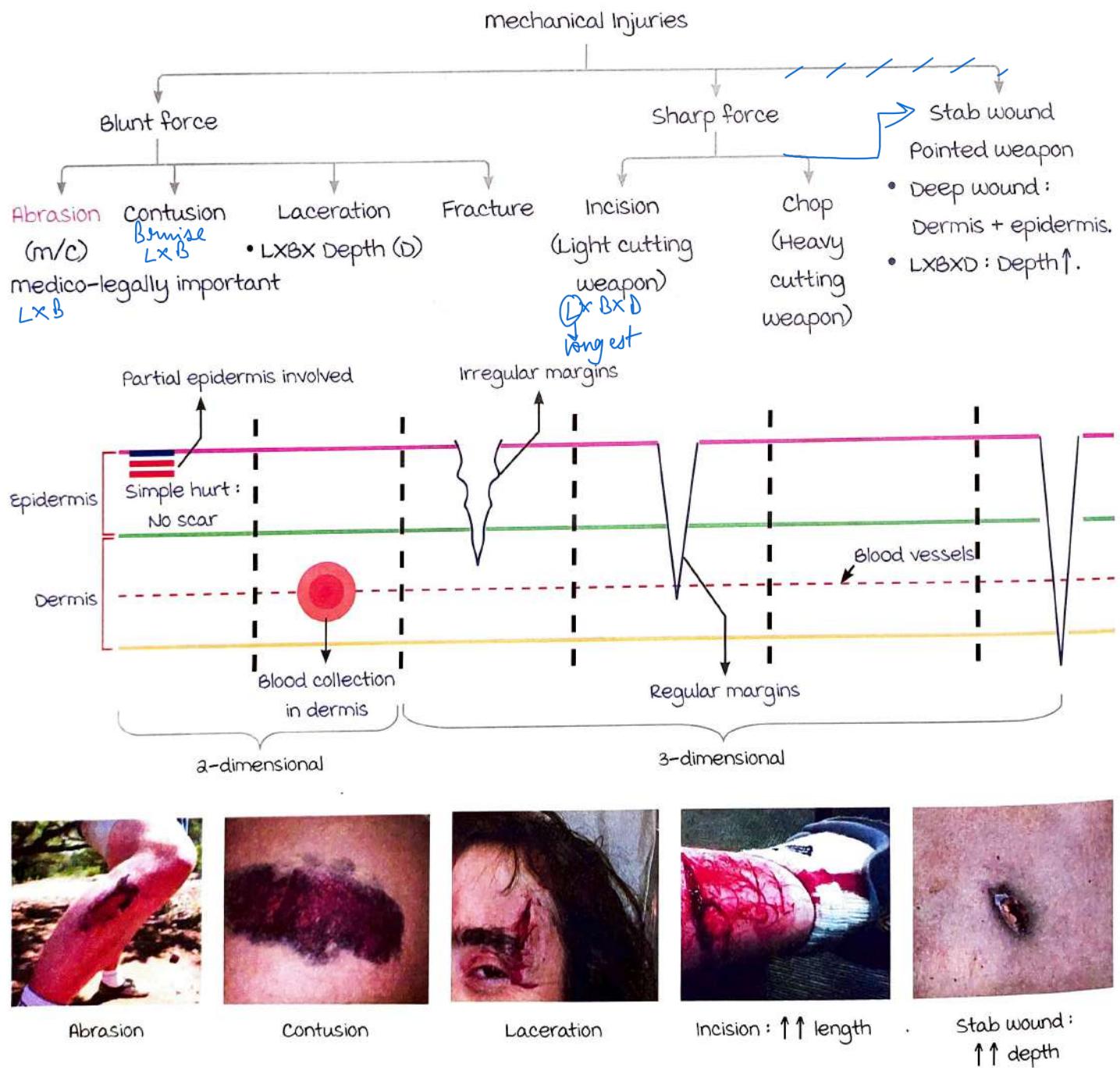
Type	Judicial magistrate (Jm)	Executive magistrate (Em)
Concerned department	Judiciary.	Administration.
Appointment	High court and state government.	State government.
Hierarchy	Chief Jm (Supervisory role). I st class Jm. II nd class Jm.	District magistrate (Dm)/ Additional Dm (Supervisory role). Subdivisional magistrate. Executive magistrate.
Function	Maintain court of law (Trial).	Maintain law and order in society.

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BLUNT TRAUMA INJURIES

Mechanical Injuries

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**Note :**

- Any wound that involves dermis will scar.
- Corneal abrasion is a grievous injury as it causes opacity (scarring) → Loss of vision.

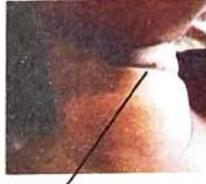
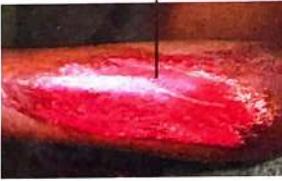
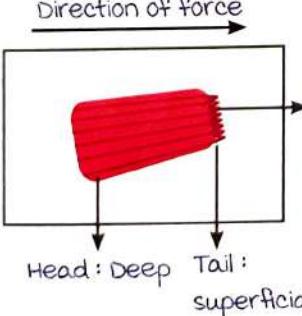
Abrasions → Only partial epidermis is involved, less bleeding

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- most medico-legally significant wound.
- 'Abrade': To scrape.

Types of abrasions:

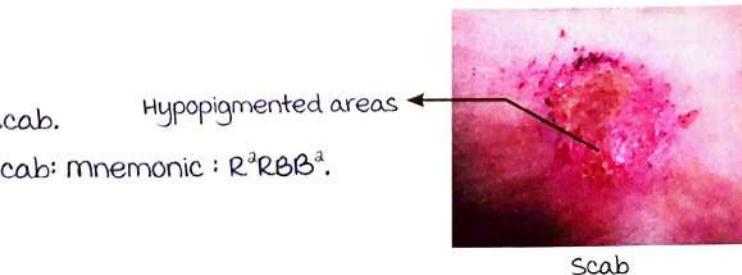
Caused by tangential force (scraping off epithelium)	Caused by perpendicular force (crushing of epithelium)
<p>1. Scratch abrasion:</p> <p>Injury with pin, fingernails, thorn.</p> 	<p>1. Pressure abrasion: ↓ force, ↑ duration.</p>    <p>Ligature mark</p>
<p>2. Graze abrasion (m/c):</p> <p>Due to friction between skin and rough surface.</p> <p>multiple scratches over a wide area.</p>  	<p>2. Impact/Imprint abrasion: ↑ force for ↓ duration.</p> <p>Eg: Tyre mark, radiator grill mark, <i>biking</i>.</p>  
<p>• AKA Gravel rash (RTA)/ brush burn/Sliding abrasion/ friction burn.</p>  <p>Direction of force</p> <p>Head: Deep Tail: Superficial</p> <p>Skin tag: heaping of epithelium.</p>	<p>3. Patterned abrasion:</p> <p>Imprint/pressure + pattern of weapon abrasion.</p>

Aging of abrasion:

- Healing time: 1 week.
- Heals with formation of scab.
- Aging based on color of scab: mnemonic: R²RBB².

R: Raw → < 12 hrs.

R: Reddish scab → > 12 hrs.



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- RB : Reddish Brown scab → 2-3 days.
 - B : Brown scab → 4-5 days.
 - B : Black scab → 6-7 days.

then hypopigmented area

Differential diagnosis :

- Pigmented over time*
1. Ant bite mark : Usually at mucocutaneous junction.
Interspersed with normal skin : Sand paper appearance.
 2. Skin excoriations.
 3. Decubitus ulcers.
 4. Post-mortem abrasion.

	Antemortem abrasion	Post-mortem abrasion
Site	Anywhere on body	Over bony prominences
Appearance	Reddish	Yellowish (no bleeding) + parchment-like
Scab	Present	Absent
Vital reaction	Present	Absent

Contusion/Bruise

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Bruise : Skin.

Contusion : Viscera.



mechanism of Injury :

Blunt trauma → Rupture of dermal vessels → Extravasation of blood → Contusion.
(veins/venules/arteries/arterioles). *in dermis*

Note : When the skin over a bruise is incised, a collection of clotted blood is seen that cannot be washed away.

Factors influencing bruising :

more bruising seen in :

- Lax, vascular areas (Eg : Scrotum, face).
- Delicate subcutaneous tissue (F>m).
- Age : Children, elderly.
- Pre-existing diseases (Bleeding disorders, leukemia).

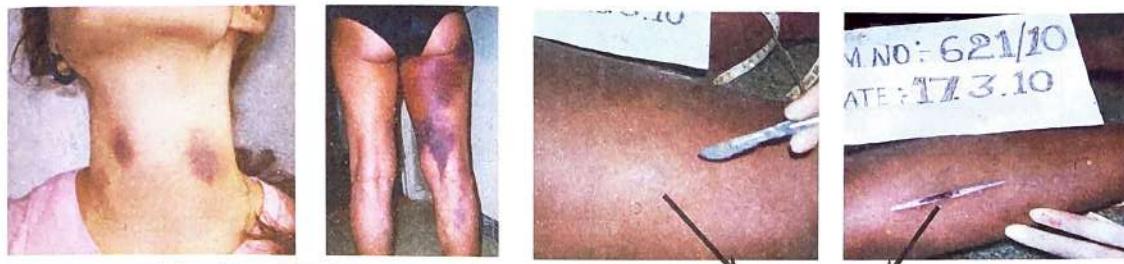


Less bruising seen in areas with :

- Good muscle tone. (*athletes*)
- Firm fibrous tissue (Eg : Palms, soles).

Types of bruises :

1. Intradermal bruise (Superficial).
2. Subcutaneous bruise (Subepidermal).
3. Deep bruise (AKA come-out bruise) : Delayed appearance, initially not visible
4. Patterned bruise : Pattern of striking surface of weapon seen.

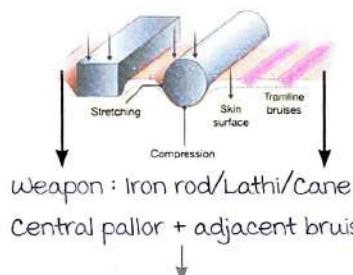


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Intradermal bruise

Deep bruise : Incision shows clotted blood.

Patterned bruise

Railway-line bruise
AKA Tram-line bruises

Weapon : Iron rod/Lathi/Cane

- Central pallor + adjacent bruise

Indicative of diameter of weapon

Six-penny bruise

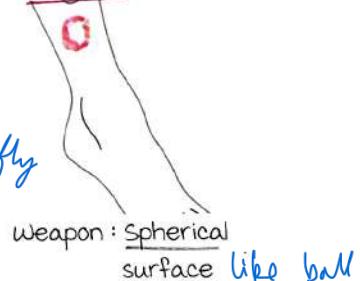


- D/t finger-tip pressure.
- Seen in :
 - Throttling. (Like choke)
 - Child abuse/ Battered baby syndrome.

Butterfly bruise

- Skin pinching (Child abuse)
- *Bruise looks like wings of butterfly*

Doughnut bruise



5. Ectopic bruise (AKA migratory/percolated bruise) :

- Shifting of blood d/t gravity → Bruise away from site of impact.



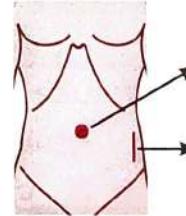
black-eye/raccoon eye : Forehead injury (B/L : spectacle hematoma)



black-eye/raccoon eye : Forehead injury



battle sign : Diagnostic of fracture of middle cranial fossa



Abdominal ectopic bruise

Peri-umbilical bruise : Cullen's Sign

Bruise on flanks : Grey Turner's Sign

6. Artificial bruise :

- Fabricated bruise with extracts from irritant plants.
 - Bhilawa (Semecarpus anacardium : marking nut), calotropis, Plumbago.
- Can be used to malinger.

	True Bruise	Artificial Bruise
Cause	Trauma	Irritant plant extract
Site	Anywhere on body	Accessible parts of body
Colour change during healing	Present	Absent
margins	Irregular	✓ Regular
Vesication/blisters	Absent	Present (d/t inflammatory reaction)
Content	Blood	Inflammatory fluid
Itching	Absent	Present

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	True Bruise	Artificial Bruise
Inflammation	Only on the bruise	Surrounding skin involved
Pain	Present	Absent

Aging of bruise :

methods used

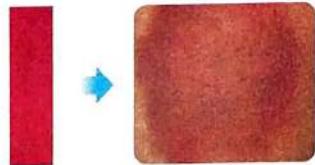
Colour of Bruise
m/c used in live person

Histology

spectrophotometry

Pearls stain reaction

RBBGYN

Colour of bruise :

1. Red : at first (Oxy-hemoglobin)

3. Bluish : black to brown (Hemosiderin) - 4th day

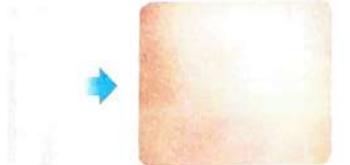
2. Blue : few hours to 3 days (Deoxy-hemoglobin)



4. Greenish (Hematoidin/ biliverdin) : 5 to 6 days



5. Yellow (Bilirubin) : 7 to 12 days



6. Normal : 2 weeks

- multiple bruises of different colour : Sign of child abuse (Battered Baby Syndrome).

- Bruises with no typical colour change :

- Sub-conjunctival hemorrhage : Red → Yellowish → Normal (Little exposure to atmospheric O₂).
- Sub-dural hematoma.

Livor mortis vs Bruise :

apply pressure
paleness appears

	Livor mortis (Hypostasis)	Contusion
Site	Dependent parts	Can occur anywhere on body
margins	Regular	Irregular
blanching	Present	Absent
Extravasation of blood	Absent	Present
colour changes	Absent	Present
Water poured after incision	Washes away	Remains
Appearance		

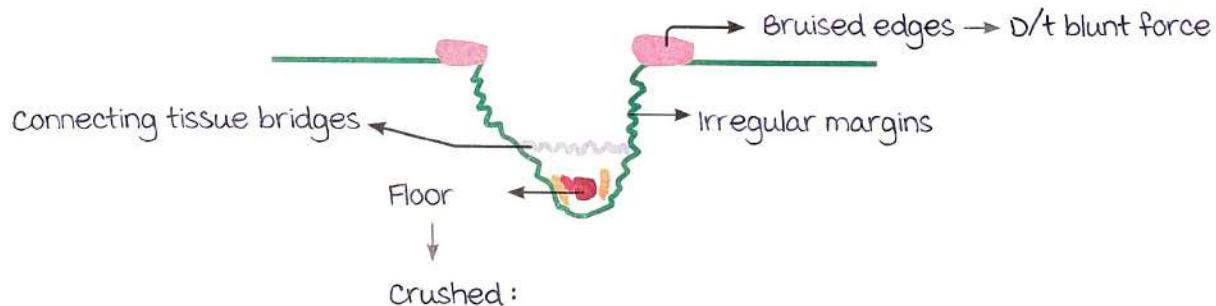
Laceration

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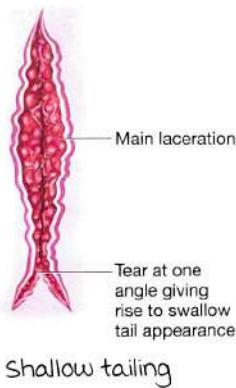
- Lacer : To tear.
- Tearing of skin with irregular margins.

CHARACTERISTICS



Crushed :

- Neurovascular bundles.
- Hair bulb.
- Blood vessels (Less bleeding).



↓ Bleeding in lacerations



TYPES

I. Split laceration :

AKA *incised looking laceration*.

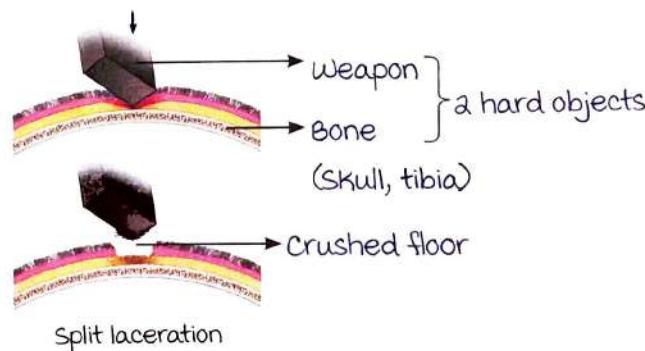
mechanism : Skin crushed between two hard objects.

Appearance :

- Naked eye : Regular margins.
- Hand lens : Differentiates from incision.
 - Small irregular margins.
 - Crushed floor.



Split laceration: Skull



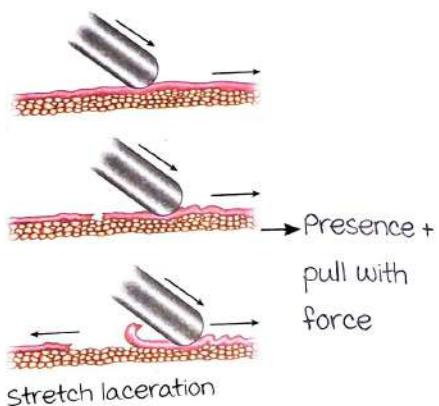
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2. Stretch laceration :

mechanism : Pressure with pull force →

Overstretching of skin.

- Commonly seen with compound fractures.

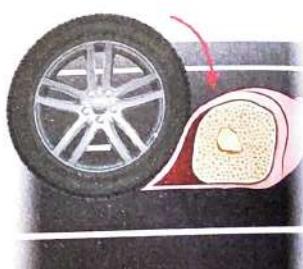
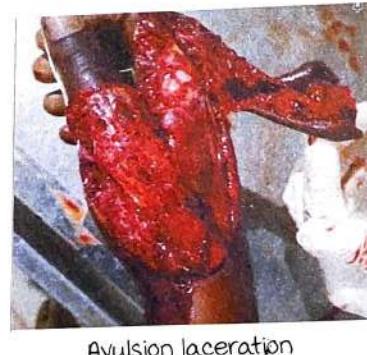
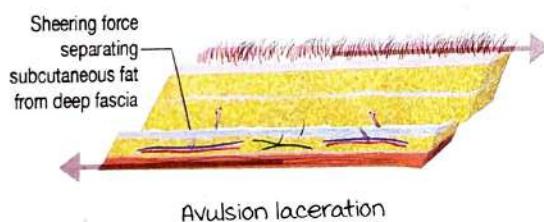


3. Avulsion laceration :

mechanism : Shearing/tangential/grinding force → Flaying of skin

- Commonly seen with run over injuries.

- Eg : Degloving injury, scalping.



4. Tear laceration :

mechanism : Hard protruding objects → Tearing the skin.

5. Cut laceration :

mechanism : Semi sharp weapon → Cut laceration.

SHARP TRAUMA INJURIES

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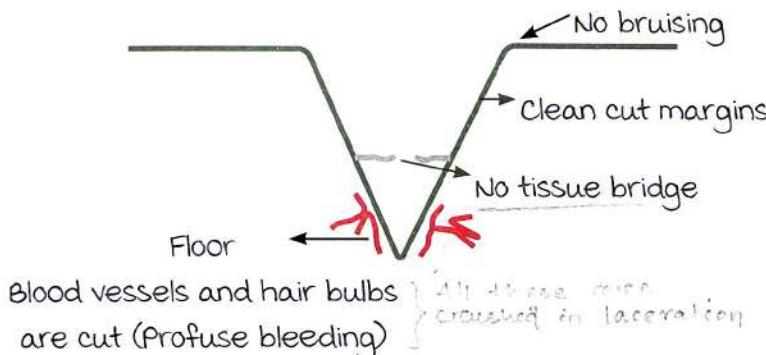
Incised Wounds

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AKA cut wound/slash/slicing injury.

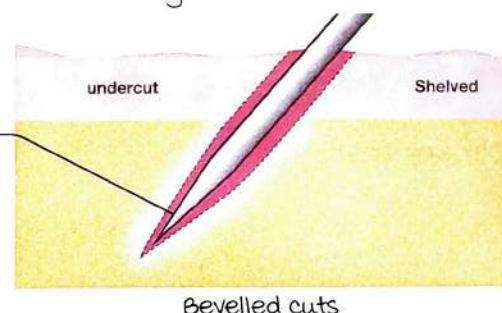
Weapon : Light cutting weapon, sharp surface. Eg : Surgical blade.

APPEARANCE



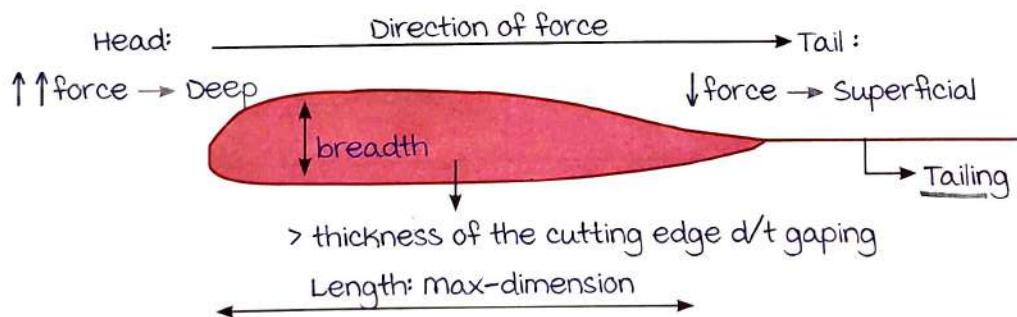
Oblique incisions :

- Blade enters the skin **obliquely** → **Bevelled cuts** → Undermining edges.
- Feature of homicidal wound.



FEATURES

Dimensions :



Shape : Spindle-shaped.

LACERATED LOOKING INCISED WOUND

An incised wound that looks like a laceration.

Weapon : Knife with serrated edge.

Common site : Areas with skin folds (Axilla, scrotum).

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Hesitation cuts

MEDICOLEGAL IMPORTANCE

1. Aging of wound → Time since injury.
2. Manner :
 - Homicidal → Cuts on nose/genitalia/bevelled cuts.
 - Suicidal cuts/ hesitational cuts : AKA tentative cuts, intentional cuts, feeler's strokes, trial cuts.
 - multiple superficial, linear cuts in the **accessible parts** of the body.

Stab injury/Puncture wound

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Injury d/t weapon with pointed end.

Skin provides maximum resistance during a stabbing.

Hence Depth is
main dimension
but in incised
wound length is
main dimension

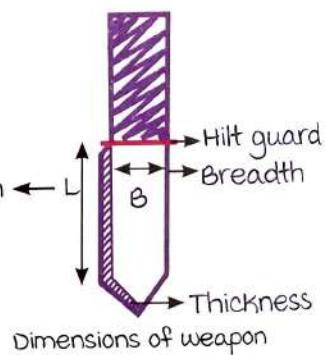
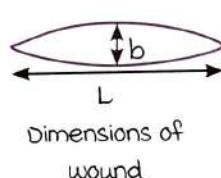
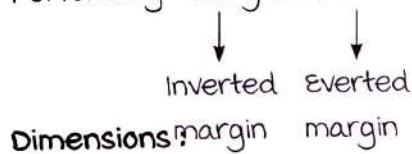


Weapon with pointed end

Penetrating and perforating wounds :

Penetrating : Only an entry wound seen.

Perforating : Entry and exit wounds seen.

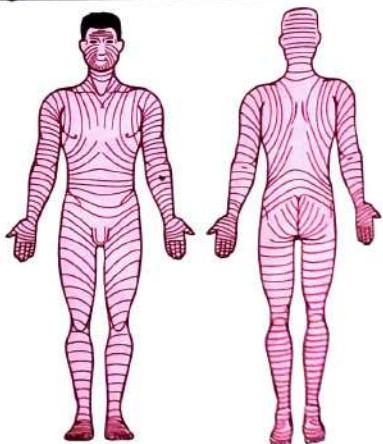


Dimensions of weapon

Length of the wound	Breadth	Depth
<ul style="list-style-type: none"> • Corresponds to breadth of the blade. • maybe <u>lesser</u> d/t <u>elasticity of skin</u>. 	<ul style="list-style-type: none"> • Corresponds to <u>thickness</u> of blade. • Affected by gaping. 	Only assessed in penetrating wounds ↓ corresponds to length of blade. Can be > length of blade in tissue yielding. Eg : Thorax, abdomen.

Lines of Langer/cleavage lines : Correspond to collagen fiber arrangement of skin.

- Stab wounds parallel to lines of langer : Less gaping.
- Stab wounds perpendicular to lines of Langer : ↑ gaping.



Lines of Langer/cleavage lines

Note : Assessment of wound permitted only during surgeries autopsy.

- Probing in an alive person → Clot dislodgment → Fatal bleed.

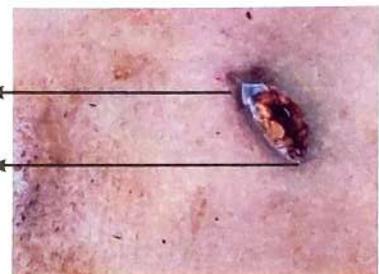
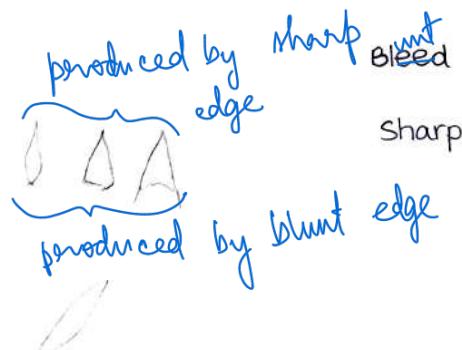
Shape of stab wound:

Single edge knife :

- Tear drop/triangular/wedge shaped.
- Fish tailing is seen.

Double edge knife :

- Oval or spindle-shaped wound.
- Stellate part of screw driver :
- Dining fork :

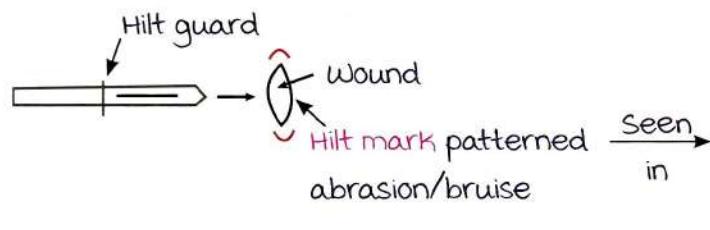


blunt double edged knife



sharp double edged knife

Complete penetration:



- Complete penetration.
- Type of weapon.
- Direction of stabbing
 - B/L → Perpendicular
 - U/L → Oblique
- Aging of injury.

Hara-Kiri/Seppuku:

Honorary suicide performed by ancient Japanese soldiers.

method :

Long wound → Stab the left iliac fossa and cut the abdominal wall → upto right hypochondrium till the right iliac fossa.



Features :

- Big L-shaped incision.
- Cause of death : Evisceration → Circulatory collapse (Hypotension) → instant death.

→ Abdominal viscera fall down

Hara Kiri: L shaped incision

Chop wound

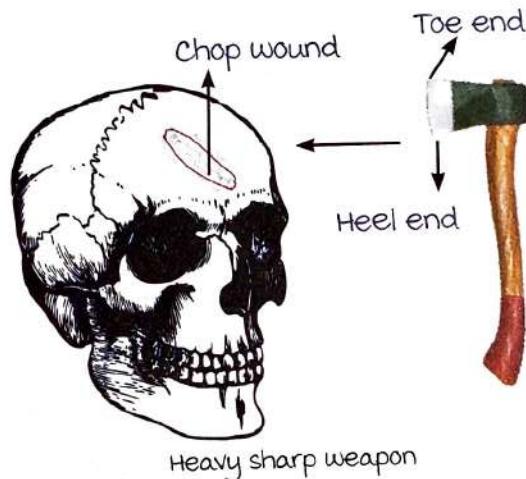
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Produced by a heavy sharp weapon.

Eg : Axe or chopper.

- Force produced
 - Sharp (Due to sharp blade)
 - Blunt (Due to weight of weapon)

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Examination of chop wound:



chop wound

medicolegal importance:

Chop wounds are usually homicidal.

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Defense injuries

Due to defensive reaction of the victim to the injury.

Active defense injuries:

D/t grasping the weapon.

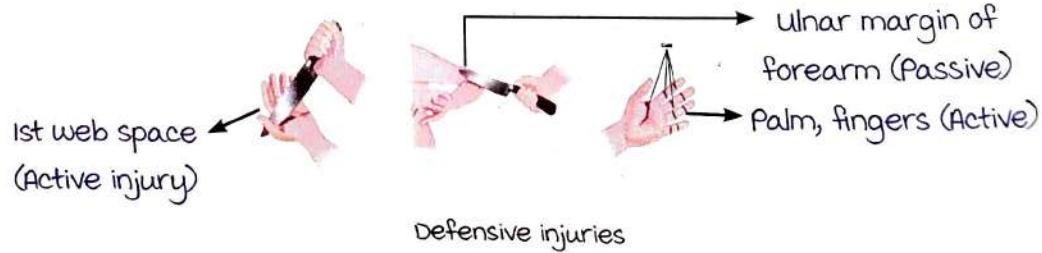
Passive defense injuries:

while protecting yourself.

medicolegal importance:

- Suggestive of homicide.

✓ Absent if victim was attacked from behind/while sleeping/unconscious.



Defensive injuries

REGIONAL INJURIES : PART 1

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Head injury → Closed : Intact dura.
→ Open : Ruptured dura.

Skull Fractures

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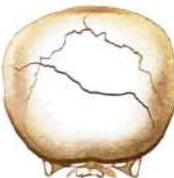
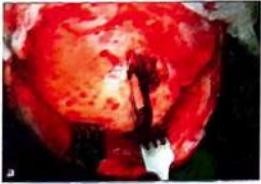
MECHANISM OF FRACTURE

Direct : Direct impact (Eg : Impact with rod, bullets, rock).

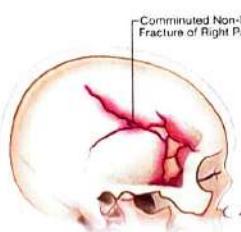
Indirect : Indirect impact (Eg : Falling from a height).

TYPES OF SKULL FRACTURES

Skull vault fractures :

Type	Weapon/ mechanism	Characteristics
1. Fissure fracture	 Heavy weapon with <u>broad striking</u> <u>surface</u> .	<ul style="list-style-type: none"> m/c type of skull fracture. General deformation. Thin linear fracture line.
2. Depressed fracture	  Heavy weapon with narrow striking surface (Eg : hammer).	<p>Fracture segment is displaced inward/<u>depressed</u>. — <u>Depressed</u> ↗</p> <ul style="list-style-type: none"> Signature fracture AKA fracture ala signature : Pattern of fracture represents <u>pattern of striking surface</u>. Complications : Brain contusion, laceration, cerebral injury. mx : <pre> graph TD A[Intracranial injury] --> B[Present] A --> C[Absent] B --> D[Sx elevation of fracture segment] C --> E[Conservative management] </pre>

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Type	Weapon/ mechanism	Characteristics
3. Comminuted fracture	 <p>Comminuted Non-Depressed Fracture of Right Parietal Skull</p> <p>Repeated blows ↓ multiple fracture lines ↓ multiple fracture segments</p>	<ul style="list-style-type: none"> Complication of fissure fracture or depressed fracture. AKA mosaic fracture / spider web fracture (No displaced segments).
4. Sutural/diastatic fracture	<p>Blow to skull → Sutural separation</p>	<ul style="list-style-type: none"> Fracture line along sutures. m/c in young adults. Not seen in elderly due to fused sutural lines.
5. Pond/indented/ping pong ball fracture	 <p>Trauma on soft skull ↓ Dent in suture (No fractures)</p>	<ul style="list-style-type: none"> variant of depressed fracture. m/c in children (< 4 yr) d/t soft, elastic, pliable skull. Seen in obstetric forceps delivery (d/t force on either sides of skull).
6. Gutter fracture	 <p>Oblique/glancing bullets ↓ Gutter fracture</p> 	<ul style="list-style-type: none"> Type 1 : Injury to outer table. Type 2 : Injury to outer & inner table. Type 3 : keyhole defect (Penetrate the skull over a small area).

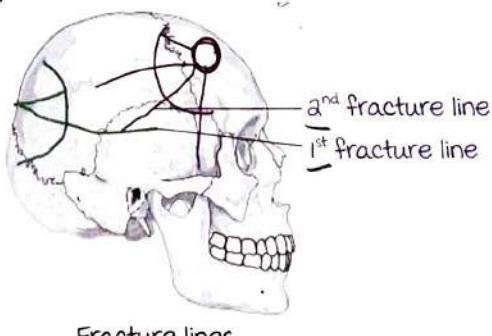
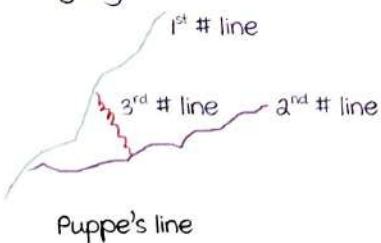
Skull base fractures :

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Type	Weapon/mechanism	Characteristics
1. Ring fracture	<p>I. Fall from height :</p> <ul style="list-style-type: none"> a. Lands on feet Impact : Legs → vertebral column → Base of skull b. Lands on buttock Impact : Indirect force to base of skull. 2. Heavy weight on the head. 	<ul style="list-style-type: none"> • Fracture in base of skull : Around <u>foramen magnum</u> (Size : 3-5 cm). • Fracture in posterior cranial fossa.
2. Hinge fracture	<p>Type I : Sideway impact in middle cranial fossa</p> <p>Type 2 : Posterior impact</p> <p>Type 3 : Sideway impact in anterior cranial fossa</p>	<p>Fracture lines reach opposite side through <u>sella turcica</u> (Through middle cranial fossa).</p> <p>✓ Nodding face sign : Abnormal mobility of base of skull.</p> <p>✓ AKA motorcyclist fracture.</p> <p>Fracture from posterior to anterior cranial fossa</p> <p>Fracture in anterior cranial fossa</p>

Puppe's rule : George Puppe

- The new fracture line will never cross previous fracture line. *repeated*
- Sequencing the fracture lines due to blows.
- Applicable to all skull fracture despite the mechanism of injury.



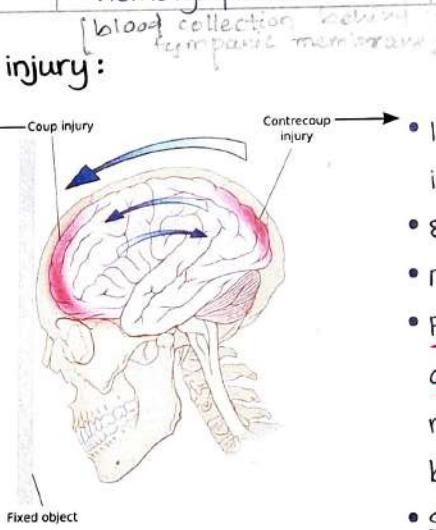
----- Active space -----

CLINICAL FEATURES

Fracture of anterior cranial fossa	Fracture of middle cranial fossa	Fracture of posterior cranial fossa
<p>Clear ring surrounds a central bloody spot after a bloody nasal discharge</p> <p>CSF rhinorrhoea:</p> <ul style="list-style-type: none"> Halo sign. Glucose ↑, protein ↓. β_2 transferrin (specific). Bleeding from nose. Paraesthesia in tip of nose. Periorbital hematoma (black eye). 	<ul style="list-style-type: none"> CSF otorrhoea (CSF leaking through the ears). Battle sign: Ecchymosis in mastoid region. Facial nerve palsy. CSF rhinorrhoea (CSF leak through eustachian tube into the nose). Hemotympanum. 	Boggy swelling in the neck.

Coup and counter coup injury:

- Injury at site of impact.
- m/c site: Occipital impact.
- mild/no injury.



- Injury opposite to site of impact.
- Exception: Occipital lobe.
- m/c site: Frontal lobe.
- Frontal & temporal lobe are more prone (D/t rough surface of base of brain).
- Severe injury.

Presentation: Rare in < 3 yrs.

mechanism of injury: Blow/ fall, seen in mobile head.

Theory: Struck Hoop theory (vacuum theory). Injury to one side

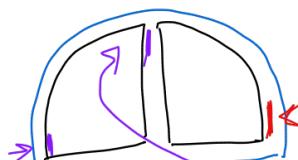
Impact:

↓
CSF shifts → vacuum created on opposite side

a. In occipital lobe → Injury in frontal lobe (contusion).

b. In frontal lobe → No injury in occipital lobe (D/t smooth surface).

c. In temporal lobe → Injury in contralateral temporal lobe/ contralateral surface of ipsilateral lobe (D/t falx cerebri).



Note: Coup and contrecoup is also seen in liver, lungs & spleen.

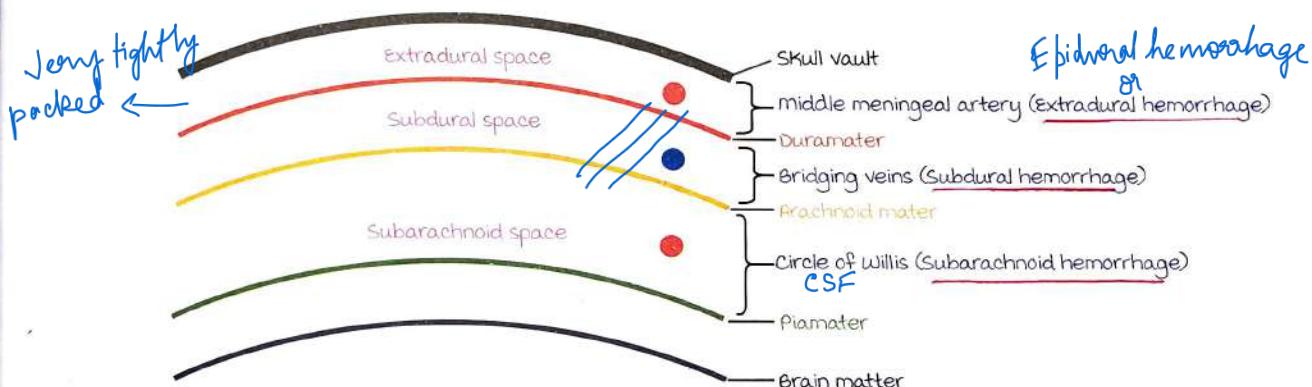
REGIONAL INJURIES : PART 2

----- Active space -----

Intracranial Hemorrhages

00:00:10

ANATOMY OF MENINGES



EXTRADURAL HEMORRHAGE (EDH)

Least common intracranial hemorrhage.

Highest fatality.

Unilateral, coup injury.

Age group : Young adults (20-40 yrs).

Blood vessel involved :

- middle meningeal artery (Injury to temporal lobe) : m/c.
- Anterior ethmoidal artery (Injury to frontal lobe).
- Transverse sinus (Injury to occipital lobe).
- Sagittal sinus (Impact on vertex).

Mechanism :

- Blow to temperoparietal region → Fracture of temporal bone
(Pterion)
(m/c : Fissure fracture)



Bleeding in extradural space ← Rupture of middle meningeal artery



↑ intracranial tension → Brain compression

- Brainstem herniation → Respiratory failure → Death.



EDH

----- Active space -----

Clinical features :

- **35 ml** of blood : Clinical features, 150 ml of blood : Fatal.
- **Lucid interval** : Period of consciousness between unconsciousness.
 - a. Concussion → Lucid interval → Brain compression d/t bleeding → Unconscious + death.
 - b. Patient can provide valid evidence, will and is criminally liable.
 - c. Death d/t failure in diagnosing lucid interval : medical negligence. *weakness to move part of body*
- Dilated & fixed pupil (**3rd cranial nerve palsy**) + **contralateral hemiparesis**.
- Kernohan's notch phenomenon : Dilated pupil + Ipsilateral hemiparesis
 - False localising sign.
 - mechanism : Uncal herniation → Compression of opposite area into tentorium cerebelli → Compression of fibres in cerebral peduncle → Ipsilateral hemiparesis and dilated pupils.

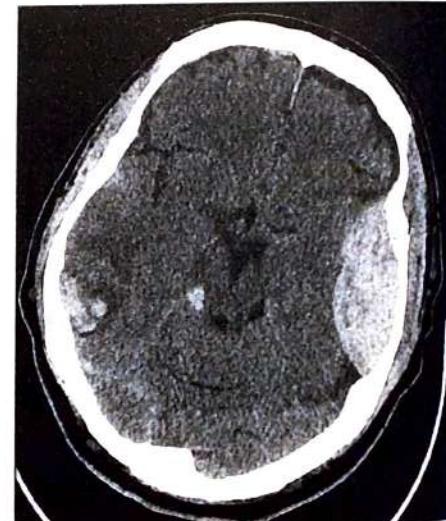
Note : Lucid interval : **EDH** > **SDH**.**Investigation :**

Non contrast CT (NCCT).

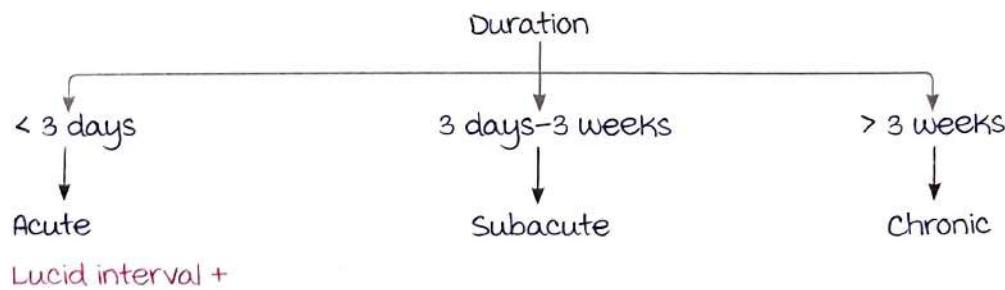
- Biconvex/ lentiform/ lens shaped hemorrhage.
- ✓ Does not cross suture.

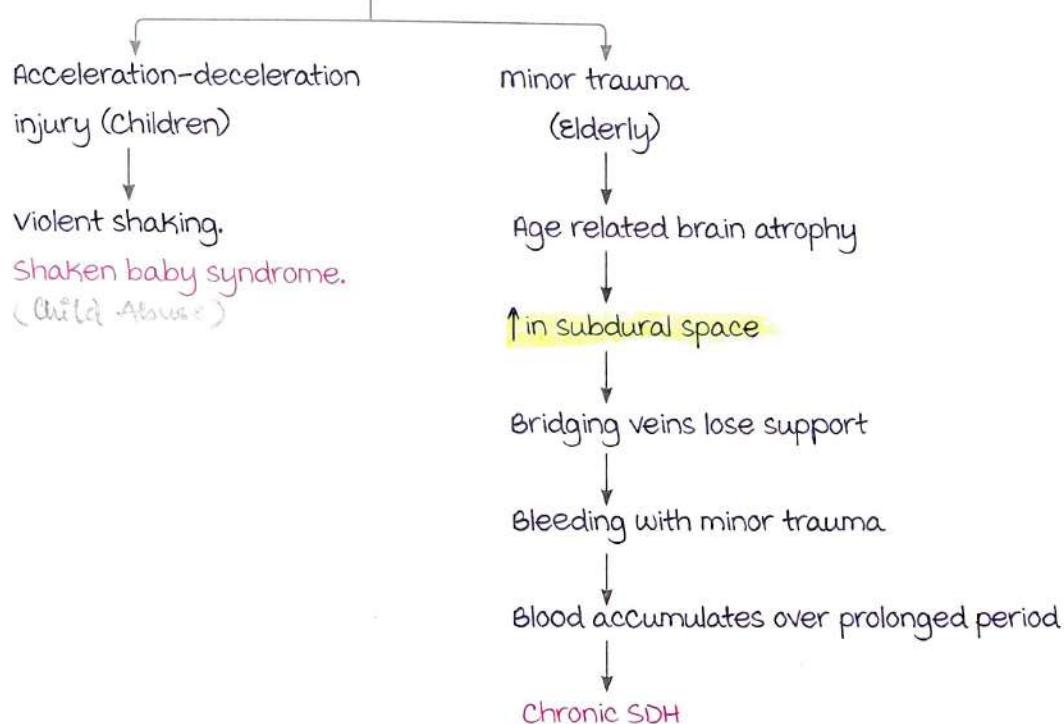
management :

Surgical removal of clot : Craniotomy / burrhole.

**SUBDURAL HAEMORRHAGE (SDH)**

Age group : Children, elderly.

Blood vessels involved : **Bridging vein**.**Type :**

mechanism :**Clinical features :**

- Headache.
- Altered sensorium.
- Hemiparesis.
- Dilated & fixed pupil.
- Personality changes.

Investigation :

NCCT brain :

- Concavoconvex opacity.
- Banana shaped / crescentic hemorrhage.
- Cross suture.

management :

- Conservative mx.
- Surgical removal of clot.



Note : A : Aged persons, alcoholics.

B : Bridging veins, boxers (dementia pugilistica).

C : Child abuse, crescentic opacity.

----- Active space ----- Dementia pugilistica AKA punch drunk syndrome :

- Seen in longterm boxers.
- m/c hemorrhage : SDH.

SUBARACHNOID HEMORRHAGE (SAH)

Cause :

- BATS : Berry aneurysm
- AV malformation
- Trauma (m/c)
- Stroke
- Spontaneous



SAH

Clinical features :

- Thunderclap headache : Sudden onset severe headache.
- Nausea, vomiting.
- Neck stiffness.
- Drowsiness.
- Loss of consciousness.
- Focal neurological deficit.

Investigation :

- NCCT brain : Hyperdense bleeding in brain near base of brain.
- Lumbar puncture : Xanthochromia (4-6 hrs).

management :

Clipping / endovascular coiling of aneurysm.

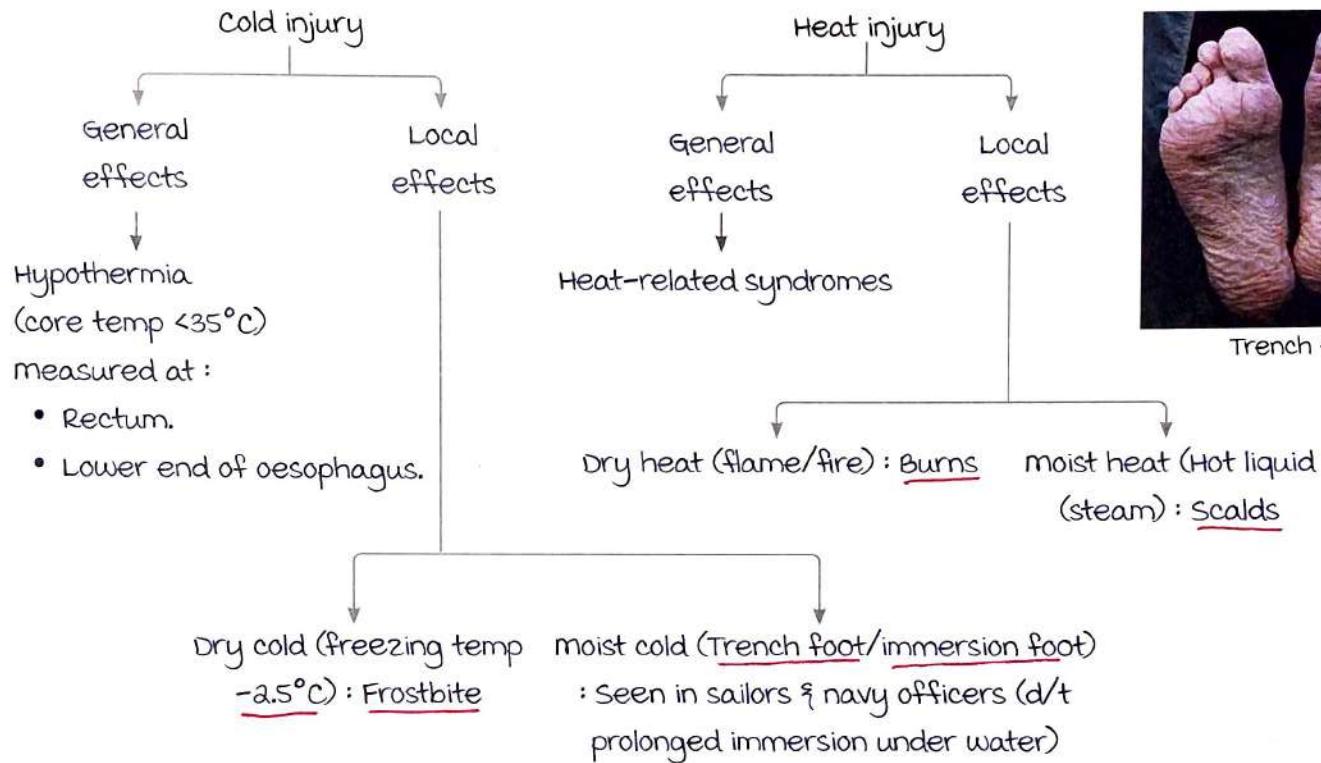
Note :

Postmortem differentiation SDH & SAH : Water is poured on the specimen.

- SDH : Hemorrhage washed away.
- SAH : Hemorrhage persists.

THERMAL INJURIES

----- Active space -----



Trench foot

Cold Injury

00:03:53

HYPOTHERMIA

Susceptible population : Newborns/elderly/hypothyroid/alcoholic.

Classification :

Severity	Temperature	Features
mild	$35^{\circ}\text{C} - 32^{\circ}\text{C}$	Shivering
moderate	$32^{\circ}\text{C} - 28^{\circ}\text{C}$ (Hypothalamic failure : $< 30^{\circ}\text{C}$)	<ul style="list-style-type: none"> Shivering stops. \downarrow Reflexes. J wave (Osborn wave) on ECG.
Severe	$< 28^{\circ}\text{C}$	<ul style="list-style-type: none"> Coma. Suspended animation (apparent death). Paradoxical/reciprocal undressing : Severe cold exposure → Paralysis of thermoregulation → Failure of vasoconstriction/vasodilation (\uparrow Blood flow) → \uparrow sense of warmth → Undressing → Death (may resemble sexual assault). Hide & Die syndrome/terminal burrowing : Hypothermia → mental disorientation → Hide in cabinets/narrow spaces (may resemble homicide).

----- Active space ----- Treatment : Rewarming.

Autopsy findings :

- White death.
- Pink hypostasis
- Pancreatic necrosis
- ✓ **Wischnewsky's ulcers** : Bleeding spots in stomach.

FROST BITE

Exposure to dry cold.

Site : Peripheries.

Degrees of frostbite :

Degree	Features
Frost nip	Pallor (reversible)
Superficial frost bite	<ul style="list-style-type: none"> • Anesthesia. • Erythema.
Deep frost bite	<ul style="list-style-type: none"> • Edema. • Blisters. • Gangrene.



Frost bite

Treatment : Rewarming at 37-40°C.

Heat Injuries

00:14:35

HEAT-RELATED SYNDROMES

Syndrome	Pathophysiology	Clinical features	Thermo-regulation	Body core temperature
Heat cramps (AKA miner's/ fireman's cramps)	<ul style="list-style-type: none"> • Sweating • Loss of Na⁺ 	Painful muscle spasm	Normal	Normal
Heat syncope	<ul style="list-style-type: none"> • Profuse sweating. • Loss of water. 	<ul style="list-style-type: none"> • ↓ circulating volume → ↓ BP → ↓ cerebral perfusion → Dizziness/ Syncope. • Rx : Supportive. 	Normal	Normal
Heat stroke (medical emergency)	<p>Triad of :</p> <ul style="list-style-type: none"> • CNS dysfunction. • Core temperature > 40.5°C. • H/o heat exposure. 	<ul style="list-style-type: none"> • HR ↑, BP ↓. • Dry skin. • Lack of sweating (except exertional heat stroke). <p>Autopsy :</p> <p>Post-mortem caloricity :</p> <p>Body remains warm for a long time after death.</p>	Impaired	↑↑↑

BURNS

Exposure to dry heat (flame/fire).

Duration of heat to cause burns :

- 44°C : 5-6 hrs.
- 65°C : 2 seconds.

----- Active space -----

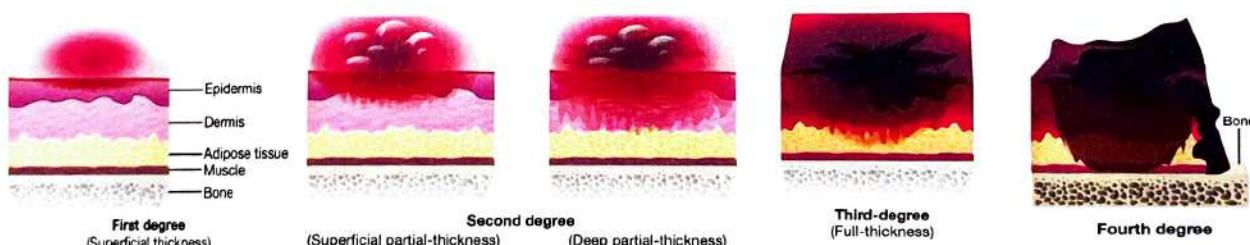
Classification :

1. Dupuytren's classification (6 degrees).

2. Wilson's classification (3 degrees).

3. modern classification.

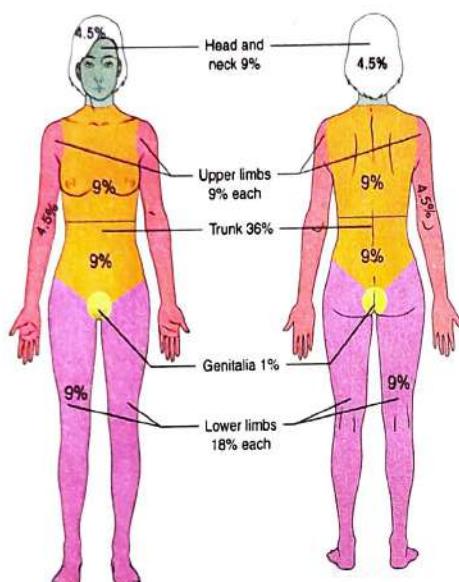
Degree	Layers involved	Features	Pain	Scarring	Healing
1°	Epidermis	Erythema	+	-	< 1 week
2°	Superficial partial	Epidermis + Papillary dermis	Erythema + Blisters	+	Unusual 1-3 weeks
	Deep partial	Epidermis + complete dermis	Blisters	-	> 3 weeks
3°	Epidermis + dermis + dermal appendages	Charred	-	+ Eschar	-
4°	Skin + fascia + muscle + bone	Charred	-	+ Eschar	-



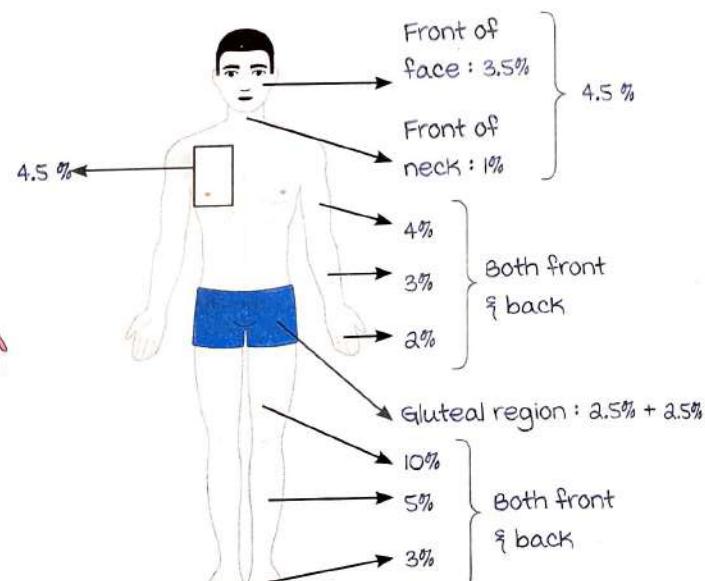
----- Active space ----- Estimation of burnt surface area :

1. Rule of Wallace : Rule of 9.
2. Lund & Browders chart : Best for children < 15 yrs.
3. Rule of palm :
 - Size of burnt surface area = size of palm \rightarrow 1% body surface area.
 - used for patchy burns.

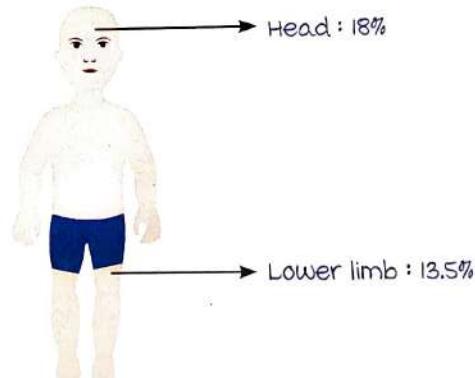
Rule of Nine :



Wallace rule of 9

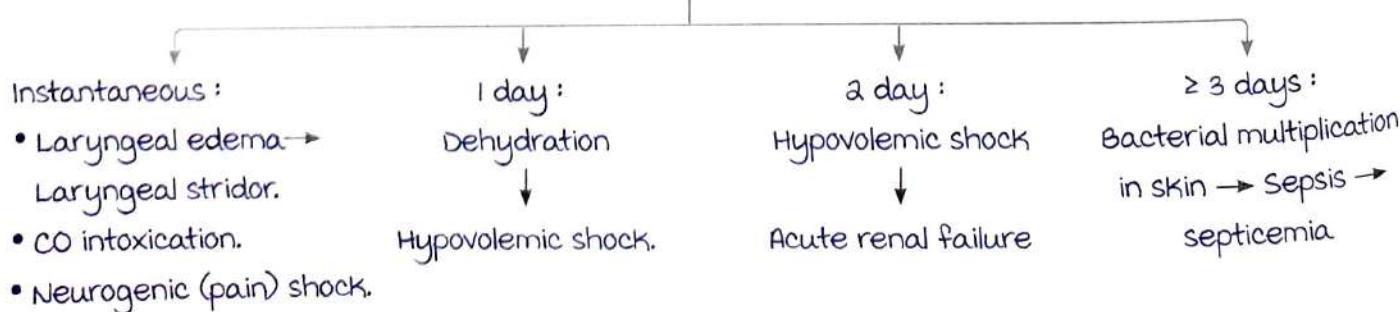


Division by parts



Exceptions in a child

Causes of death in burns :



Note :

marjolin's ulcer : malignancy in the burns scar years later.



----- Active space -----

Autopsy findings :

External examination findings :

- Absence of livor, algor & rigor mortis.
- Presence of **Crow feet's sign**.
 - Absence of soot deposition in wrinkles around eyes.
 - Feature of antemortem burns.
- Heat artefacts (non-specific findings) :

charred body



Crow feet sign

Artefact	Pathogenesis	Features	Image
Heat stiffening	<u>muscle exposed to heat</u> $>65^{\circ}\text{C}$ → <u>Protein coagulation</u> → stiffening	AKA boxers/pugilistic / fencer's attitude	
Heat rupture	<u>Skin exposed to heat</u> → drying of skin → splitting	Differences from incised wounds : <ul style="list-style-type: none"> • Large & irregular. • Seen on extensor surfaces. • Intact vessels & nerves in floor → No bleeding → Pale. • No vital reaction. 	
Heat hematoma	Hematoma in epidural space (d/t <u>rupture of emissary veins & dural venous sinuses</u>)	<ul style="list-style-type: none"> • Differences from traumatic epidural hemorrhage. • Chocolate-brown colour & honeycomb appearance. • Bilateral carboxy Hb in blood clot. 	
Heat fracture	Drying & charring of bone	<ul style="list-style-type: none"> • Skull : Spiderweb fracture. • Long bones : Street & avenue fracture. 	-

- Specific antemortem burns findings :

Mnemonic : FIRE

- Fluid in blisters rich in protein & Cl^- .
- Inflammation signs : Granulation tissue (Healing).
- Redness redline repair.
- Enzymes $\uparrow\uparrow\uparrow$.



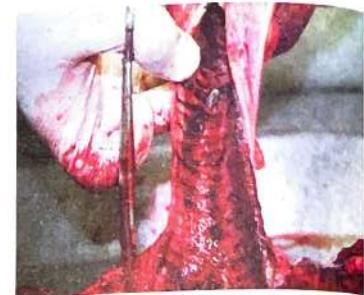
erythema

----- Active space -----

Internal examination findings : mnemonic : 4Cs :

- Carbon (soot) deposition in airways upto terminal bronchioles (d/t inhalation of smoke).
- ↑ CarboxyHb in blood ($> 10 \text{ g\%}$).
- ↑ Cyanide in blood.
- Curling ulcer (stress ulcer).

Features of
antemortem
burns



Soot in trachea

Differences b/w burns & scalds :

	Burns	Scalds
Cause	Fire	Hot liquid/steam
Charring & singeing	+	-
Soddening & bleaching of skin	-	+
Lines of blisters	-	+
Splashing	-	+
Clothing	Burnt	Intact/wet
Level of contact	Seen at or above level of contact	Seen at or below level of contact

PROXIMAL BALLISTICS

----- Active space -----

Introduction to Ballistics

00:00:28

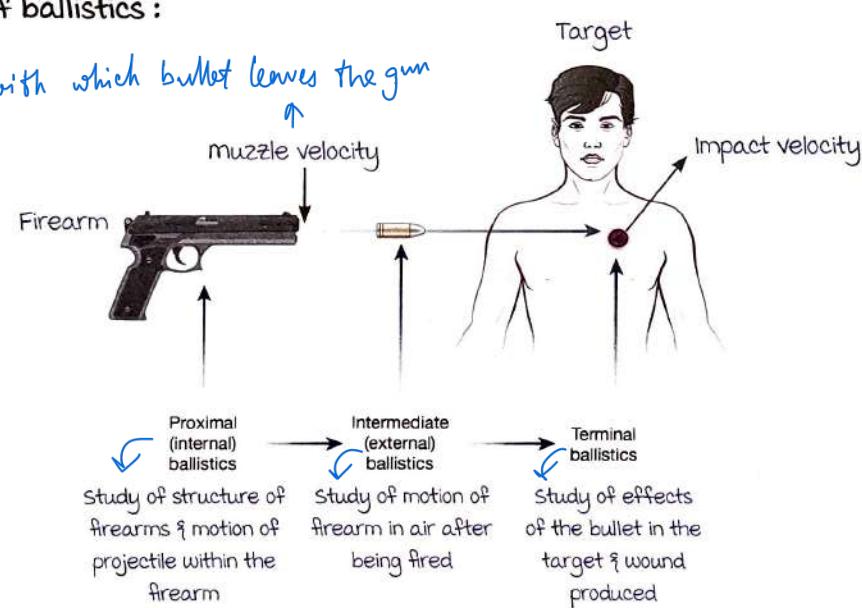
Ballistics : Science that deals with motion of the projectile.

Forensic ballistics :

- Science that deals with investigation of firearms, ammunition & wounds. produced by them
- Father of forensic ballistics : *Calvin Goddard*.

Fire Lance : First firearm, invented by the Chinese.

Types of ballistics :

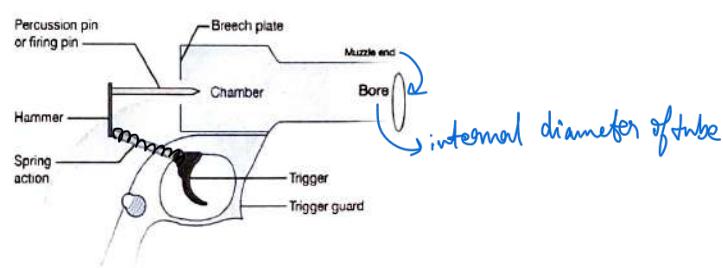
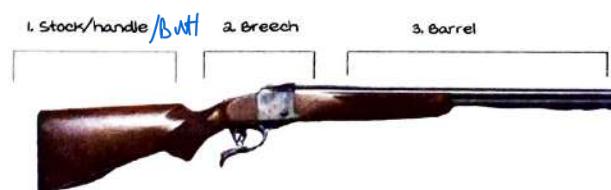


Basics of Firearms

00:04:40

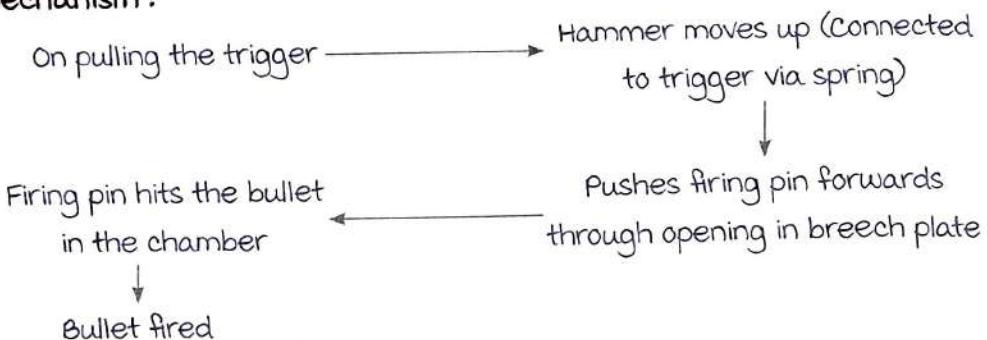
PARTS AND MECHANISM OF A FIREARM

Parts :



Section of breech & chamber of a gun

----- Active space ----- mechanism :



Firing
 ↓
 old case/cartridge
 is unloaded
 ↓
 Loading of new
 cartridge
 ↓
 Trigger pulled
 ↓
 Again fired

CLASSIFICATION OF FIREARMS

1. Based on the number of barrels:



Single barrel



Double barrel



Triple barrel



multibarrel

2. Based on loading:

muzzle loading : Loaded from front end.

breech loading : Loaded from breech end by breaking it (m/c now)

3. Based on number of bullets fired in each loading :

Single : Fresh cartridge loaded after each firing.

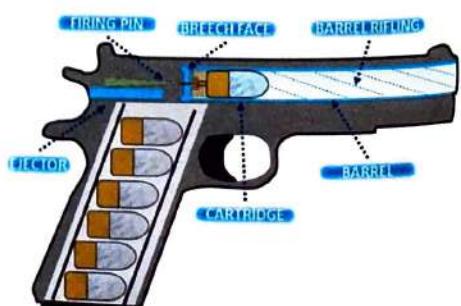
Repetitive :

- multiple bullets can be fired after loading once.

Eg :

- Revolver : Has multiple chambers with bullets in each

- Pistol : Has a magazine with multiple bullets loaded by spring mechanism



at the same time old case is ejected with loading of new case

Repetitive can be

- Semiautomatic : Fires a bullet each time trigger is pulled.

- Automatic : Fires continuously till trigger is released

----- Active space -----

once bullet is fired, lever has to be pulled down to eject the empty case

4. Based on action (mechanism of ejecting empty case):

- Lever action

- Bolt action

- Pump action

Pump is pulled



backwards to load the bullet

5. Based on inner surface of barrel:

Studied using

	Rifled gun	Smooth-Bored gun
Inner surface of barrel	<p>Rifling (+) (Spiral grooves made in the inner surface of barrel using broach/hook cutter)</p> 	<p>Smooth</p> 
Example	<p>Revolver (Range : 200 m) Pistol (Range : 400 m) military rifle (Range : 1-3 Km)</p>	<p>shot gun (scatter gun/pepper gun)</p>
mechanics	<p>Rifling spins the bullet → ↑ Stability → Long range & good precision.</p>	<p>Dispersion of lead shots → Short range, poor precision</p>
Projectile	<p>Bullets (made of lead predominantly)</p>	<p>Lead shots/pellets</p>

⇒ Bolt is pulled backward

↓
Chamber open

↓
Old case ejected

↓
Bolt rotated

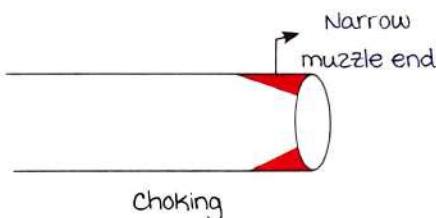
↓
New bullet loaded

↓
Bolt moved forward

↓
Chamber closed

:

- Narrowing the last 5-7 cms of the barrel in smooth-bored guns → ↓ dispersion of lead shots.
- Grades :
 - unchoked/cylinder (maximum dispersion)
 - Quarter choked
 - Half choked
 - Three-fourth choked
 - Fully choked (Least dispersion)



Paradox gun : Barrel is mostly smooth but

- Rifling in terminal part only.
- uses lead shots/slugs.

----- Active space -----

The diameter measured across 2 opposite land is called calibre

INTERNAL DIAMETER OF FIREARMS

	Calibre	Gauge/Bore
Type of gun	Rifled guns	Smooth-bored guns
measurement	<p>elevated part → land</p> <p>Between 2 diametrically opposite lands</p> <p>depressed part → groove</p>	<p>2 methods :</p> <ul style="list-style-type: none"> • Direct : Diameter measured directly. • Indirect : No. of spherical lead balls made from 1 pound of lead that precisely fit the barrel (Diameter of 18G > 24G). <p>18, 24 balls made respectively</p> <p>00:37:31</p>

Ammunition

MECHANISM

Primer

- Impact sensitive
- On pressure → Burns

On applying pressure or hitting
STRUCTURE the primer → burns

that pushes bullet out

Propellant
(gun powder)

Projectile
(bullets/shots)

Shotgun cartridge :

made of cardboard and metal base.

3 compartments :

1. Top compartment : Contains [REDACTED]

2. middle compartment :

contents [REDACTED]

- Travels 2-5 metres, produces minor bruise.

• material : Wood/cork/plastic/felt.

• Functions :

a. Separation : Between gun powder and lead shots.

b. Lubrication (Grease added) : Of barrel as the wad passes through it.

c. Obturation : Prevents dissipation of energy between lead shots.

d. Piston : Pushes the lead shots up when gunpowder blasts.



3. Base compartment :

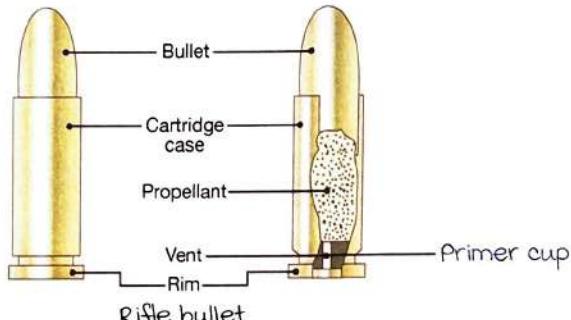
----- Active space -----

Contents :

- a. Gun powder
 - b. Primer/detonator/percussion cup.
- Contains primer.
 - Brain of the cartridge.

Rifle bullet :

Has bullet case :

- made of metal (Eg : Brass).
- Has a constriction to hold the bullet : 
- Contains :
 - Bullet
 - Gun powder
 - Primer

wad : Absent (Single bullet directly placed over gun powder).

1 gram on
burning produces

	Black gunpowder	Semismokeless	Smokeless gunpowder
Energy produced	Low (1g → 3-4 litres gas)	-	High (1g → 12-13 litres gas)
Smoke	High	-	Low
Components	Potassium nitrate (75%) Charcoal (15%) Sulphur (10%) (Preethi Can Sing)	Black gunpowder (80%) + Smokeless gunpowder (20%)	Nitrocellulose Nitroglycerine Nitroguanidine
			

Types of smokeless gunpowder

- Single base : Nitrocellulose.
- Double base : Nitrocellulose + Nitroguanidine.
- Triple base : Nitrocellulose + Nitroguanidine + Nitroglycerine.

----- Active space ----- Fineness of gunpowder :
 $FG < FFG < FFFG$
 ↑ Fineness of gunpowder.

Note : Potassium → Chlorite : Part of primer
 → Nitrate : Part of gunpowder

PRIMER

Helps to **BLAST** the gunpowder (Impact sensitive).

- Barium nitrate.
- Lead peroxide.
- Antimony sulphide.
- Styphnate (Lead).
- Tetrazine.

PROJECTILE

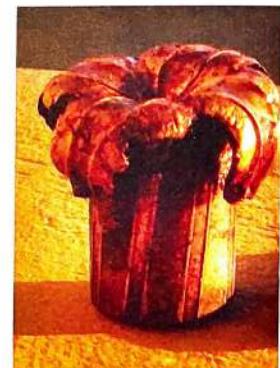
Types of lead shots :

Based on components used for making

- Soft shot : Lead only
- Hard/chilled shot : Lead + metal
- Steel shot : Steel only

Based on size of shots

- Dust shot : 2000 shots
- Bird shot : 200 shots
- Buck shot : 20 shots
- Rifle slug : Single shot



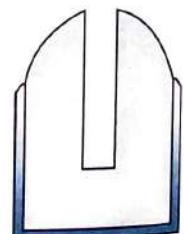
mushrooming

Types of bullets :

Non jacketed : Only lead (Can melt & get stuck to the barrel)

Jacketed :

- Has a jacket made of copper/Nickel
- Subtypes :
 - Fully jacketed : Has maximum penetration.
 - Semi jacketed :
 - (Deforms on impact mushrooming)
 - Dum dum bullet
 - Hollow point bullet



Semi jacketed hollow point bullet

Powdered iron or copper bullet/Frangible bullet/Frgmented bullet :

- Disintegrates on impact → Limited penetration.
- Causes lead snowstorm (multiple pellet particles in tissue; Also seen with Dum dum bullet).

Tracer bullet :

- Has chemicals that glow in the base.
- Advantage : Helps trace path of bullet.

Incendiary : Has phosphorous at the tip → Catches fire on impact.

Explosive bullet : Explodes on impact.

Plastic bullet : made of PVC.



Tracer bullets

Poisoned bullet :

- Has chamber with resin/curarine.
- Slowly delivers poison into tissue of victims.

Note :

- Tandem/Duplex cartridge : Two bullets placed one behind the other inside.
- Injury caused by bullets depends on
 - mass
 - velocity (more important)

----- Active space -----

INTERMEDIATE AND TERMINAL BALLISTICS : PART 1

Rifle

00:00:12

DISCHARGES

1. Flame :

Effects :

- Burning & charring of skin.
- Singeing of hair.

2. Smoke and unburnt gun powder :

	Smoke	Gun powder
Effects	Blackening or smudging of skin	Tattooing/stippling/peppering of skin
Deposition of particles	On the surface of skin	Embedded in the skin
Bullet velocity	High	High
On wiping with wet cloth	Can be wiped	Can't be wiped
On palms and soles	Seen	Not seen (d/t thick skin)

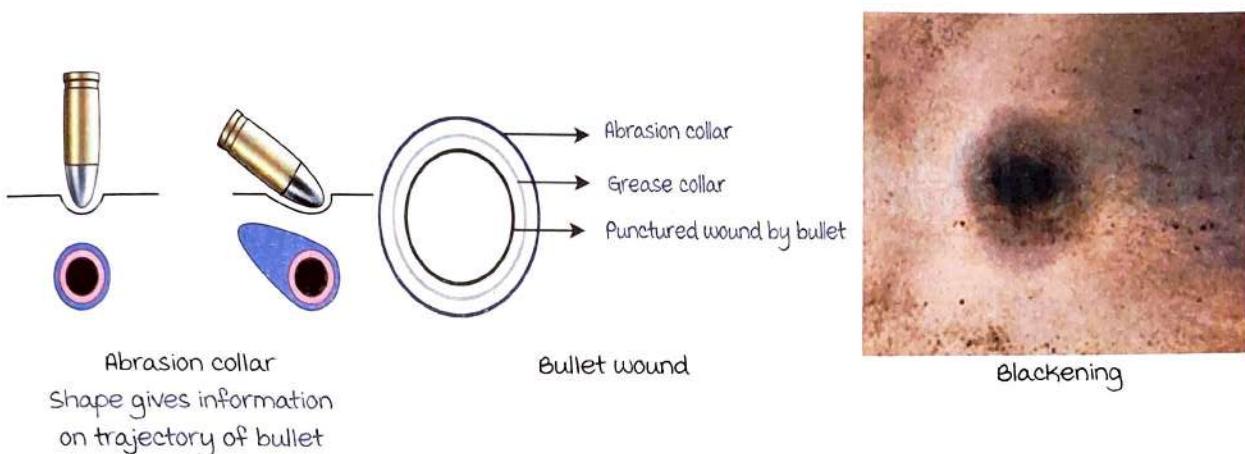
3. Bullet :

Effects :

- Punctured wound.
- Grease collar/dirt collar/bullet wipe.
- Specific to entry wound.
- Abrasion collar :
 - Not seen on buttocks, abdomen (yielding surfaces).
 - D/t gyroscopic action of bullet.



----- Active space -----

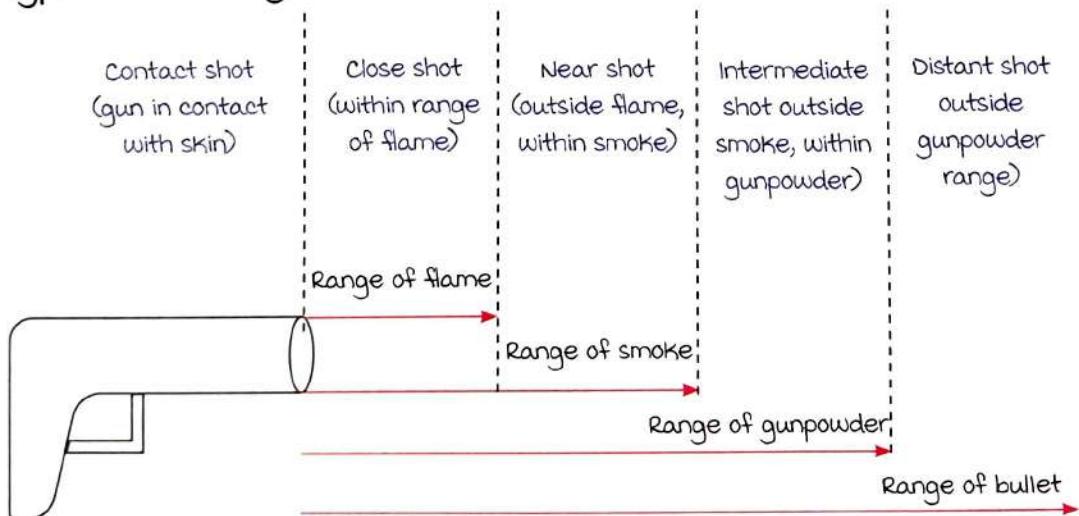


AVERAGE RANGE OF DISCHARGES

Particles	Rifle	Shot gun
Flame	8 cm	15 cm
Smoke	15 cm	30 cm
Gun powder	60-90 cm Revolver } Pistol } 50 cm	60-90 cm

WOUND BALLISTICS

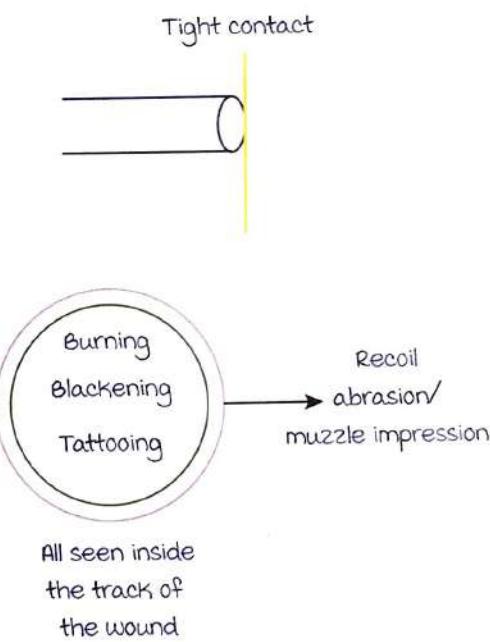
Types of Rifle ranges :



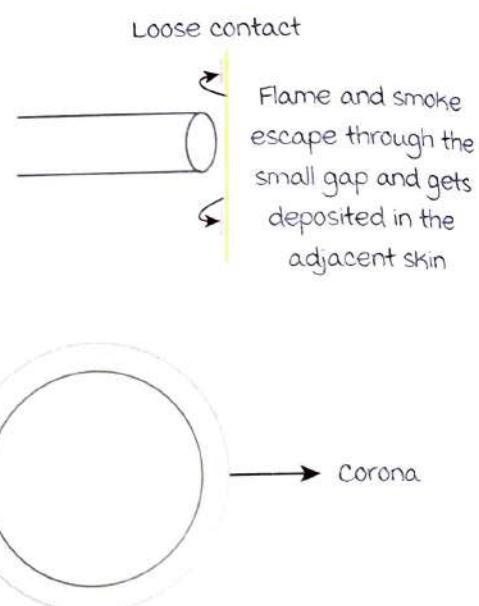
----- Active space -----

Contact wounds :

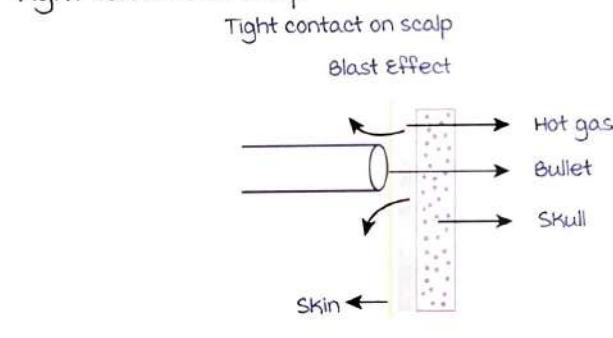
1. Tight wounds :



2. Loose contact :



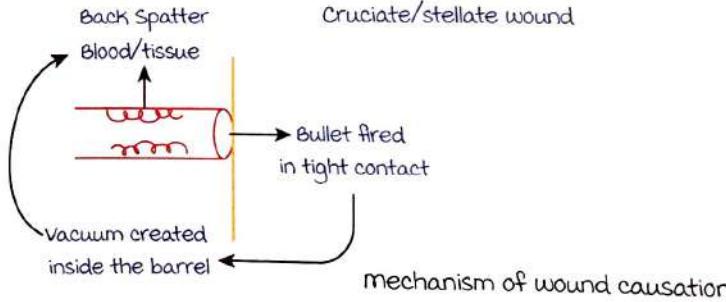
Tight contact on scalp :



Hot gas diffuses between skin
and skull vault and comes
out by rupturing the skin



Cruciate/stellate wound



Determination of range based on wound characteristics :

----- Active space -----

	Close shot	Near shot	Intermediate shot	Distant shot
Entry wound	+	+	+	+
Grease collar	+	+	+	+
Abrasion collar	+	+	+	+
Burning	+	-	-	-
Blackening	+	+	-	-
Tattooing	+	+	+	-



Close shot



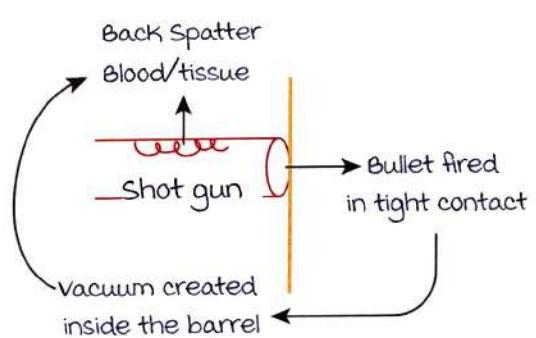
Intermediate shot



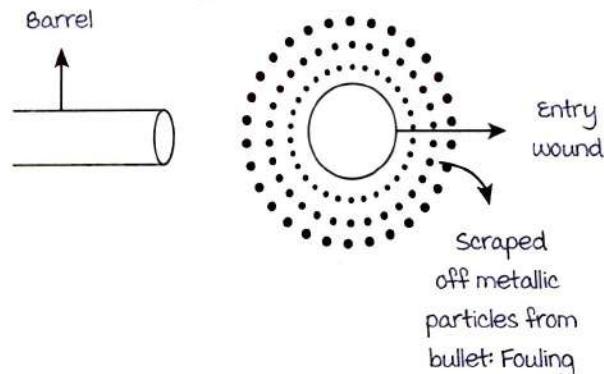
Distant shot

Note :

1. Back spatter



2. Wound fouling :

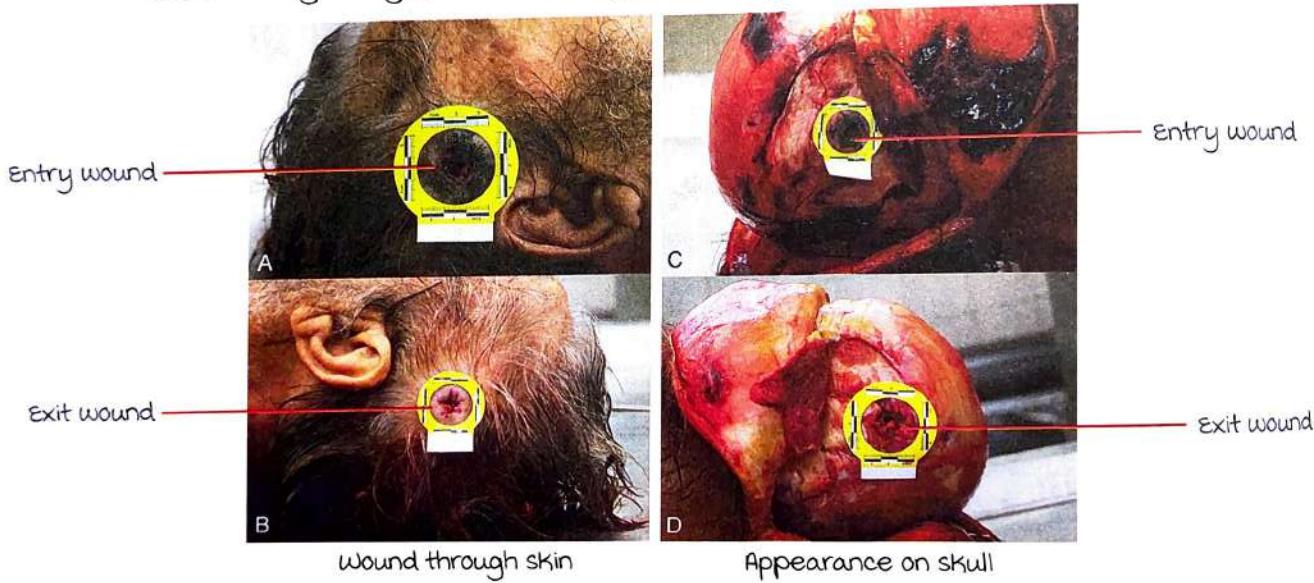


Determination of entry & exit wound :

	Entry wound	Exit wound
Shape of wound	Inverted	Everted
Burning, blackening, tattooing	Present	Absent
Grease collar & Abrasion collar	Present	Absent

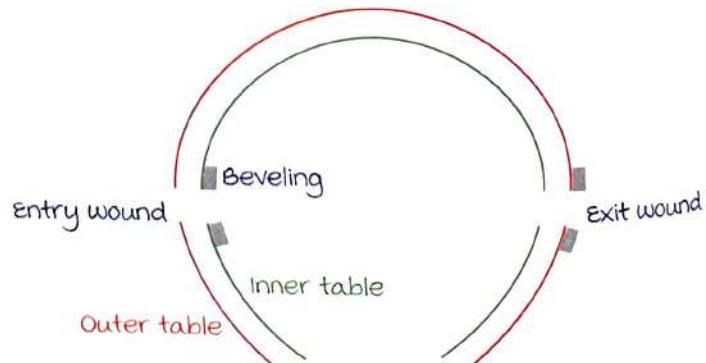
----- Active space -----	entry wound	exit wound
Size of wound	Smaller	Larger
Bleeding	Less	more bleeding and spattering (Tissue protrusion)

Determining entry & exit wound by examining the skull bone :



Beveling is seen in the unsupported table.

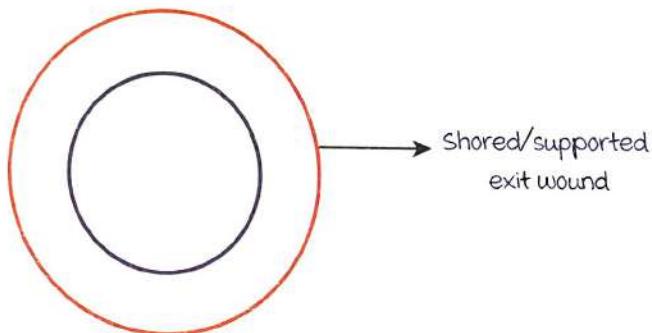
Entry wound	Exit wound
Beveling in inner table	Beveling in outer table
Note : In contact shot, entry wound (stellate) larger than exit wound	



Note :

- **Cherry red** skin in entry wound seen d/t carbon monoxide discharge.
- Shored/supported exit wound :

----- Active space -----



When there is any support
to the skin at the site of exit
of bullet

----- Active space -----

INTERMEDIATE AND TERMINAL BALLISTICS : PART 2

Firearm Investigations

00:00:10

Crime bullet : Bullet recovered from crime scene victim.

Bullet fingerprinting :

Identifying the gun from the markings on bullet.

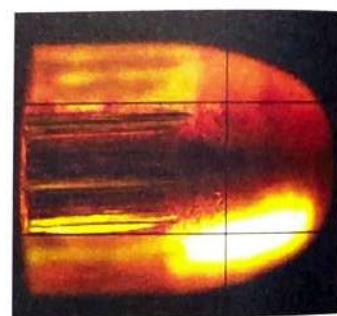
1. Primary marking/class characteristics :

- marks produced on a bullet by rifling in the barrel.
- Give information about make/model of gun.

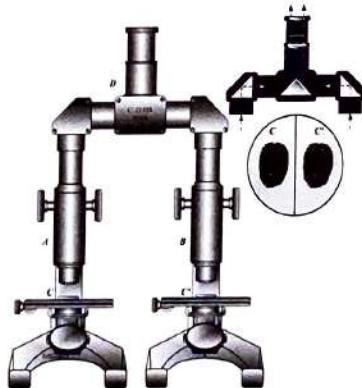


2. Secondary marking/fingerprint of a gun :

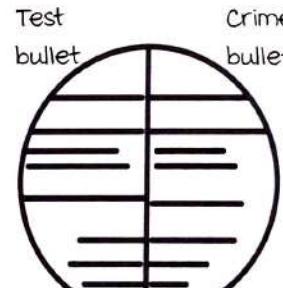
- Produced by irregularities of the barrel
(individual characteristics : vary from gun to gun).
- Irregularities are caused by :
 - Wear & tear.
 - manufacturing defect.
 - metallic fouling : molten lead particles deposited on barrel → Produce additional markings on bullet.



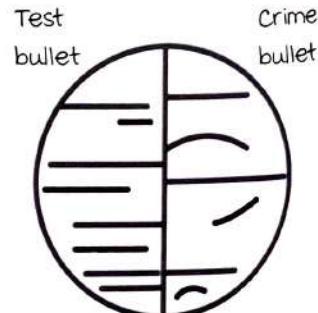
Secondary marking



Comparison microscope



Same gun



Different guns

Note :

Handling of bullet :

- Rubber-tipped tweezers toothed forceps cause additional markings).
- Gloved hands.



Rubber tipped tweezers

----- Active space -----

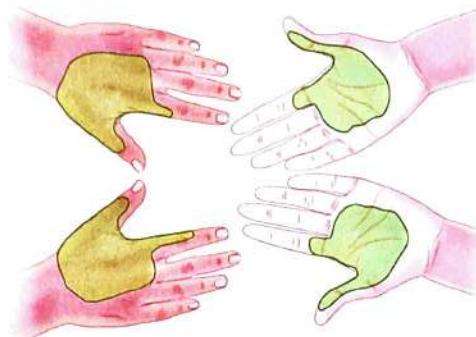
Gunshot Residue (GSR) test :

To find out if accused has used the gun.

GSR test can be done by :

(mnemonic → Firing HANDS)

- Flames Atomic Absorption Spectrometry (AAS).
- Harrison Gilroy test.
- Atomic Absorption spectrometry (AAS).
- Neutron Activation Analysis.
- Dermal Nitrate Test.
- SEM-EDXA (specific test).



Areas of maximum GSR deposition
(swabs to be taken from here)

must be done within 3 hrs (Loss of GSR after 3 hrs).

Infrared photography : To find out deposition of GSR on clothing.

Shot Gun

00:13:59

Projectile : Lead shots.

Wad travels upto 2 - 5 m & causes minor contusions (no fatal injuries).

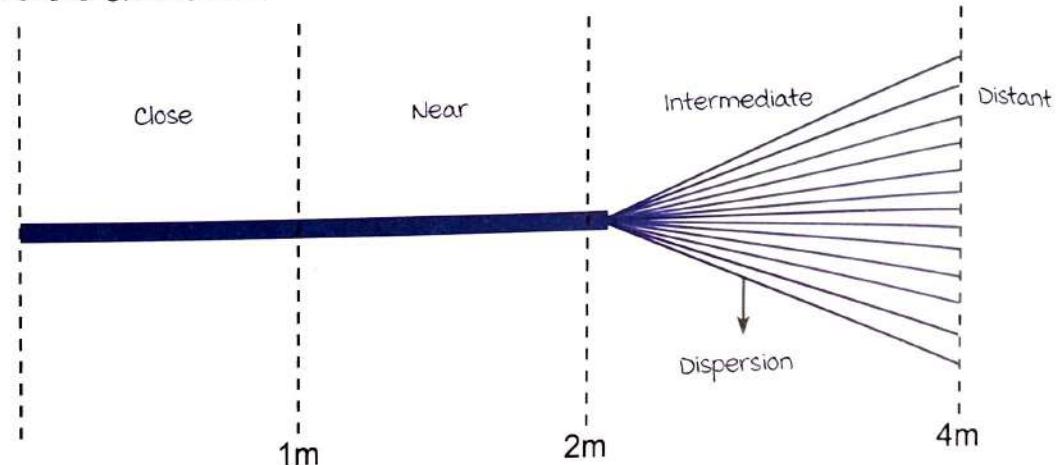
Range	Distance
Contact	-
Close	< 1 m
Near	1-2 m
Intermediate	2-4 m
Distant	>4 m

Dispersion of shot gun	Distance
Starts at	2 m
Completed by	4 m

Depends on gun being fully choked, half choked or unchoked.

----- Active space -----

WOUND BALLISTICS



Range	Wound	Characteristics
Contact		<ul style="list-style-type: none"> • Stellate or cruciate margin. • Lead shots inside the track of wound as a single mass.
Close		<ul style="list-style-type: none"> • All lead shots enter as a single mass. • Burning, blackening, tattooing seen around the wound.
Near		<ul style="list-style-type: none"> • Central single hole with lead shots as single mass. • No other effects around wound.
Intermediate		<ul style="list-style-type: none"> • Dispersion has started. • Central hole with satellite holes. • Satellite holes : Independent pellet holes seen around the wound.
Distant		Complete dispersion. Every pellet seen as independent hole.

Conditions where exit wound is seen in shotgun :

- Contact shot.
- Thin body part.
- Tangential wound.



Intermediate shot



----- Active space -----

Distant shot

Atypical Ballistics

00:24:51

RIFLE

1. Tandem bullet/piggyback bullet :

- Seen in old, unused guns.
- Two bullets coming out back-to-back.

2. Yawning bullet :

Bullet travels along irregular path.



Yawning bullet

3. Tumbling bullet :

- Rotates along its long axis.
- Causes atypical entry wound.



Tumbling bullet

4. Ricochet bullet :

- Deflected bullet from intermediate object.
- Angle of deflection/Ricocheting angle (angle at which bullet hits intermediate object) : 10-30°.
- After deflection :
 - No abrasion collar (no spinning).
 - No effects of flame, smoke, gunpowder.
 - Keyhole shaped wound (due to tumbling of bullet).

5. Souvenir/sleeping bullet :

- Bullet retained inside the body (removal causes significant harm).
- Fibrosis seen around the bullet.
- Leakage of lead → chronic lead poisoning (plumbism).

6. Kennedy phenomenon :

Iatrogenic alteration of gunshot wound causing difficulty in range determination.

----- Active space -----

7. Rayalaseema phenomenon :

- Insertion of bullet into stab wound.
- Done earlier by naxalites.

SHOTGUN

Results in difficulty in range determination.

1. Balling/welding of shots :

- Incomplete dispersion of lead shots.
- D/t excess grease/lubricant/heat.
- Wound mimics intermediate shot.

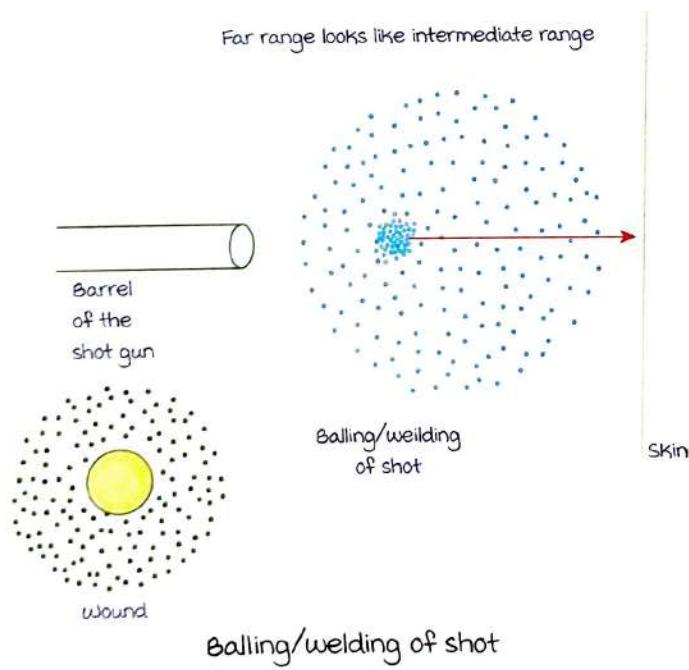
2. Billiard Ball Ricochet effect :

- D/t erratic dispersion on hitting intermediate object.
- Near shot resembles distant range.

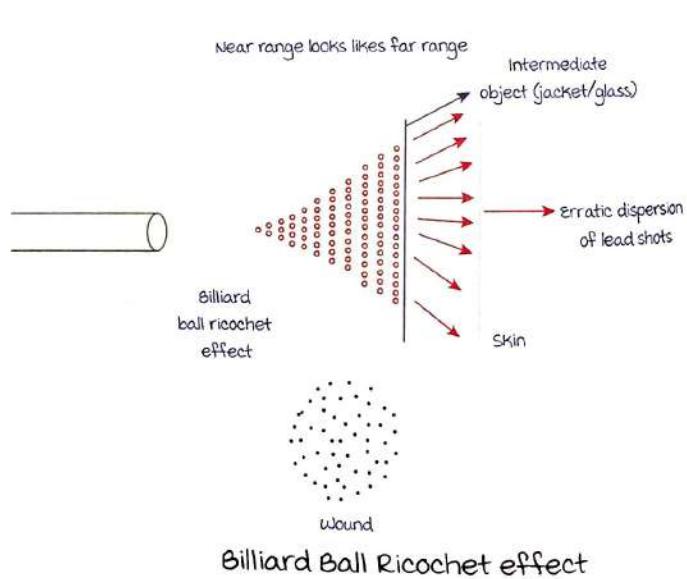
3. Kronlein shot :

Expulsion of brain parenchyma & skull fracture caused by contact shot (d/t expansion of gases within the skull).

Far range looks like intermediate range



Near range looks like far range

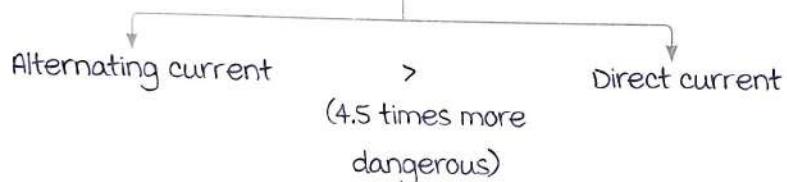


ELECTRICAL INJURIES, EXPLOSION INJURIES AND TORTURE METHODS

Electrical Injuries

00:00:13

TYPES OF CURRENT



Eg : Current in domestic appliances.

Eg : Lightning (high voltage).

Note : Passage of current → Electrical injuries.

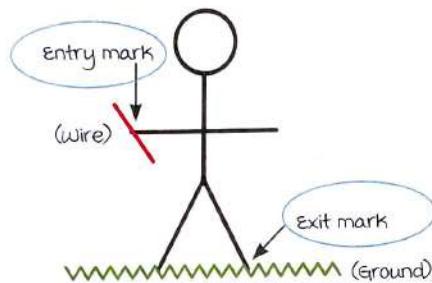
RELATED TERMINOLOGIES

	Amperage (current flow)	Voltage	Resistance
Proportionality to injuries	Direct	Direct	Inverse
Specific features	<ul style="list-style-type: none"> • most important factor in fatality due to electrocution. • 5mA : Tingling & numbness. • 10mA : Able to release wire. • 20mA : Tetanoid/ Hold on spasm (unable to release wire) • 25-80 mA : ↑ in arrhythmia & death 	<ul style="list-style-type: none"> • Average fatal voltage : 240V (Normal domestic supply). 	<ul style="list-style-type: none"> • Resistance offered : Dry skin > Bone > moist skin.

Note :

- most important barrier for electrical entry : Skin.
- Once skin breached → Easy for electricity passage.
- Least resistance to electricity : Blood, body fluids.

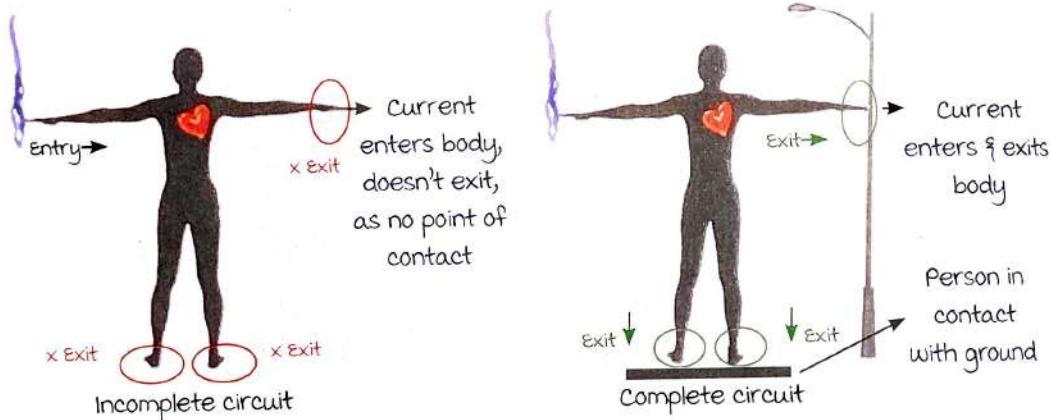
----- Active space -----

PASSAGE OF CURRENT IN BODY**entry & exit mark:**

- Entry mark : Site where current enters body.
- Exit mark : Site where current exits body (appears as skin splits/burns).
- Reasons for no entry mark :
 - a. Broad point of contact.
 - b. Currents passes through low resistance (eg. water filled bath tub).

Note :

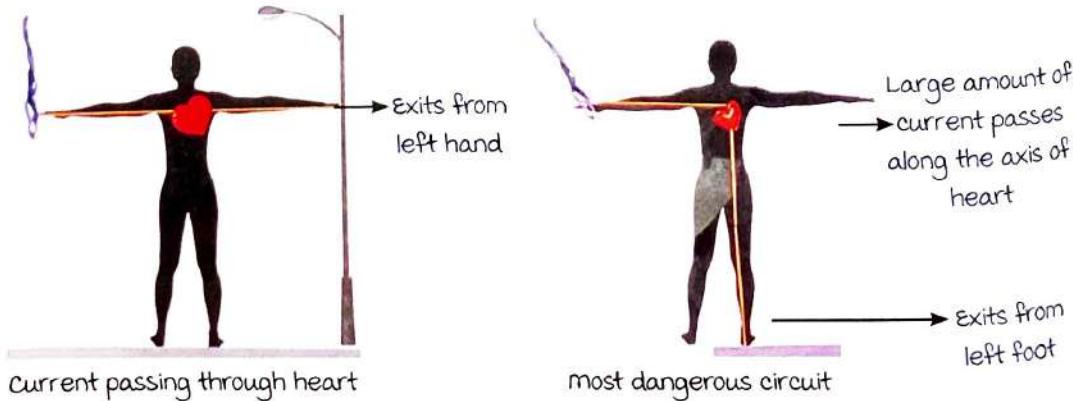
- Electricity travels the **shortest route**.
- Electrocution occurs with **complete circuit**.

**CAUSES OF DEATH**

organ damage depends on route of current in the body.

cardiac arrhythmia (ventricular fibrillation) :

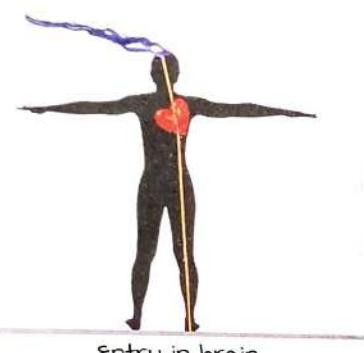
- most common cause of death due to electrocution.
- Reason : multiple passages of current in heart → Arrhythmias.



Respiratory failure :

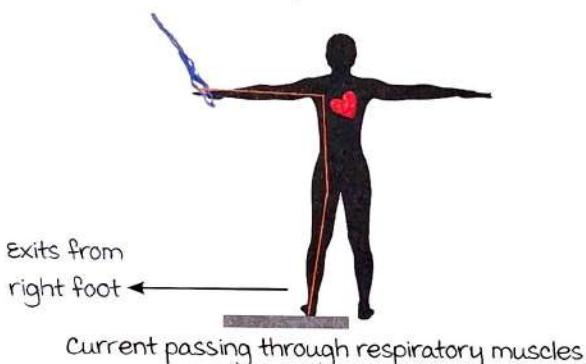
----- Active space -----

Entry of current in brain
↓
Brainstem paralysis
↓
Respiratory failure



Entry in brain

Eg : Entry of current in right arm
↓
Passes through diaphragm, respiratory & intercostal muscles
↓
Respiratory failure



Current passing through respiratory muscles

POSTMORTEM FINDINGS

Skin :

Injuries

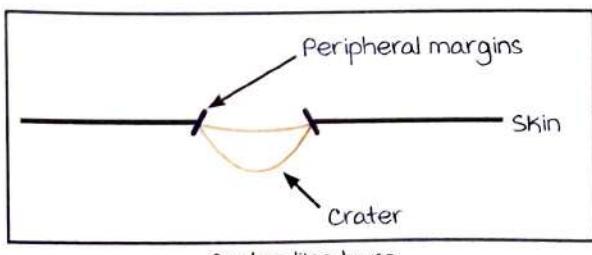
Low voltage current injuries

- Firm contact of skin with conductor.
- Endogenous burns (Joule burn) : Electricity passes from wire to skin.

Heat generation

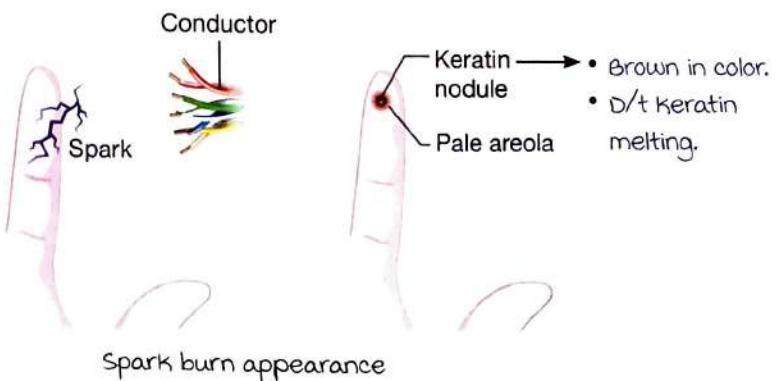
Formation of blister

Collapse of blister



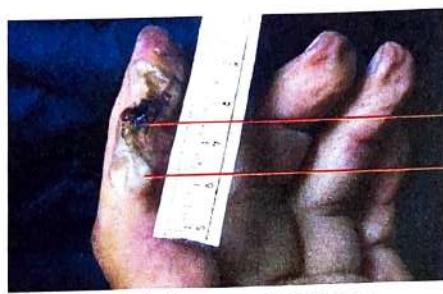
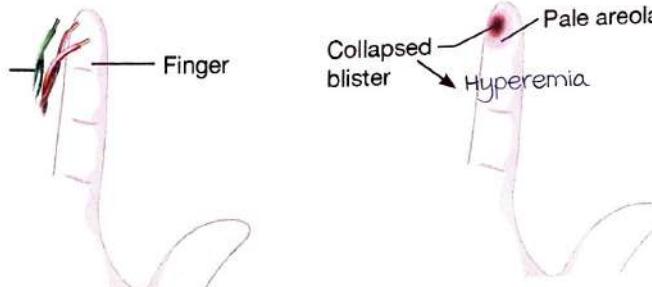
High voltage current injuries

- Loose contact with conductor is sufficient (d/t high voltage current jumping air gap).
- Exogenous burns :
 - Flash burns.
 - Spark burns.
 - Crocodile burns : multiple sparks → multiple skin nodules.



Spark burn appearance

----- Active space -----



Joule burn appearance



Crocodile burn

metallisation :

- Passage of metallic ions from conductor into entry wound.
- Acro reaction test : Identifies metallisation.
- Color of various deposited metallic ions :

Deposited metallic ion	Color of entry wound
Aluminium	Silvery
Copper	Reddish brown
Iron	Brownish black

Deeper tissue :

molten metal deposition → Current pearls.

Bone :

High current voltage passes through bone
 ↓
 molten Calcium phosphate
 ↓
 Bone Pearls/wax drippings
 (Round densities on x-ray)

muscle :

Zenker's degeneration
 (Degeneration of muscle)
 ↓
 Rhabdomyolysis
 ↓
 myoglobinuria
 ↓
 Renal failure.

MEDICOLEGAL IMPORTANCE

1. Accidental (most common).
2. Homicidal (Judicial electrocution : Execution method in US)
3. Suicidal.

----- Active space -----

Lightning Injuries

00:27:06

LIGHTNING (AKA KERAUNO)

Electrical discharge from clouds to earth's surface.

High voltage, direct current (1000 million Volts, 2 lakhs Amperes).

Note :

- Kerauno medicine : Study of lightning (medical aspects).
- Kerauno pathology : Pathological aspects of lightning.

modes of contact :

- Direct strike.
- Side strike (After reflection from an intermediate object).
- Contact with a conducting object.

Causes of injury :

- Direct contact.
- Superheated air.
- Expanded & repelled air.
- Sledge Hammer effect (blow of compressed air pushed before current).



BURNS

Endogenous in nature.

Cause of death : Cardiac arrhythmias.

1. Linear burns :

Site : Skin creases.

medicolegal importance : Accidental.



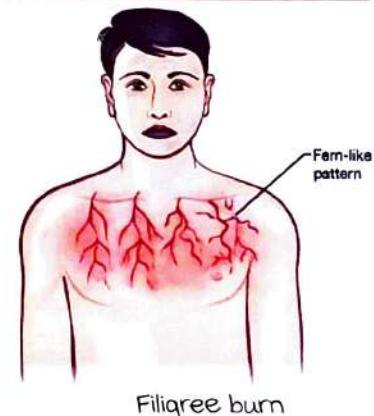
2. Pierced burns.

3. Filigree burns :

- AKA lightning burns/ Arborescent burns/ Ferning/ Litchenberg burns/ Keraunographic burns/ Feathering.
- Seen in 20-30 % cases.
- Appearance : Branching pattern (Persists upto 48 hrs).
- mechanism : Passage of electrical discharge.



- Staining of skin d/t RBC lysis (not along the blood vessel).
- D/D : marbling (occurs along blood vessel).



----- Active space -----

00:35:08

Explosion/ Bomb Blast Injuries

BOMB

Container filled with explosive material & missiles.
Ignited by a detonator or fuse.

Types:

1. Incendiary bomb :

- Contains Phosphorous.
- When thrown → Catches fire.

2. molotov's cocktail (Petrol bomb) :

- Petrol filled bottle + rag (Serves as wick).
- Rag is lit & thrown → Bottle breaks → Surface catches fire.

BLAST INJURIES

Types

Air blast

Immersion blast (Underwater)

Solid blast :

- Occurs when part of body is in contact with solid vibrating surface.
- Force of blast passes through surface → Injury.
- Eg : Person on shipdock during underwater blast.

Air blast injuries :

	Primary	Secondary	Tertiary	Quaternary
Reason	Blast wave	Flying missiles/projectiles/shrapnels	Wind	miscellaneous
Description	Wave starts from explosion site ↓ Spreads concentrically outwards (non directional).	<ul style="list-style-type: none"> • most common blast injury. • missiles fly at high speed → Impact on victim with large force. 	Bomb blasts ↓ Person thrown against nearby solid structure d/t wind	-
Features	Affects air filled organs : <ul style="list-style-type: none"> - Ear : Tympanic membrane rupture (m/c primary injury). - Lungs : ARDS - Blast lung (most fatal primary injury). - GIT : Perforation. 	<ul style="list-style-type: none"> • marshal's triad : - Abrasion. - Contusion. - Laceration. } Same side of body • Triad helps to identify the direction of bomb blast occurrence. 	Skeletal injuries	<ul style="list-style-type: none"> • Burns d/t fire. • Building collapse injuries (eg : Traumatic asphyxia).

Torture Methods

00:46:20

----- Active space -----

Declaration of Tokyo : Deals with reporting and treatment of torture victims.

Parrot's Perch :

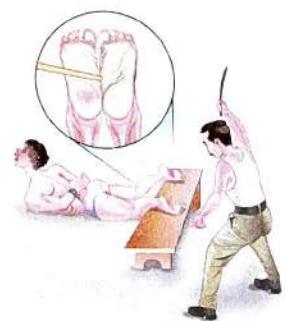
Tying limbs against horizontal pole.

Cattle's Prod :

Electric shock to genitalia.



Falanga/Falaka/Bastinado : Beating over the soles.



Wet submarine :

Forced immersion of head under water.



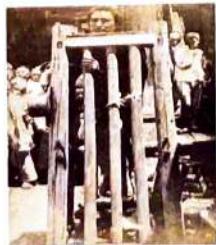
Dunking :

Forced immersion of whole body under water.



El Planton :

Prolonged standing.



Black slave :

Inserting hot metal rod into anus.



Telefono :

Repeating slapping over the ears.



Saw Horse :

Forced straddling.



Dry submarine :

Plastic bag asphyxiation.



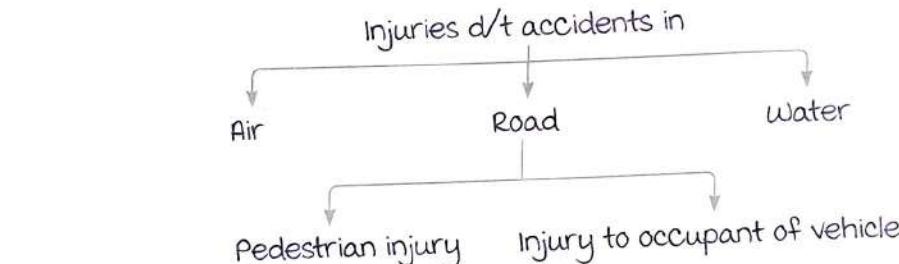
Hog Tying :

Tying wrist and ankle together in prone position.



----- Active space -----

TRANSPORTATION INJURIES



Injury to Pedestrians

00:00:43

Injury varies depending on

- Impact
 - Side (Back/lateral)
 - Level (Above or below centre of gravity)
- Vehicle
 - Type (Car/bus)
 - Speed Note :

centre of gravity (in adults) : At the level of sacrum.

TYPES OF IMPACTS AND INJURIES

First impact with vehicle → Second impact vehicle → Third impact with ground.

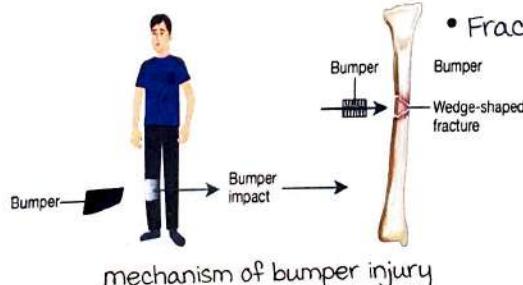
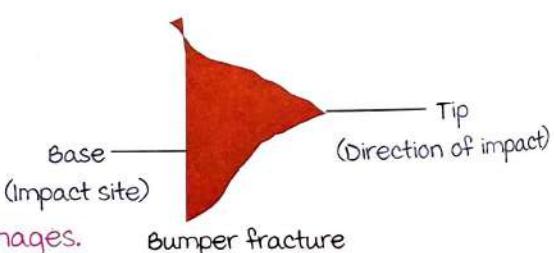


Primary impact injuries :

AKA bumper injuries. Injuries :

site : usually legs.

- Abrasion.
- Contusion.
- Laceration.
- Internal hemorrhages.



- Fractures
- Bumper
- Wedge-shaped fracture

- In children : Fracture of femur.
- In adult : Fracture of tibia (Bumper fracture).
- Side of impact : Gives direction of vehicle.
- Height of injury : Gives approximate height of the bumper from ground.
- Shape : wedge/triangular.

Secondary Impact Injuries :

----- Active space -----

- Pedestrian lifted off the ground onto bonnet/windshield → Injury of body part hitting vehicle.
- Head injury is common.

Tertiary Impact/Secondary injuries :

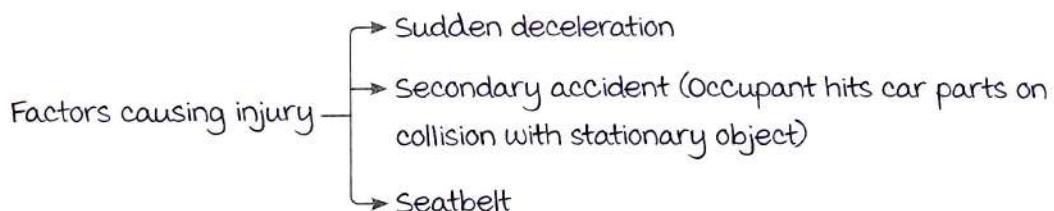
- Head injuries
 - Extensive abrasions/lacerations
 - Fracture
- } D/t fall on the ground/road.

Other injuries :

	Runover injuries	Rolling injuries
Cause	Vehicle with high chassis	Vehicle with low chassis
Injuries	<ul style="list-style-type: none"> • Tire marks. • crushing injuries. • Avulsions lacerations. • Amputation of limbs. 	<ul style="list-style-type: none"> • circumferential injuries (D/t being rolled on the ground). • lacerations/abrasions. • Grease marks. (D/t contact with undersurface of chassis).

Injury to Vehicle Occupants

00:12:15



INJURIES AT VARIOUS LEVELS

Windshield injuries :

Sparrow foot injuries :

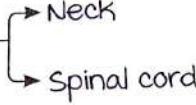
- multiple cut lacerations to exposed body part.
- D/t broken glass.
- m/c site : Face.



Sparrow foot mark injuries

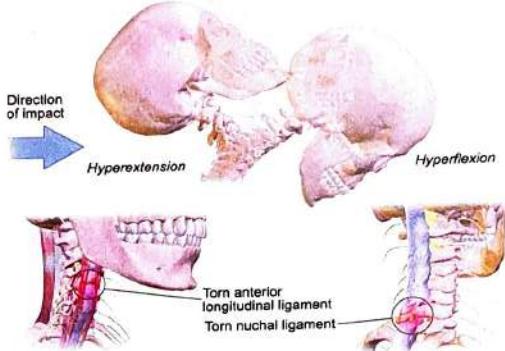
----- Active space -----

Whiplash injuries :

- Soft tissue contusions of 
- Fractures at cervical level.

Types

Sudden acceleration
↓
Hyperextension f/b flexion
↓
Anterior longitudinal ligament injury

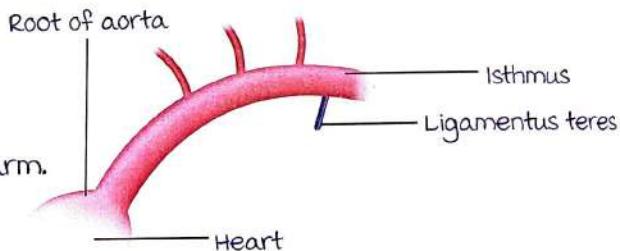


Sudden deceleration
↓
Hyperflexion f/b extension
↓
Nuchal ligament injury

Steering wheel injuries :

Impact to chest causing :

- Patterned bruise.
- Fracture of sternum, wrist & forearm.

**Sudden deceleration injuries :**Injury to **aorta** causing :

- Aortic rupture at the isthmus.

mechanism : Shearing force of mobile root of aorta → Pulls at the isthmus
(Fixed by ligamentum teres).

- Transverse tears in aorta : Ladder-rung tears.

Seatbelt injuries :

Force involved	Injury caused
Direct compression	<ul style="list-style-type: none"> • Seatbelt bruise. • Intraabdominal injuries.
Sudden deceleration	<ul style="list-style-type: none"> • mesenteric avulsion. • Small intestine.
Flexion-distraction (Lap-belt type)	Chance fracture (Transverse fracture of posterior & middle component of vertebra).

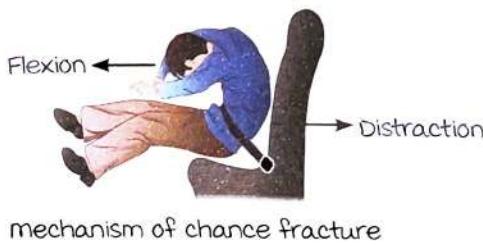


Seatbelt bruise

mechanism of injury to mesentery :

Small intestine (6 meters) anchored to posterior wall by the mesenteric root (6 inches)

Small intestine moves forward tearing the mesentery



Dashboard injuries :

Impact on knee d/t sudden deceleration.

Injuries caused :

- Patellar fracture.
- Tear of posterior cruciate ligament.
- Posterior dislocation of hip (Associated with dash-board fracture).

Injury	Driver	Front seat victim
Sparrow foot injuries	+	+
Whiplash injuries	+	+
Steering wheel injuries	+	-
Aortic injuries	+	+
Seat belt injuries	+	+
Dashboard injuries	-	+

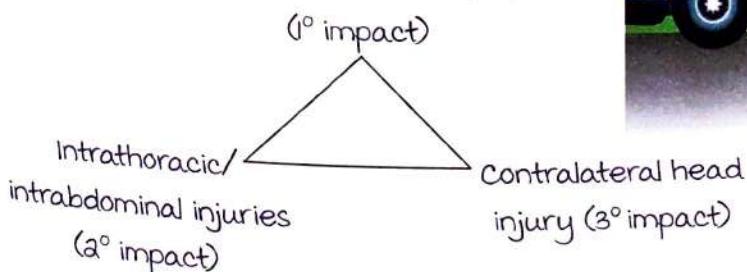
Important terminologies

00:28:35

Waddell's triad :

In a pediatric pedestrian hit by a car :

Fracture shaft of femur



----- Active space -----

Tailgating/underrunning:

Front-end collision with the tail end of a vehicle ahead.

Injuries caused:

- Face injuries.
- Decapitation.

Concussion:

Reversible loss of function.

Based on the organ involved:

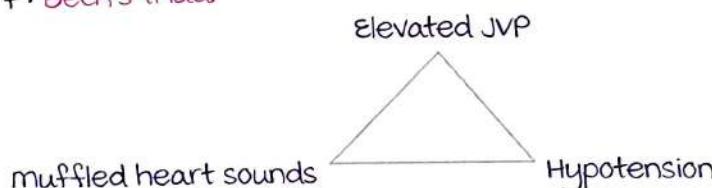
Organ	Known as	mechanism of injury	Consequences
Brain	Cerebral stunning	Sudden blow to head	<ul style="list-style-type: none"> • Transient loss of consciousness • Amnesia
Heart	Commotio cordis	Severe blunt trauma to chest (Common in sports person)	Sudden death
Spinal cord	Railway spine	Violent impact to spinal cord against bony canal	<ul style="list-style-type: none"> • Transient weakness of limbs. • Loss of control of bowel & bladder.
Retina	Berlin's edema	Blunt trauma to eye	<ul style="list-style-type: none"> • Transient loss of vision. • White opacification of a patch of retina.

Injuries to Organs

00:35:04

INJURIES TO HEART**Cardiac tamponade:**

Accumulation of blood in pericardial cavity → Diastolic dysfunction leading to death.

c/f: **Beck's triad**

Rx: Pericardiocentesis.

----- Active space -----

Perforating injuries :

- m/c chamber injured in stab injury to heart : Right ventricle.
- Fatality of injury :
 - Indirectly proportional to thickness of heart chamber.
 - Thick walls → Arrest bleeding → ↓ fatality.
 - Fatality of stab injury to right ventricle > left ventricle.

INJURIES TO SPLEEN

m/c organ affected in blunt injury to abdomen.

Alphabetical laceration.

INJURIES TO SPINAL CORD

m/c level : Cervical spine.

High fatality : C₄ level.

Seen in whiplash injuries and railway spine.

Note :

Ewing's postulates :

To determine relationship between trauma and tumor.

Tumor is caused by the trauma if it satisfies all the following criteria :

1. Tumor site prior to injury was normal.
2. Adequate trauma.
3. Significant time interval between trauma & tumor (3 weeks - 3 years).
4. Tumor originates from same part.
5. Same histological type.

INDIAN LEGAL SYSTEM

----- Active space -----

00:00:29

Inquest

To seek/conduct enquiry.

TYPES

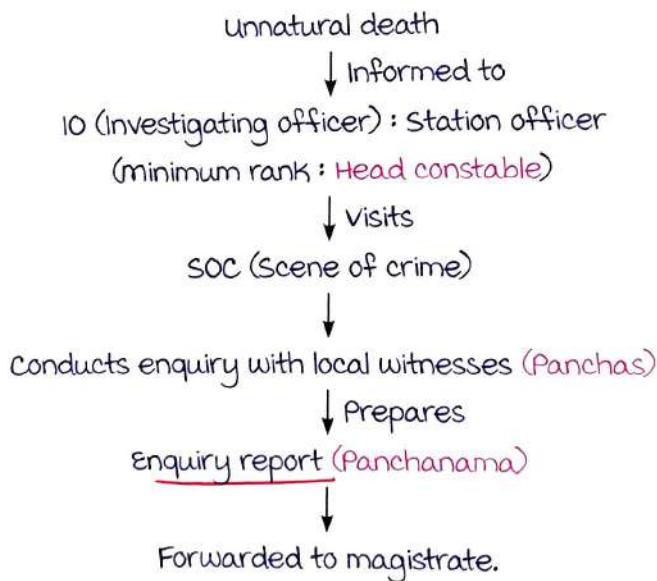
- Police.
 - magistrate.
 - Coroner's system : Obsolete.
 - medical examiner system : **Best** (USA).
 - Procurator fiscal system (Scotland).
- } India

Police inquest :

m/c in India.

Section : **194 BNSS**.

Process :



Powers of IO : may summon witness for enquiry (**195 BNSS**).

magistrate inquest :

most **superior** in India.

Section : **196 BNSS**.

Criteria :

1. **Custodial death/rape. P.S./ Jail / Bootral / Remand Home
Psy Hospital**

2. Dowry death/suspicion :

----- Active space -----

- Death of woman < 7 years of marriage under suspicious circumstances.
- Subjection to cruelty/harassment in connection to dowry before death.

3. Exhumation : Digging body out of grave.

Types :
 ↗ Judicial magistrate (Jm) : All 3 situations.
 ↗ Executive magistrate (Em) : Dowry death/exhumation.

Criminal Courts

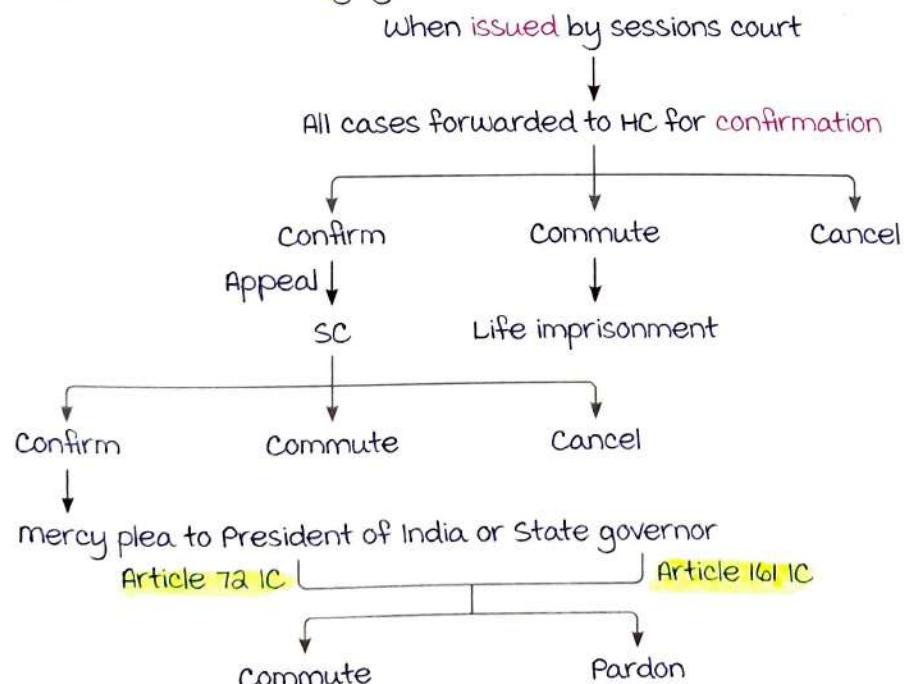
00:11:00

HIERARCHY & POWERS

Court	Apex at	max punishment	max fine	Level of appeal
Supreme court (SC)	National level			Courts of appeal
High court (HC)	State level			
Sessions court				
Additional sessions court	District level	Any punishment given by law including death sentence.	Unlimited	
Fast track court				
Assistant sessions court		Imprisonment : 10 years		Courts of trial
Chief Jm		Imprisonment : 7 years		
1 st class Jm		Imprisonment : 3 years	₹50,000/-	
II nd class Jm		Imprisonment : 1 year	₹10,000/-	

Death sentence :

Judicial execution : Hanging.



----- Active space -----

Pregnant woman :

- Cannot be executed d/t life of fetus.
- HC : Commute to life imprisonment (456 BNS).

Evidence

00:23:17

Statement/document to prove/disprove a fact/truth.

CLASSIFICATION**Depending on validity in court :**

1. Direct evidence :

- Directly proving the facts.
- Eyewitness/CCTV footage/confession statement.

2. Indirect evidence :

- Not directly proving facts.

• Types :

a. Hearsay evidence :

- Heard from elsewhere.

- Limited validity

b. Circumstantial evidence :

- Proved based on circumstances.

RECORDING OF EVIDENCE

	Prosecution	Defence
Lawyer	Public prosecutor (PP)	Defence lawyer
Witness	Prosecution witness (PW)	Defence witness (DW)

Procedure :

1. Oath :

- Sworn by God/solemnity (Atheists).
 - Refusal : Punishable under 213 BNS.
 - Exemption : Child <12 years of age.
 - Perjury (227 BNS) : False evidence under oath.
 - Fabrication (228 BNS).
- } Punishable under
229 BNS.

2. Examination :

Defined by : 142 BSA.

----- Active space -----

	Conducted by	Leading questions	✓ Objectives
i. Examination in chief/ direct examination	Same side lawyer	Not permitted	<ul style="list-style-type: none"> • Placing facts before court. • Fact interpretation (Expert witness).
ii. Cross examination	Opposite side	Permitted	<ul style="list-style-type: none"> • Elicit favourable facts. • Test accuracy. • Discredit witness.
iii. Re-direct examination	Same side	Not permitted	<ul style="list-style-type: none"> • Clear doubts of cross examination. • Avoid fact misinterpretation. • <u>No new facts placed.</u>

Order of trial :

- Oath → Direct examination → Cross examination → Re-direct examination.
- Given by : 143 BSA.
- Judge :
 - Ask questions at any stage (168 BSA).
 - Recall/re-examine any witness.

Hostile witness :

- Adverse/unfavorable witness.
- Same side lawyer can ask leading questions.

Circumstances :

- Conceals truth.
- Not favoring the same side.
- Contradicting the previous statement.

Declarations

00:46:33

Dying declaration :

- 26(1) BSA.
- Document made on statement by a dying person about cause or circumstance leading to death.
- Documentary evidence.

Statement :

- Oral.
- Written.
- Gesture.

----- Active space -----

Recorded by :

- Anybody.
- magistrate > Doctor > Police > Common public.
- Pre-requisite : 2 witnesses.

Validity :

- Sound mind : *Compos mentis*.
- Not under force/influence.
- Complete statement (Decided by court).
- Related to cause of death.
- Person must die (If person survives : used as corroborative evidence).

Procedure :

- No oath.
- No alteration of words/prompting/leading questions.
- Record **verbatim** in same language without translation.
- Sign/thumb impression of victim, recorder, 2 witnesses.
- Forward to magistrate at the earliest.

Dying deposition :

- AKA bedside court.
- Recorded by magistrate/judge.
- Oath : Compulsory.
- In the presence of accused/defence lawyer



Cross examination will be conducted → Leading questions permitted

- Superior than dying declaration.
- valid irrespective of pt. death/survival.
- Not practiced in India.

MEDICAL ETHICS

----- Active space -----

Set of moral principles a doctor must abide by.

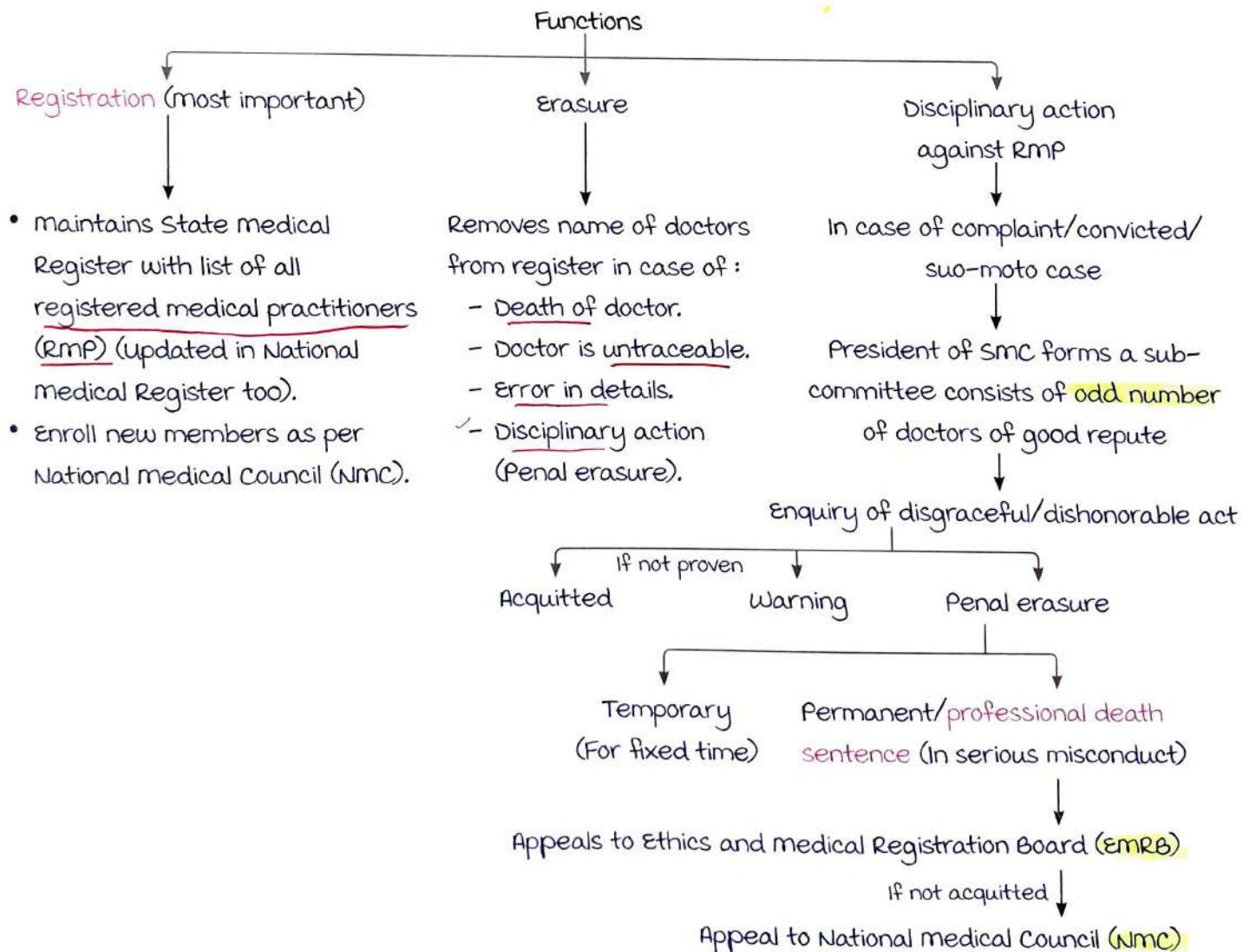
Basic ethical principles :

1. **Autonomy** : Patient's right to choose treatment.
2. **Justice** : Treat patients equally and fairly.
3. **Beneficence** : Promote well being of patient.
4. **Non maleficence** : Do no harm.

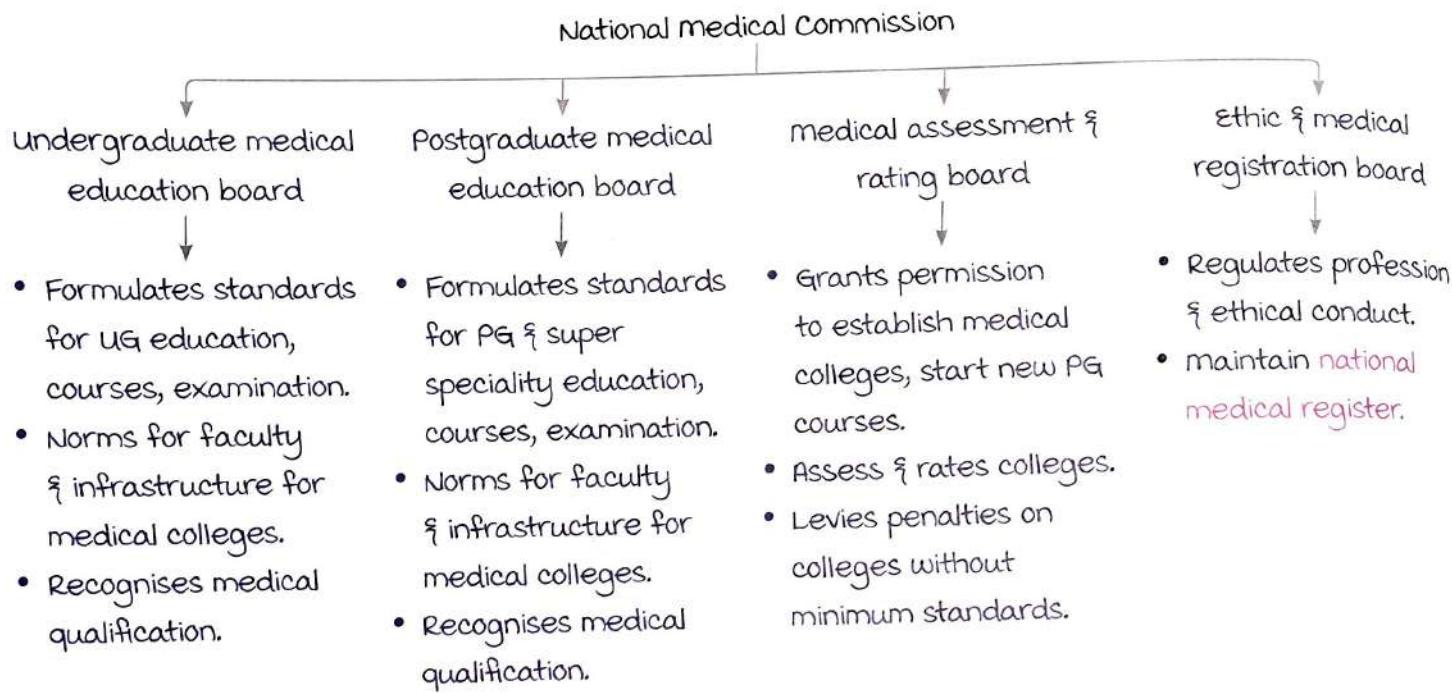
Medical Councils

00:02:10

STATE MEDICAL COUNCIL



----- Active space ----- **NATIONAL MEDICAL COUNCIL**
Boards and their functions :



Schedules in NMC :

First	List of degrees awarded by Indian universities	
Second	List of degrees awarded by foreign universities	
Third	Part 1	medical qualifications by Indian university not included in schedule 1
	Part 2	medical qualifications by foreign university not included in schedule 2

Professional Misconduct

00:12:35

Any disgraceful or dishonorable act done by a doctor.

AKA infamous conduct.

Warning notice :

List of infamous conduct acts released by NMC.

It is given to all RMP at time of registration.

It is an **incomplete list** that is updated regularly.

A	Addiction. Alcohol. Associations with unqualified persons. Abortion (Not in accordance with MTP act - Criminal). Advertisement (Repeated/inappropriate). Adultery (Improper conduct with patient/patient attender).
---	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

B	Bribery	----- Active space -----
C	Conviction in criminal case. Accepting/ giving commission. Covering : Employing/ assisting unqualified persons.	
D	Dichotomy/ splitting of fee : Referring patients to a particular facility for a part of fee	
E	Endorsement of brand / product/ hospital	
F	False certificate : Crime as well as an unethical act	
G	Gifts/monetary benefit accepted from pharmaceutical companies	

Warning v/s Warning notice :

Warning	Warning Notice
<ul style="list-style-type: none"> Form of punishment. Given to doctor accused of professional misconduct. 	<ul style="list-style-type: none"> List of misconduct. Given to all RMPs.

Note :

Registered medical Practitioners Professional Conduct Regulations, 2023 is currently on hold.

Professional Secrecy

00:23:32

Implied contract between doctor and patient to maintain confidentiality.

- Applicable to all adult (>18 yrs).
- Disclosure of patient information only with consent of patient



If done without consent : Breach of professional secrecy



Patient can file defamation case in court / complaint to SMC

Privileged communication :

Exception to professional secrecy in case of

- Community benefit
 - Notifiable conditions : Birth/death/ mTP and communicable disease (eg : COVID, yellow fever, cholera).
 - Crime/ suspected crime : Doctor is bound to inform nearest police (33 BNSS).
 - Infectious disease : Notify employer/ family authority.
 - Disease detrimental to self and others (eg : epileptic/ colour blind driver).

- Patient benefit
 - Psychiatric illness / suicidal tendencies : Informed to guardian.

- Court of Law
 - Court ordered examinations.
 - Expert opinion on negligence cases.

- In self-interest
 - If patient files a case of negligence.

----- Active space ----- Note : medical information about minors/mentally challenged/convicted prisoner can be informed to guardian/concerned authority.

00:33:06

Red Cross Emblem

- To be used only by :
 - a. members of Red Cross movement.
 - b. Army medical Services at times of armed conflict or natural disasters.
- Cannot be used by doctors → misuse punishment :
 - rs 500 ₹ fine.
 - impounding of goods and vehicles displaying the emblem.



Red cross emblem

00:33:52

Declarations

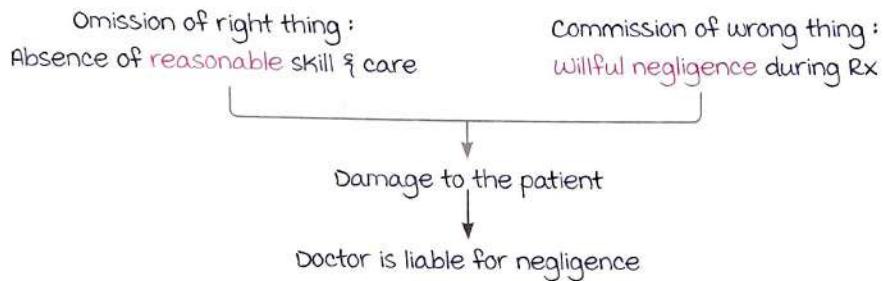
1. Tokyo : Guidelines to handle torture victim patients.
2. Helsinki : Guidelines to handle victims of human experimentation.
3. Geneva : medical ethics.
4. Oslo : Guidelines for therapeutic abortion.
5. Sydney : Death declaration and organ transplantation.
6. Venice : Guidelines to handle terminally ill patients.
7. Lisbon : Patient rights.
8. Malta : Hunger strikes (Protocol regarding force feeding).
9. Washington : Biological weapons.

MEDICAL NEGLIGENCE

----- Active space -----

Professional Negligence/Professional Malpraxis

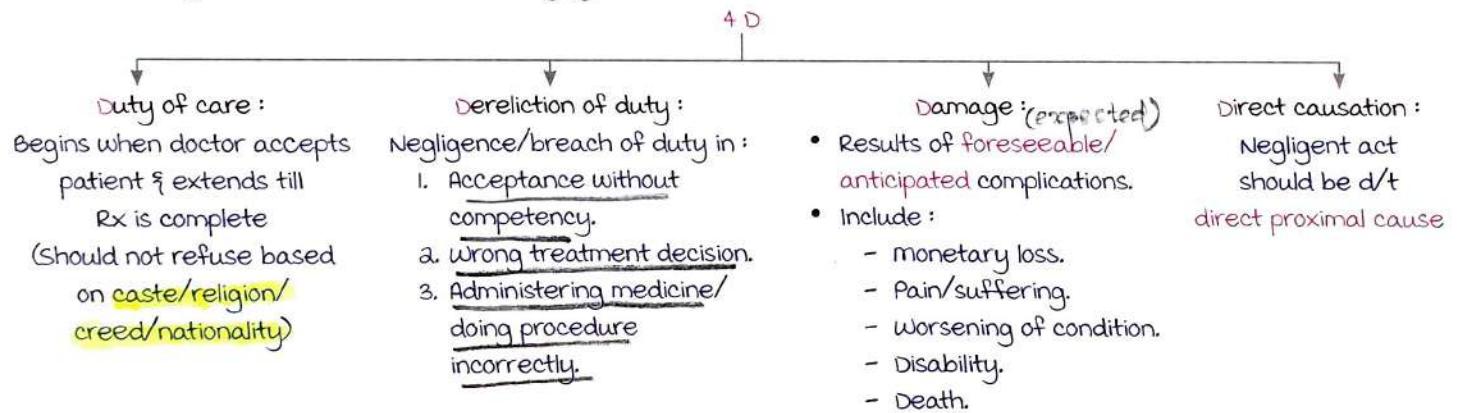
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Bolam's test:

- Doctor not liable : If standard guidelines/accepted clinical practices followed.
- Expert witness : Guide/assist resist residing authority & provide expert opinion on standard guidelines.

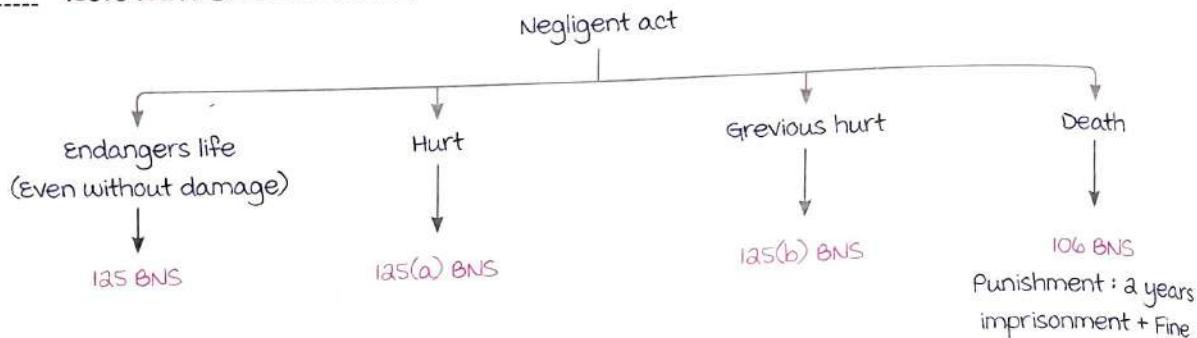
Essential ingredients of medical negligence case :



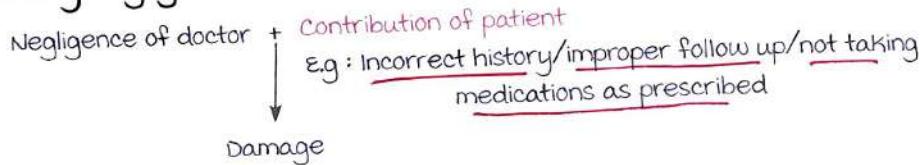
Types of negligence :

	civil negligence	Criminal negligence
Explanation	Simple lack of skill/care → Damage	Gross/willful negligence/utter carelessness/illegal act (Can be filed even without damage)
Example	wrong dose/prescription	<ul style="list-style-type: none"> • Wrong surgery/surgery on wrong side. • Criminal abortion.
Presiding court	<ul style="list-style-type: none"> • Civil court (Even if Rx for free). • Consumer court. 	Criminal court (For criminal action).
Parties	Patient vs doctor	Prosecution vs doctor
Burden of proof	Plaintiff (Person filing the case)	Prosecution
Evidence	Probability of evidence	Prove beyond reasonable doubt
Punishment	monetary compensation	Imprisonment/fine/both

----- Active space -----

Relevant BNS sections :

- 131 BNS : Procedure performed without consent amounts to assault.
- 271 BNS : Negligent act → Spread of fatal infection.
- 272 BNS : Malignant act → Spread of fatal infection.

Contributory negligence :

- Burden of proof : On doctor.
- Only applicable : Civil negligence.
- If proved : Liability of doctor reduced (Depends on doctrine of comparative negligence).

Doctrines of Medicolegal Proceedings

00:33:30

Doctrine of comparative negligence :

Judge decides relative contribution of parties : Damage & fines decided accordingly.

Relative contribution decided with help of :

Last clear chance doctrine	Avoidable consequence rule
Both parties wrong	
One party had last clear chance to avoid damage	Patient actions have aggravated the damage
Party that had last clear chance : Liable	Patient : Liable

Doctrines where expert opinion not needed :**Res Ipsa Loquitur :**

- The thing speaks for itself.
- Obvious gross negligence → Damage.
- Eg : Surgery on wrong side.

- Not giving TT
- Retaining foreign body inside during surgery

Doctrine of common knowledge :

- Negligence not related to specialised knowledge.
- Expert witness not required.
- Eg : IV fluid not given for dehydration.

Burden of proof of innocence on doctor

----- Active space -----

Doctrine of calculated risk :

- Every treatment/ procedure : Certain risk of unavoidable damage.
 - Doctor not liable : If risk explained before procedure.
- E.g : Cardiac arrest during dialysis.

Novus actus interveniens :

- New (Novus) unrelated act (actus) intervening (interveniens)/Act of god → Damage.
- Doctor may or may not be reliable : Depends on case.
- Chain of sequence broken.
- E.g :



Vicarious liability doctrine :

- AKA Respondent superior/let the master answer.
- Superior/employer is liable for negligence of third party/employee.
- Applicable for civil charges only.
- 2 doctors practice together : Both liable.

Borrowed servant doctrine :

When servant is borrowed : New temporary employer responsible for negligence.

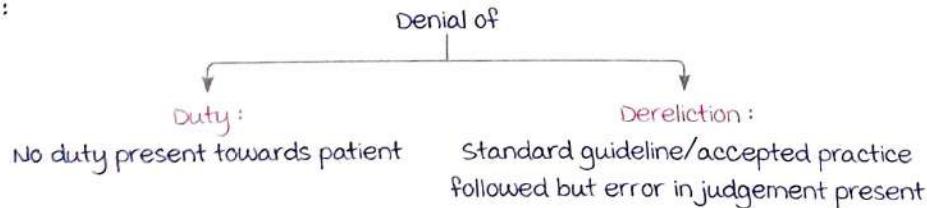
Captain of ship doctrine :

- Variant of borrowed servant doctrine : For operating room.
- If any of staff (New) make mistake : Surgeon (Captain) is liable.

Defences in Medicolegal Proceedings

00:59:05

1. Denial :



2. Res Judicata/Double jeopardy :

- Individual cannot be tried twice :
 - For same offense.
 - With same facts/evidence.

--- Active space -----

3. Res indicata :

- AKA limitation period.
- Period in which patient should file case of civil negligence.
- In India : 2 years.
- Not applicable for criminal negligence.

4. misadventure :

- Accidental act/unintentional act (Standard guidelines followed) → Damage.
- Can be : Diagnostic, therapeutic or research (Experimental).
- Doctor not liable.

5. maloccurrence :

- Best care/proper attention given → Still no improvement/poor outcome : Doctor not liable.

6. Voluntary non fit iuris :

- "To willing person, no wrong done".
- Patient aware of risks : Doctor not liable.

7. Novus actus interveniens.

8. Contributory negligence : Only a partial defense.

9. Calculated risk doctrine.

10. Product liability :

- Doctor prescribe product/drug → Product/drug defective → Damage to patient.
- manufacturer is liable.
- Burden of proof : On manufacturer.

CONSENT IN MEDICAL PRACTICE

----- Active space -----

Consent

00:00:13

Agreement/permission/compliance.

- 2/more persons consent when they agree upon something in same sense.
- Given by : Section 13 of ICA (Indian Contract Act).

Assault :

- Examination/treatment without consent, even in the best interests of patient.
- Punishable under 131 BNS.

TYPES

1. Implied consent : Gesture/body language.

2. Expressed consent :

- Verbal/written.
- Obtain in the presence of witness (medicolegal purposes).
- Best : written informed consent.
- Patient has all information of the procedure and the choice to refuse.

3. Surrogate/proxy consent :

- Consent by someone other than patient.
- Eg : Child/mentally ill/intoxicated persons Consent by Guardians.

4. Open/generic/blanket consent :

- One consent for all necessary procedures & investigations.
- Obtained during admission.
- Invalid in India.

5. Authorised consent : mandated by the court/law.

DOCTRINES

1. Doctrine of full disclosure :

- Impart complete information to the patient before obtaining consent.
- Consent with inadequate information = No consent.

2. Doctrine of partial disclosure/therapeutic privilege :

- Partial disclosure for the benefit of the patient.
- Full disclosure to be given to guardian.

----- Active space -----

3. Doctrine of informed refusal :

- Pt has the right to refuse treatment, after knowing risks.
- Documented with patient's signature.

4. Doctrine of extended consent :

- Extending the obtained consent of one procedure to another life saving procedure.
- Valid only in emergency cases.

5. Doctrine of therapeutic waiver : patient waives their right to consent.

6. Doctrine of emergency :

- Consent not mandatory in emergency, life saving situations.
- Section 30 BNS.
- Valid when unable to obtain consent from pt/guardian.

7. Doctrine of loco parentis :

- Child <12 yrs; Consent obtained by person in charge (Teacher/warden).
- In absence of parent/guardian.

Rules for Consent

00:22:42

Validity :

28 BNS :

- Free & voluntary.
- Physically competent.
- Sound mind.
- No fraud/misinterpretation of facts.
- No intoxication.

1. Medical examination :

	General physical examination	major procedures
minimum age for consent	12 years	18 years
<12 yrs : Consent by guardian (27 BNS)		

2. medicolegal examination in rape :

----- Active space -----

	Victim	Accused
Consent	mandatory	Not mandatory
Given by	184 BNSS	52 BNSS
No consent	Document informed refusal.	use reasonable force.

3. Autopsy :

	medicolegal	Pathological/clinical
Consent	Authorization from IO.	From relatives.

4. MTP :

- mandatory consent from pregnant woman.
- min age : 18 yrs.
- <18 yrs/mentally ill : Legal guardian.
- Husband's consent : Not required.

miscellaneous points :

1. 26 BNS :

- Act not intended to cause death.
- Done by consent, for patient's benefit.

2. 27 BNS :

- Act done in good faith for benefit of child/ person of unsound mind.
- By guardian's consent.

Not an offence.

3. mandatory consent for examination of undertrial prisoner.

4. Consent of authority for examination of a convict.

AUTOPSY PROCEDURES

----- Active space -----

Autopsy AKA Post mortem examination, Necropsy (Necro : Dead, opsy: study), Thanatopsy, sectio cadaveris.
 Eligibility to perform autopsy in India : MBBS (Registered medical Practitioner).

Types of Autopsy

00:01:55

1. medicolegal autopsy (m/c).
2. Clinical (Pathological) autopsy.
3. Virtual autopsy (Vistuopsy).
4. Endoscopic autopsy (keyhole).
5. Needle autopsy.
6. Psychological autopsy.
7. Verbal autopsy.
8. Obscure autopsy.
9. Negative autopsy.

	1. medicolegal	2. Clinical/pathological/academic
most common	In India	Western countries
Indication	Unnatural death (Accident, suicide, homicide, suspicious)	Natural death
Objective	<ul style="list-style-type: none"> • Identity (Decomposed, mutilated, blunt). • Cause of Death (COD). • manner of death (Natural/unnatural). • Injuries : Document character and type. • Weapon/poison responsible for death. • Fetus : Live birth (Viable/Non-viable) or Dead born. • evidence : Collect, preserve and forward or further investigation and present in court. 	Identify the cause/pathology of death
Authorization	Investigating Officer (IO) : Police or magistrate inquest through requisition letter (relatives consent : Not required).	Consent of relatives
Examination	Complete autopsy : All 3 primary cavities (Cranial, thoracic, abdominal).	Partial autopsy. Examine cavity with suspected pathology
Body handover	Investigating Officer	Relatives

3. Virtual autopsy (Vistuopsy) :

Procedure :

- Complete imaging of body (CT/mRI/3D optical measuring technique).
- minimally invasive technique : On suspicion can be followed by intervention.

Objective : Assess status/disease/injury in the body.

Disadvantage : Only structural lesions can be identified.

4. Endoscopic autopsy (keyhole) :

----- Active space -----

Procedure : Internal organs seen through endoscope/laparoscope.

Advantage : Body remains intact (Restrictive approach).

5. Needle autopsy :

Procedure : multiple tissue samples taken through biopsy needle & analyzed.

	6. Psychological autopsy	7. Verbal autopsy
Indication	<ul style="list-style-type: none"> • Doubt regarding manner of death. • To confirm suicidal death. 	Statistical, research purpose (not very accurate)
Objective	To assess state of mind of deceased before death	Determine cause of death
Procedure	Interview family, friends and relatives	Data collected by qualified people : Structured interview of family relatives

	8. Obscure autopsy	9. Negative autopsy
On external & internal examination	Finding not significant/minimal	No findings
Lab tests, history, interviews	Provides results	No results
Opinion on cause of death	Positive Eg : Vagal inhibition of heart, status epilepticus, paroxysmal fibrillation, uraemia, diabetes, etc.	Negative. Seen in 2-5% of all autopsies.

Post Mortem Examination

00:21:40

Identification :

By Police/Investigating officer.

External examination :

- Identification and documentation of injuries.
- Post mortem findings : To determine time of death etc.

Internal examination :

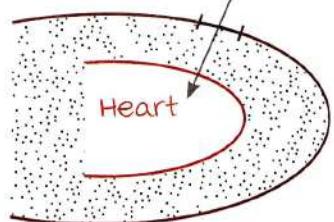
1st cavity to be dissected : Choice of autopsy surgeon.

m/c cavity dissected 1st : Thorax.

Rules :

	First cavity dissected	Observation
Poisoning	Cranial	Detect smell of poison (Eg : cyanide → Bitter almond smell)
Head injury	Cranial	

----- Active space -----

	First cavity dissected	Observation
Asphyxial death	Cranial	<ul style="list-style-type: none"> For bloodless dissection first : Open : Cranial → Thorax → Abdomen → Neck (last). Reason : To avoid Prinsloo's gordon artefact (misinterpretation of extravasated blood in neck at dissection as a mimic of asphyxial death).
In newborns	Abdomen (Dome of diaphragm)	Level of diaphragm : <ul style="list-style-type: none"> Live born : 6/7th rib (Expanded lung). Dead born : 3/4th rib.
Pneumothorax (Air in pleural cavity)	Thorax	Open skin flap → Pour water in pocket → Puncture intercostal space and pleura with knife → Bubbles in water (Air +).
Air embolism : <ul style="list-style-type: none"> venous (m/c) Systemic 	Thorax	Open sternum → Incise pericardial membrane → Fill pericardial cavity with water → Puncture ventricle → Bubbles in water. 
	Cranial	Pyrogallol test : Syringe with wide bore needle containing 2% Pyrogallol solution + NaOH → Insert and aspirate ventricle → mix with air → Brown colour (Positive test).

Note :

In poisoning : Abdominal cavity may have gases due to decomposition →
 Disturb smell of poison → Not opened first.

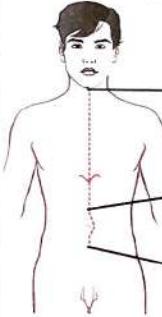
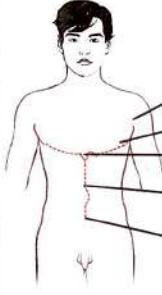
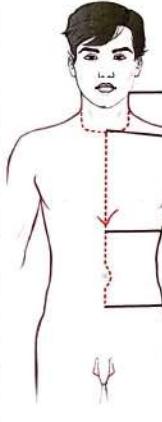
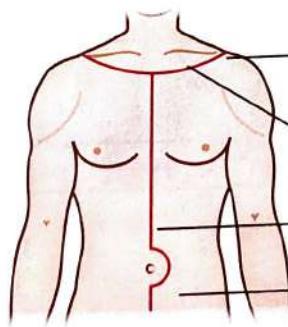
Incisions

00:33:45

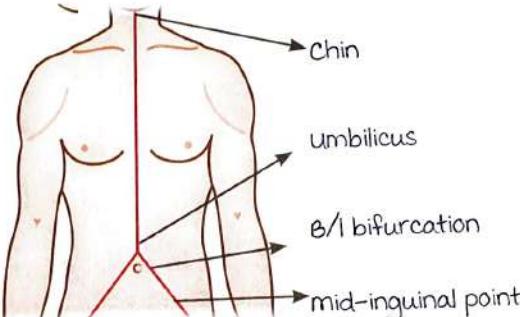
Types	Site of incision
Primary	On external skin
Secondary	On skull vault, rib & sternum
Tertiary	On serous membranes
Quaternary	On individual organs

Primary skin incisions :

----- Active space -----

	Characteristics	Advantages
I incision	<p>Central midline vertical incision</p>  <p>Chin Umbilicus : Avoided (is cicatricial → Tissue → Difficult to suture) Pubic symphysis</p>	<ul style="list-style-type: none"> most common. Easy. Single incision to open neck, thorax, abdomen.
Y incision	 <p>Acromian process B/l extension below breast Xiphoid process vertical incision Pubic symphysis</p>	Cosmetic purpose : Especially females
modified Y incision	 <p>mastoid process suprasternal notch vertical incision Pubic symphysis</p>	Detailed neck examination : In asphyxial deaths
T incision (Bucket handle)	 <p>Acromion process Horizontal : B/l along subclavicular line Vertical : From midpoint Pubic symphysis</p>	
X- incision	<ul style="list-style-type: none"> Posterior surface of body. x-shaped incision. 	Custodial deaths : <ul style="list-style-type: none"> D/t torture. Assess deeper injuries (Bruise/ internal injury).

----- Active space -----

	Characteristics	Advantages
Inverted Y incision	 <p>Chin umbilicus b/l bifurcation mid-inguinal point</p>	In newborns

Organ Examination

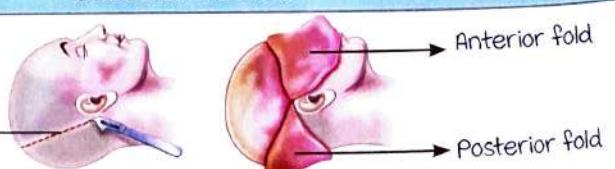
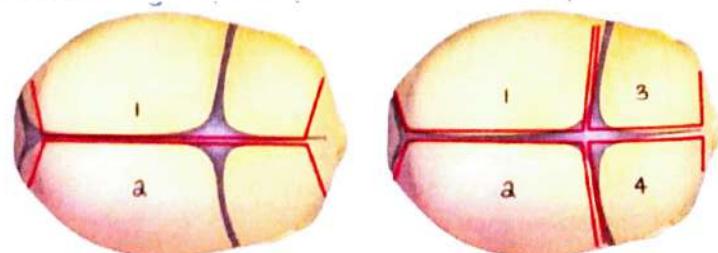
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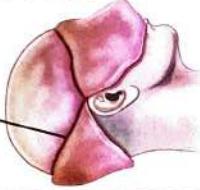
ORGAN REMOVAL TECHNIQUES

	Removal of organ	Advantage	Disadvantage
Organ by organ (Virchow's technique)	One by one	<ul style="list-style-type: none"> most common. Study organ in detail. 	Cannot study inter-organ relationship
en masse (Lettulle's) technique	From tongue to anus as a single mass	<ul style="list-style-type: none"> Study inter-organ relations. Rapid removal (Save time). Detect fetus malformation. 	Difficult to handle
Block (Ghon's) technique	Single cavity cervico-thoracic/abdomen/urogenital block	Easier than en masse	
In situ dissection (Rokitansky technique)	No organ removal (In-situ)	↓ Exposure in infectious diseases (HIV)	

ORGAN DISSECTION

Head dissection :

		Dissection methods
	Adult	 <p>Bimastoid incision (Along vertex) Anterior fold Posterior fold</p>
Scalp	Fetus	 <p>Benekes method : 2 butterfly shaped flaps Barr's method : 4 flaps</p>

	Dissection methods	----- Active space -----
Skull vault	Electric saw : Stryker's saw. V-shaped skull cap opening	
Brain	<ul style="list-style-type: none"> • Examination samples : <ul style="list-style-type: none"> - Fresh : most common. • Formalin fixed (ideal) : Fixed in 10% formalin for 2-3 weeks. • Cranial cutting method: <ul style="list-style-type: none"> - Vertically cutting brain along coronal plane. - most reliable to examine brain parenchymal lesions. 	

Spinal cord dissection :

Not routinely done (cumbersome).

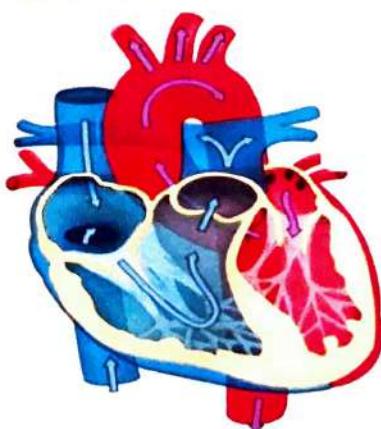
In suspected lesions :

	Anterior approach	Posterior approach
Procedure	Anterior incision → Dissection of thorax and abdominal cavity → Spinal cord	<ul style="list-style-type: none"> • Anterior dissection not needed. • Directly open posteriorly.
Advantage	Examine nerve roots and Dorsal ganglion	<ul style="list-style-type: none"> • Easier. • Cervical spinal cord : Better accessible and visualised. • Assess continuity of brain and spinal cord
Disadvantage	complex dissection	

Heart dissection :

1. Inflow - outflow method : m/c

- Along direction of blood flow.
- Right atrium → Tricuspid valve → Right ventricle → Pulmonary valve → Left atrium → mitral valve → Left ventricle → Aortic valve.



Direction of blood flow

2. Ventricular slicing (Short axis method) :

multiple cuts perpendicular to axis of heart.

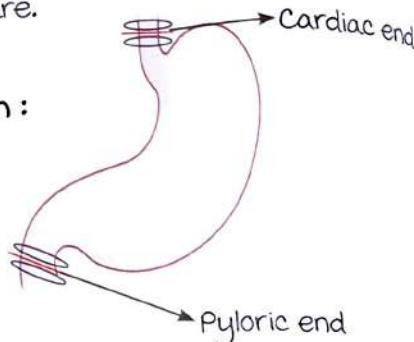
3. Sandwiching (Intramural method) :

- multiple cuts along muscle plane (Horizontal cut parallel to axis).
- To detect : Infarct/fibrotic plaques.

----- Active space -----

Stomach dissection :

- Double ligation → Cut in between 2 ligatures (To prevent leakage of gastric contents, preserve for further examination).
- Incision : **Along greater curvature.**
- Magenstrasse : In acid consumption → Area of maximum damage is lesser curvature.

**Visceral organs (kidney, liver, spleen) dissection :**

Bread loafing method : multiple parallel cuts.

Note :

Samples preserved for DNA investigations :

- No decomposition : Blood.
- Early decomposition : Muscle, spleen.
- Late decomposition : Bone & teeth (Last organs to decompose), hair roots.

Exhumation

01:02:50

AKA disinterment (Internment : Burying).

Lawful digging out of already buried body.



Exhumation

Authorised by : magistrate (Section 196(4) BNSS).

Time limit : In India no maximum limit.

Supervisors :

1. magistrate.
2. Police.
3. Doctor.

Time : Early morning (Changes visualised better in daylight).

Soil sample :

- 6 samples from body : Anterior, posterior, superior, inferior, right, left.
 - >500 g each.
- 1 control sample from soil : To rule out post mortem imbibition.

Note :

Post mortem imbibition :

- Absorption of metallic poison from soil into body post death.
- most common : **Arsenic.**
- In poisoning : Arsenic (Body) > Arsenic (Soil).
- Postmortem imbibition : Arsenic (Soil) > Arsenic (Body).

EARLY POSTMORTEM CHANGES

----- Active space -----

Definitions :

Thanatology	Study of death in all aspects.	
Death	2(6) BNS	The word death denotes the death of the human being unless the contrary appears from the context.
	Clinically	Permanent cessation of all the signs of life i.e. circulation, respiration and brain function.
Taphonomy	Postmortem resorption	

Bishop's tripod of life :

AKA : Gateway of death/Atria mortis.

Components	modes of death
Respiration	Asphyxia
Circulation	Syncope
Brain function	Coma

Death

00:02:04

TYPES OF DEATH

	Somatic death	molecular death	Apparent death
Other names	Clinical death	Cellular death	Suspended animation
Features	Irreversible stoppage of circulation, respiration and brain function	Death of individual tissues and cells	<ul style="list-style-type: none"> • Looks dead → Alive on resuscitation. • BMR ↓ & vitals ↓. • Cells will utilise dissolved O₂ from the blood. • Can lead to premature declaration of death.

Supravital period :

- Time b/w somatic & molecular death.
- Variable with different tissue types.
- Cells with high metabolism → Sensitive to hypoxia → ↓ Supravital period.
- Significance : Organ harvesting/cadaveric transplant.

----- Active space -----

Causes of suspended animation :

mnemonic : I NEW HDTV.

- Insanity/iatrogenic.
- Newborn (m/c).
- Electrocution.
- Chronic wasting diseases
(Like TB/cachexia/cholera).

- Hypothermia/heat stroke.
- Drowning.
- Typhoid.
- Voluntary (Yoga practitioners).

TEST TO CONFIRM DEATH

To confirm circulation :

	Diaphanous test	Icard's test	magnus test
Result in case of death	No redness in the web space between the fingers on transillumination	No discoloration of distal part of fingers on injecting fluorescent dye	No congestion in distal part of finger on applying ligature

To confirm respiration :

	Winslow's test	Feather test	mirror test
Procedure	Bowl of water placed on the chest ↓ Look for movement of the bowl	Feather kept in front of the nose ↓ Look for movements of feather	mirror placed in front of the nose ↓ Look for fogging

POSTMORTEM CHANGES

Immediate	Early	Late
within few minutes	Hrs to days	Days to weeks
<ul style="list-style-type: none"> • Loss of brain function → Loss of voluntary movements/insensibility (earliest sign). • Loss of circulation. • Loss of respiration. • Similar findings as somatic death. 	<ul style="list-style-type: none"> • Skin changes. • Eye changes. • Algor mortis (cooling). • Livor mortis (staining). • Rigor mortis (rigidity/stiffening). 	<ul style="list-style-type: none"> • Decomposition. • Autolysis (By lysosomal enzymes). • Putrefaction (By bacterial enzymes).

Early Postmortem Changes

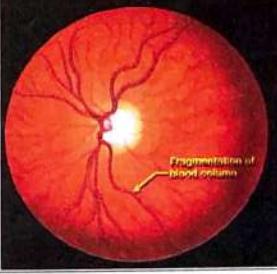
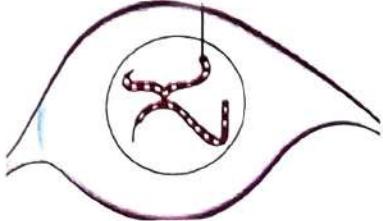
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SKIN CHANGES

Loss of elasticity.

EYE CHANGES

	Features	Time since death (TSD)
Retina	<ul style="list-style-type: none"> Stoppage of circulation → Fragmentation of retinal vessels. AKA Kevorkian sign/railroad sign/cattletracking sign. 	  <p>Few minutes</p>
Sclera	<ul style="list-style-type: none"> eyelids open → Drying/ dessication/ dust deposition. Triangle shaped opacities on either side of cornea → <i>Tache noire sclerotica</i>. Yellow → Brown + black. 	 <p>3-6 hrs</p>
Cornea	<p>Transparent → ^{1 hr} Hazy → ^{6 hrs} Opaque</p>	<p>1-6 hrs</p>
IOP	<p>20mm of Hg → ^{2 hr} 0 mm of Hg</p>	<p>2 hrs</p>
Vitreous	<ul style="list-style-type: none"> Resistant to decomposition (Difficult for bacteria to enter). vitreous K^+: most reliable indicator for TSD. Best medium for TSD. 	

medicolegal importance (MLI) :

Estimation of TSD.

ALGOR MORTIS

Chill of death.

Onset: 15 mins after death.

mechanism: Death → Heat loss (Conduction, radiation, evaporation) →

↓ body core temperature (BCT).

----- Active space -----

Site to measure :

- Ideal : Subhepatic space.
- m/c : Rectum (Except in sodomy as it can disturb evidence).
- Others : Lower end of oesophagus, nasal cavity, tympanic membrane.

Instrument :

- Chemical thermometer/thanometer (25 cm long).
- Thermocouple (Advanced).

Phases in reduction of BCT :

- Shape : Sigmoid/inverted S-shaped.
- Rate of fall : $0.4 - 0.7^{\circ}\text{C}/\text{hr}$.

Note :

Factors affecting cooling of the body :

- Location of the body (inside/outside).
- Naked/clothed body.

TSD :

- Hensge monogram.
- Formula : $\text{TSD} = \frac{\text{Normal body temp} - \text{rectal temp}}{\text{Rate of fall of temp}}$

Postmortem caloricity :

- Body remains warm for 1-2 hrs after death.
- Seen when BCT is raised at the time of death.
- Causes :
 - Impaired heat regulation : Heat stroke, pontine haemorrhage.
 - ↑ Heat production (Excessive muscle contraction) : Strychnine poisoning, tetanus.
 - ↑ Bacterial activity : Septicemia, cholera.
- Absent in burns.

LIVOR MORTIS

AKA Cadaveric lividity/Pm lividity/Pm staining/
suggillation/cogitation/Pm hypostasis.



Pm staining

mechanism :

Blood in capillaries & venules → Pooling down in dependent parts → Bluish purple discolouration
 Site : (D/t gravity) (D/t deoxy Hb)

Depends on position of the body.

Supine	Back of head, back of chest and abdomen, back of legs
Prone	Front of face, front of chest and abdomen.
Vertically suspended	Glove and stocking distribution : Lower part of forearm, legs

Note :

----- Active space -----

- Glove & stocking distribution does not indicate hanging but vertical suspension.
- conditions when PMS is not seen :
 - Body keeps rolling (Fast flowing river).
 - Severe anemia.
 - Haemorrhagic/ hypovolemic shock (No blood for stasis).

Appearance of hypostasis :

- Onset (30 mins after death) → visibility (4 hrs) → maximum (6-12 hrs).
- Fixation :
 - 8 hrs (6-12 hrs after death).
 - To confirm : Apply pressure → Blanching → Not fixed.

Contact pallor :

Areas of tight contact → Compression of vessels → No Pm staining.

Causes : Tight clothing, pressure points (Occiput, shoulder blades, gluteal region, calf region).

Color :

- | | |
|---------------------------------------------------------------|------------------------------------------------------|
| • Normal : Blue. | • Opium : Black. |
| • CO poisoning : Cherry red. | • Methanol poisoning : Purple. |
| • H ₂ S poisoning : Bluish green (D/t sulf-Hb). | • Hypothermia : Pink (Rich O ₂ in blood). |
| • Cyanide poisoning : Brick/bright red. | • Clostridium welchi infection |
| • Phosphorous aniline/nitrite/bromide poisoning : Dark brown. | (Septic abortion) : Bronze. |

Medicolegal importance :

- Estimation of TSD.
- Position of body at death.
- Cause of death.

RIGOR MORTIS (RM)

AKA cadaveric rigidity.

Progression :

	Primary relaxation	Rigor mortis	Secondary relaxation
Cause	ATP: 100% present	ATP : Depletion Onset : At 85% } of normal ATP max : At 30% level	Decomposition Proteolysis of actin-myosin
Features	Passage of feces & urine (Sphincters relax)		

Onset :

- 60 min.
- Early onset if existing ATP in the muscle is less at time of death.

----- Active space -----

Rules of progression :**Nysten's rule :**

- Rigor mortis progresses in a specific sequence.
- myocardium → eyelids (Orbicularis oculi) → Neck → Jaw → Face → Thorax → Upper limb → Abdomen lower limb → Fingers & toe.
- Order of appearance : Descending.
- Order of disappearance : Descending.

Shapiro's rule :

- Rigor mortis is a biochemical process that occurs simultaneously in all muscles of the body.
- visibility depends on bulk of muscles.

Rule of 12 :

Onset at → maximum → Remains → Disappears → Resolution
 60 mins at 12 hrs for 12 hrs in 12 hrs

Site :

- Generalised (Involuntary > voluntary).
- 1st internal site : myocardium.
- 1st external site : eyelids.

Factors influencing :

1. Age
- According to Narayan reddy : Rm absent if fetus < 7 month of IUL.
 - According to Anil agarwal : Rm is absent if < 8 weeks of IUL
(Protein synthesis starts after 8 wks).
2. muscle bulk
- ↓ Bulk : Early onset (Less ATP)
 - ↑ Bulk : Late onset (more ATP)

Early onset of Rm :

- Violent death. Eg : Firearms, cut throat injury, electrocution.
- Chronic wasting disease (↓ ATP). Eg : TB, cholera.
- Strychnine poisoning } D/t ↓ ATP at time of death.
- Tetanus
- Heat stroke.
- Cyanide poisoning.

Late onset of Rm :

- Asphyxia.
- Pneumonia.
- Haemorrhage.



Rigor mortis

Differential diagnosis :

----- Active space -----

Heat stiffening :

- Exposure to heat ($>65^{\circ}\text{C}$) → Protein coagulation → Body stiffens.
- Antigravity muscles become bulkier → Flexed attitude.
- Attitude in burns :
 - Stiffer joints (Flexed), hyperextended neck, claw fingers.
 - AKA boxers/pugilistic defense/fencing attitude.

Cold stiffening :

- Body in cold chamber → Joint fluids freeze → Stiffness.
- Disappears at normal temperature.

Gas stiffening :

- Gas produced during decomposition → Bloating & stiffness of body.
Protrusion of tongue & eyeballs.

Cadaveric spasm :

- AKA instantaneous rigor/cataleptic rigidity.
- Occurs immediately after death.
- Spasm of group of voluntary muscles in use at the time of death.
- No primary relaxation.
- Antemortem finding.
- Cannot be mimicked/produced artificially.



Cadaveric spasm

----- Active space -----

LATE POSTMORTEM CHANGES

Decomposition

00:00:20

Late change : Body disintegrates.

PROCESS

Autolysis :

- Self destruction.
- Done by lysosomal enzymes (Endogenous).
- First external sign : Clouding of cornea.

Putrefaction :

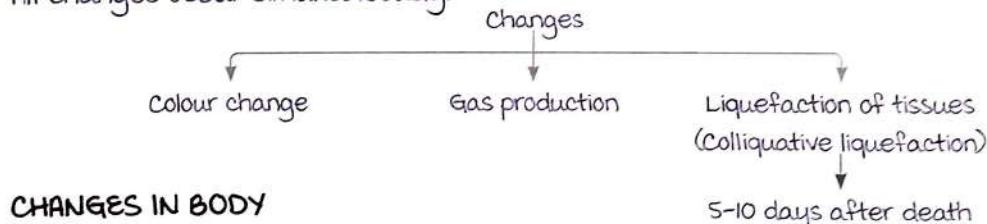
- Done by bacterial enzymes.
- E.g :

- | | | |
|------------------------------------------------------------------------------------------------------------------|-----------------|--------------|
| - E.coli | - Streptococcus | Source : GIT |
| - Staphylococcus | - Bacteroides | |
| - Clostridium welchii (chief destructive agent) → Produces lecithinase → Hemolysis, lysis of proteins, fats etc. | | |

Putrefaction

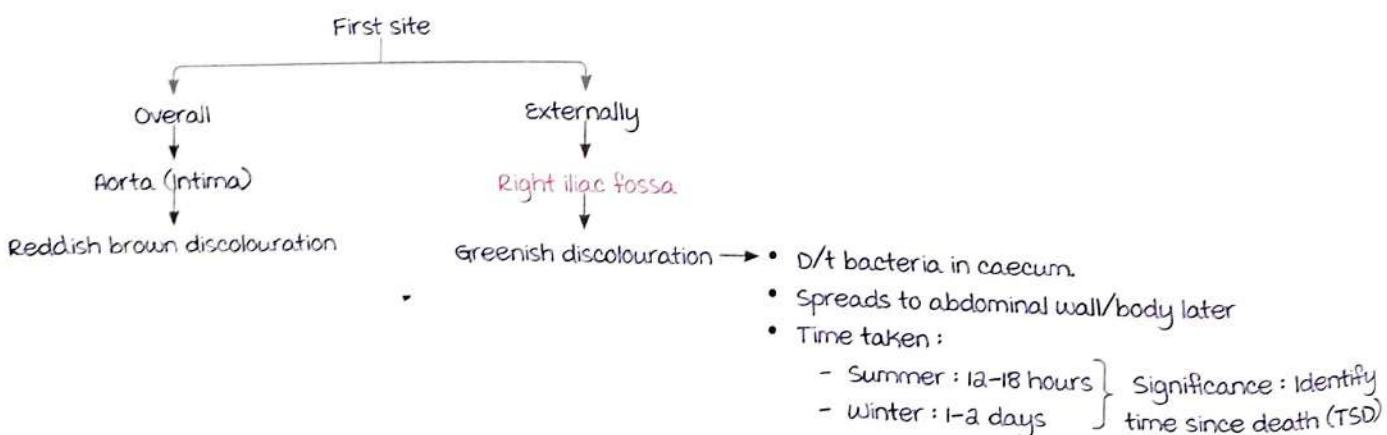
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All changes occur simultaneously.

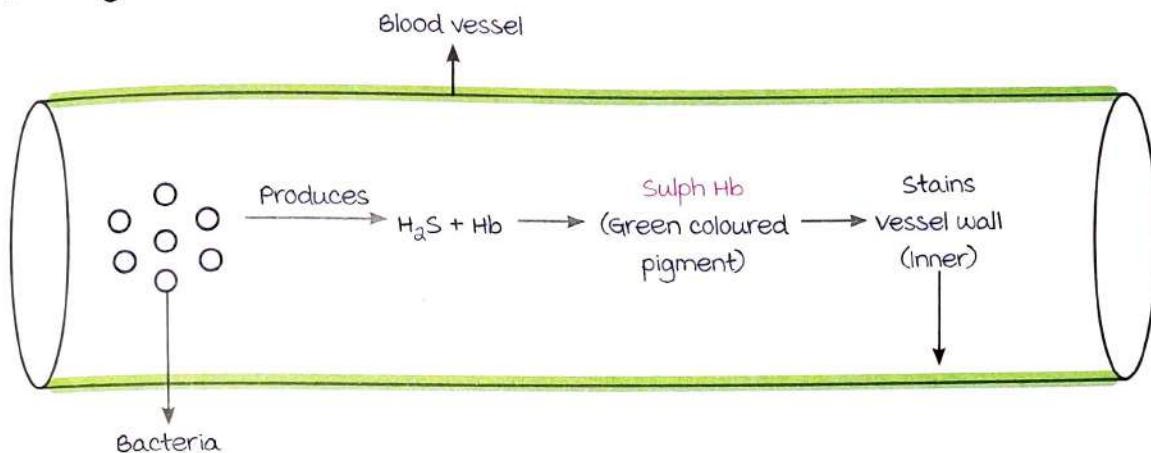


CHANGES IN BODY

Colour change :



marbling :



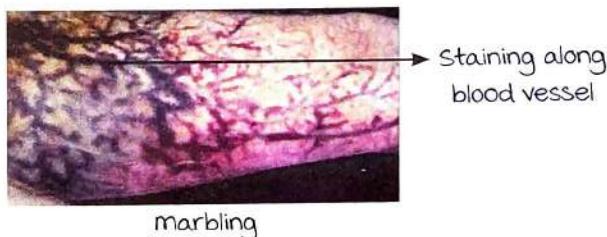
- Linear green coloured markings on the skin.

- Site :

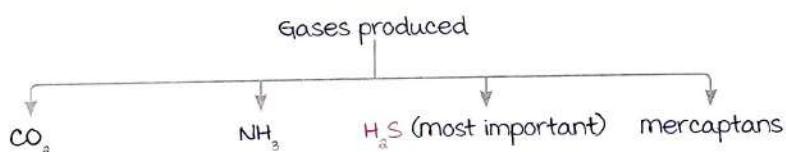
- Flanks.
- Shoulders.

- Occurs 36-72 hrs after death.

- medicolegal importance : TSD.



Gas production :

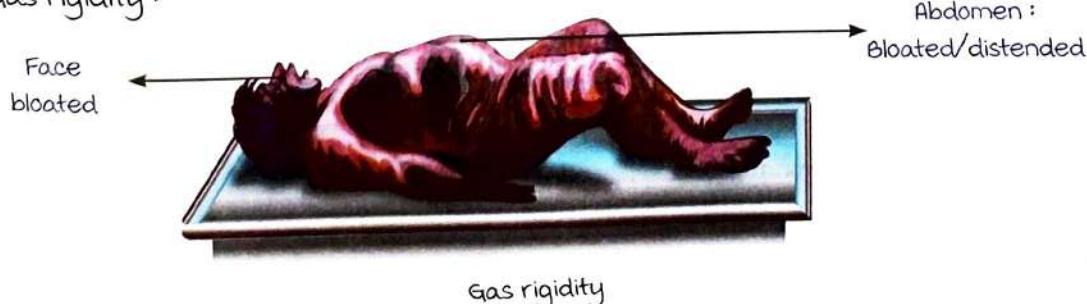


I. PM skin blisters :

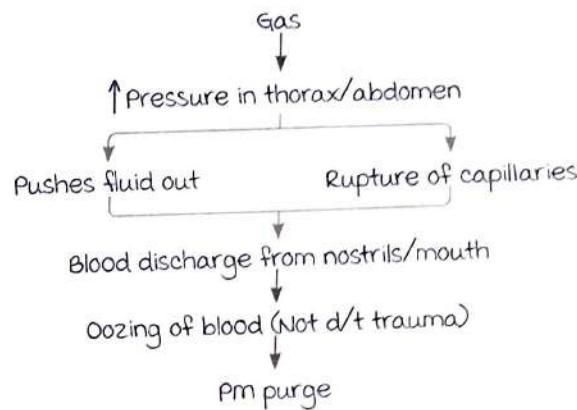
Antemortem vs post mortem blisters :

Feature	Ante mortem (Am)	Post mortem (PM)
Cause	Burns	Decomposition
Content	Inflammatory fluid (\uparrow Protein & Cl^-)	Gas
Base	Reddish (Hyperemic)	Pale

2. Gas rigidity :



----- Active space ----- 3. Pm purge :

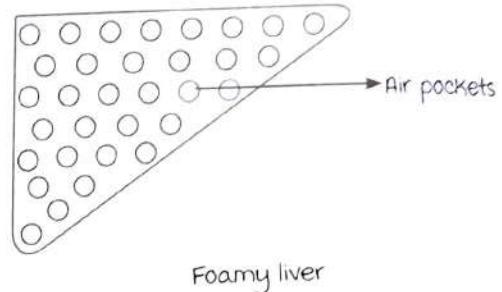


4. Foamy liver :

AKA honey comb liver.

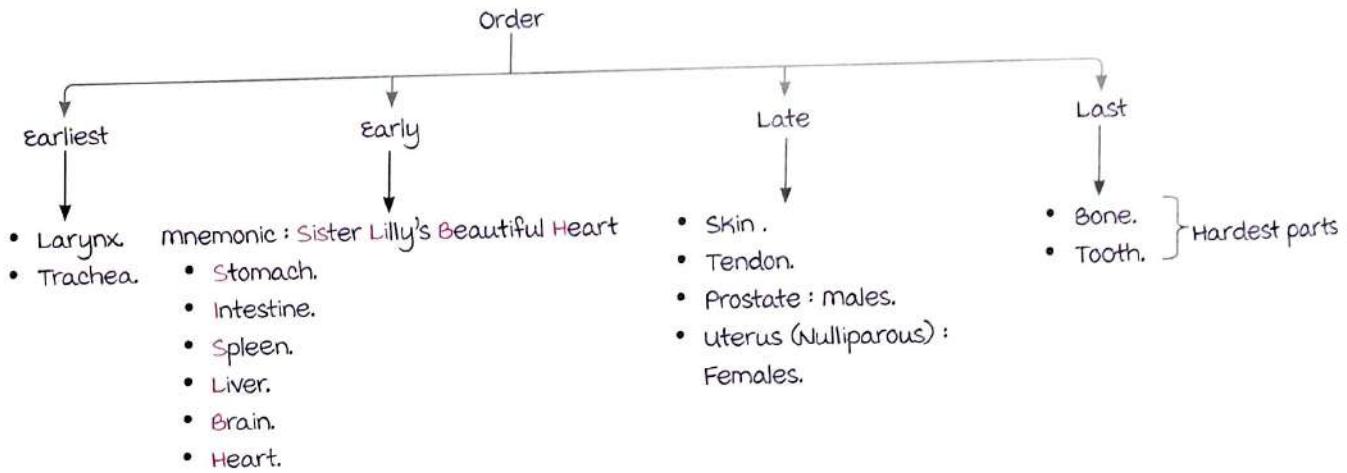
Liquefaction of tissues :

All organs → Liquified.



Foamy liver

ORDER OF PUTREFACTION



Note :

- Gravid uterus decomposes early (\uparrow vascularity).
- Putrefaction : Surest sign of death.

POISONS DELAYING PUTREFACTION

Mnemonic : State Medical Council.

- Strychnos nux-vomica.
- metals (Arsenic, antimony, thallium, etc).
- Carbolic acid.

RATE OF PUTREFACTION

----- Active space -----

Casper's dictum :

- Rate of putrefaction in different mediums : mnemonic AWESOME.
- Air : Water : Earth (Soil) = 1 (Fastest) : 2 : 8 (Slowest).

Methods of Preservation

00:20:07

NATURAL

modified forms of putrefaction.

Adipocere :

AKA grave wax.

mechanism :

- Hydrolysis/hydrogenation of fat.
- Fat → Fatty acids (Palmitic/Stearic acid) → Ca/salt deposition → Soap/wax like tissues (Adipocere).

Significance :

pH of tissue is acidic → Bacteria can't multiply → Body is preserved (Injuries/identification features).

Factors required :

- Warm climate.
- moisture.
- Clostridium welchii (Lecithinase).
- Intrinsic lipase (Lysis of fat).
- Still air.



Adipocere

Sites :

- S/c fat (earliest)
 - Breast
 - Gluteal region
- } ↑ Fat areas.

Time taken :

- 3 weeks to 3 months.
- Earliest : 3 days.

Smell : Ammoniacal.

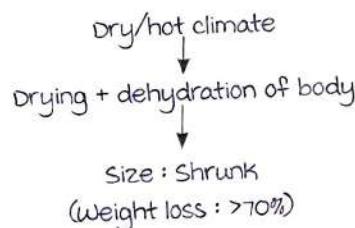
medicolegal importance :

1. Identification of person.
2. Identify injuries (Cause of death).
3. Time since death.
4. Place of disposal.

----- Active space -----

Mummification :

mechanism :



mummification

Factors required :

- Dry and hot climate.
- Free flowing air.

Smell : Odourless.

Time taken : 3-12 months.

medicolegal importance :

1. Identification.
2. Place of disposal.
3. Time since death.

Poisons favouring : Antimony & arsenic.

Note :

PM luminiscence : Body glows d/t organisms in it.

- Bacteria : Photobacterium fischeri.
- Fungus : Armillaria.

ARTIFICIAL**Embalming :**

- AKA **thanatopraxia**.
- Technique of preserving dead body by injecting chemicals.

Types :

- Artificial.
- Cavity.
- Surface (Skin).

Embalming fluid :

- Preservative : Formalin/formaldehyde/methanol.
- Germicide : Phenol (Carbolic acid).
- Wetting agent : Glycerine.
- Buffer : Sodium borate.
- Anticoagulant : Sodium citrate.
- Dye : Eosin.
- Vehicle : Water.

Note :

----- Active space -----

Ethanol : Not a part of embalming solution.

Best time : < 6 hours of death (most effective).

Best injection technique : Discontinuous injection & drainage.

Best vessel : Carotid & femoral vessels.

Best embalming technique : High pressure & low flow (Ensures proper perfusion & preservation).

Skin colour :

- Normal individual : Brown/grey.
- Jaundiced individual : Green (D/t reaction with bilirubin).

Results of embalming :

1. Preserves body.
2. Alters appearance of injuries (Interpretation : Difficult).
3. Chemical rigor (Permanent stiffening of body).
4. All poisons : Destroyed.
5. Dislodges thrombus/clots.

For above reasons → Never do embalming before autopsy

(Intentional disappearance of evidence : Punishable under section 238 BNS).

00:37:45

Forensic Entomology

Entomology : Study of insects.

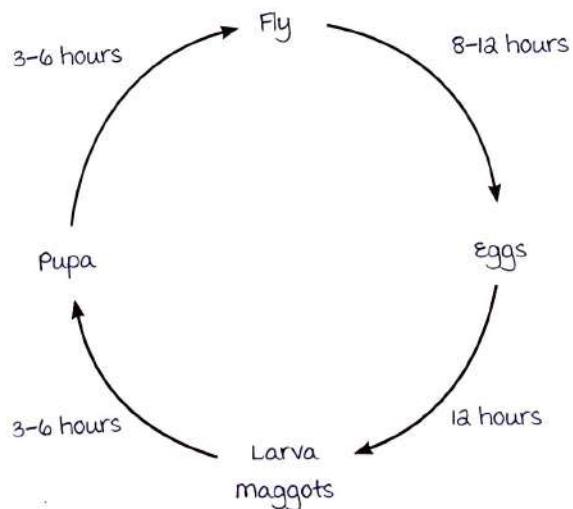
Forensic entomology : Application of entomology for forensic purposes & administration of justice.

Relevant insects :

1. Housefly (*musca domestica*).
2. Blowfly (*Calliphoridae*).
3. Flesh fly (*Sarcophagidae*).

Life cycle of insect :

- Average life span : 1-2 weeks.
- maggots appear : After 6-7 days after death.



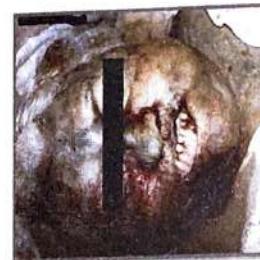
----- Active space -----

medicolegal importance :

1. Place of disposal (From type of species).
2. Time since death.
3. Poisoning case : Entomotoxicology (Analysis of insects to detect poison in decomposing tissues).

Preserving insects :

1. Absolute alcohol (ideal).
2. Hot water.



Insects

Note :

earliest eye sign of death : Kevorkian sign (Loss of circulation → Fragmentation of retinal vessels).

HUMAN IDENTIFICATION : PART 1

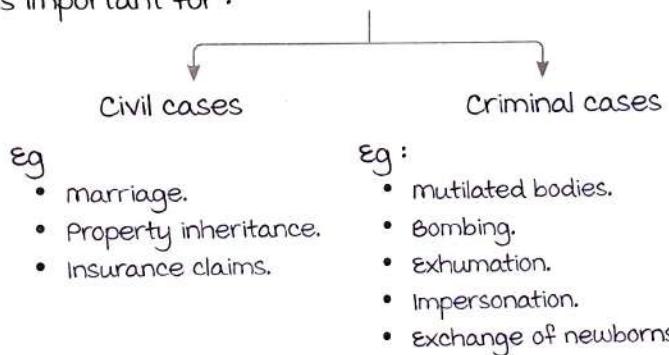
----- Active space -----

Determining the individuality of a person.

corpus delicti :

- Body of offence/body of crime/essence of crime.
- Includes :
 - Positive identification of the dead body (victim).
 - Proof of death by criminal act of accused.

Identification is important for :



Identification parameters :

Presumptive / Incomplete ID	Definitive identification
Big 4 : <ul style="list-style-type: none"> • Race. • Sex. • Age. • Stature. 	<ul style="list-style-type: none"> • Dactylography (most reliable) : Can differentiate monozygotic twins. • DNA fingerprinting. • Scars. • Tattoos. • Superimposition.

Race

00:33:45

3 broad races (Outdated) :



Race can be identified by bones, teeth, skin, iris, hair texture.

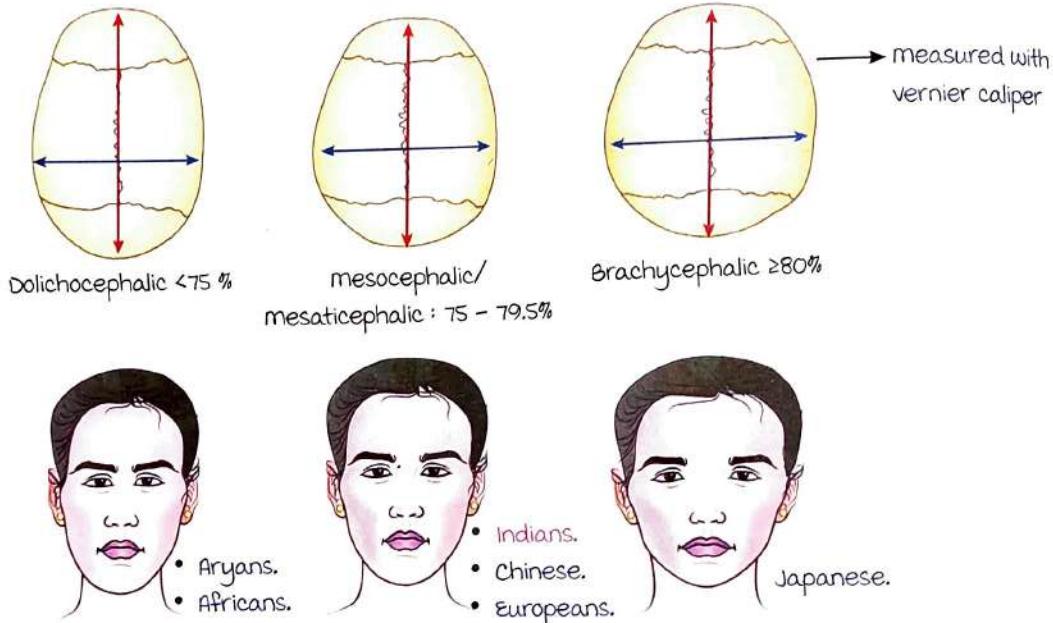
----- Active space -----

Bone :

Indices for race determination :

mnemonic : **BCCI**.1. **Brachial index** (Upper limb) : AKA radio-humeral index.2. **Crural index** (Lower limb) : AKA tibio-femoral index.3. **Cephalic index (C.I.)** : **SKULL** (Best method).

$$\frac{\text{max breadth (b/w parietal eminences)}}{\text{max length (b/w glabella \& occipital protuberance)}} \times 100$$



4. **Inter-membrial / Intra membral index** : Between upper and lower limb / between two limbs.

Teeth :

Negroid:
↑ tooth size.
↑ cusps.

Caucasoid:

mongoloid:

mnemonic : **PASTE**

- Pointed canines.
- Absence of molars.
- Shovel incisors.



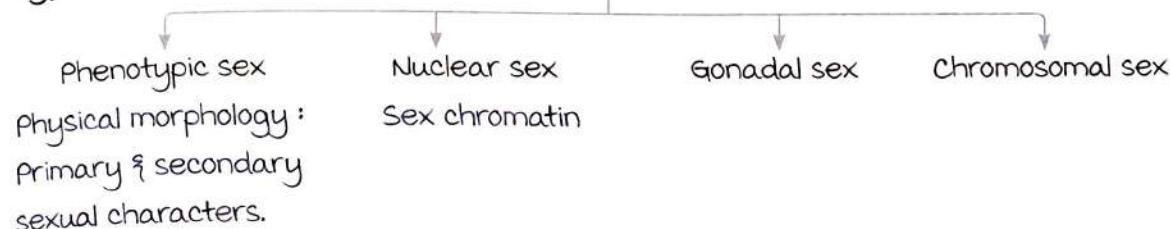
- **Taurodontism**.
- **Large tooth** (labeled with a yellow arrow).
- **Big pulp cavity** (labeled with a pink arrow).
- **Enamel pearl** : Nodule in enamel.

Sex Determination

00:14:47

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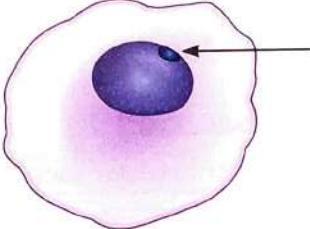
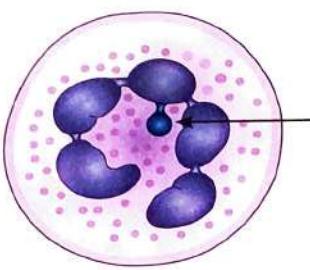
Types of sex :



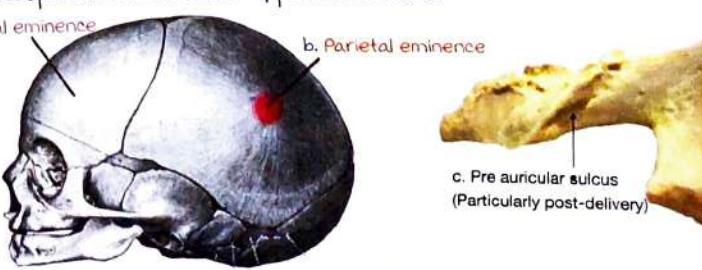
Concealed sex : Hiding sex with **criminal intent** (Revealed O/E).

Note : Transvestism is wearing clothes of the opposite sex for sexual gratification
(Not a crime).

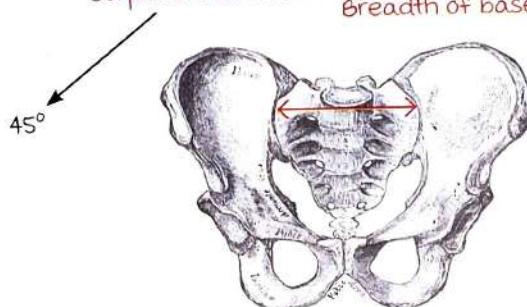
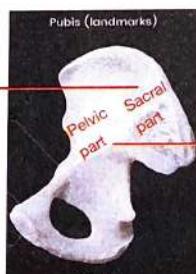
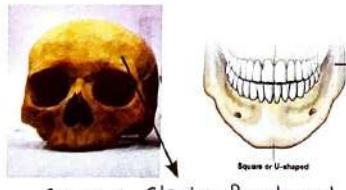
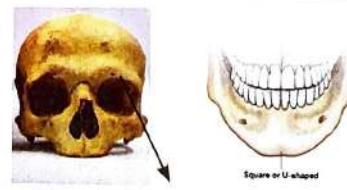
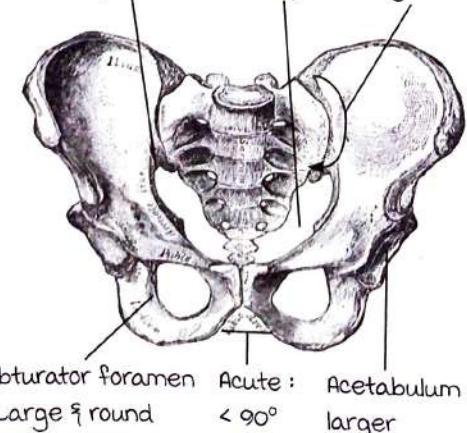
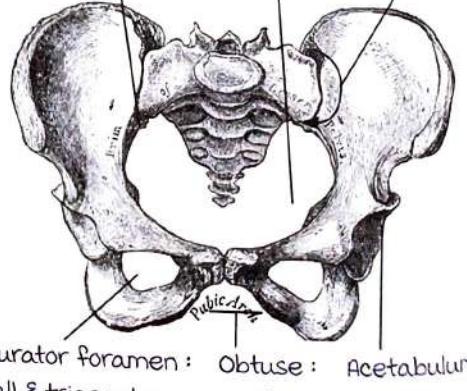
Sex chromatins :

	Barr body	Davidson body
Definition	Inactivated X chromosome in all female & few male somatic cells	Appendage attached to the lobes of neutrophils in females
Appearance	Plano-convex mass near nuclear membrane 	Drumstick-like 
Specimen	Buccal smear, saliva, hair, teeth	Peripheral smear
% of male cells	0 - 4	0
% of female cells	20 - 80	6
Number present	Number of X chromosomes - 1	-

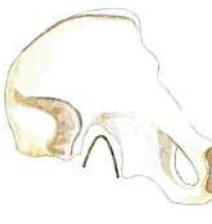
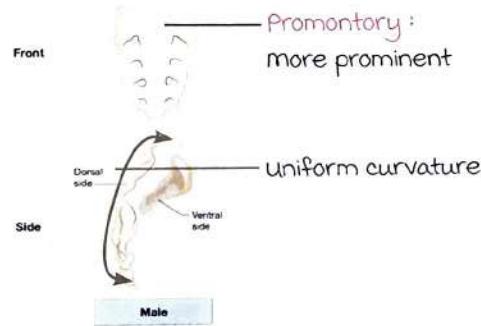
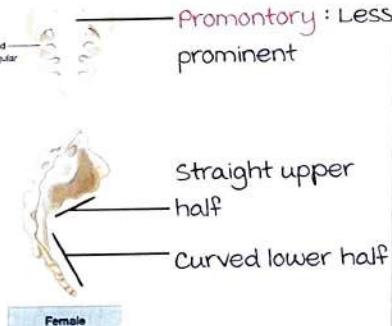
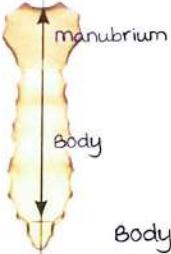
EXAMINATION OF SKELETAL REMAINS

Skeletal remain	male	Female
<ul style="list-style-type: none"> muscle markings. Ridges. Prominences : <ul style="list-style-type: none"> Glabella. Supraorbital ridge. mastoid process. Occipital protuberances. 	more prominent	<ul style="list-style-type: none"> Less prominent & smooth. Exceptions in females : ↑ prominence of <ul style="list-style-type: none"> a. Frontal eminence b. Parietal eminence c. Pre auricular sulcus (Particularly post-delivery) 

----- Active space -----

Skeletal remain	male	Female
	<p>Lower</p> <ul style="list-style-type: none"> • Sciatic index • Sacral index • Ischiopubic index (Washburn index). • Sternal index. 	<p>Higher</p>
Indices	<p>Corporobasal index = $\frac{\text{Breadth of body of SI} \times 100}{\text{Breadth of base of sacrum}}$</p>  <p>45°</p> <p>40.5°</p>	
		<p>Chilotic line index</p> 
mandible, orbits ♀ chin	 <p>Square Sloping forehead</p> <p>Angle of mandible : Less obtuse ($< 125^\circ$)</p>	 <p>Rounded vertical forehead</p> <p>Angle of mandible : more obtuse ($> 125^\circ$)</p>
Pelvis :	<p>Pelvic inlet : Heart shaped</p> <p>Pelvic cavity : Tunnel shaped</p> <p>Large SI joint</p> <p>Obturator foramen : Large & round</p> <p>Acetabulum : Acute : $< 90^\circ$</p>	<p>Pelvic inlet : Circular</p> <p>Pelvic cavity : Flat bowl shaped</p> <p>Smaller SI joint</p> <p>Obturator foramen : Small & triangular</p> <p>Obtuse : $> 90^\circ$</p>
Shapes & angles		

----- Active space -----

Skeletal remain	male	Female
• Ischial tuberosity	Inverted	Everted
• Greater sciatic notch (Best criteria).	 Small, narrow and deep greater sciatic notch	 Large, wide and shallow greater sciatic notch
• Sacrum	 <p>Front: Promontory: more prominent</p> <p>Side: Uniform curvature</p> <p>Male</p>	 <p>Front: Broader and more triangular</p> <p>Promontory: Less prominent</p> <p>Side: straight upper half</p> <p>curved lower half</p> <p>Female</p>
<p>Sternum :</p> <ul style="list-style-type: none"> Ashley's rule of 149 : Sternal length (manubrium + body). <p>• Hyrtl's law.</p>	<p>$> 149 \text{ mm}$</p> <p>Body $> 2 \times$ length of manubrium</p>	<p>$< 149 \text{ mm}$</p> <p>Body $< 2 \times$ length of manubrium</p>  <p>manubrium</p> <p>Body</p>

Accuracy of sex determination from bones :

AKA Krogman's accuracy.

1. Pelvis : 95% (Best overall) : Differences seen even in children.
2. Skull : 90%.
3. Long bone : 80% (Best : Femur).

In combination :

- Pelvis + skull.
 - Skull + long bone.
 - Complete skeleton : 100 %.
- } 98%

----- Active space -----

HUMAN IDENTIFICATION : PART 2

AGE ESTIMATION

Fetus	Prepuberty	Adult
<ul style="list-style-type: none"> Crown to heel length (CHL) : Rule of Hasse. Fetal development. Ossification centres. 	<ul style="list-style-type: none"> Teeth : <ul style="list-style-type: none"> - eruption. - mineralisation. (Reliable) Ossification. 	<ul style="list-style-type: none"> Teeth : Secondary changes (Gustavson's method). Skull sutures (in both living & dead). Pelvis symphyseal surface changes : Todd's method/ Suchey brook's method. Sternal end changes : Iscan's method.

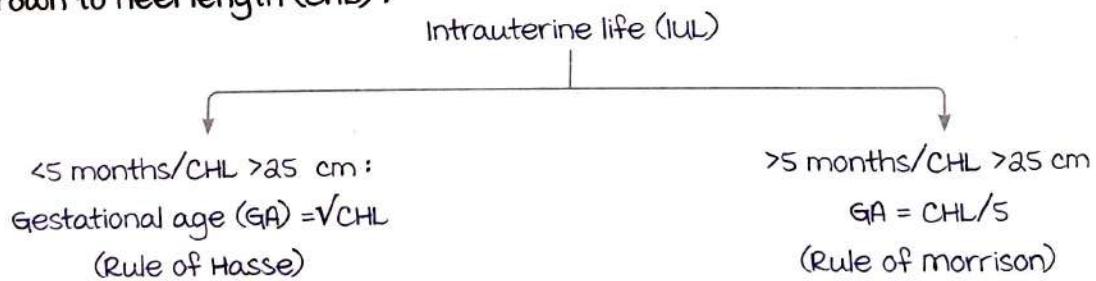
Note :

- Teeth eruption and ossification of bone is earlier in females.
- Skull sutures fusion occurs 1 year later in females.

Fetal Age Estimation

00:03:53

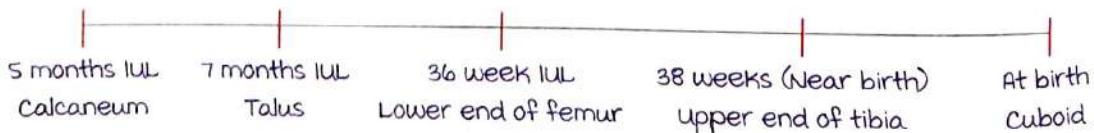
Crown to heel length (CHL) :



If CHL is not known, crown-to-rump length (CRL) is used.

- CRL = $2/3 \times CHL$
- CHL = CRL + Length of lower limb

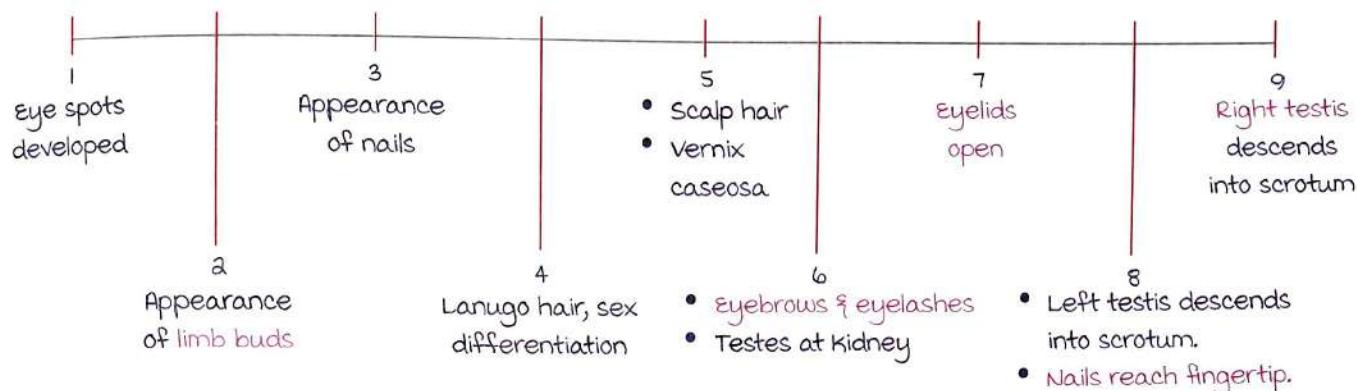
Fetal ossification centres :



Fetal development :

IUL (in months) :

----- Active space -----

**Age Estimation From Ossification**

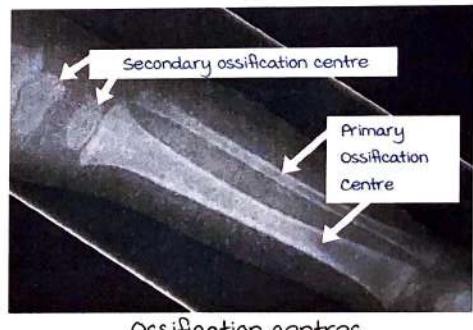
00:09:43

Basic rules :

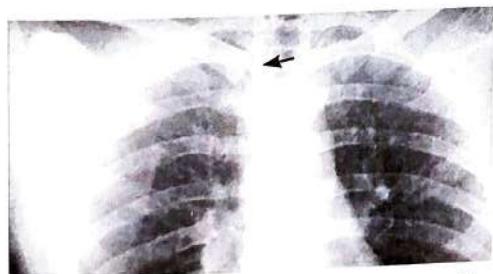
- Primary ossification centre → Shaft of long bone
 - Secondary ossification centre → Epiphysis.
- Fusion
(1 year earlier in female)
- Ossification centre has specific age of appearance and fusion.
 - Centre which appears first fuses later.

mandible :

Two halves fuse at 1-2 years of age.

**Clavicle :**

- Ossification centre at medial end.
- Appearance : 18-19 years → Fusion : 21-22 years.

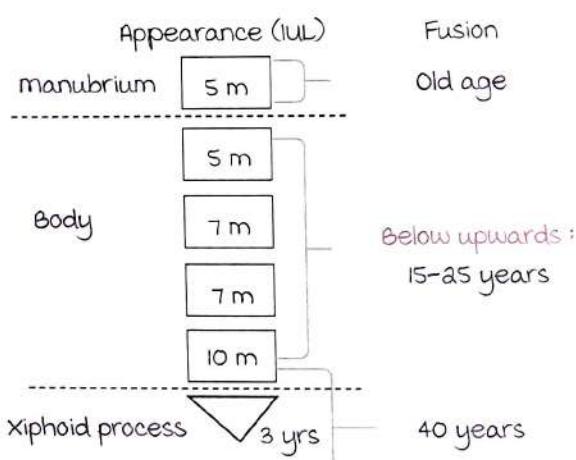


Appeared but not fused : 18-22 years



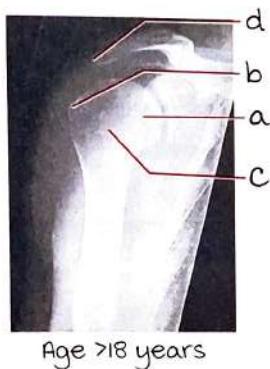
----- Active space -----

Sternum :



Ossification centre in sternum

Shoulder joint :



Ossification centre	Appearance	Fusion
a. Head of humerus	1 year	Conjoint epiphysis 18-19 years fuses to shaft
b. Greater tubercle	3 years	
c. Lesser tubercle	5 years	
d. Tip of acromion	14-15 years	17-18 years

Elbow joint :

Mnemonic : CRITOE.

Ossification centre	Normal age of appearance	Normal age of fusion
Capitulum	1 year	Conjoint epiphysis : 14-15 years
Radial head	5 years	
medial/Inner epicondyle	6 years	
Trochlea	9 years	Conjoint epiphysis
Tip of olecranon	9 years	
Lateral/External epicondyle	11 years	Conjoint epiphysis

Joint space



wrist joint :

----- Active space -----

Ossification centres	Normal age of appearance	Normal age of fusion
Lower end of radius	2 years	18-19 years
Lower end of ulna	5 years	17-18 years

Age of appearance of carpal bones :

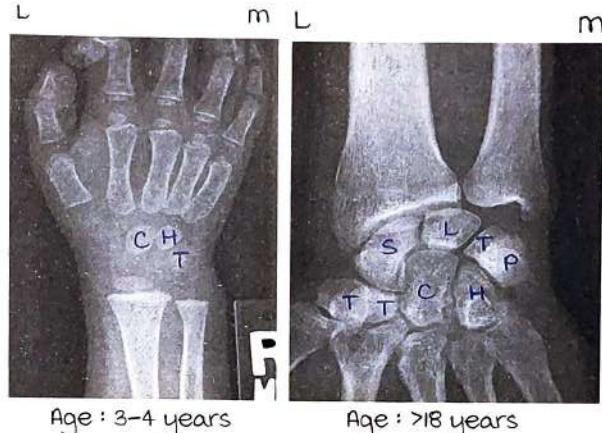
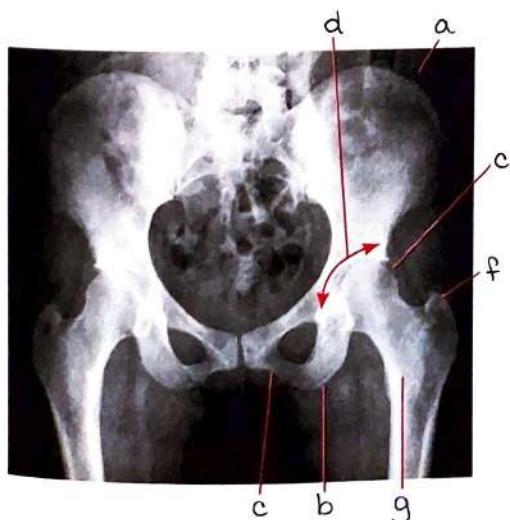
Ossification centre	Appearance
Capitate (Largest)	2 months
Hamate	3 months - 1 year
Triquetral	3 years
Lunate	4 years
Scaphoid	5 years
Trapezium	5-6 years
Trapezoid	5-6 years
Pisiform	9-12 years

Mnemonic : She Looks Too Pretty

Try To Catch Her.

Pelvis :

Pelvis proper :



Ossification centre	Normal age of appearance	Normal age of fusion
Pelvis proper		
a. Iliac crest	14-16 years	18-20 years
b. Ischial tuberosity	16 years	20-21 years
c. Ischiopubic ramus		6-9 years
d. Triradiate cartilage	Present since birth	13-15 years
upper end of femur		
e. Head of femur	1 year	
f. Greater trochanter	4 years	
g. Lesser trochanter	12-14 years	17-18 years

----- Active space ----- Note :

Triradiate cartilage : Components of ilium, ischium & pelvis fuse to form acetabulum.



unfused acetabulum : Age <15 years



Ischial tuberosity appeared
but not fused



Iliac crest appeared but not fused
Head of femur fused

Age : >18 years

Sacrum :

All sacral vertebra fuse to become single bone : 22-25 years.

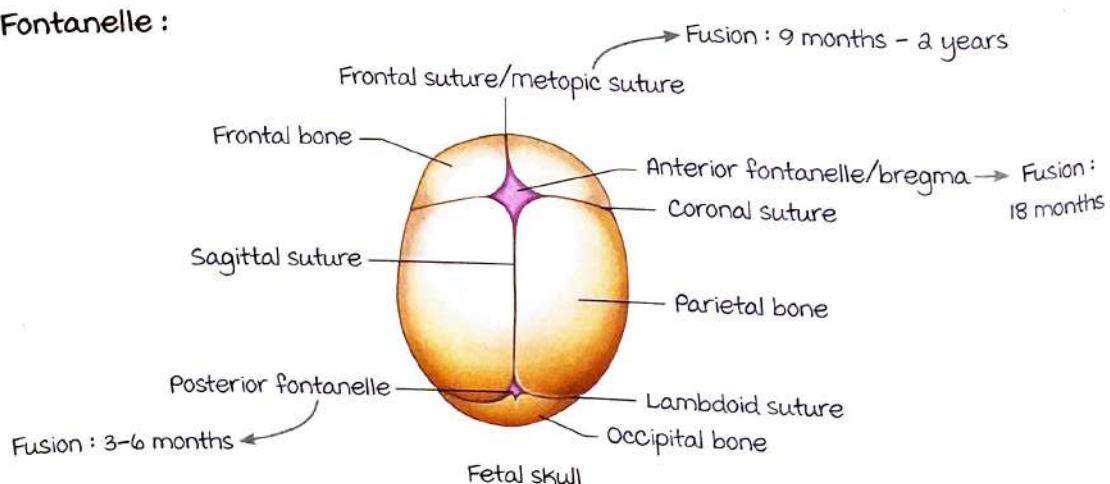
Age Estimation from Skull

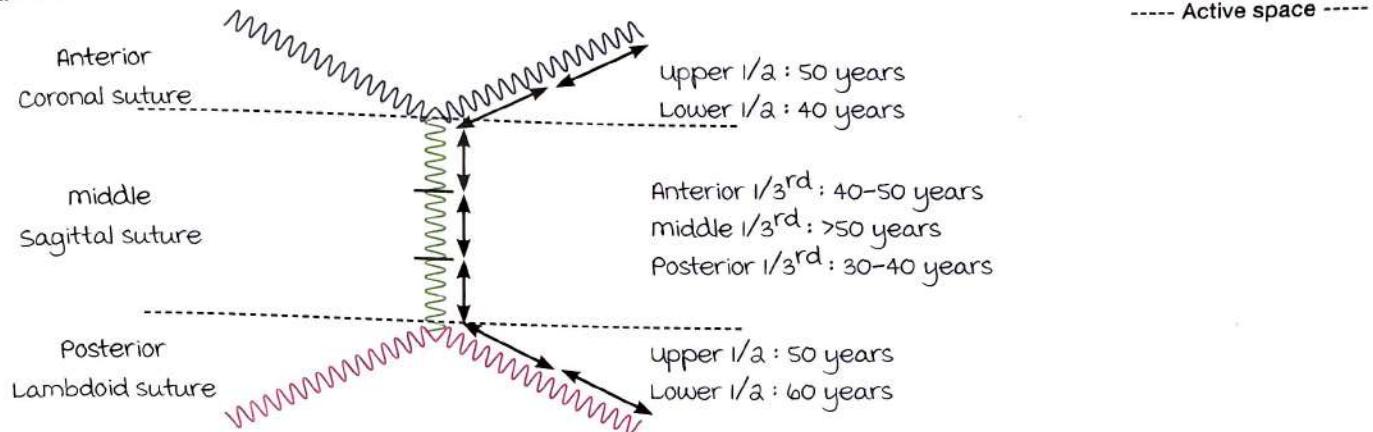
00:34:32

Estimation based on :

- Fontanelle
- Sutural fusion
- Base of skull

Fontanelle :



sutural fusion :**differences in fusion :**

- Endocranial sutures (Reliable) fuses earlier than ectocranial sutures.
- male sutures fuses earlier.

base of skull :

basi-sphenoid & basi-occiput fuse : 18-21 years.
(Spheno-occipital sutures)



Base of skull

Dentition

00:42:00

- Consists of :
 - Eruption : Emergence of tooth from alveolar space.
 - Calcification : Occurs 1-2 years after eruption.
 - Alveolar cavities contain teeth/cellular tooth germ.
 - At birth → rudiments of
 - All temporary teeth
 - First permanent molars (m_1)
- } In the jaw

Note :

- Early eruption (Premature dentition) : Congenital syphilis.
- Late eruption : Hypothyroidism.

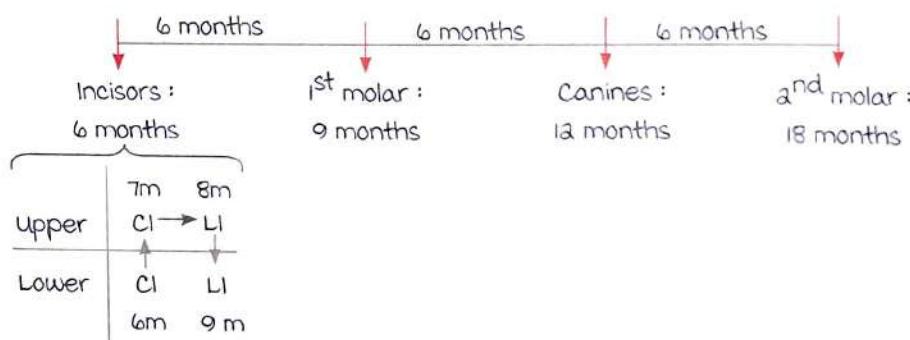
ERUPTION PATTERN

Temporary/deciduous/milk teeth	Permanent teeth																																		
<ul style="list-style-type: none"> • AKA primary dentition • 20 teeth <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>m_2</td><td>m_1</td><td>c</td><td>L1</td><td>C1</td><td>RUQ</td><td>LUQ</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td>RLQ</td><td>LLQ</td> </tr> </table>	m_2	m_1	c	L1	C1	RUQ	LUQ						RLQ	LLQ	<ul style="list-style-type: none"> • AKA secondary dentition • 32 teeth <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>m_3</td><td>m_2</td><td>m_1</td><td>Pm_a</td><td>Pm_a</td><td>C</td><td>L1</td><td>C1</td><td>RUQ</td><td>LUQ</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>RLQ</td><td>LLQ</td> </tr> </table>	m_3	m_2	m_1	Pm _a	Pm _a	C	L1	C1	RUQ	LUQ									RLQ	LLQ
m_2	m_1	c	L1	C1	RUQ	LUQ																													
					RLQ	LLQ																													
m_3	m_2	m_1	Pm _a	Pm _a	C	L1	C1	RUQ	LUQ																										
								RLQ	LLQ																										

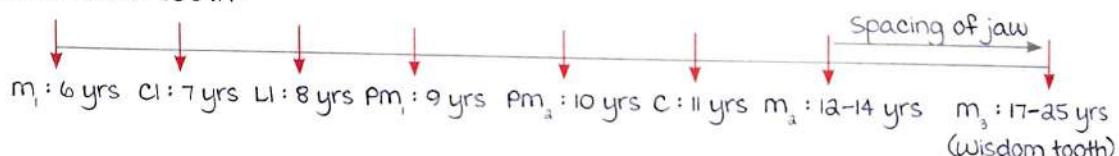
----- Active space ----- RUQ : Right upper quadrant, LUQ : Left upper quadrant,
 RLQ : Right lower quadrant, LLQ : Left lower quadrant,
 CI : Central incisors, LI : Lateral incisors, C : Canine, Pm : Premolar, m : molar.

Eruption sequence :

Temporary teeth :



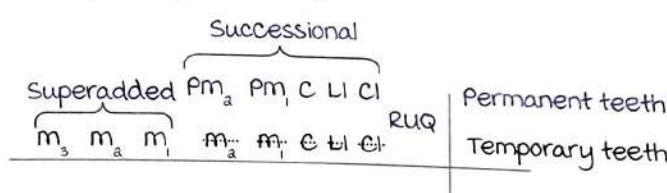
Permanent teeth :



Note : Impaction of wisdom tooth if spacing doesn't occur.

Period of mixed dentition :

Usually 6-11 years of age.

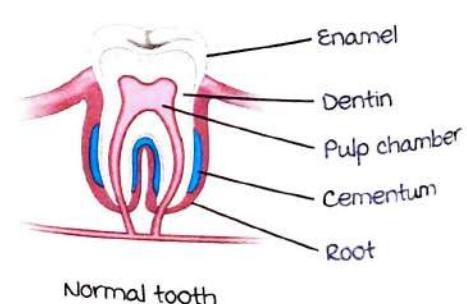


Teeth in same place as temporary teeth : Successional teeth (ao).

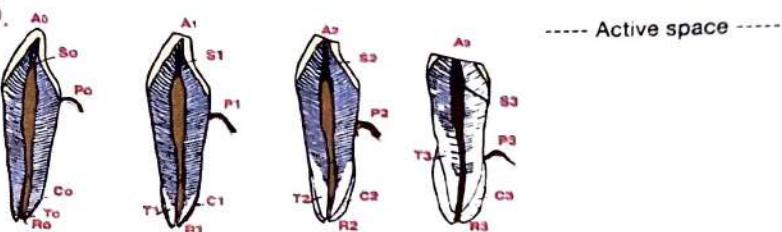
Teeth in additional space : Superadded teeth (ia).

Gustafson's method :

- Determination of age in the dead (As extraction is required) after eruption of m₃ (Based on secondary changes).
- Six criteria (Graded from 0 to 3) : mnemonic → APSRTC.
 - Attrition : Wear and tear of enamel.
 - Parodontosis : Loosening of teeth d/t regression of gums (checked before removing tooth).



- Secondary dentin deposition (*2nd best*).
- Root resorption (*worst*).
- Transparency of root (*best*).
- Cementum apposition.



- Reliability: Decreases from anterior → Posterior.
- Age range: ± 4–7 years of actual age.

Lamendin's method :

Criteria :

1. Parodontosis.
2. Transparency of root.

Advantage :

- Latest method.
- Only one tooth required.

Stack's method :

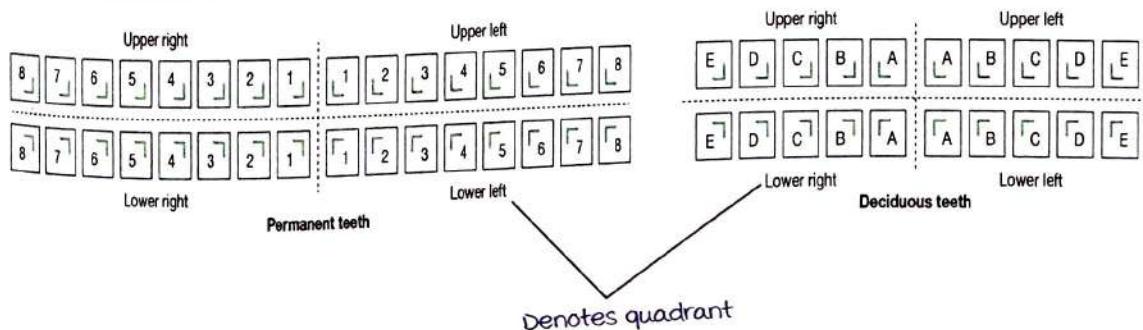
- used in infants and children.
- Based on height and weight of tooth.

DENTAL CHARTING

universal method :

Left								Right							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
Permanent dentition															
A	B	C	D	E	F	G	H	I	J						
T	S	R	Q	P	O	N	M	L	K						
Temporary dentition															

Palmer notation :



----- Active space ----- Haderup's system :

Permanent teeth											
RIGHT						LEFT					
8+	7+	6+	5+	4+	3+	2+	1+	+1	+2	+3	+4
8-	7-	6-	5-	4-	3-	2-	1-	-1	-2	-3	-4
Temporary teeth											
RIGHT						LEFT					
05+	04+	03+	02+	01+		+01	+02	+03	+04	+05	
05-	04-	03-	02-	01-		-01	-02	-03	-04	-05	

- Symbol (+/-) : Denotes row.
- Placement of symbol :
 - To the left side of number : Left.
 - To the right side of number : Right.

Federation dental international (FDI) method :

AKA 2 digit system.

Prefix (Clockwise)

1	2										
4	3	18	17	16	15	14	13	12	11	21	22
		48	47	46	45	44	43	42	41	31	32
Permanent teeth											
5	6	55	54	53	52	51	61	62	63	64	65
8	7	85	84	83	82	81	71	72	73	74	75
Temporary teeth											

- Internationally accepted.
- Universally used.

Prefix (Clockwise)

5	6										
8	7	55	54	53	52	51	61	62	63	64	65
		85	84	83	82	81	71	72	73	74	75
Temporary teeth											

HUMAN IDENTIFICATION : PART 3

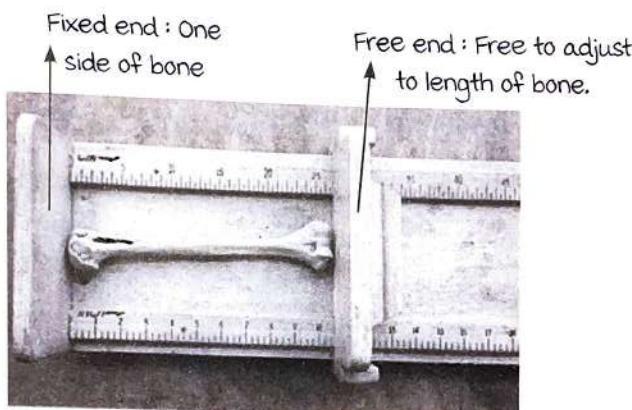
Stature

00:00:12

Height of a person.

estimation done using long bones (Best : Femur).

Osteometric board :



Osteometric board

Estimation of stature from length of bone :

Factors	Interpretation
Regression formulae	Substitute value of length into formulae <ul style="list-style-type: none"> Karl Pearson equation. Trotter Glessner's equation.
multiplication factor	Length of bone × multiplication factor (constant for each bone) : stature multiplication factors : mnemonic FeTHUR <ul style="list-style-type: none"> Femur : 3.7 Tibia : 4.5 Humerus : 5.3 Ulna : 6.1 Radius : 6.5
Percentile	Based on contribution of each bone to stature : <ul style="list-style-type: none"> Femur : 27% Tibia : 22% Humerus : 20% Spine : 35%

Note :

Best bone to determine :

- Stature : Femur.
- Race : Skull.
- Sex : Pelvis (most important factor : Greater sciatic notch).

----- Active space -----

Definitive Identification Methods

00:04:08

FINGERPRINTS

- Impression of papillary ridges on skin/surface.
- Study of fingerprints : Dactylography, dermatoglyphics, Galton's system.

History :

- First person to use fingerprint : William Herschel (1850's).
- First person to systematize fingerprint : Francis Galton (1890's).
- World's first fingerprint bureau : Kolkata (1890s).
- Current system of fingerprints : Galton system.



Fingerprint

Advantages of dactylography :

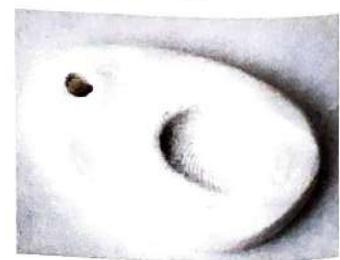
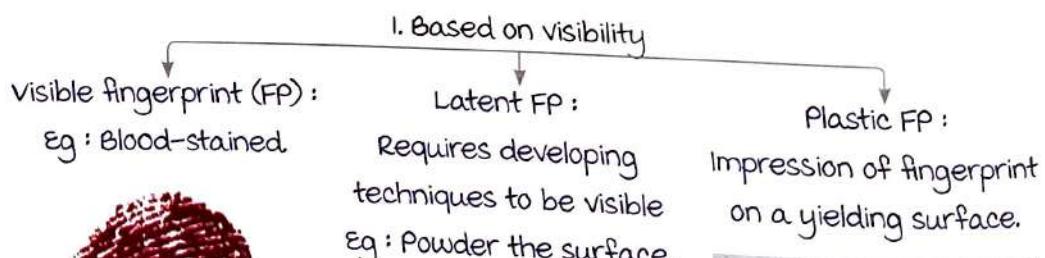
most reliable because :

- Superior to DNA fingerprinting : D/t difference even among monozygotic twins/ no familial inheritance.
- Probability of the same fingerprint : 1 in 64,000 million.
- Recovery of fingerprint upto 0.6 mm of skin (upto dermis).

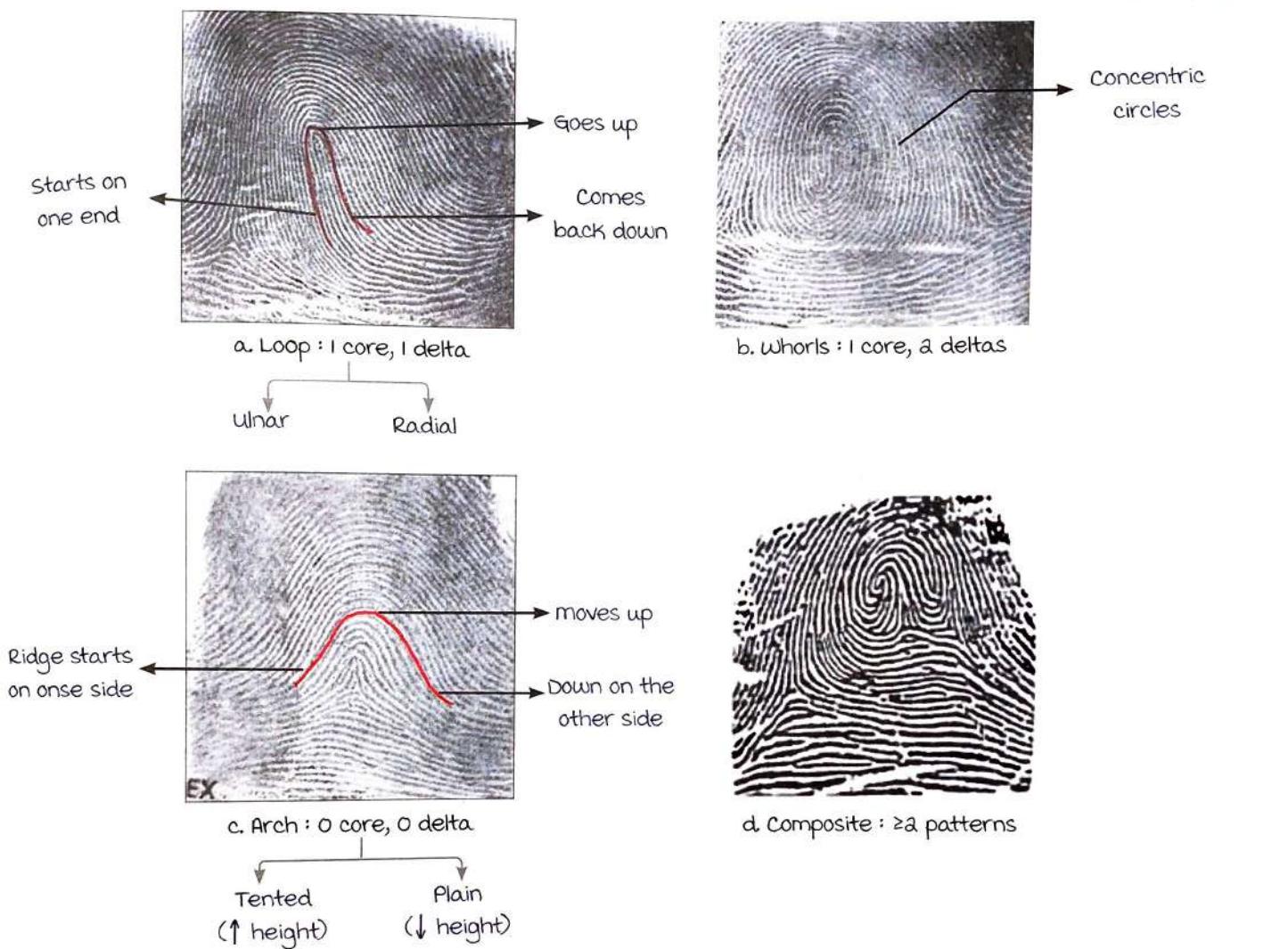
Development :

Starts in : 12th to 16th weeks → Completed : 20th-24th weeks.
 (3rd to 4th month) (5th to 6th month)

Types of fingerprint :

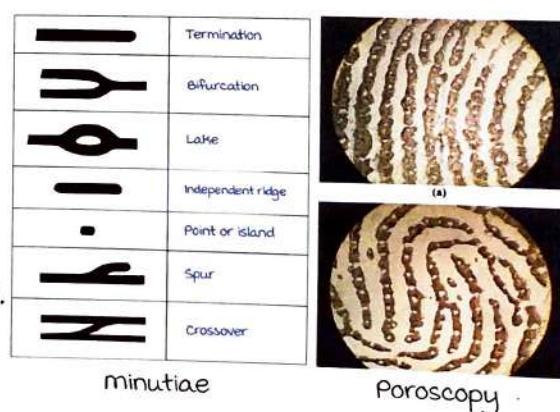


2. Based on patterns :

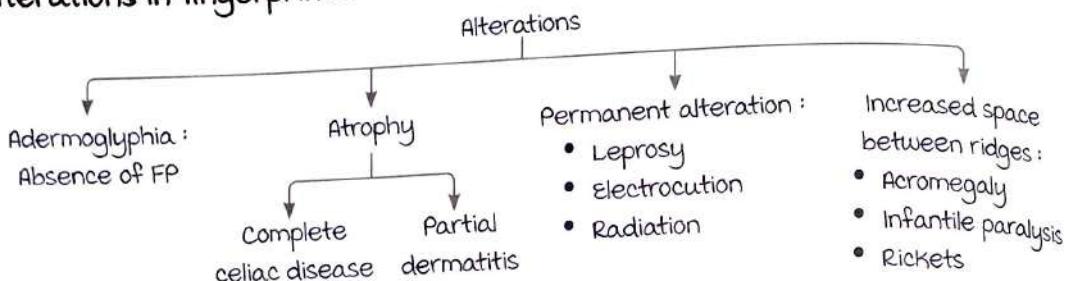


Comparison of fingerprint :

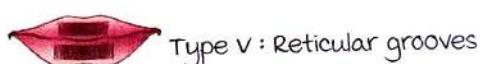
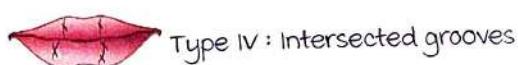
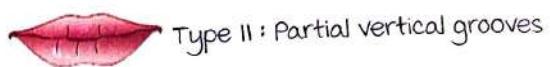
- Pattern alone : Insufficient to identify.
- **Ridgeoscopy** (Study of ridge characteristics) : minimum 16 identical minutiae for matching.
- **Edgeoscopy** (Study of edge characteristics).
- **Poroscopy** (Study of sweat glands between ridges) :
 - Size, shape, location & arrangement : Unique to individual.
 - 9-18 pores/millimeter.



----- Active space -----

Alterations in fingerprint:**CHEILOSCOPY**

- Study of lip printing.
- Sites to recover lip print :
 - Glass.
 - Butt of cigarette.
 - Edible items.
 - Straw.



Lip printing : Surgukis classification

RUGOSCOPY/PALATOSCOPHY

- Study of patterns of rugae on anterior 1/3rd of palate.
- Advantage : Can be used even in mutilated/charred bodies (Hard palate is preserved).

Types of rugae (Based on length)

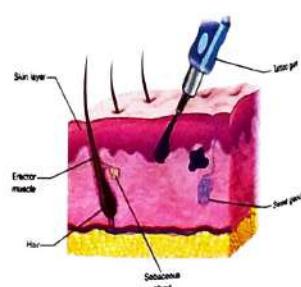
Primary :	Secondary :	Tertiary :
5-10 mm	35 mm	<3 mm

**TATTOO MARKS**

- Designs produced by injection of dye into the dermis of skin.
- Dye in
 - Epidermis : Fades away.
 - Deeper than dermis : Phagocytosed.

Visualization of faded tattoo marks :

- magnifying glass.
- uv light.
- Infrared light.



Tattoo marks

- Examination of regional lymph nodes (LN) : Dye taken up by regional lymph nodes from dermis.

----- Active space -----

Presence of dye in LN



Indicates presence of tattoo even if concealed/removed/faded.

Information that can be gathered from tattoo :

- Name.
- Religion.
- Place : Based on pigment used.
- Political interest.
- IV drug use : Repeated scarring over veins → Concealed with multiple tattoos.

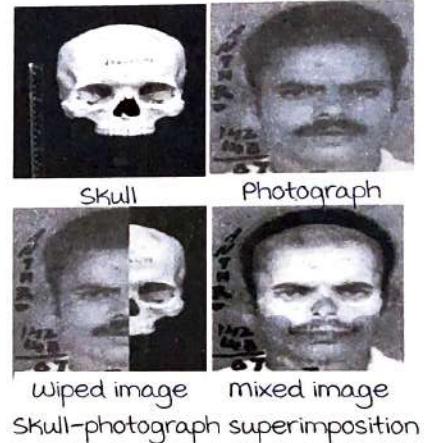


Tattoos

SUPERIMPOSITION

- Recovered bone is matched with antemortem photograph/videograph.
- method :

video/photo of bone → Superimposed over photo of person → Bony landmarks checked (inner canthus, outer canthus, nasion).

Skull Photograph
wiped image mixed image
skull-photograph superimposition

Medicolegal Importance of Age

00:25:00

Age	medicolegal importance
<1 year : Infant	Infanticide : Killing of infant (Punishable under 103 BNS : murder)
<7 years	No criminal responsibility : 20 BNS
7-12 years	Criminal responsibility based on mental maturity as per judges opinion : 21 BNS
<12 years	<ul style="list-style-type: none"> Oath need not be undertaken. Consent can be given for general physical examination only. Consent for other medical examination/treatment : Invalid (28 BNS). <ul style="list-style-type: none"> - Consent of guardian required : 27 BNS.

----- Active space -----

Age	medicolegal importance		
<14 years	Cannot be employed		
<16 years	Taking a boy from lawful guardian	Amounts to Kidnapping	
<18 years (Juvenile)	Taking a girl from lawful guardian		
18 years (major)	Legal age to : <ul style="list-style-type: none"> • Vote. • Get driving license. • Get married, if female. • Give consent for : <ul style="list-style-type: none"> - major surgeries. - Organ donation. - Sexual intercourse. • Write a valid will (Testamentary capacity). 		
21 years	<ul style="list-style-type: none"> • Age of becoming major under courtship. • Legal age of marriage for males. 		

HANGING

----- Active space -----

Asphyxia

00:00:27

Asphyxia : Pulselessness.

NON SPECIFIC/OBSOLETE SIGNS

Signs

Asphyxial triad :

i. Peripheral Cyanosis (Fingues & toes).

a. Petechial hemorrhage :

- Pinpoint hemorrhages (Present above the level of obstruction).
- Due to rupture of capillaries & venules.
- Site : eyelids, mastoid, scalp, heart, pleural surface of lung.

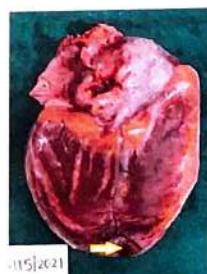
3. Visceral congestion.



Peripheral cyanosis



Pinpoint hemorrhages



Petechial hemorrhage in heart

Asphyxial Quintet :

i. Triad +.

ii. Postmortem fluidity of blood.

iii. RV enlargement.

TYPES

Hanging :

Caused by :

- Suspension of the body.
- By a ligature encircling the neck.
- Constricting force is the weight of the body.

Strangulation :

Constriction of air passage at the neck by ligature or any other means.

Types :

- Ligature strangulation.
- Manual (Throttling : By hands).
- Mugging (Bend of elbow).
- Bansdola (Bamboo stick).
- Garotting (Iron cuff/leaver).

Note : Does not involve suspension of the body.

----- Active space -----

Suffocation:

mechanical obstruction to passage of air without constriction of neck or drowning.

	Hanging	Strangulation	Suffocation
Neck compression	⊕	⊕	⊖
Body suspension	⊕	⊖	⊖
	Body weight compresses neck		Pure asphyxia

Note : Artefactual hemorrhages/Prinsloo's gordon artefact.

- Hemorrhages in the neck during dissection may be falsely interpreted.
- Ways to avoid artefacts :
 - Open cranium first (Decompresses cerebral vessels) & neck last → Bloodless dissection.
 - Incise jugular vein before neck examination (Decompression).

Classification and Features

00:11:50

CLASSIFICATIONBased on
position of knot

Typical hanging : knot in occiput.

Atypical hanging : knot anywhere other than occiput.



Atypical hanging



Typical hanging

Based on suspension :

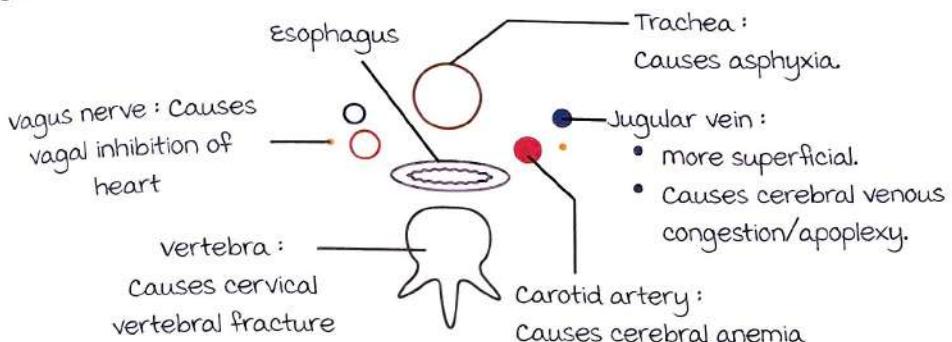
Complete
hanging

complete hanging	Partial hanging (incomplete hanging)
whole body suspended	Partial body suspended
No body part touches ground	Body part is touching the ground (e.g. leg, knee)
Constricting force : whole weight of the body	Constricting force : Partial weight of the body.
Faster death	Slower death (Suicidal)



Incomplete hanging

COMPRESSION FORCES FOR ASPHYXIA



----- Active space -----

Weight required for compression:

- Trachea : 15kg.
- Jugular vein : 2kg.
- Carotid artery : 5kg.
- vertebra : 30kg.

m/c cause of death by hanging : Asphyxia + cerebral venous congestion.

cause of death in judicial hanging : Cervical vertebral fracture (instant death).

LIGATURE

Any available material can be used (Eg : Saree, rope, dupatta).

Ligature mark :

Pressure/patterned abrasion due to ligature.

Initially pale/parchment like → Eventually turns dark brown.

Factors :

1. Ligature material.

- Thin/narrow : AKA cheese cutter method.
Narrow, deep mark, can pierce tissues.

- Broad/soft : Faint, superficial mark.

2. Knot

- Fixed Knot → Fixed noose → Incomplete/oblique ligature mark.

- Slip Knot → Running noose → Complete/Transverse mark.

00:29:20

Autopsy Findings

Hypostasis :

Glove & stocking pattern.

- Body was in vertical position.
- Does not imply hanging.

Face :

- 1. Appearance
 - Congested : d/t venous occlusion in partial hanging.
 - Pale : d/t arterial + venous occlusion in complete hanging.

----- Active space -----

2. Dribbling of saliva : Surest sign of antemortem hanging.

Ligature puts pressure on salivary gland → Stimulation → ↑ salivation towards dependent position.

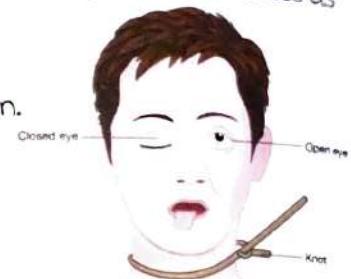
3. Protrusion of tongue : D/t lifting of pharyngeal skeleton.

4. La facie sympathique : Sign of antemortem hanging.

Pressure on cervical sympathetic chain.

↓ Stimulation

Ipsilateral opening of eyes + ipsilateral pupillary dilatation
(Unequal pupils).



Neck :

- Visible ligature mark

→ Oblique, incomplete \nexists above thyroid (85% cases).

→ Transverse ligature mark :

- In low point of suspension.
- Slip knot with running noose.



Suspension peak

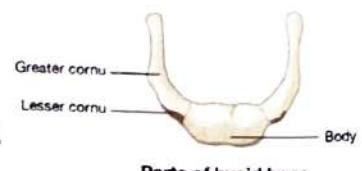
- Suspension peak : Helps differentiate hanging from strangulation.
Inverted v or triangle shaped.



Ligature marks

Internal findings :

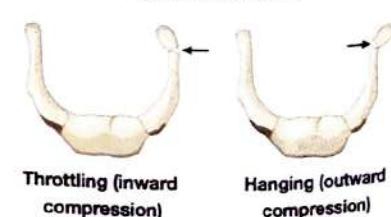
1. Thyroid cartilage fracture : Greater cornu involved.



2. Hyoid bone fracture : Seen in 15-20% of cases.

- Age >40yrs (<40yrs hyoid is a cartilage).
- Abduction fracture (Anteroposterior compression fracture) : Both ends are fractured \nexists displaced outwards.

- Side to side compression fracture : One end is displaced outwards \nexists other inwards.



Throttling (inward compression)

Hanging (outward compression)

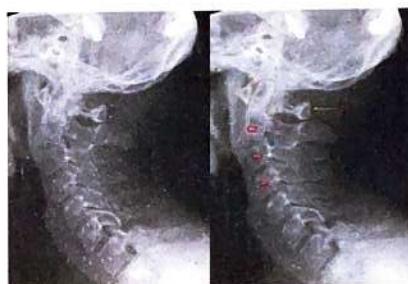
Note : Inward compression fracture is seen in throttling.

3. vertebral injuries :

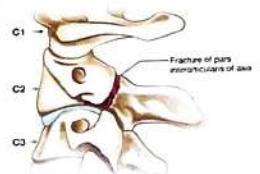
- D/t hanging with a long drop (\uparrow force to the neck).
- Eg : **Judicial hanging**, hanging from a tree/balcony.
- AKA **hangman's fracture** :
 - C2/C3/C4 fracture (Never C1 : Atlas).
 - Spondylolisthesis of C2 over C3.
- Simon's hemorrhage :

Prolonged suspension \rightarrow Bleeding behind the anterior longitudinal ligament \rightarrow Stripe like hemorrhages in intervertebral disc b/w lumbar vertebra.

----- Active space -----



Hangman fracture



4. carotid artery injury :

- D/t hanging with a long drop. Eg : Judicial hanging.
- **Amussat sign** : Transverse intimal tear.
- Associated areas of bruising is an antemortem sign.

Manner of Death

00:52:06

Suicidal :

- m/c method of suicide \rightarrow Hanging \rightarrow Poisoning.
- Fatal period : 3-5 mins.
- Painless death.

Homicidal :

Judicial hanging :

- Practiced in India.
- **Hangman's Knot** :
 - Ideally : Submental.
 - India : Below the ear/angle of mandible.



Lynching

Lynching/extra-judicial hanging :

Hanging by a group of people in public.

----- Active space ----- Accidental :

Autoerotic/sexual asphyxia :

- AKA hypoxiphilia/asphyxiophilia/koczwarszt.
- Asphyxiation → Sexual gratification.
- m/c in male perverts.
- mechanism : Partial neck compression

↓
Carotid compression → Cerebral ischemia

↓
Erotic hallucinations → orgasm

Release of compression → Normal.

Failure to release
pressure → Death.

- Form of masochism.

- Other signs at scene of crime :

- Transvestism.

- Naked body.

- Pornographic material.

- No suicidal note.

STRANGULATION

----- Active space -----

Types and Features

00:00:10

LIGATION STRANGULATION

mark :

- Transverse, complete $\frac{1}{2}$ below thyroid cartilage.
- Rarely oblique (Person is dragged from behind).
- Surrounding bruising & abrasion (d/t struggle).
- Strap muscles can get injured.



Bruising around ligature mark

Face :

- Congested.
- Sub conjunctival hemorrhage.

Pseudoligature mark :

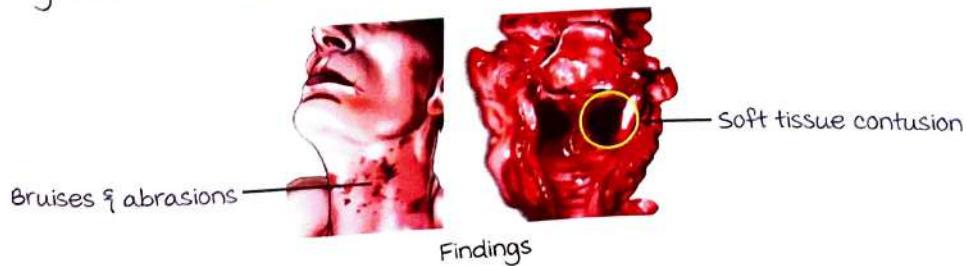
- Skin folds mistaken as ligature mark.
- Eg : Elderly, obesity.

THROTTLING

- manual strangulation, using hands.
- Almost always homicidal.
- If tried as suicide \rightarrow Person becomes unconscious d/t carotid compression \rightarrow Relieves pressure on neck.

Findings :

- Crescentic/vertical finger nail scratches on neck.
- Six penny bruise : Round/discoid bruises d/t pulp of fingertips.
- Extensive soft tissue contusion on the neck.
- Thyroid cartilage fracture.
- Hyoid bone fracture \rightarrow Inward compression/adduction fracture.
- Rarely cricoid fracture (When extensive force is used).



Findings

----- Active space ----- Note : m/c cause of hyoid bone fracture : Throttling > Hanging.

PALMAR STRANGULATION

- 2 hands used
- 1 hand horizontally to cover nostrils.
 - Other hand perpendicular to the 1st with base of its palm covering the neck.



MUGGING

Neck compression by bend of elbow/forearm.

Carotid sleeper : Compression using bend of elbow → Occludes carotid artery
(Not trachea) → Unconscious.

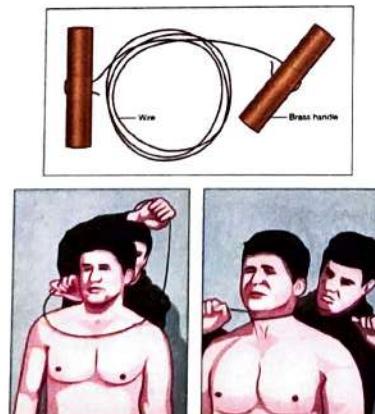
Choke hold : using front of forearm → Trachea compressed → Asphyxia.

GARROTING

Twisting a thin ligature cord/iron cuff around the neck from behind.

Spanish windlass technique :

- Variant of garroting.
- Judicial execution in Spain & Turkey, earlier.
- Using a lever to twist the iron cuff around the neck.



Garroting



mugging

BANDOLA

compressing the neck using bamboo sticks.

Techniques :

1.



Bamboo sticks in front &
back of the neck

2.



Join the 2 sticks at the
back

Tied here

3. victim can be on the floor & bamboo stick placed over his neck.
Accused stands on both sides of the stick to compress it.

----- Active space -----



Spanish windlass technique



Bansdola

SUFFOCATION

----- Active space -----

00:00:10

Types and Features

Exclusion of air from lungs without neck compression.

SMOTHERING

Simutaneous closure of mouth & nostrils.

Accidental :

- Newborns born with an intact sac.
- Infant covered by heavy blanket/bedsheet.
- Adult falls into pile of sand/mud (Especially if intoxicated).

Homicidal :

Intentionally smothering with pillows/hands.

If hands used it leads to :

1. Perioral injuries (Abrasion/bruises).
2. Lip injuries.



Infants & elderly can be easily smothered.

Swicidal smothering :

very unlikely.



Smothering

GAGGING

- Thrusting of cloth/pad (gag) into the mouth → Obstruction of naso/oropharynx → Asphyxia

CHOKING

- Accidental obstruction of airway → Respiratory distress → Asphyxia
in a healthy person d/t foreign body (Food bolus/coin) entry

----- Active space -----

First aid:

Heimlich maneuver (pressure over epigastrium).

If person is intoxicated/drugged

leads to depressed gag reflex

(more chances of choking).



Heimlich maneuver

Cafe coronary syndrome:

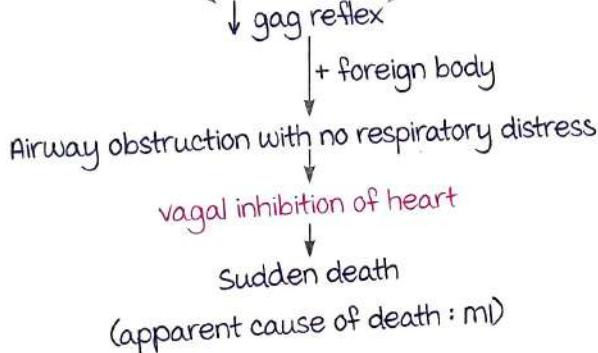
Obese person (intoxicated/drugged) undergoes a sudden death while eating.

Cafe coronary syndrome:

- Elderly person.
- Intoxicated.

Creche coronary:

- Pediatric population



Note: Cafe coronary was coined by Roger Haugen.

TRAUMATIC ASPHYXIA

Heavy weight upon the chest
(Stampede & collapse of buildings)

mechanical fixation of chest
↓
Restricted lung expansion
↓
Asphyxia

Blockage of venous return from upper body
↓
cyanosis: masque ecchymotique

----- Active space -----



masque ecchymotique



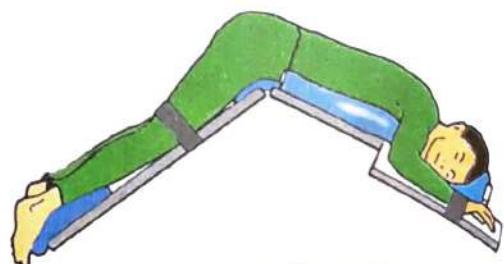
wedging:
Infant wedged in a small space

**POSITIONAL ASPHYXIA**

Restriction of lung expansion d/t abnormal position of the body.
(Especially in alcoholics).

1. Jack knife position :

Abdominal organs compress lungs.



Jack knife position

2. Inverted crucifixion :

Asphyxia d/t compression of lungs by internal organs.

BURKING

- Accused sits on chest of victim & closes mouth & nostril.
- mechanism : Homicidal.
- Smothering + traumatic asphyxia.



Burking

Overlaying :

- Larger person shares the bed with a small baby.
- mechanism : Smothering + traumatic asphyxia.



Overlaying

DROWNING

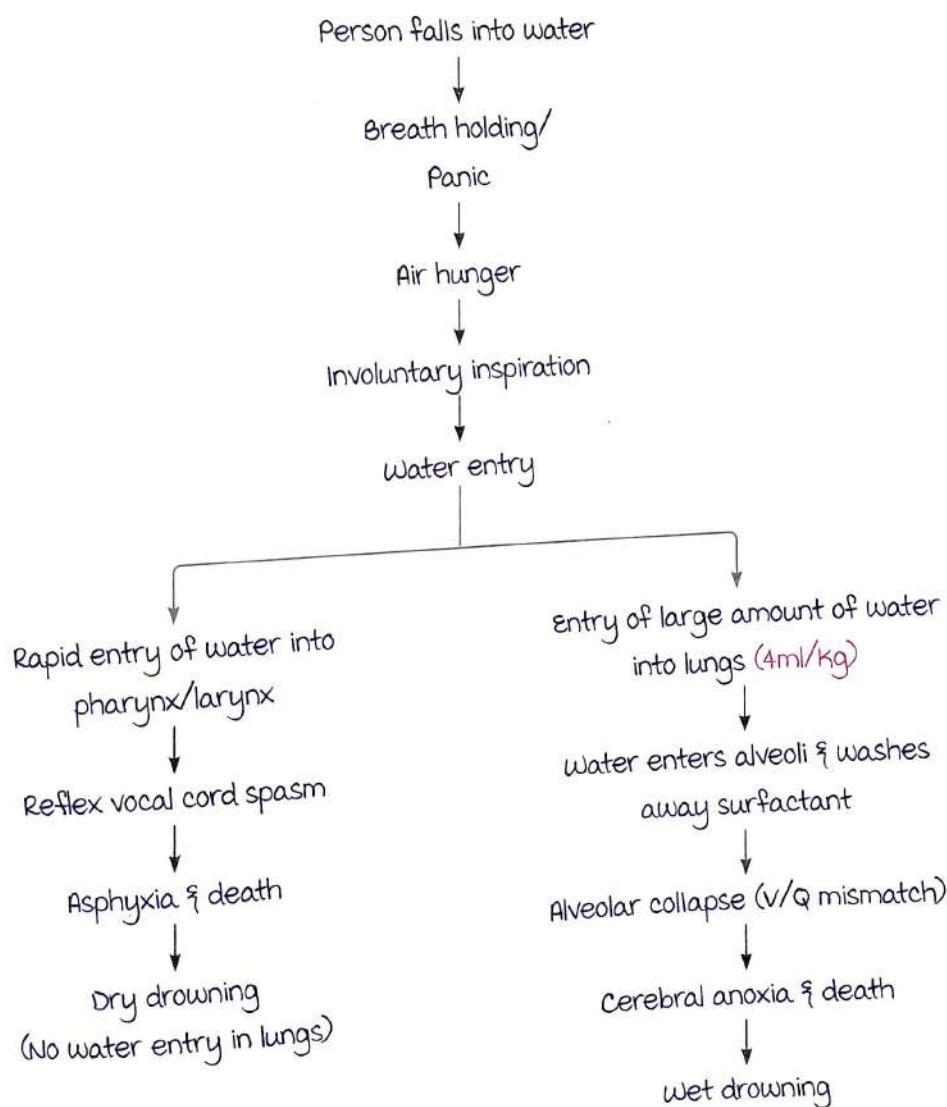
----- Active space -----

WHO Definition:

process of respiratory impairment d/t submersion (Complete/Incomplete) or Immersion in water.

mechanism of drowning:

most deaths : Accidental

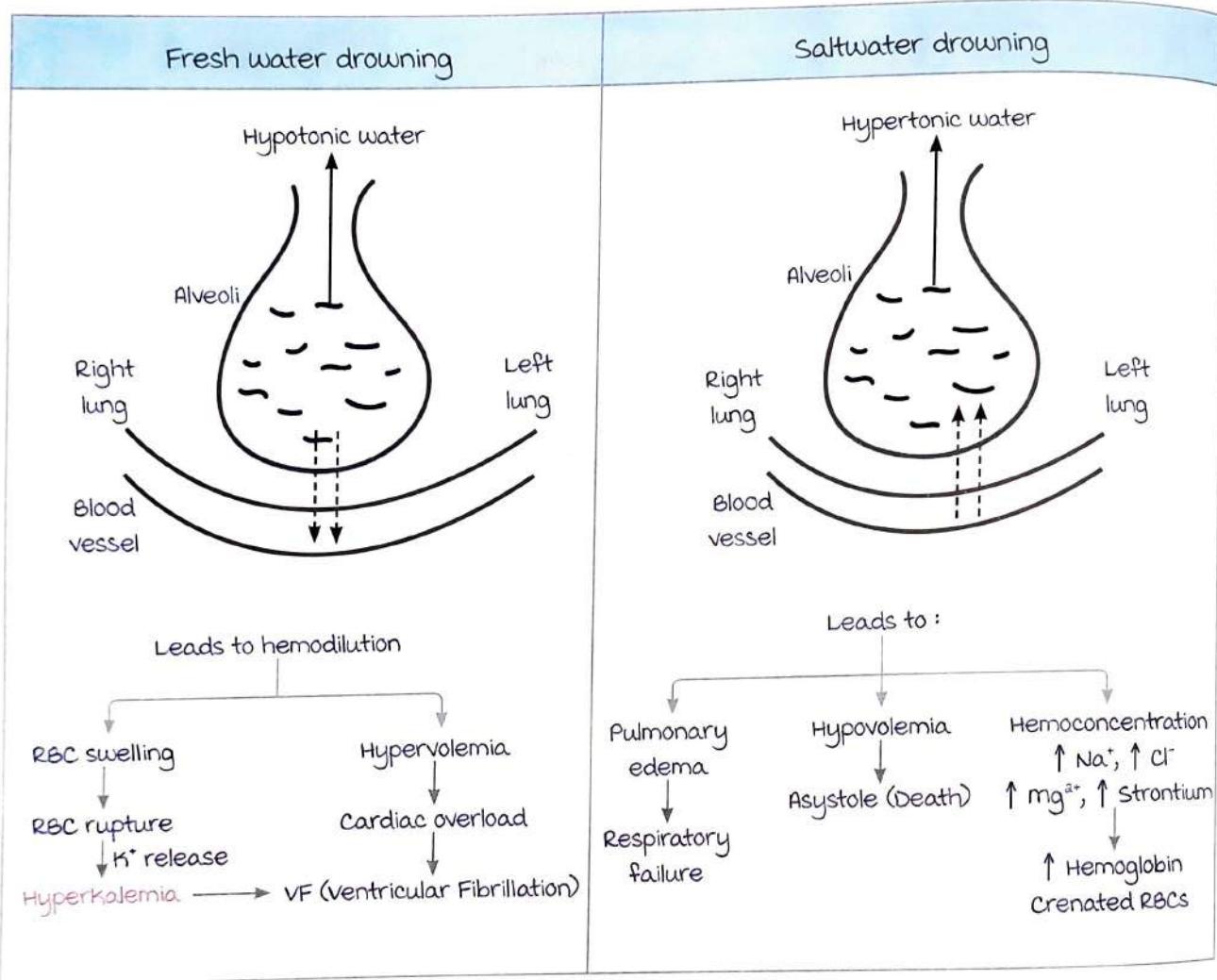


----- Active space -----

Fresh water Vs Saltwater drowning

00:07:07

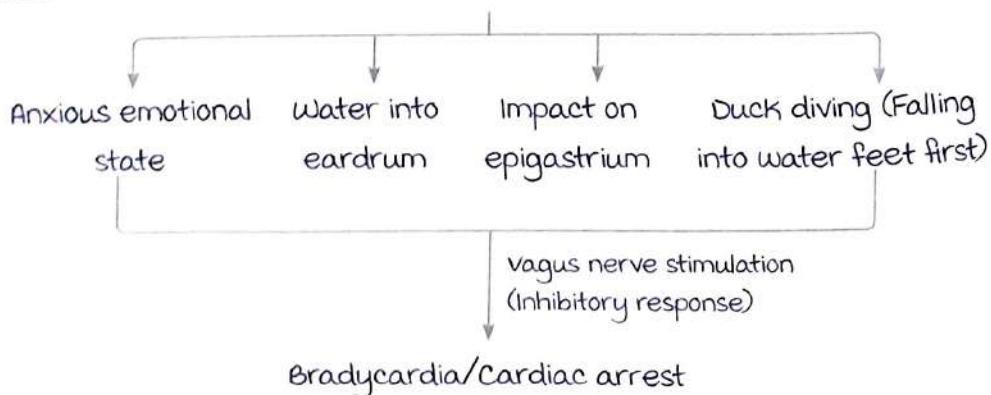
mechanism of death differs if water entry increases upto 16mL/kg.

**Hydrocution/Immersion syndrome**

00:16:43

MECHANISM

- Person falls into cold water ($5^\circ C$ below body temperature).
- Leads to :



secondary drowning/Post immersion syndrome (Near drowning) :

----- Active space -----

- person rescued from drowning.
- death d/t water entry in lungs.

complications :

- Hypoxic ischemic encephalopathy (HIE).
- metabolic acidosis.
- Electrolyte imbalance.
- Aspiration pneumonia.

Findings in drowning

00:20:20

Antemortem or postmortem drowning : Diagnosis of exclusion.

Floatation of body :

- Summer : 1 day.
- Winter : 2 - 3 days.

PHYSICAL FINDINGS

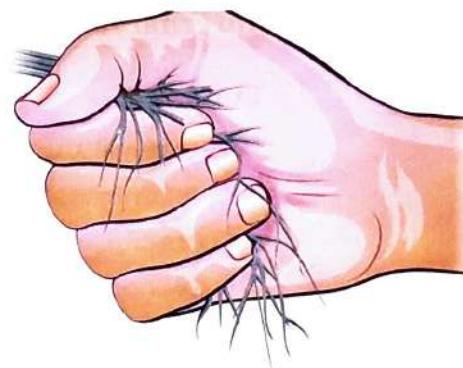
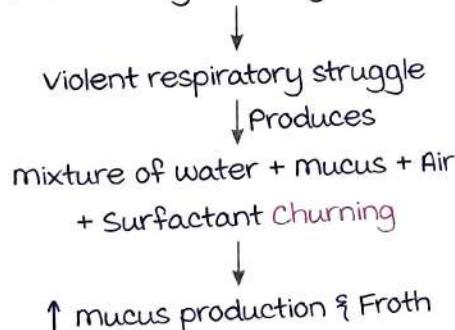
specific Findings (Antemortem drowning) :

1. Cadaveric Spasm :

- Presence of grass/mud slightly clenched in hand
- Suggests Antemortem drowning

2. Froth in nostril/mouth :

- Features :
 - Fine.
 - Tenacious (mucoid).
 - Copious.
 - Persistent (Even after wiping).
- mechanism : Water entry + airway irritation



Cadaveric spasm



Frothing

- Suggests : Antemortem drowning.
- Absence of froth :
 - Dry drowning.
 - Hydrocution.
 - Unconscious person (Absence of respiratory struggle)

----- Active space ----- Non specific finding (Post or Antemortem drowning) :

1. Cutis anserina/goose flesh :
 - Erector pili muscle spasm after death
(Erect hair follicles on body)
2. Washer woman's hand :
 - maceration of skin of hands/palm due to imbibition of water into skin layers.
 - Significance : Time since immersion
 - Wrinkling : 3-4 hrs.
 - Peeling of cuticle : 12 hrs.
 - Bleaching : 12 hrs.
 - Softening : 24 hrs.
 - Progression : Fingers → Palm → Back hand → Sole.
 - Seen : Warm water > Cold water



Cutis anserina



Washer woman's feet

Internal finding

00:33:05

Lungs :

Features of submerged lungs :

- Voluminous.
- Crepitant.
- Ballooning out : Upon opening sternum.
- mud particles : In lower airway.

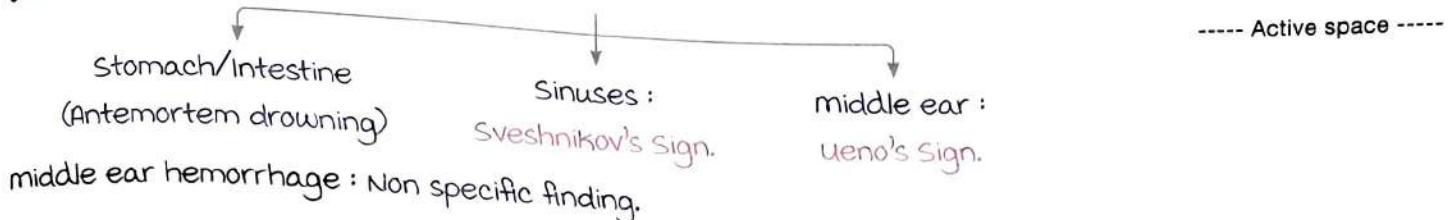


Pulmonary hemorrhage

Signs :

Conscious Drowning	Antemortem Drowning	Post mortem Drowning
<ul style="list-style-type: none"> • Pulmonary hemorrhage : Respiratory struggle ↓ (Lower lobe & Subpleural area) Rupture of alveolar wall/ Capillaries • Emphysematous bullae. • Emphysema aquosum : <ul style="list-style-type: none"> - Pulmonary hemorrhage + - Emphysematous bullae 	<ul style="list-style-type: none"> Edema aquosum : • Heavy lungs with edema. • No frothing. 	<ul style="list-style-type: none"> Hydrostatic lungs.

water in:



Test in drowning

00:41:30

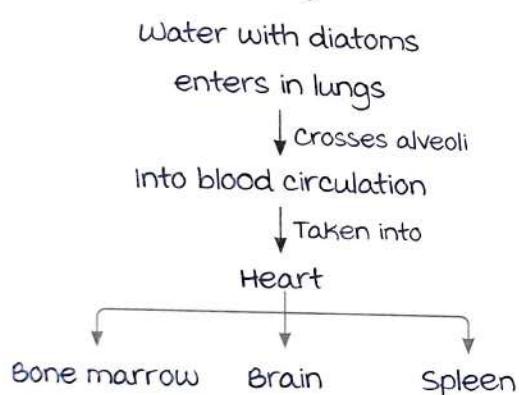
Diatom test :

unicellular algae present in water bodies varies in size & shape.

microscopy :

- Outer wall coated with silica.
- Resistant to heat acid & putrefaction.

In antemortem drowning :



Significance :

- Sign of antemortem drowning.
- Compare control (water body) with specimen in MLC.

Gettlers test :

Principle : Compare Cl^- concentration of blood in right and left heart chambers.

Inference :

Normal : Left = Right (Cl^- concentration)

Significant : Difference $>$ 25%.

Not useful :

- Dry drowning.
- Patent foramen ovale (Blood mixing).

Cl^- concentration	Effect	Drowning type
$\text{Rt} > \text{Lt}$	Hemodilution	Freshwater
$\text{Lt} > \text{Rt}$	Hemoconcentration	Salt water

Note :

Typical drowning	Atypical drowning
Water entry into lungs. • Fresh water drowning. • Salt water drowning.	Death not because of water entry. • Dry drowning. • Hydrocution.

----- Active space -----

IMPOTENCE, VIRGINITY AND DELIVERY

Impotency & Sterility

00:00:33

RELATED TERMINOLOGIES

	Impotence	Frigidity	Sterility
Specific To	♂	♀	♂/♀
Description	Inability to achieve and maintain penile erection	Loss of sexual arousal in female (Coldness)	Inability to beget (Conceive) children

Satyriasis : ↑ Sexual desire in ♂.

Nymphomania : ↑ Sexual desire in ♀.

CAUSES OF IMPOTENCY

1. Psychological (most common) : Anxiety, depression, stress, fear.
2. Vascularogenic (most imp. organic cause).
3. Neurological.
4. Congenital deformities of penis.
5. Acquired disease (eg : Infections, malignancy).

Psychological Impotency :

- Impotence Quod Hanc :
 - ♂ impotent with 1 particular ♀, but not with others.
 - marriage can be null & void (D/t non-consummation).
- Impotence Quod Hunc :
 - ♀ impotent with 1 particular ♂, but not with others.

Marriage

00:06:23

RELATED TERMINOLOGIES

- Valid marriage : Given by Section 5 - Hindu Marriage Act (HMA).

	Null & Void	voidable	Divorce
Description	void ab initio : marriage never existed from the beginning	<ul style="list-style-type: none"> • 1 party applies to court ↓ Court declares if marriage is NULL. • Given by 11 & 12 HMA. 	<ul style="list-style-type: none"> • Legally married couple asking for legal separation. • Partner eligible for alimony. • Given by 13 HMA.

	Null & Void	Voidable	Divorce
Indications	<p>1. Bigamy: Partner already has another living spouse.</p> <p>2. Prohibited Relationship: Eg: marriage b/w brother & sister/father & daughter/mother & son.</p>	<p>1. Incurable impotency.</p> <p>2. Incurable insanity: If a partner is insane at the time of marriage.</p> <p>3. Invalid consent: Fraud/forced/intoxicated.</p> <p>4. Impregnated wife: By someone other than husband at the time of marriage.</p> <p>5. Marriage consent obtained by impersonation.</p>	<p>mnemonic: DIVORCE.</p> <p>1. Desertion (>2 years).</p> <p>2. Incurable Insanity.</p> <p>3. Venereal incurable disease.</p> <p>4. Offence (Eg: Rape/bestiality).</p> <p>5. Renunciation (Partner becomes saint)/religion conversion.</p> <p>6. Cruelty (Physical/mental)</p> <p>7. Eg: Abstinence from sex.</p> <p>8. Extramarital affair (Adultery).</p>

Consummation of marriage:

- Requires complete penetration.
- Requires at least 1 act of sexual intercourse.
- Does not include the inability to satisfy the partner.

Fecundation ab extra:

- Conception in a female, when semen is deposited in vulva / on upper thighs.
- Pregnancy does not always mean the marriage is consummated.
- If husband is declared impotent medically.

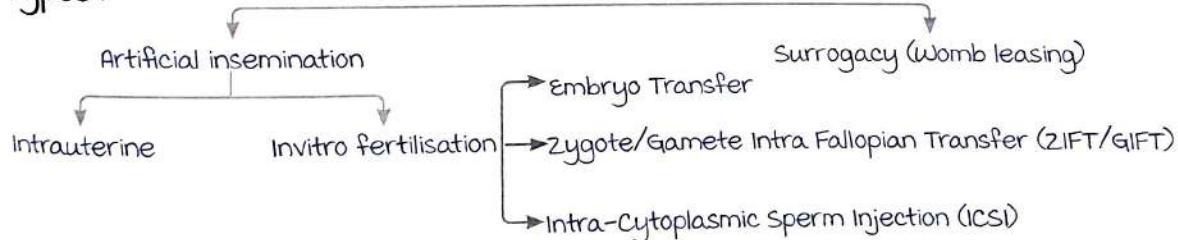


Pregnant women can apply for nullity of marriage.

Assisted Reproduction Techniques

00:20:07

Types:



ARTIFICIAL INSEMINATION (AI)

Artificial introduction of semen in female genital tract → Pregnancy.

Types:

- AI - Homologous:
 - Husband's semen is used.
 - Semen quality is good.
 - Unable to deposit spermatozoa in female genital tract.
 - Consent required from: wife + husband.

----- Active space -----

- AI - Donor :

- Semen of donor is used.
- Consent Required from: wife + husband + donor + donor's wife.

Indications :

AI - Homologous	AI - Donor
σ° : <ul style="list-style-type: none"> • Erectile Dysfunction. • Congenital defects. • mild reduction in sperm count. φ : <ul style="list-style-type: none"> • Vaginitis / cervicitis. • Cervical stenosis. 	<ul style="list-style-type: none"> • Sterility in husband. • Hereditary disease. • Widows. • Rh incompatibility.

Donor Eligibility Criteria :

1. Married.
2. Should have atleast 1 healthy child.
3. No Rh incompatibility.
4. Unrelated to couple.
5. < 40 yrs.
6. Preferably same race.

medicolegal Importance :

1. If AI is due to impotency \rightarrow Nullity can be granted.
2. If AI is done w/o husband's consent \rightarrow Husband can file divorce.
3. Legitimacy : Child born via assisted reproductive techniques is legitimate.
4. Adultery : AI not considered as adultery (No physical union occurring).
5. Incest : Remote risk present (Child of donor + Child of recipient couple have intercourse).
6. Litigation : If child born via AI is defective \rightarrow Couple can sue doctor.

Surrogacy

00:28:21

Surrogate mother :

One who by contract agrees to bear the child for someone else.

Types :

Commercial	Altruistic
<ul style="list-style-type: none"> • For monetary compensation 	<ul style="list-style-type: none"> • Done out of love & affection. • No monetary exchange. • Hospital & insurance expenses covered by intending couple.
<ul style="list-style-type: none"> • Prohibited in India 	<ul style="list-style-type: none"> • Permitted in India

SURROGACY REGULATION ACT 2021

Act specifies :

----- Active space -----

1. Eligibility criteria for intending couple & surrogate mother.
2. Medicolegal importance of child born.

Eligibility criteria :

Intending Couple	Surrogate mother
<ul style="list-style-type: none"> • married : ≥ 5 yrs, proven infertility. • Indian (Live in couple & NRI care not eligible for surrogacy). • Widow. • Divorcee. 	<ul style="list-style-type: none"> • Close relative. • married. • ≥ 1 Healthy Child. • Age : 25-35 yrs. • Can only be surrogate once in lifetime.

Medicolegal importance :

1. Child born through surrogacy is **legitimate** (Biological child of intending couple).
2. Sex selection not permitted.
3. Abandonment of child → Legally punishable.

MODES OF SURROGACY

1. Husband's sperm + wife's ovum.
2. Donor's sperm + wife's ovum.
3. Donor's sperm + surrogate mother's ovum.

} Implanted in surrogate's womb.

Virginity

00:35:10

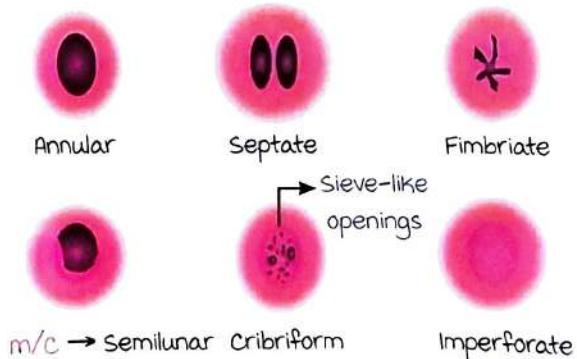
RELATED TERMINOLOGIES

- Apta viro : Female fit for marriage/husband/procreation.
- Virgin : Female who has not experienced sexual intercourse.
- Defloration : Loss of virginity.

HYMEN

- Fold of mucosal membrane in vaginal orifice.
- Narrow opening.
- Admittance capacity :
 1. Prepubertal Age → Tip of little finger.
 2. After Puberty → 1 finger.

Types of Hymen :



----- Active space -----

Note : On examination, fimbrial notch can be mistaken for hymenal tear.

Fimbrial Notch (Anatomical variant)	Hymenal Tear
<ul style="list-style-type: none"> • Symmetrical Notch • Does not extend till margin. • Bleeding (-) • mucosal margins intact. 	<ul style="list-style-type: none"> • Asymmetrical notch. • Extends till margin. • Congestion, bleeding (+). • mucosal margins torn.

Causes of hymenal rupture :

1. Sexual intercourse.
2. masturbation.
3. Accident.
4. Surgery.
5. Foreign body insertion (Eg : Sola pith).

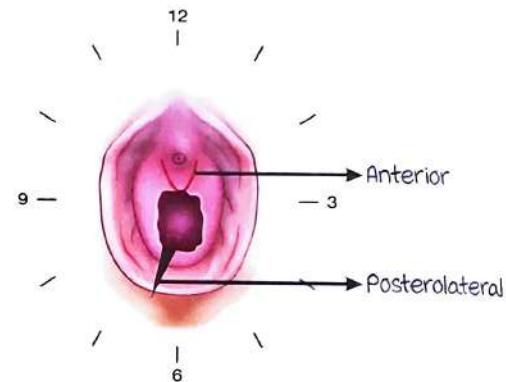
Positions of hymenal tear :

1. D/t Penile Penetration

↓
Posterolateral
4-7 o'clock
(most common)

2. D/t Digital / foreign body insertion

↓
Anterior



Reasons for intact hymen :

Positions of Hymenal Tear

1. Female child : Hymen is **deep seated** → will not rupture.
2. False virgin :
 - Female who had intercourse & still has intact hymen.
 - Reason : ↑ in thickness/elasticity or loose hymen.

Glaister Keen Rod :

- Luminous bulb.
- Purpose : To examine margins and edges of hymenal tear.

Carunculae myritiformis :

Hymenal remnants post child birth.

SIGNS OF VIRGINITY

1. Intact Hymen (Ruptured hymen does not mean defloration).
2. Intact fossa navicularis / fourchette / posterior commissure.
3. Narrow vagina & **mucosal rugosity** (Repeated intercourse → Loss of rugosity).

Pregnancy

00:48:20

----- Active space -----

SIGNS OF PREGNANCY

Presumptive signs :
(Least predictive)

1. Amenorrhea.
2. morning sickness
(Alt ↑ hCG).
3. Abdominal enlargement.
4. ↑ Urinary frequency.
5. breast changes.
6. Pigmentation.
7. Quickenings.

Probable signs :

1. Goodell's sign.
2. Hegar sign.
3. Braxton - Hick's contractions.
4. Ballottement.
5. +ve HCG test
(D/D : Choriocarcinoma).

Positive signs :
(Confirmatory signs)

1. Palpation of fetal movements & fetal parts (By doctor).
2. Fetal heart sounds.
3. Radiograph } Confirms presence
4. USG Imaging } of fetus in uterus.

Radiograph findings of fetus in uterus :

1. Linear series of small dots.
2. Crescentric shadow (Suggestive of skull).
3. Series of curved parallel lines (Suggestive of ribs).
4. Linear shadows.



x-ray findings of fetus

PHANTOM PREGNANCY

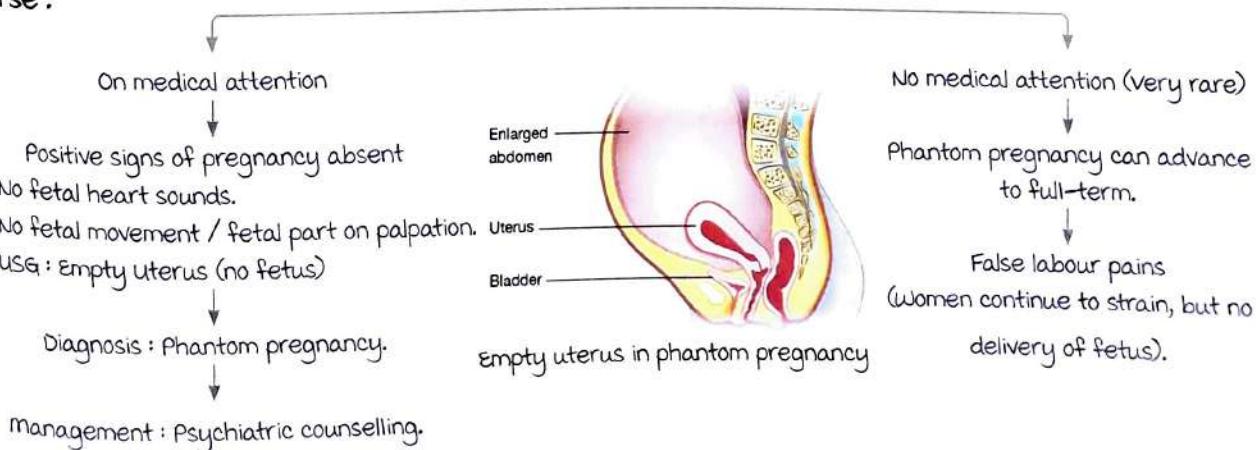
- AKA pseudocyesis/spurious pregnancy.
- Female believes she is pregnant.
- Usually occurs in childless women nearing menopause with intense desire to have a child.

Clinical presentation :

Subjective symptoms of pregnancy +ve.

1. Abdominal distension (Due to fat deposition).
2. Amenorrhoea (Due to hormonal disturbances).
3. Breast changes.
4. Morning sickness.
5. Fetal movements.

Course :



Management : Psychiatric counselling.

----- Active space ----- **TWIN PREGNANCY**

	Superfecundation	Superfetation
Timing of Fertilization of 2 ova	<ul style="list-style-type: none"> • Same ovulatory cycle. • By a different acts of coitus. <ul style="list-style-type: none"> - monopaternal : Same father. - Heteropaternal : Different father (Eg :Adultery). 	<ul style="list-style-type: none"> • 2 different ovulatory cycles. • Superfetus : One fetus over the other. • usually seen in Animals (Rarely in humans).
Fetus Description	2 Fetuses (Same age & development).	2 Fetuses (different age & development).

Fetus papyraceus/compressus :

The growth of one fetus compresses the other.



Heteropaternal superfecundation



Superfetation : 1 baby bigger in development than the other

RELATED TERMINOLOGIES

Legitimate child :

A child who is born :

- During continuation of lawful marriage/within 280 days of separation (Death/divorce).
- With wife remaining unmarried.

Note : Wife can be pregnant with husband's baby, even after 280 days of his death through artificial insemination using preserved semen.

Illegitimate Child (Bastard) :

Born out of lawful wedlock.

Affiliation Case :

Female alleging a particular man to be the father of her child & asking for fixing paternity.

Suppositious Child :

- AKA **Fictitious**/substituted/forged child.
- Female pretends pregnancy, later produces a child, claiming it as her own (Eg : Kidnapping baby from hospital, substituting girl child for boy child).
- Reason : For money/↑ in compensation.

----- Active space -----

Posthumous child :

- meaning : After death.
- Child born after the death of alleged father.
- Important in dispute of paternity cases.

ATAVISM

- meaning : Ancestor.
- Child does not resemble parents.
- Resembles grandparents (Due to genetic transmission).

LOCHIA

- Vaginal discharge : Sign of recent delivery.

Types :

1. **Rubra**
(first 4-5 days)

Sequence of Lochia mnemonic :
Republic of South Africa

2. **Serosa**
(5-9 days)

3. **Alba**
(>9 days)

MEDICOLEGAL IMPORTANCE

45% BNS : High court has the power to postpone/commute the death sentence of a pregnant woman.

----- Active space -----

ABORTION

Terminologies :

Abortion	medical abortion	Legal abortion
Expulsion of products of conception	Before period of viability (< 28 wks)	Anytime before delivery of baby

Types :

1. Spontaneous Abortion.
 - AKA natural abortion.
 - most common type.
 - Causes : Chromosomal anomalies, anatomical defects, hormonal problems.

2. Induced abortion
 - Legal (Performed as per MTP Act).
 - Illegal (Criminal abortion, not as per MTP Act).

Legal sections for illegal (criminal) abortion :

voluntary miscarriage : Legal term for criminal abortion.

88 BNS	89 BNS	90 BNS
voluntary miscarriage with consent of woman (Severe punishment if child is quickening).	voluntary miscarriage w/o consent of woman (Eg : Relatives forcing the abortion).	voluntary miscarriage resulting in death of woman (Due to procedure complications).

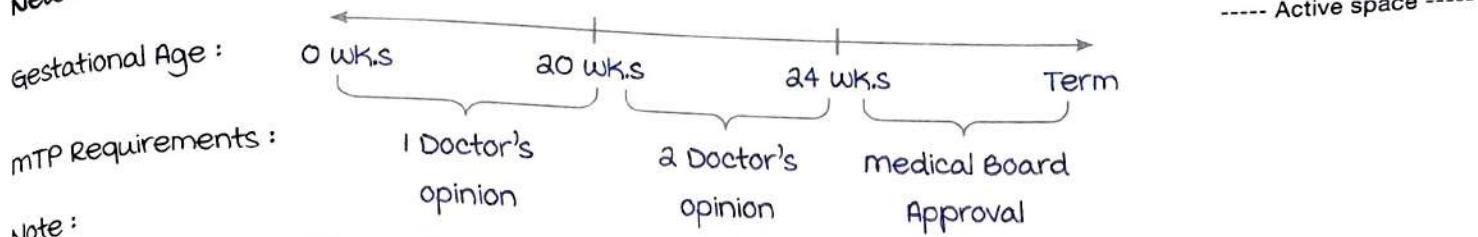
MTP Act 1971, MTP Amendment Act 2021

00:06:03

Indications :

1. Therapeutic : Continuation of pregnancy → grave risk to mother's life.
2. Eugenic : Any risk of physical / mental fetal defects
(Eg : mother exposed to TORCH infections / teratogenic agents).
3. Social : Failure of contraception (This pregnancy can cause mental agony to the mother).
4. Humanitarian : Pregnancy due to rape.

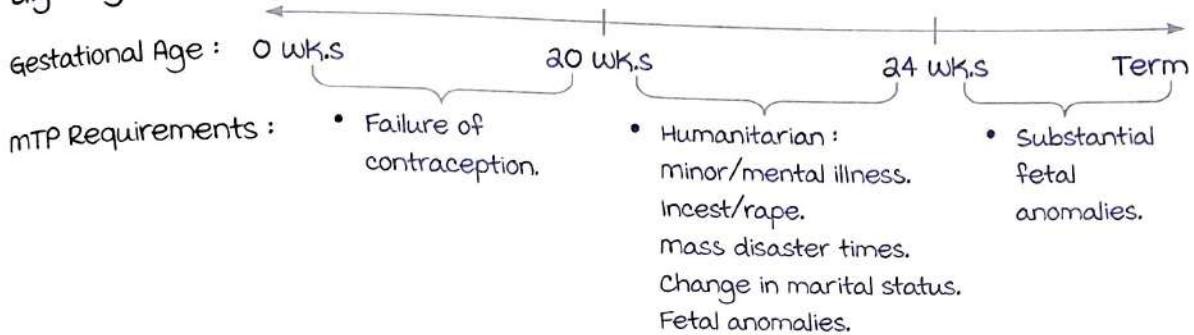
New 2021 Guidelines for mTP :



Note :

mTP is done only in authorised institutions.

eligibility for mTP :



Note : Irrespective of gestational age, emergencies are an indication for mTP
(To save the mother's life).

Conduction of mTP :

- Government institutions.
- Any institution authorised by committee.

Qualifications to perform mTP :

Registered Medical Practitioner with eligibility :

- Diploma/PG degree in OBG.
 - 6 months of internship in OBG.
 - 1 year experience in OBG.
 - Assisted in 25 mTP cases + Performed ≥ 25 cases independently :
- Can perform mTP upto 20 weeks.
- Can do mTP upto 12 wks.

Note : Violation of patient confidentiality is punishable.

Consent for mTP :

- minimum age : 18 years.
- For minor : Consent of guardian required.
- Husband's Consent is not required.

Note :

- Maintenance of records : 5 years.
- Monthly reporting to CMO.

----- Active space ----- **Illegal Abortion Methods**

00:22:10

Abortifacients	General Violence	Local Violence
<ul style="list-style-type: none"> GIT irritants - Castor, calotropis, mgSO_4. Genitourinary irritants - Cantheride, turpentine. Ecbolics : \uparrow Uterine contraction Eg : Quinine, oestrogen, ergot. Emmenagogues : \uparrow menstrual blood flow. Eg : Borax, Oestrogen, Sanguinaria, Sarin (mnemonic : BOSS). Systemic - Lead, copper, mercury, iron. 	<ul style="list-style-type: none"> Violent exercises. Cupping : <p style="text-align: center;">↓</p> <p>Cup over lit candle used as vacuum over abdomen</p> <p style="text-align: center;">↓</p> <p>Extinguishes oxygen</p> <p style="text-align: center;">↓</p> <p>Cup forcefully pulled upwards</p> <p style="text-align: center;">↓</p> <p>Separation of membranes</p> <p style="text-align: center;">↓</p> <p>Abortion</p> 	<ul style="list-style-type: none"> Syringing : Soap water pumped into uterine cavity. Abortion stick : (Eg : Plant irritant \rightarrow uterine contraction). Rupture of membranes. Dilatation of cervix (Slippery elm bark \rightarrow Attracts moisture ↓ Dilates cervix).

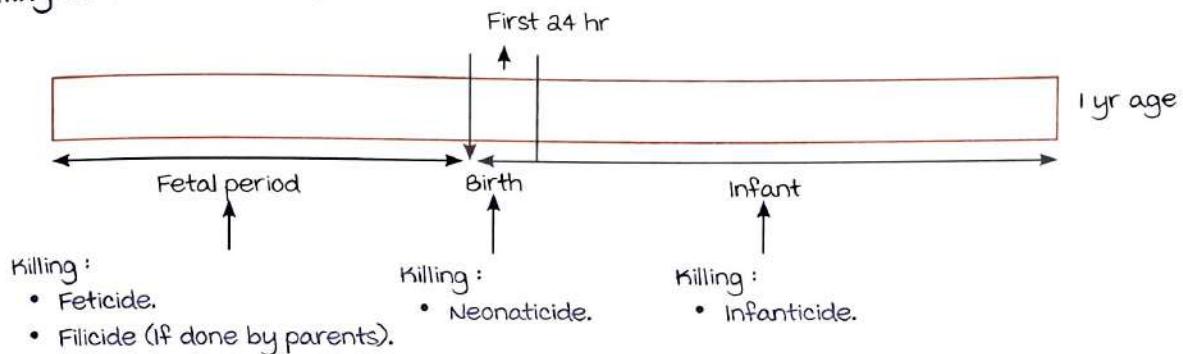
INFANT DEATHS AND CHILD ABUSE

----- Active space -----

Terminologies

00:00:15

Killing of a fetus/infant:



medicolegal importance :

As per Indian law, infanticide = murder (Punishable under 103 BNS).

Viability:

Ability of the baby to lead a separate existence apart from its mother by virtue of its development.

Period of viability : 28 weeks of gestation.

Status at birth :

Dead born :

Death of fetus in utero.

Features :

- Rigor mortis.
- maceration : Autolysis d/t amniotic fluid.
- mummification : Dehydration of baby due to lack of amniotic fluid and blood supply.

Still born : Baby born after 28 weeks of gestation, but did not show signs of life.

Live born : Baby born after 28 weeks of gestation and showing signs of life.

Features :

- Cry of the baby (Not definitive).
- Muscle movement of the baby.
- Respiration.

----- Active space -----

Note : Conditions where cry of child is heard **before birth**.

- **vagitus vaginalis** : cry of the baby inside the vagina.
- **vagitus uterinus** : cry of the baby inside the uterus.

Maceration

00:07:00

Aseptic autolysis of the baby.

External findings :

Duration	Features
By 12 hrs	<ul style="list-style-type: none"> • Reddening of the skin. • Skin slippage.
By 24 hrs	<ul style="list-style-type: none"> • Skin blebs and blisters. • Abdominal bloating.
After 2 days	<ul style="list-style-type: none"> • Soft and flaccid baby. • Hypermobile joints, flat baby. • Sweetish disagreeable smell.

Radiological features :

1. Robert's sign : Gas shadow seen in aorta, heart, umbilical vessels on x-ray.
Seen by 12 hrs.
- 2: Overcrowding of ribs (d/t collapse of lung).
3. Ball's sign : Hyperflexion of the spine d/t vertebral collapses.
4. Dual halo sign : Separation of scalp from skull vault.
d/t edema.
5. Spalding sign : After 4-7 days.
Overriding of skull vault bones.
Liquefaction of the brain.
Shrinkage of cerebrum. } → Skull vault bones lose support

Autopsy differences b/w Live born & Dead born

00:12:10

TESTS PERFORMED

Wreden's middle ear test :

- Gelatinous tissue is present in the middle ear at birth.
- On respiration → Eustachian tube opens → Gelatinous tissue cleared.

Breslau's second life test: AKA Stomach bowel test.

- Baby starts breathing → Swallows air → Air in the gastric cavity.
- During dissection, ligate both ends of the stomach → Drop it in water → Puncture stomach wall underwater → Look for air bubbles.

----- Active space -----



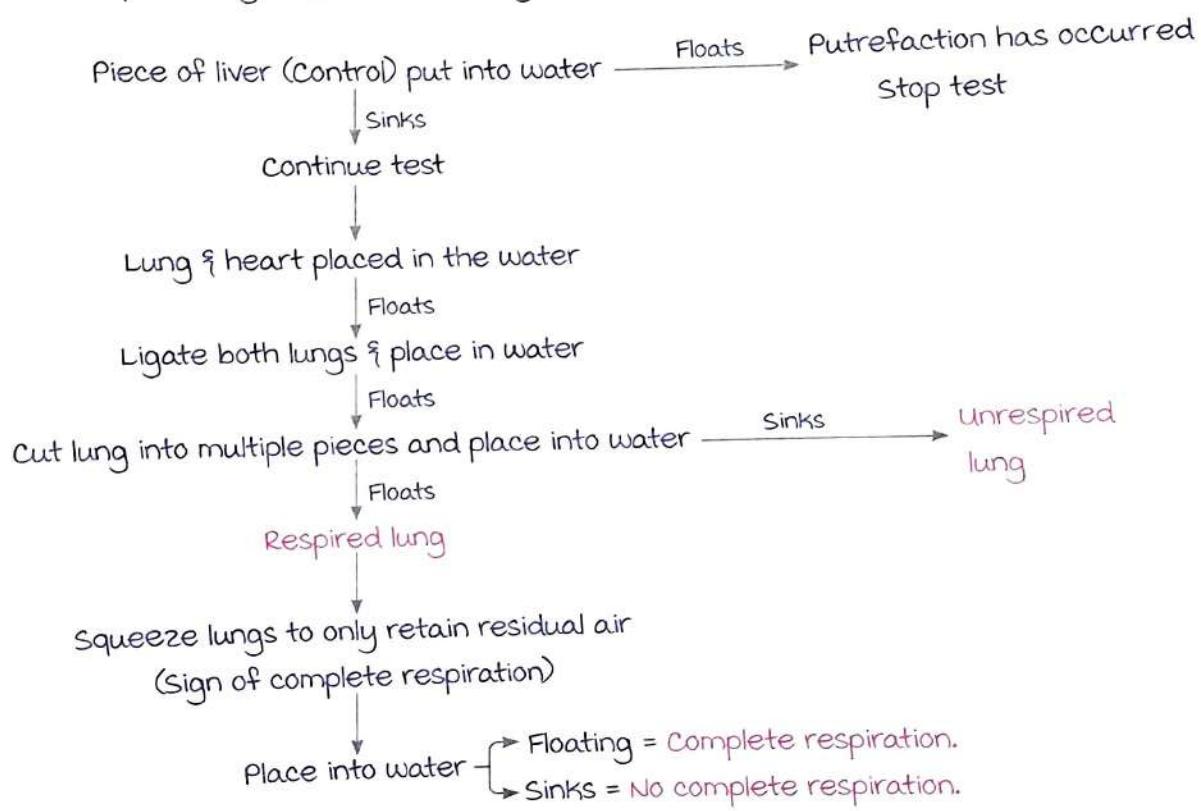
Raygat's test/hydrostatic test:

Principle:

specific gravity

- Unrespired lung (1.04) > water (Lung sinks).
- Respired lung (0.9) < water (Lung floats).

method:



False negative: Congenital pneumonia, feeble respiration, pulmonary oedema.

False positive: Artificial respiration, putrefaction.

	unrespited baby	respited baby (Live born)
Level of diaphragm (Open abdominal cavity first to check level of diaphragm)	3 rd /4 th rib (Higher level)	6 th - 7 th rib (Lower level) Respiration pushes the diaphragm down
Fodere's/static test (Weight of the lungs)	30 g	60 g (D/t ↑ blood flow to the lungs on respiration)
Plouquet test Ratio { weight of lungs / weight of the baby }	1 : 70	1 : 35 (D/t ↑ in weight of the lung)
Wredens middle car test	Gelatinous tissue present	Clearing of gelatinous tissue

----- Active space -----

	Unrespired baby	Respired baby (Live born)
Breslou's second life test (Stomach bowel test)	No air bubble seen	Air bubbles seen
Hydrostatic/Raygat's test (Lung floatation test)	Lung sinks	Lung floats

Battered Baby Syndrome

00:23:49

AKA Caffey syndrome, Caffey Kempe syndrome, Parent infant traumatic stress syndrome.

Battered child :

Child who has received multiple repetitive physical injuries as a result of non-accidental violence, produced by a parent or guardian.

Susceptible child :

- males > females.
- Eldest/ youngest child.
- Unwanted & illegitimate child.

Factors related to parent :

- Unmarried couple.
- Victims of child abuse.
- Substance abuse.

Classical features :

- Delay b/w occurrence of injury & medical attention.
- Injury is inconsistent with history.
- multiple injuries at different ages/stages of healing (Sign of repeated trauma).

Injuries :

Perioral bruises/lacerations (Lip, frenulum).



Battered child

Shaken baby syndrome :

AKA infantile whiplash syndrome.

Cause : Violently shaking the baby →

Acceleration deceleration injury.

Features :

- | | |
|--------------------------------------------------------------------------|-------------------------------|
| Retinal detachment/haemorrhage
Subdural haemorrhage
Encephalopathy | Triad of shaken baby syndrome |
|--------------------------------------------------------------------------|-------------------------------|



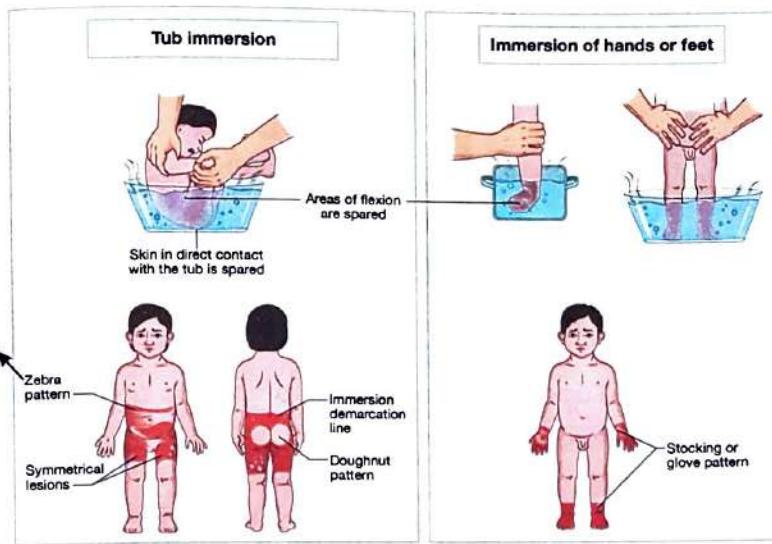
Shaken baby syndrome

scalds :

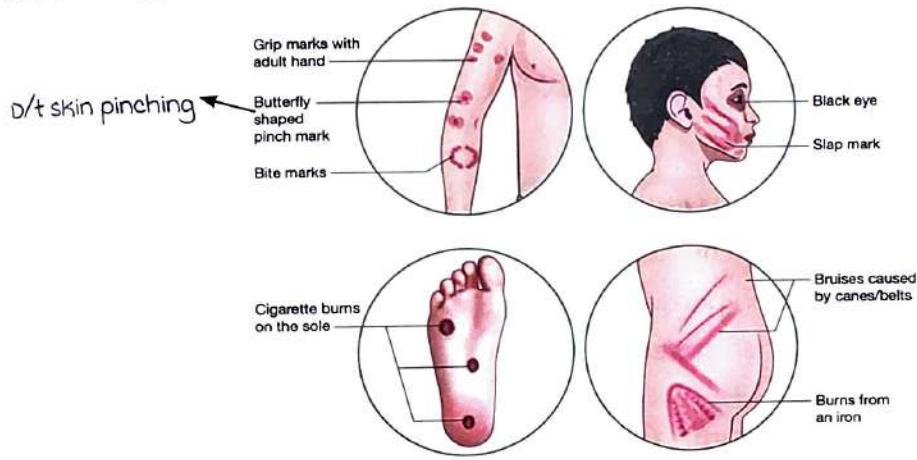
cause : Immersing the baby in hot water.

Features :

----- Active space -----



surface injuries :



Skeletal injury :

Skull : Egg shell fracture.

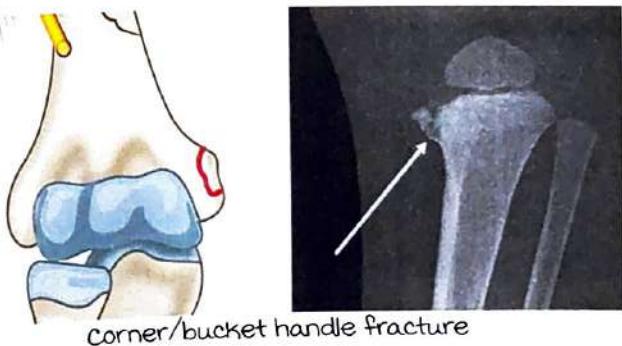
Ribs :

- Compression of chest of the baby → Anteriorly : Fracture at mid-axillary line.
- Healing calluses : String of beads appearance on chest X-ray.
- Laterally : Fracture of posterior end of ribs.



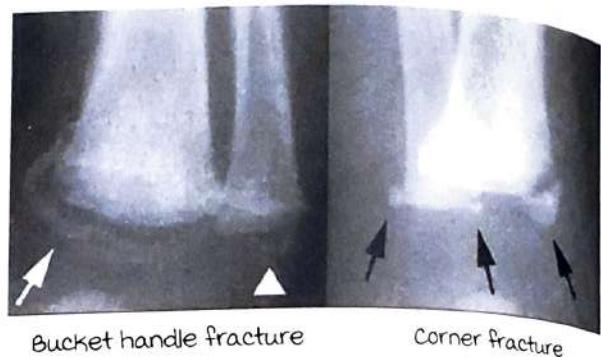
Long bones :

Cause : Shearing force.



----- Active space -----

- metaphyseal fracture.
- Bucket handle fracture.
- Corner fracture.



Manchausen's Syndrome by Proxy

00:32:37

Parent fabricates illness : Type of child abuse in a child to gain attention (child is repeatedly brought to the hospital).

methods of simulation of illness :

- Hematuria : By mixing blood with urine.
- Asphyxia.
- Hypoglycemia : By giving the baby insulin.
- Vomiting/diarrhea : By emetics or laxatives.

Diagnosis :

- Previous h/o multiple hospitalisations in multiple hospitals.
- Signs & symptoms does not correlate with h/o illness.
- Baby becomes worse when parent is present.
- Baby becomes better when parent is absent.

Sudden Infant Death Syndrome (SIDS)

00:35:16

AKA crib death or cot death :

- Sudden unexpected death of a seemingly healthy infant.
- Death remains unexplained even after the rough.
- Investigation & autopsy.
- Diagnosis of exclusion.

Features :

- Age group : 2 weeks-2 yrs.
- males > females
- Prematurity : ↑ Risk.
- m/c in twins (As there is ↑ incidence of prematurity).
- Time of death : m/c in early mornings.
- Alcohol & cigarette smoking of parents.

----- Active space -----

Autopsy findings :

- usually negative.
- constant finding : Petechial hemorrhages in visceral organs (Heart, lungs).
- milk/blood stained froth at mouth & nostrils.

probable causes :

1. prolonged sleep apnoea.
2. viral respiratory infection that depresses respiratory center : ↑ Sleep apnoea.
3. Hypersensitivity to cow's milk.

medicolegal implications :

- SIDS may present as a case of infanticide.
- Infanticide maybe claimed as SIDS by parents.

----- Active space -----

SEXUAL OFFENCES

Rape

00:00:10

Section 63 :

- Penetration of penis into vagina, urethra, anus and mouth.
- Insertion of object/body part into vagina, urethra and anus.
- manipulates any body part of woman to cause penetration :
Vagina, urethra, anus and part of body.
- Applies his mouth to the vagina, anus, urethra of a woman or makes her to do so.

Above mentioned acts :

- Against will.
 - without consent.
 - Consent obtained due to fear of death or hurt.
 - Consent due to misrepresentation of facts/fraud/impersonation.
 - Consent due to unsoundness of mind/intoxication/stupefying substance.
 - Age <18 years.
 - when she is unable to communicate consent.
- Invalid
consent
(28 BNS)

Exception : medical interventions.

Persecution in rape :

- Accused : male.
- Victim : Female.

Age of consent :

- Females : 18 years.
- males : Not given under section 63 BNS.

Statutory rape : Intercourse with a female (<18 years) with or without consent.

Note : If adult female commits sexual intercourse with minor boy (<18 years) she will be charged under POCSO act.

----- Active space -----

punishment for rape :

64(1) : 10 years to life imprisonment.

64(2) : under special circumstances, including custodial rape.
→ 10 years to life imprisonment.

65(1) : Rape of girl <16 years.

65(2) : Rape of girl <12 years.

66 : For rape → Persistent vegetative state.

67 : Sexual intercourse with wife during separation without consent.

68 : Sexual intercourse by person in authority.

69 : Sexual intercourse by deceitful means (e.g. False promise of employment/promotion/marriage by suppression of facts).

70 : Gang rape.

71 : Rape by repeat offenders.

72 : Disclosure of identity of rape victim (Imprisonment : 2 years).

397 BNSS :

- victims of rape/vitriolage/POCSO should be treated immediately and free of cost by all doctors.
- Police intimation to be done.
- violation : Punishable under 200 BNS.

120 BSA :

- Presumption as to absence of consent in certain prosecution of rape.
- Burden of proof falls on accused.

366(2) BNSS : Closed court proceeding (in camera trial).

Medical Examination

00:23:50

ACCUSED & VICTIM

	Accused	Victim
Section	53 BNSS	184 BNSS
Examination request	By police (Not below subinspector)	-
Consent	Not mandatory (Reasonable force can be applied)	<ul style="list-style-type: none"> • mandatory : <ul style="list-style-type: none"> - Informed consent to be taken. - male doctor can examine in presence of female attendant. • minor female : Only female RMP in the presence of parents/guardians/person of trust.

----- Active space -----

EXAMINATION OF ACCUSED**Smegma:**

- Cheesy secretions under prepuce.
- If rubbed off : 24 hours for redeposition.
- If smegma present : Rule out possibility of complete penetration in last 24 hours.

Lugol's iodine test (Obsolete) :

- To detect vaginal epithelial cells on penile glans/shaft.
- Swab exposed to I_2 vapour : Brown colour (Positive).
- Test viability : 4 days.

EXAMINATION OF VICTIM

SAFE kit.

Things to be examined and preserved :

Clothing.

General physical examination : Injuries.

Local examination :

- Injuries over vulva/labia.
- Hymen :
 - Glaister Keen rod.
 - Tear +/- : Absent in child (Deep seated)/false virgin (Too thick).
 - Site of tear :
 - a. Anterior : Digital/object.
 - b. Posterolateral : Penile.
- Recent microinjury : Toluidine blue (1% spray).

Swabs to be preserved (Condition : Not taken bath) :

- vaginal swab.
 - mobile sperm : Recent rape (<12 hours).
 - Sperm : upto 3 days.
 - Semen : upto 4 days.
- Anal swab/buccal swab/bite mark.

Blood sample : Grouping/typing/DNA typing/STD testing/alcohol.

POLICE INFORMATION

- 397 BNSS.
- POCSO Act (Section 19).
- 33 BNSS.

Adultery and Incest

00:42:50

----- Active space -----

Adultery :

male having sexual intercourse with another man's wife without his consent/connivance.

medicolegal importance :

- No longer a criminal offence.
- If any one of spouse commits suicide d/t adultery → Considered abetment of suicide (108 BNS).

Incest :

sexual relation between blood relatives.

complex :

Type	Relation
Electra	Father and daughter
Oedipus	mother and son
Pharoan	Siblings

medicolegal importance :

Punishable :

- Non consensual : Section 63 BNSS.
- minor involved :
 - Section 63 BNSS.
 - POCSO.

Unnatural Sexual Offences

00:47:10

SODOMY

- AKA buggery/Greek love.
- Penile anal intercourse.
- B/w : male-female/male-male.

Types :

	Active agent	Passive agent
Gerontophilia	Adult (male)	Elderly
Pedarasty (Habitual sodomy)	Adult (male) : Pedarast	male child: Catamite

----- Active space -----

Anal examination/findings :

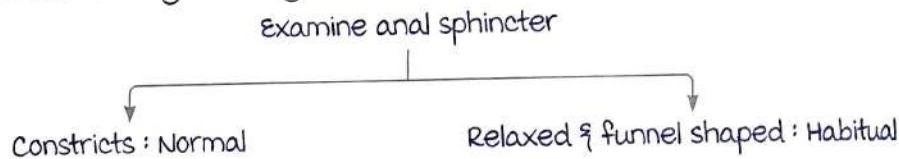
	Non habitual passive victim	Habitual passive victim
Perianal pain & tenderness	Present	Absent
Semen	Present	Present/absent
Perianal region	Abrasions/contusions/ lacerations/anal fissures	Skin thickening (d/t constant friction)
Anal sphincter	Intact	Patulous
Tyre sign	Present	Absent

Tyre sign : Obliteration of anal skin folds d/t perianal hematoma.

Differentiation b/w habitual and non habitual :

Lateral traction test :

- In knee-elbow position.
- Lateral traction to gluteal region :



OTHERS

Buccal Coitus :

- AKA sin of Gomorrah/oral sex.
- Oral stimulation of :
 - Penis : Fellatio/penilelingus.
 - Vagina : Cunnilingus.
 - Anus : Anilingus.

Lesbianism :

- AKA tribadism/sapphism.
- Sexual activity b/w 2 females :
 - Active partner : Dyke/butch
 - Passive partner : Femme.

Bestiality :

Sexual intercourse with lower animals.

MEDICOLEGAL ASPECT

No specific section in BNS for punishment.

Sexual Perversions/Paraphilias

00:57:40

----- Active space -----

sexual gratification achieved by methods other than sexual intercourse.

sadism and masochism :

	Sadism	masochism
AKA	Active algolagnia	Passive algolagnia
sexual gratification upon	inflicting pain	Suffering pain

Lust murder : Extreme sadism → Sexual gratification through murder.

Bondage : Sadism and masochism in a couple.

Transvestism/Eonism :

sexual gratification upon wearing clothes of opposite sex.

Exhibitionism :

- sexual gratification by exposing one's private parts to an unsuspecting stranger.
- punishable under 296 BNS (Obscene acts) and 292 BNS (Public nuisance).
- Types :

Term	Act
streaking	Running naked
mooning	Exposing gluteal region
Flashing	Exposing private parts briefly

Voyeurism/Scopophilia/Peeping Tom :

- sexual gratification upon watching/capturing private acts of female : undressing/taking bath/engaged in sexual activity.
- punishable under section 77 BNS.
- microscopia : Watching sexual activity of different couple.

Troilism :

- 3 people engaged in sexual activity.
- Watching wife having sexual intercourse with other male (Extreme form).

Fetishism :

sexual gratification with inanimate objects/non sexual body part.

----- Active space -----

Frotteurism :

- Rubbing of genitals by a man against body of a non consenting female.
- Punishable under section :
 - 75 BNS (Victim : Female).
 - 294 BNS (Public nuisance : Gender neutral).

Scatology :

- Talking obscenity with non consenting female.
- Variant of exhibitionism.

Masturbation/onanism/ipsation :

- Sexual gratification by self stimulation.
- Punishable when done publicly.
- Punishable under section 296 BNS.

Other sexual gratifications :

Klismaphilia : Taking enemas.

Undinism/urolagnia/urophilia : Sight/smell/thought of urine.

Coprophilia/coprolagnia : Sight/smell/thought of feces.

Oralism/uranism : Licking/fondling/sucking.

Penilingus/fellatio : Licking penis.

Anilingus/rimming : Licking anus.

Cunnilingus : Licking vulva.

Narratophilia : Telling obscene stories or words to partner.

Pygmalionism : Sexual gratification with statues.

Necrophilia : Sexual activity with dead body.

Necrophagia : Eating dead body.

Bobbit syndrome : male genital amputation by female partner.

} Punishable under 301 BNS

GENERAL TOXICOLOGY

----- Active space -----

study of poisoning (source, properties, mechanism of action, signs & symptoms, diagnosis and management).

Significance :

- Acute : medical emergency.
- Leading cause of morbidity & mortality in India and major health problem worldwide.
- 2nd most lethal cause of suicide.

Basic Terms

00:01:30

Forensic toxicology	Occupational toxicology	Eco-toxicology
medicolegal aspects of poisoning : <ul style="list-style-type: none"> • medicolegal reporting • Gastric lavage • Post mortem (PM) findings • Samples to be preserved 	Study of poisons in relation to specific occupation.	Study of poisons in relation to environment.

Poison :

Definition : Any substance given in any form (solid/liquid/gas), any route (Oral/injectable/inhalation/direct contact) causing ill health or death by its local or remote action.

Rapid absorption : Inhalational > Intravenous > Intramuscular.



Paracelsus :
Father of Toxicology

Drug vs poison :

"sola dosis facit venenum" (Given by Paracelsus) : The dose makes the poison.

	Drug	Poison
medical significance	Low dose	High dose
Legal significance	Intention to heal	Intention to cause harm



mateu Orfila :
Father of modern Toxicology

Toxin vs venom :

	Toxin	Venom
Description	Any biological substance produced by a living organism (Plant/animal)	<ul style="list-style-type: none"> • Toxin produced by an animal • Proteinaceous substance injected into the body, causing ill effects
Study	Toxicology	Venomics

----- Active space -----

00:08:40

Classification of Poisons

mnemonic : CINCAm.

Poison type	Features & examples
Corrosives	<ul style="list-style-type: none"> Causes corrosion. maximum tissue destruction. Eg : Acids and alkalis.
Irritants	<ul style="list-style-type: none"> Causes inflammation. Types : <ul style="list-style-type: none"> Non metallic : Phosphorous, iodine, chlorine, bromine. metallic : Lead, iron, copper, arsenic, cadmium, thallium, mercury. Plant sources : <i>Ricinus communis</i>, <i>Abrus precatorius</i>, <i>calotropis</i>, <i>Croton tiglium</i>, <i>Capsicum annuum</i>, <i>Semecarpus anacardium</i> Animal sources : Snake bite, scorpion sting, spider bite.
Neurotoxins	<ul style="list-style-type: none"> Acting on brain (Cerebral poison) : <ul style="list-style-type: none"> Somniferous (Induces sleep) : Opioids. Deliriants (Cause delirium) : Datura, cannabis, cocaine. Inebriants (Cause intoxication) : Alcohol, chloral hydrate. Stimulant (Cause excitation) : Caffeine, cocaine, amphetamine. Psychoactive : Cannabis, phencyclidine (Angel's dust) Acting on spinal cord (Spinal poisons) : <ul style="list-style-type: none"> <i>Strychnos nux vomica</i> : Excitation <i>Gelsemium</i> : Inhibition Acting on peripheral nervous system : <ul style="list-style-type: none"> <i>Conium maculatum</i> (Hemlock) Curare
Cardiotoxins	<ul style="list-style-type: none"> Cardiac poisons mnemonic → Car DONA : <ul style="list-style-type: none"> Cardiac poisons Digitalis (Fox glove) Oleander (Pink or yellow) Nicotine (Tobacco) Aconite (Sweet poison)
Asphyxiants	<ul style="list-style-type: none"> Induce asphyxia. most are gases : <ul style="list-style-type: none"> Simple/inert : Carbon dioxide, nitrogen, helium. Chemical (Interact with cells) : Carbon monoxide, cyanide, hydrogen sulphide. Irritant : Chlorine, methyl isocyanate, ammonia.
miscellaneous poisons	<ul style="list-style-type: none"> Agricultural poisons : <ul style="list-style-type: none"> Insecticides mosquito repellents (Pyrethroids) Rodenticides Food poisoning agents

Diagnosis of Poisoning

00:23:30

----- Active space -----

IN LIVING PEOPLE

1. History :

- Onset : Sudden/insidious.
- Progression : Worsens uniformly.
- H/o recent food/drink intake.
- Similar features in family members.

2. Clinical features :

Toxicdromes → Collection of signs for type of poisoning :

- Cholinergic (Organophosphates, carbamates).
- Anticholinergic (Datura, tricyclic antidepressants, anti-psychotics).
- Opioids (morphine).
- Sedative-hypnotics.
- Sympathomimetics (cocaine, amphetamine, theophylline).

	Cholinergic	Anticholinergic	Opioids/Sedative-hypnotics	Sympathomimetics
HR	↓	↑	↓	↑
BP	↓	↑	↓	↑
Sweating	↑	↓ (dry)	No effect	↑
Temperature	↓	↑	↓	↑
Pupils	Pinpoint	Dilated	Pinpoint	Dilated
CNS features	<ul style="list-style-type: none"> • Convulsions • Coma 	<ul style="list-style-type: none"> • Delirium • Hallucinations 	Coma	<ul style="list-style-type: none"> • Hyperalert • Convulsions
Other features	<ul style="list-style-type: none"> • Bowel sounds & GI motility : ↑ • All secretions : ↑ 	<ul style="list-style-type: none"> • Urinary retention • Bowel sounds : ↓ • All secretions : ↓ 	Respiratory depression	Tremors
<ul style="list-style-type: none"> • HR → Heart rate, BP → Blood pressure • Toxicdromes of opioid and sedative-hypnotics : Similar to each other • Triad of pinpoint pupils + Coma + Respiratory depression : morphine poisoning 				

3. Lab investigations :

- Blood.
- Urine : Oxalate casts/crystals in urine → Suggestive of oxalic acid/ethylene glycol poisoning.

Note : Proximal convoluted tubule (PCT) necrosis → Phenol.

----- Active space -----

IDEAL HOMICIDAL VS SUICIDAL POISON

	Ideal homicidal poison	Ideal suicidal poison
Property	Colorless, odorless & tasteless	Pleasant taste
Cost	Cheap	Unimportant
Onset of symptoms	Delayed	Immediate
Nature of symptoms	Resembles natural disease	Painless death
Pm findings	Non specific (Difficult to identify)	Unimportant
Lab test	Undetectable	Unimportant
examples	<ul style="list-style-type: none"> • No ideal homicidal poison • Nearly ideal homicidal poison : <ul style="list-style-type: none"> - Thallium (Poisoner's poison) - Arsenic - Aconite 	<ul style="list-style-type: none"> • Cyanide • Organophosphates • Aluminium phosphate (Commonly used in North India) • Opioids

IN DEAD PEOPLE**Analysis****Physical**

- Odour of poison.
- Color of hypostasis.
- Stomach mucosa :
 - Color
 - Nature

Chemical

AKA toxicological analysis/
poison detection in tissues.

Odor of poison :

To perceive smell → Open cranial cavity.

Poison	Odor
Cyanide	Oil of bitter almonds
Cannabis	Burnt rope
Hydrogen sulphide Disulfiram	Rotten egg
Alcohol	Fruity
Chloral hydrate Paraldehyde	Acrid pear
Organophosphates	Kerosene (D/t addition of aromax, a petroleum product) or garlic
Phosphorous Arsenic	Garlic
Conium maculatum	mousy
Salicylates	Oil of winter green

color of hypostasis :

Normal color : Blue.

----- Active space -----

Poison	Skin color
Carbon monoxide	Cherry red
Cyanide	Brick/bright red
Phosphorous	Dark brown
Mnemonic → BAN :	
• Bromide	
• Aniline	Chocolate brown
• Nitrites	
Aniline	Deep blue
Hydrogen sulphide	Bluish green
Opium	Black
methanol	Purple

Stomach mucosa :

Poison	Nature/color
Sulphuric acid	Black necrotic, charring
Nitric acid	Yellow or brown d/t altered blood
Carbolic acid (Pheno)	Buff white & leathery
Arsenic	Red velvety mucosa or white particles on the mucosa
mercury	Slate grey
Copper sulphate	Bluish
Sodium amyntal	
Phosphorous	Yellow or dark brown

Preserved gastric content : Can be used to detect poison

Chemical analysis :

Identification of poison in tissues is an absolute proof of poisoning.

Organs to be sent for analysis :

Poison → Stomach → Small intestine → Liver → Kidney
 ingested (Food storage) (Absorption) (metabolization) (Organ of excretion)

Mnemonic : Bloody silk.

organ	Quantity to be preserved
Blood (most reliable) & urine sample	-
Stomach	Entire stomach
Small intestine	Proximal 30cm
Liver	500g
Kidney	Half of each kidney

----- Active space -----

Note :

In infants : Complete kidneys, intestine and liver have to be preserved.

Target organs to be preserved for suspected poisonings :

Organ to be preserved	Suspected poison
Heart	Digitalis Aconite
Brain	Cerebral poisons : <ul style="list-style-type: none"> • Alcohol • Poison • Cocaine
Spinal cord	Spinal poisons : <ul style="list-style-type: none"> • Strychnos nux vomica • Gelsemium
CSF Vitreous sample (Particularly if body is decomposed)	Alcohol
Lungs	Volatile/gaseous (E.g : Asphyxiants)
Abdominal fat	Pesticides Inhalational anaesthetics
Bone Hair Nails Skin (Can be recovered even after complete decomposition)	Metallic poisons : <ul style="list-style-type: none"> • Arsenic • Antimony • Thallium
Spleen	Carbon monoxide Cyanide

Preservatives

01:05:30

To be added in glass container containing the organ.

FOR CHEMICAL ANALYSIS

1. Saturated solution of sodium chloride : Cheaper, m/c used.
2. Rectified spirit : 95% alcohol, ideal preservative.

	Saturated solution of sodium chloride	Rectified spirit
Avoided in poisoning by	<ul style="list-style-type: none"> • Aconite • Corrosives (except phenol) 	<ul style="list-style-type: none"> • Alcohol (False positive reaction) • Formalin • Phosphorous (Luminescent property is lost) • Kerosene • Chloroform • Acetone

PRESERVATIVES USED FOR SPECIFIC ORGANS/TISSUES

----- Active space -----

organ/Sample	Preservative used
Blood	Sodium fluoride + Potassium oxalate • Sodium fluoride : 10mg/ml of blood, stops bacterial growth. • Potassium oxalate : 3mg/ml of blood, anticoagulant.
Urine	Thymol > Sodium fluoride > Toluene
Virology	Glycerol

Note :

- No preservatives are needed in :
 - Analysis of bone, hair and nails.
 - Analysis < 24 hours.
 - Deeply frozen samples.
- Formalin :
 - Never used in chemical analysis (Destroys the poison).
 - used only in histopathological examinations.

----- Active space -----

DUTIES OF A DOCTOR IN A CASE OF POISONING

Duties

00:00:30

LEGAL

Every hospital has a legal obligation to treat a case of poisoning.

In the absence of adequate infrastructure : First aid should be administered.

	Duty	Salient points
1	Preservation of evidences	<ul style="list-style-type: none"> Food samples, stained clothing, stained vomitus, gastric lavage sample etc. If these are not preserved → Punishable under section 238 BNNS (Intentionally not preserving evidence).
2	Adequate documentation	
3	Police intimation	<ul style="list-style-type: none"> Section 33 BNSS : Inform police if a citizen is aware of/suspects a crime being committed. <ul style="list-style-type: none"> Includes suspicious cases of poisoning (Homicidal, suicidal with suspected foul play). Doctor fails to inform police : Punishable under section 211 BNNS. Doctor gives false information to police : Punishable under section 212 BNNS.
4	Arrange for dying declaration	<ul style="list-style-type: none"> A conscious patient on the verge of death who is willing to give a statement.

Note : Attempt to suicide is **not a punishable offence** under mental Health Act, 2017.

MEDICAL (HIGH PRIORITY)

1. Stabilization of the patient (Airway, breathing, circulation, CNS depression).
2. Decontamination (Removal of unabsorbed poison).
3. Removal of absorbed poison.
4. Neutralization with antidotes.
5. Symptomatic treatment.

Decontamination

00:06:38

methods :

Depending on the route of exposure to the poison.

- Oral intake (m/c route) : Gastric lavage/stomach wash.
- Skin contact : Wash with water.
- Gas inhalation : Oxygen.

Note :

Gastric lavage is preferred in some non oral routes of poisoning (morphine, phenobarbitone) d/t secretions into the stomach.

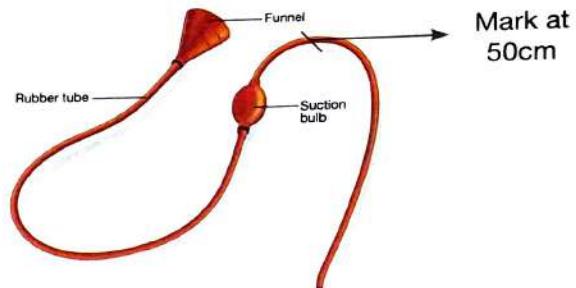
GASTRIC LAVAGE

----- Active space -----

Tubes used	Fluids used	Time for lavage	Best position
<ul style="list-style-type: none"> Lavacuator (preferred : Longer & has double lumen). Ewald's tube. Boa's tube 	<ul style="list-style-type: none"> Water. Normal saline. Potassium permanganate (1 : 5000). 	<p><1 hr post exposure :</p> <ul style="list-style-type: none"> most effective. minimal to no absorption. 	Left lateral.

Ewald's tube :

- Length : 1.5 m ; Diameter : 1 cm.
- mark at 50cm → Tube is inserted till this point.
- Funnel : To pour fluid in.
- Suction bulb : To take fluid out.



Ewald's tube

Contraindications :

Absolute	Relative
<ul style="list-style-type: none"> Corrosives : <ul style="list-style-type: none"> Risk of perforation d/t fragile esophageal/gastric mucosa. Exception : Phenol (carbolic acid) poisoning → Causes leathery stomach mucosa → Less risk of perforation. 	<ul style="list-style-type: none"> Comatose patients : <ul style="list-style-type: none"> Risk of aspiration. Can use a cuffed endotracheal tube. Convulsant poison : <ul style="list-style-type: none"> E.g : Strychnos nux vomica Insertion of tube can induce a seizure. Esophageal varices. Volatile poisons (e.g : Kerosene or petrol → Can evaporate & cause aspiration pneumonitis). Advanced pregnancy. Hypothermia

Activated charcoal :

- Given in gastric lavage.
- Mixed with water → Fed through Ryle's tube.
- 'Activated' by distillation.
- MOA : Adsorption of poison onto the surface → Excreted in the stool.
- Not useful for poisons that don't bind with charcoal.
- Avoided in (mnemonic → CHEMICAL) :
 - Cyanide.
 - Hydrocarbons.
 - Ethanol.
 - Heavy metals.
 - Iron.
 - Corrosives.
 - Airway compromise.
 - Lithium.



Activated charcoal

----- Active space -----

Removal of Absorbed Poison

Done by either hemodialysis or peritoneal dialysis.

HEMODIALYSIS

Indications :

General	Toxicological
(mnemonic : AEIOU) <ul style="list-style-type: none"> • Acidosis. • Electrolyte imbalance (Refractory hyperkalemia). • Intoxication. • Overload (Congestive cardiac failure). • Uremia. 	(mnemonic : BLAST) <ul style="list-style-type: none"> • Barbituates. • Lithium. • Alcohol. • Salicylates. • Theophylline.

OTHER METHODS

Urinary alkalinization	Urinary acidification
<ul style="list-style-type: none"> • Earlier name : Forced alkaline diuresis. • Preferred for excretion of acidic drugs : <ul style="list-style-type: none"> - Aspirin (Salicylates). - Phenobarbitone (Barbituate). 	<ul style="list-style-type: none"> • Not routinely used d/t side effects. • Preferred for excretion of alkaloid drugs.

Neutralization with Antidotes

00:20:02

Poison	Antidote
Arsenic	<ul style="list-style-type: none"> • BAL (British Anti Lewisite) AKA dimercaprol. • DMSA (Better chelating agent).
Copper	<ul style="list-style-type: none"> • D-penicillamine. • DMSA.
Iron	<ul style="list-style-type: none"> • Desferrioxamine.
Lead	<ul style="list-style-type: none"> • Calcium disodium EDTA. • For severe lead poisoning/lead encephalopathy : BAL/DMSA + EDTA since EDTA can't cross blood-brain barrier (EDTA given alone → Lead redistributed to the brain → worsening of symptoms)
mercury	<ul style="list-style-type: none"> • DMSA. • BAL.
Cocaine	<ul style="list-style-type: none"> • Amyl nitrite.
Beta-blocker	<ul style="list-style-type: none"> • Glucagon.
Carbon monoxide	<ul style="list-style-type: none"> • High flow/hyperbaric oxygen.
Cyanide	<ul style="list-style-type: none"> • Hydroxycobalamin. • Sodium/amyl nitrites (To induce methemoglobin formation).
Digitalis, oleander (Blocks Na ⁺ -K ⁺ ATPase pump)	<ul style="list-style-type: none"> • Digibind (Fab antibody).

Poison	Antidote	----- Active space -----
morphine	Naloxone.	
methanol	Ethanol + Fomepizole.	
Ethylene glycol (used in anti-freeze solution)	Ethanol.	
Organophosphates	Atropine + Oximes (Both have synergistic effect).	
Carbamates	Atropine.	
Organochlorine		
Pyrethroids	No specific antidote → Symptomatic Rx is given.	

Note : Older methods (Emesis) aren't used anymore for decontamination d/t higher rate of complications.

Chelating Agents

00:25:35

Group of antidotes specifically used in heavy metal poisoning.

Combines with the insoluble metal (Chelation) → Water soluble complex → Easy excretion.

CHELATING AGENTS USED

Chelating agent	Salient points
BAL	<ul style="list-style-type: none"> Contains -SH group, that combines with metal & both get eliminated from the body. uses (mnemonic → mAL): <ul style="list-style-type: none"> - mercury. - Arsenic. - Lead. c/l (mnemonic → mlCA): <ul style="list-style-type: none"> - methyl mercury. - Iron - Cadmium } d/t toxicity of chelated complex - Arsine (Gaseous form of arsenic). Given as deep intramuscular injection (Painful).
Calcium disodium EDTA	<ul style="list-style-type: none"> Used in lead poisoning. Primary excretion via kidneys (used with caution in patients with renal impairment).
D-penicillamine	<ul style="list-style-type: none"> uses (mnemonic → mLC): <ul style="list-style-type: none"> - mercury. - Lead. - Copper. Derived from same source as penicillin. c/l : Penicillin allergy.
DMSA/succimer	<ul style="list-style-type: none"> uses (mnemonic → mLA): <ul style="list-style-type: none"> - mercury. - Lead. - Arsenic. Oral substitute to BAL.
Desferrioxamine	<ul style="list-style-type: none"> Used in iron poisoning.

----- Active space -----

CORROSIVE POISONS

AKA caustics.

Corrosives

00:00:18

TYPES

	Acid		Alkali
Necrosis	Coagulative (Except hydrofluoric acid)		Liquefactive
Eschar	Formed		Absent
Lateral spread	Restricted		Unrestricted (Faster)
Injury	Superficial, less severe		Deeper, more severe
mucosal involvement	Gastric > Oesophageal		Oesophageal > Gastric
Clinical features	Inorganic	Organic	
	Local effects	Local + Systemic effects (D/t absorption)	-
Examples	<ul style="list-style-type: none"> • Sulphuric acid. • Nitric acid. • Hydrochloric acid. • Hydroflouric acid. 	<ul style="list-style-type: none"> • Carbolic acid (Phenol). • Oxalic acid. • Formic acid. • Acetic acid. 	<ul style="list-style-type: none"> • Sodium carbonate. • Potassium carbonate. • Ammonia. • Potassium hydroxide. • Sodium hydroxide.

CLINICAL FEATURES

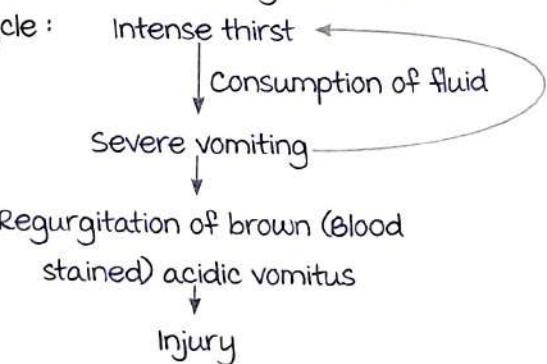
1. Pain :

- **Odynophagia** (m/c).
- Throat.
- Chest.
- Abdomen.

2. Chemical peritonitis : D/t perforation.

3. Dyspnoea & stridor : D/t airway involvement.

4. Vicious cycle :



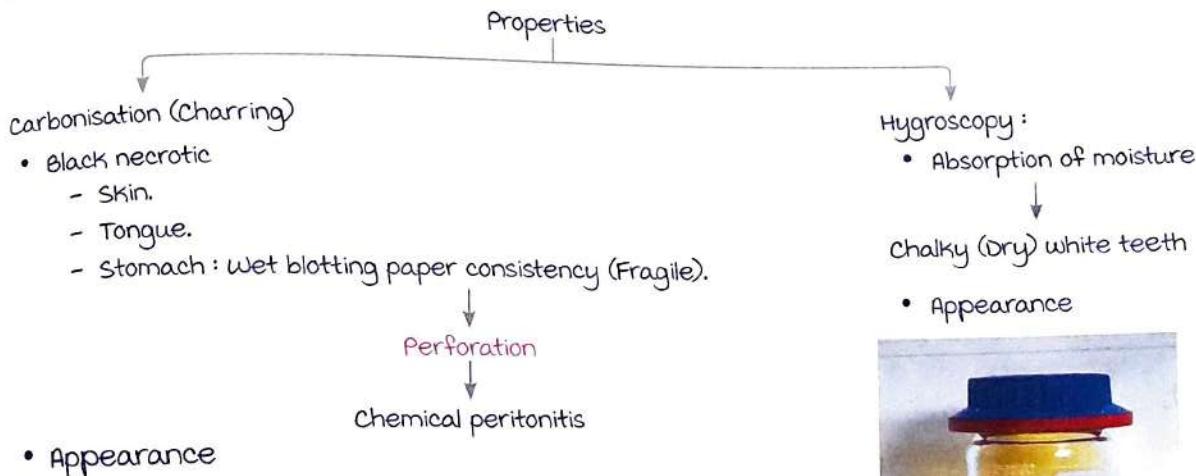
Sulphuric Acid & Nitric Acid

00:08:27

----- Active space -----

SULPHURIC ACID

AKA Oil of vitriol/battery acid.



NITRIC ACID

AKA Aqua fortis/spirit of nitrate.

Xanthoproteic reaction :

Tissues (Skin + Nitric acid → picric acid → Yellow staining of
mucosa)

- Skin
- Teeth
- mucosa

Note : Stomach mucosa can be dark brown d/t digested blood.

00:12:00

Vitriolage

Intentional throwing of **any corrosive** substance with the intention to disfigure a person.

Commonly used :

- Sulfuric acid.
- Nitric acid.
- Juice of Semecarpus anacardium.



vitriolage

----- Active space -----

CLINICAL PRESENTATION

- Chemical burns on exposed region (Face, neck).
- Corrosion/Ulcration.
- No singeing of hair/No blisters (Except formic acid).

Complication : Contractures.

MANAGEMENT

- Topical irrigation : Water/normal saline.
- Topical paste of magnesium oxide (MgO).

MEDICOLEGAL IMPORTANCE

- 397 BNSS : All doctors should provide compulsory free treatment to victims of vitriolage and sexual crimes and inform police of the incident.
- Violation : Punishable under 200 BNS.
- 124 (1) BNS : Defines punishment for acid attack.
- 124 (2) BNS : Defines punishment for attempt of acid attack.

Carbolic Acid (Phenol)

00:16:03

APPLICATIONS

- Antiseptic.
- Disinfectant.



Phenol crystal

On exposure to air →



Phenol liquid

Phenol derivatives : Cresol, Resorcinol, Lysol, Dettol.

PHENOL POISONING

Absorbed through all routes (Including intact skin).

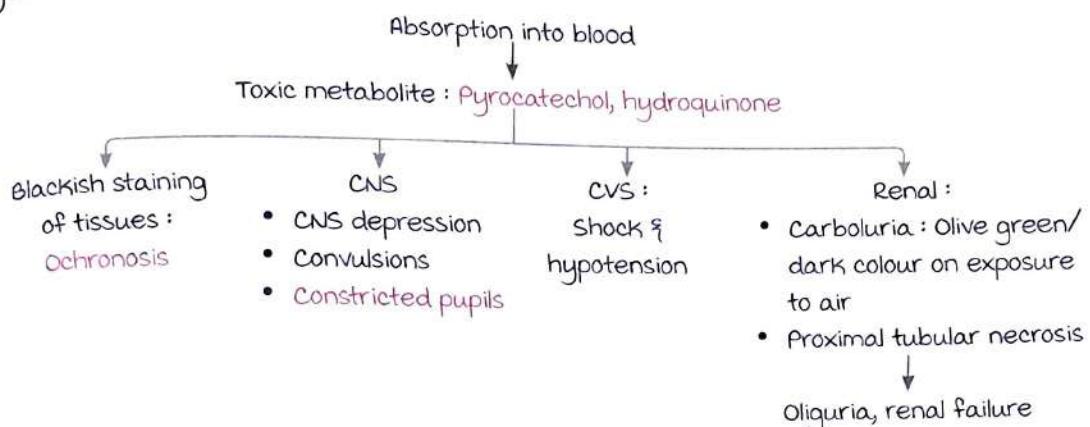
- Acute : Carbolism.
- Chronic : Phenolic marasmus.

Clinical presentation of carbolism :**Local effects :**

- Burning pain (initially) → Tingling and numbness → Anaesthesia (Damage sensory nerve endings).
- ↓ Emesis : D/t anesthetic effect.
- Leathery buff white stomach mucosa/thickening : Gastric lavage done.

Systemic effects :

----- Active space -----



Autopsy findings :

Delayed putrefaction : D/t antiseptic property (Inhibit bacteria).

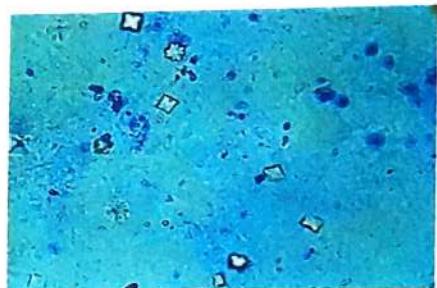
Oxalic Acid Poisoning

00:23:54

Acid of sugar.

used in ink/rust removing liquid : Signature forgery (Punishable under 336 BNS).

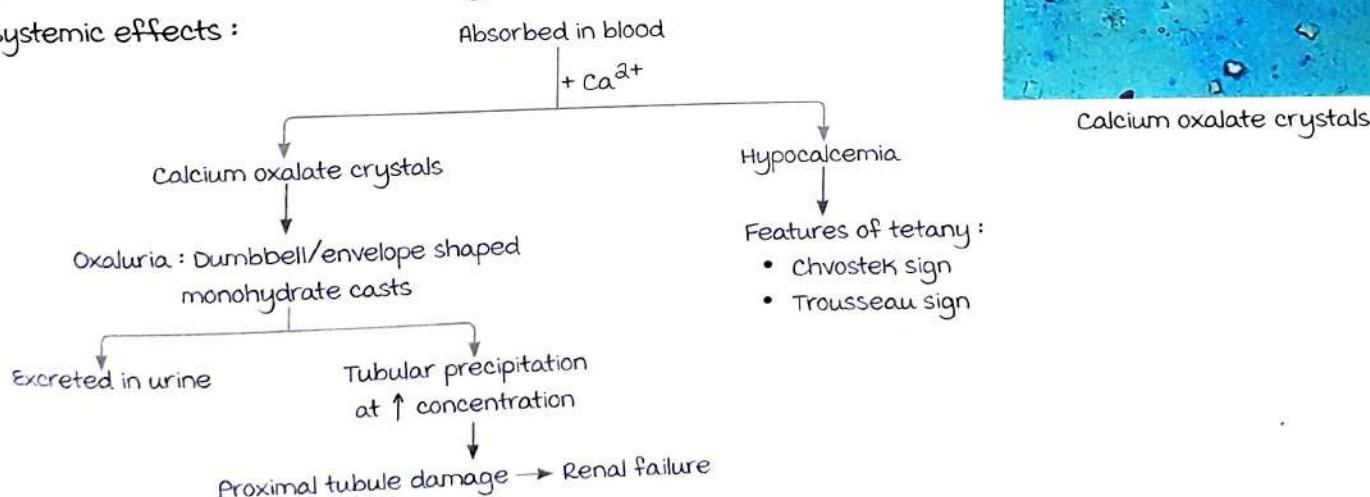
Source : Vegetables, corn, spinach, almonds etc.



CLINICAL PRESENTATION

Local effects : In GI/T (Pain, vomiting).

Systemic effects :



MANAGEMENT

- Gastric lavage : using calcium lactate solution (with caution).
- Antidote : IV calcium gluconate.
- Hemodialysis.
- Treat renal toxicity.

----- Active space -----

00:29:40

Hydrofluoric Acid Poisoning

- Inorganic acid with both local and *systemic effects*.
- Absorbed via skin
- Causes *liquefactive necrosis*.

RISK FACTOR

Occupational exposure : In glass etching.

PATHOGENESIS

Acid produces H^+ and Fluoride ions.

Fluoride ions → Liquefactive necrosis → Faster local spread (Damage skin, deeper tissues, bones).

CLINICAL PRESENTATION

Excruciating burning pain disproportionate to amount of exposure.

Forms insoluble salts with calcium and magnesium :

- Hypocalcemia.
- Hypomagnesemia.
- Hyperkalemia.

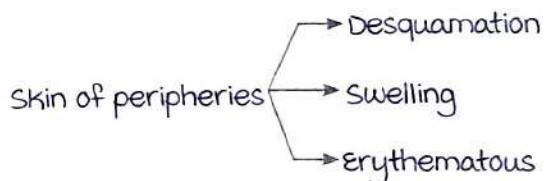
MANAGEMENT

- ICU admission.
- Continuous ECG monitoring : Watch for arrhythmias.
- Correction of electrolyte imbalance.

Boric Acid Poisoning

00:33:18

Boiled lobster syndrome :



METALLIC IRRITANTS

----- Active space -----

Features and management.

00:00:12

Heavy metals : Causes inflammation of tissues.

m/c acute heavy metal poisoning : Arsenic.

m/c chronic heavy metal poisoning : Lead.

Characteristics :

cumulative poison :

- Accumulates in body → more prone to chronic poisoning.
- Deposits in bone, hair & nail (used for detection of chronic exposure).

mechanism :

Binds & inhibit : Sulphydryl (SH) group of enzymes → cell injury.

Detection :

- Blood sample (Best for lead).
- Urine sample (Best for arsenic).

Treatment :

- Removal from exposure.
- Use of Chelating agents (Insoluble metals → Soluble complex → Excreted).

Arsenic Poisoning

00:04:14

Arsenic : metalloid.

Forms :

1. Elemental : Non Toxic (Not absorbable).
2. Organic : Non Toxic (Eg : Arsenocholine, arsenobetaine).
3. Inorganic : Toxic.



Arsenic trioxide

Salt :

1. Arsenic trioxide AKA inheritance powder.
 - most toxic arsenic salt.
 - Widely used for homicide (Colourless, odourless & tasteless properties).
2. Scheele's green (copper arsenite).
3. Paris green (copper acetoarsenite).
 - Used for painting.



Paris green

----- Active space -----

Gas :

Arsine : most toxic form.

- Garlic odour.

TYPES OF POISONING

1. Fulminant : Takes massive dose (Eg : 3g) → cardiovascular collapse → Death.
2. Acute : Takes large dose of arsenic.
3. Chronic : Takes small dose over long period of time.

Acute arsenic poisoning :

Fatal dose : 100-200 mg.

Types :

1. Gastroenteric :
 - Profuse diarrhoea (mimics cholera).
 - Hemorrhagic gastritis.
2. Narcotic :
 - Affect CNS.
 - Neurological disturbance → Death.

Acute arsenic poisoning v/s Cholera :

	Arsenic poison	Cholera
Clinical features	Throat pain ↓ Vomiting ↓ Loose stools	Loose stools (rice watery) ↓ Vomiting ↓ Throat pain
Tenesmus	Present	Absent
Autopsy finding	Red Velvety Stomach	-

Chronic arsenic poisoning :

AKA Arsenicosis.

Etiology :

- Homicidal exposure.
- Accidental exposure.
 - Occupational.
 - Hydro arsenicism : D/t arsenic contaminated ground water.

Clinical features :

Stages of presentation :

1. GIT.
2. Skin.
3. Neurological.
4. Neuromuscular.

----- Active space -----

Site	Clinical features
Skin	<p>Dark brown pigmentation :</p> <ul style="list-style-type: none"> • Seen in flexures/temples. • Resembles addison's disease/fading measles rashes. <p>Bilateral hyperkeratosis : In palms & soles.</p> <ul style="list-style-type: none"> • wart like growth. • Can cause BCC, SCC, bowen's disease.
Nail	<p>Transverse white line on nail bed : Leuconychia striata.</p> <p>Note : Also seen in thallium poisoning.</p>
Hair	Alopecia
Blood vessels	Chronic peripheral ischemia → Peripheral gangrene
Nerves	<ul style="list-style-type: none"> • Peripheral sensory motor polyneuropathy. <ul style="list-style-type: none"> - Sensory > motor (resembles gullian barre syndrome). • Parestheria, tingling, numbness later muscle weakness & palsy. <p>Note : Thallium poisoning also resembles GBS.</p>
Bone marrow	Anemia



Rain drop pigmentation



Aldrich Mee's line

Special conditions :

	Toroku arsenic disease	Black foot disease
Source	Air contamination (inhalation)/ water contamination.	drinking water in arsenic wares
Endemicity	In areas with arsenic refineries	endemicity to Taiwan
C/F	skin/lung cancer, bowen's disease	Peripheral → Ischemia → Peripheral gangrene

Investigations :

- Samples : Blood, urine, hair, nail and bone (if dead).
 - most reliable : urine sample (24 hr excretion).

----- Active space -----

- Tests :

- a. Neutron activation analysis (NAA).
 - b. Atomic absorption spectrometry (AAS).
 - c. marsh
 - d. Reinsch
-] Obsolete.

Rx :

1. Removal from exposure.
2. Chelating agent :
 - BAL (British Anti Lewisite).
 - DMSA/succimer (oral).

Note :

- Disadvantages of arsenic as homicidal agent :
 - a. Retards putrefaction.
 - b. Can be detected from decomposed bodies, skeletal/burnt remains.
- Arsenophagists :
 - use arsenic as love philter/aphrodisiac.
 - Can tolerate large amount of arsenic.
- mnemonic : ARSENIC.

<ul style="list-style-type: none"> - Anemia, Alopecia, Aldrich mees line. - Rain crop pigmentation. - Septal perforation (painless). - Excessive pigmentation & Keratosis. 	<ul style="list-style-type: none"> - Neuropathy. - Ischemia (peripheral). - Cholera like illness & Carcinogenic.
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------

Mercury Poisoning

00:28:29

Chemical name : Hydrargyrum (Hg).

Common name : Quick silver/liquid metal.

Chronic Hg poisoning : Hydrargyrim.

uses :

- Photography.
- Fingerprint powder.
- Thermometer/barometer.
- Thiomersal.
- Dental amalgam.

Routes of exposure :

- Sea food.
- Hat making industry.
- Glass blowing industry.

Forms :

----- Active space -----

	Elemental	Organic	Inorganic
Toxicity	Non toxic (Not absorbable)	most toxic	Toxic
Clinical manifestation	<ul style="list-style-type: none"> Vapour : Toxic. Deposited in anterior lens capsule → mercuria lentis. <ul style="list-style-type: none"> - Vision : Normal (incidentally found). - Slitlamp : malt brown reflex. 	<p>Eg : methyl Hg.</p> <ul style="list-style-type: none"> minamata disease : d/t consumption of fish (contamination of water & lower organism in chain by Hg). CNS toxicity (d/t lipid solubility). <ul style="list-style-type: none"> - Ataxia. - Tremors. - Convulsions. Hunter russel syndrome. 	<ul style="list-style-type: none"> mercuric salts : <ul style="list-style-type: none"> Eg : mercuric chloride, mercuric sulphide, mercuric thiocyanate. Cause : Erethism (Neuropsychiatric disturbance). mercurous Salt : <ul style="list-style-type: none"> Eg : mercury chloride (Calomel). Cause : Pink's disease (Calomel used as laxative → Hypersensitivity in children).

Note :

- Order of toxicity : Organic mercuric salt > mercurous salt.
- mercuric sulphide & lead tetroxide : used as vermillion.

Erethism :

Clinical features

1. Tremors :

- AKA **Hatter's shake/glass blower shakes/Dan bowy tremors**.
- Progressive : Fine → Coarse intentional.
- Hand (worsening of handwriting) → Tongue (slurring of speech) → Limbs (Ataxia) → Body (Concussio mercurialis).

2. Emotional Instability AKA **mad hatter syndrome**.

- Sudden outburst of violence.

Pink's disease :AKA **Calomel disease/acrodynia/swift fear/selter disease**.

Clinical features (Ps) :

- Painful peripheries.
- Peeling of skin.
- Pruritic.
- Puffy.

----- Active space ----- Rx:

1. Remove exposure.
2. Chelating agent : BAL (British Anti Lewisite) & DMSA.

Note :

- minamata disease, doesn't need chelation.
- HG IS mETAL (mnemonic) :
 - Hatters.
 - Glass blowers.
 - Inflammation of gum.
 - Salivation.
 - minamata.
 - Erethism.
 - Tremors.
 - Acrodynia.
 - Lentis.

Lead Poisoning

00:45:13

Chemical Name : Plumbum (Pb).

Chronic poisoning : Plumbism AKA saturnism.

Forms :

1. Organic

- Tetra ethyl lead : most toxic (Lipid soluble).
- Used as antiknocking agent in petrol.

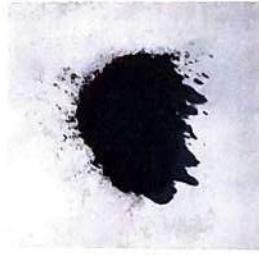
2. Inorganic (salt)



Lead acetate
(m/c form)



Lead tetroxide
(most toxic : Inorganic)



Lead sulphide
(used in eyeliner)



Lead carbonate
(used in paint)

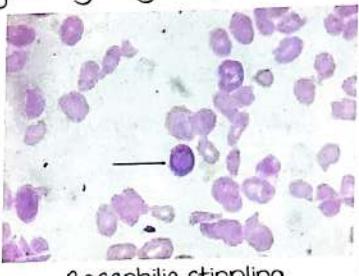
Routes :

- In children : Oral (Accidental).
- In adults :
 - Inhalational (Occupational).
 - m/c seen in plumbers, painters, polishers.

Clinical features :

mnemonic : ABCDEFG.

----- Active space -----

Clinical features	
A	<ul style="list-style-type: none"> • Anemia (microcytic hypochromic). <ul style="list-style-type: none"> - Inhibits ALA dehydrogenase & ferrochelatase.
B	<ul style="list-style-type: none"> • Burtonian line : <ul style="list-style-type: none"> - Blue colour deposit (Lead sulphide in gingivodental junction). - Seen in upper teeth caries. - Exposure : 1 week. <p>Note : Blue line also seen in mercury, iron & copper poisoning.</p>
B	<ul style="list-style-type: none"> • Basophilic stippling (inclusion bodies in RBC : Suggest dyserythropoiesis). <p>Reticulocyte ↓ 5 pyrimidine nucleotidase (inhibited) mature RBC</p> • Bone line/lead line : <ul style="list-style-type: none"> - Radiodense in metaphysis of long bone (in children). - D/t deposition of calcium.  <p>Basophilic stippling</p>
C	<ul style="list-style-type: none"> • Colics : Painter's/saturine colic. <ul style="list-style-type: none"> - Severe nocturnal pain. • Constipation : Dry belly ache. • Cabot's ring (Figure of 8 in RBC).  <p>Cabot's ring</p>
D	wrist drop & foot drop
E	<p>Encephalopathy :</p> <ul style="list-style-type: none"> - D/t tetraethylate (Toxic to developing brain). - mostly affects children : Irreversible learning.
F	Facial pallor (most consistent)
G	Gout (saturine gout)

IX:

Laboratory findings :

- Peripheral Smear :
 - microcytic hypochromic anemia.
 - Polycythemia (initially).
 - Poikilocytosis.
 - Anisocytosis.
 - Basophilic stippling.
 - Cabot's ring.

----- Active space -----

- Serum blood & urine levels :
 - ↑ lead levels.
 - ↑ free erythrocyte protoporphyrin.
 - ↑ ALA.

Radiology : x-ray findings.

1. Lead line.
2. Radio opaque deposits in GIT.
3. Whole body lead burden.

Rx :

1. Removal from exposure.
2. Calcium disodium EDTA (Best antidote for Pb).
3. BAL.
4. Supportive measures.

Severe lead poisoning :

- EDTA alone can't be used (Cannot cross blood brain barrier).
- Cause redistribution of lead to brain → Symptom worsens.
- Rx : BAL + EDTA or DMSA + EDTA.

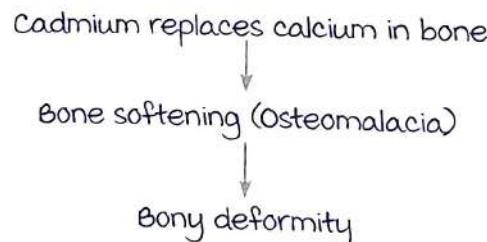
Cadmium, Thallium & Iron Poisoning

01:03:56

CADMUM POISONING

AKA itai itai disease / ouch ouch disease.

Etiopathogenesis :



Clinical features :

- multiple pathological fracture.
- Severe bone pain.

THALLIUM POISONING

AKA Poisoner's poison.

Forms :

Thallium acetate (Colourless, odourless, & tasteless property).
Thallium sulfate.

Clinical features :mnemonic : **BAN.**

----- Active space -----

Butterfly rash, Behavioural change.

Alopecia (with madarosis), Aldrich mee's line.

Peripheral sensorimotor poly Neuropathy (resembles GBS).

IRON POISONING

Cause accidental overdose.

m/c in children.

Forms :

- Ferrous sulphate.
- Ferrous gluconate.
- Ferrous fumarate.

C/f :

Stage	Duration	Clinical features
I	< 6 hrs	Gastro enteric phase : vomiting, abdominal pain
II	6-24 hrs	Asymptomatic : mild acidosis
III	1-2 days	multiorgan involvement : Liver failure
IV	2-6 weeks	Bowel obstruction d/t stenosis & stricture

Rx :

1. Decontamination.
2. Chelating agent : Desferrioxamine.
3. Hemodialysis (if severe).

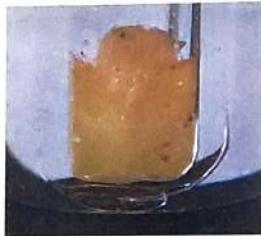
----- Active space -----

NON-METALLIC IRRITANTS

Phosphorus

00:00:20

Forms :

	white	Red
Appearance	On exposure to light → Yellow. waxy crystalline. 	Powdery amorphous 
uses	Rat poison, crackers, fertilizers	Tip of match stick
Toxicity	Toxic	Not toxic

white phosphorus :

Properties :

- Garlic odour.
- Pyrophoric (spontaneous combustion).
- Luminescent..
- Emit fumes.

mechanism :

Protoplasmic poison → Hepatotoxicity

Exposure :

- On Contact with skin → 2nd & 3rd degree burns.
 - Rx : Topical CuSO₄, AgNO₃.
- Oral ingestion : Acute & chronic poisoning.



White phosphorus burn

Acute phosphorus poisoning :

m/c in children (accidental ingestion).

In adults : Rat killer poison ingestion.

----- Active space -----

Stages	Clinical features
Stage I	Gastroenteritis : <ul style="list-style-type: none"> Burning pain. Vomiting Loose stools Garlic odour, luminescent, emit fumes : Smoky stool syndrome.
Stage II	Asymptomatic (1-4 days). Patient should not be discharged.
Stage III	Multiorgan failure : <ul style="list-style-type: none"> Liver failure (Jaundice, pruritis, bleeding, flapping tremors & encephalopathy). Renal failure.

Fatal dose : 1 mg/kg body weight.

Rx :

- Decontamination.
- Gastric lavage : KMnO₄ 1 in 5000 (use of oil worsens toxicity).
- If liver failure : N-acetylcysteine, vitamin K, FFP, liver transplant.

medico legal importance :

- Suicidal : Not preferred (painful).
- Accidental : m/c in children.
- Homicidal :
 - Not commonly used (d/t taste & smell).
 - Advantages :
 - Delayed onset.
 - mimics natural disease.
 - undetectable (d/t oxidation).

Chronic phosphorus poisoning :

Etiopathogenesis : Occupational exposure (Lucifer matchstick)

```

graph TD
    A[Occupational exposure (Lucifer matchstick)] --> B[Inhalation of vapour]
    B --> C[Osteomyelitis of jaw.]
  
```

AKA phossy jaw, Lucifer/glass jaw.

----- Active space -----

Fig. 98.



Phossy jaw

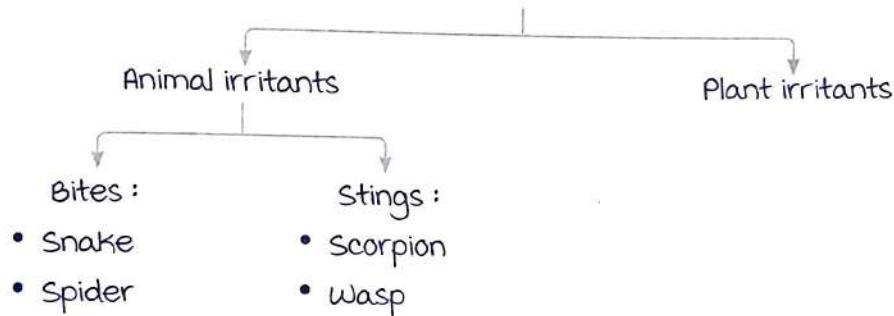
c/f:

- Toothache → Swellings → Discharging sinus (Pus : Garlic odour).
- Osteonecrosis of mandible.

Prevention: Periodic dental screening.

ORGANIC IRRITANTS

----- Active space -----



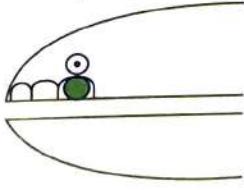
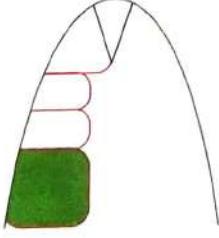
Snake Bite

00:01:15

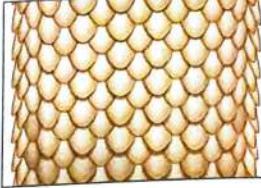
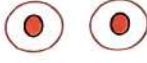
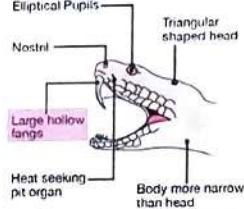
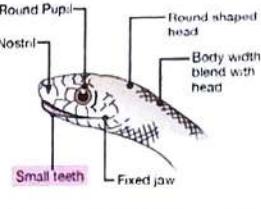
INTRODUCTION

- Annual deaths in India : 64000 (> 1.25 lakhs worldwide).
- 52 of 330 species in India are venomous.
- Ophiology : Study of snakes.
- Ophitoxemia : Snake venom envenomation.
- Venomics : Study of venom.

DIFFERENCES B/W VENOMOUS & NON-VENOMOUS SNAKES

Features	Venomous snakes	Non-venomous snakes
Head scales	<p>Smaller</p> <p>Exceptions :</p> <ul style="list-style-type: none"> • Cobra : 3rd supralabial scale is largest.  <ul style="list-style-type: none"> • Krait : 4th infralabial scale is largest. 	Larger

----- Active space -----

Features	Venomous snakes	Non-venomous snakes
Belly scales	Larger 	Smaller 
Tail	Compressed (Sea snake : Flat, Paddle-like)	Round/not compressed
Site	<ul style="list-style-type: none"> • 2 fangs • Fang mark : 	<ul style="list-style-type: none"> • multiple small teeth. • Teeth mark : 
Habit	Nocturnal	Diurnal
Image		

FAMILIES OF SNAKES

Features	Elapidae	Viperidae	Hydrophidae
Type of venom	Neurotoxic	Vasculotoxic	myotoxic
Clinical manifestation	Neuromuscular paralysis	Disseminated Intravascular Coagulation (DIC)	muscle pain/necrosis ↓ (Rhabdomyolysis) ↓ myoglobin ↓ Renal failure
Important species	<ul style="list-style-type: none"> • King cobra. • Common cobra. • Krait. 	<ul style="list-style-type: none"> • Russel's viper. • Saw-scaled viper. • Hump-nosed viper. 	• Sea snakes

Indian big 4 :

- Common cobra.
- Krait.
- Russel viper, Saw-scaled viper.

} Indian Anti-snake venom (ASV)
is effective against these species.

SPECIES

----- Active space -----

King cobra : *Ophiophagus hannah*

- Fatal dose : 12 mg.

Cobra : *Naja naja*Krait : *Bungarus cereleus*.

- Fatal dose : 6 mg.



Hexagonal scales



Banded Krait

Russel's viper with 3 rows
of diamond shaped scalesSea saw viper : *Echis carinatus*Hump nosed viper : *Hypnale hypnale*

Sea snakes

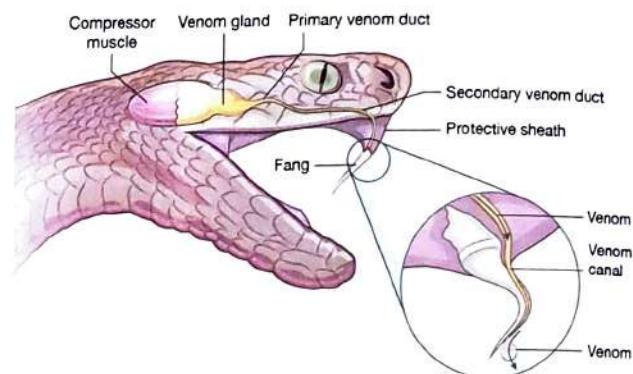


----- Active space ----- **VENOMOUS APPARATUS OF SNAKE**

- Venomous gland : modified salivary gland.
- Venom : Toxic saliva.

90% of venom are proteinaceous enzyme :

- Hydrolases.
- Hyaluronidase.
- Cholinesterase.



Fate of venom :

Orally consumed

Digested

Injected

Lymphatics
Envenomation/Ophitoxemia

CLINICAL FEATURES

m/c presentation : **Fear** (Anxiety, Palpitations).

Dry bite : Snake bite w/o injection of venom.

Evenomation :

Local findings
(m/c with viper bite)

- Swelling.
- Pain/blisters.
- Bleeding/necrosis.
- Compartment syndrome.
- Regional lymphadenopathy :

Indication for ASV.

Neurological features
(elapid bite)

- Ptosis (early)
- Descending paralysis
- Respiratory failure

Hemotoxic features
(viper bite)

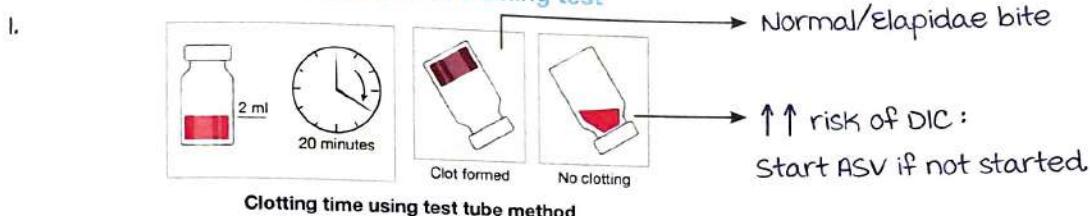
- DIC :
- Spontaneous bleeding
- Shock
- Renal failure

Occult bite : m/c with Krait bite.

- No h/o snake bite (Bite marks painless & may not be visible).
- Paralysis, abdominal pain, vomiting.

INVESTIGATION

----- Active space -----

20-min whole blood clotting test**2. PT/INR.****MANAGEMENT****First Aid:****Carry No RIGHT Approach :**

- **Carry** the victim. Do not allow them to walk.
- **No tourniquet/No electrotherapy/**
No cutting & suction.
- **Reassure** the patient.
- Pressure **Immobilization** throughout the limb by Sutherland's wrap : To occlude lymphatics.
- Get to **Hospital** immediately.
- Tell the doctor about symptoms.

**Specific treatment :****1. Polyclonal Anti-Snake Venom (PASV) :**

- Source : Hyperimmunized horse serum.
- Administered **only if signs of envenomation present (D/t risk of fatal anaphylaxis).**
- Neutralises **circulating venom only.**
- Effective against venom of Big 4 species.
- Dose : **10 vials IV.** No test dose/dose adjustment required.

2. IV Neostigmine + Atropine : For neuromuscular palsy following cobra bite.

- Acts on post-synaptic membrane.
- Not effective against Krait (Venom acts on pre-synaptic membrane).

3. Supportive measures :

- Treat renal failure, bleeding manifestations, local necrosis etc.,

----- Active space -----

Scorpion Sting

mostly accidental : Increased risk in children.

Common species in India :



Indian red scorpion
(mesobuthus tamulus)



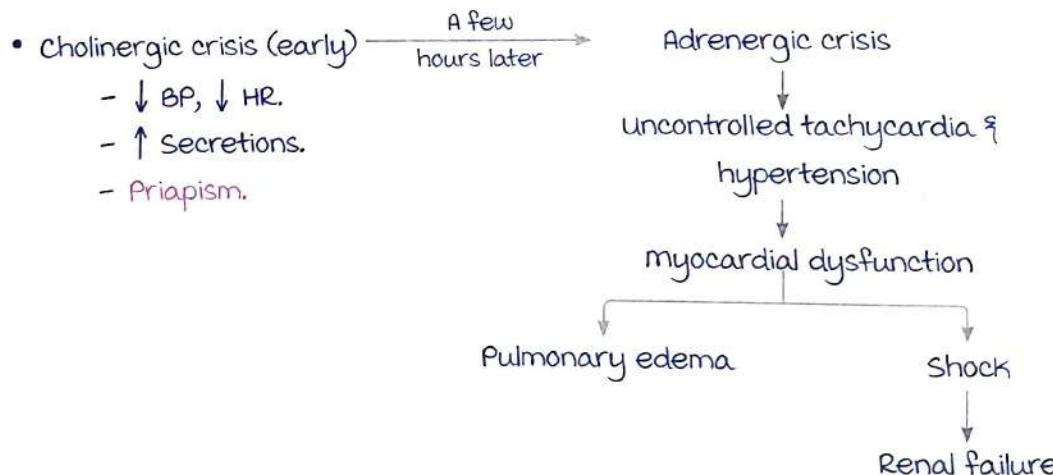
Black scorpion

Venom :

- Contains neurotoxins & hemotoxins.
- Injected dose is less → ↓ Fatality.
- Stimulates Na^+ channels → ↑ Release of catecholamines & inhibits K^+ channels

CLINICAL FEATURES

- Severe pain (dry sting : Pain is the only feature).



MANAGEMENT

1. Pain relief :

- Local infiltration of xylocaine.
- NSAID.

Note : Avoid morphines for pain.

2. Prazosin : DOC for autonomic storm.

3. Anti-scorpion venom (Not commonly available).
4. Supportive management.

Plant Irritants

00:52:24

----- Active space -----

induces inflammation (itching, blisters, nausea, vomiting).

RICINUS COMMUNIS

- Castor plant/Arandi.
- Intact seeds
 - ↓
 - On crushing the seeds
 - Oil (Non-toxic)
 - Residue (Toxic)
- Active principles : Ricin, Ricinoleic acid
(Biological weapon).
 - Inhibits protein synthesis.



Ricinus communis



Ricinus seeds

ABRUS PRECATORIUS

- Seeds (aka Rati seeds, Gunchi seede, Crabs eyes, Rosasy beads).
- Active principle : Abrin, Abrine, Abralic acid.
- Crushed
 - ↓ + Datura
- Sui/sin needles :
 - Poisoned arrows.
 - Ideal cattle poison (resembles viper bite).



Abrus precatorius

CROTON TIGLIUM

- Aka jamal gota/nepala.
- Both oil & residue of crushed seeds are toxic.

Active principles :
Crotin, crotonoside, crotonic acid → Gastroenteritis.



Croton



Croton seeds

SEMICARPUS ANACARDIUM

- Aka Bhilawa.
 - Heart-shaped seed with a tongue-like projection.
 - Seeds : Dhobi's nut/marking nut (black juice is used for marking).
- Active principles : Semicarpol, Bhilawanol → Inflammation : Blisters/Itching.



marking nutseeds

----- Active space -----



Artificial bruise

True bruise

medicolegal importance :

- used to produce **artificial bruise** on accessible parts (malingering).
 - Itching & blisters seen only in artificial bruise. Not in true bruise.

CALOTROPIS

Aka madar/akdo plant.

All parts of plant are toxic.

Active principles : Calotropin, Calotoxin, Calactin.

uses :

- Abortion stick : Criminal abortion.
- Conjunctivitis : Juice applied on eye.
- Artificial bruise : Applying juice on skin for malingering.
- Infanticide : Juice is mixed with breast milk.



Calotropis

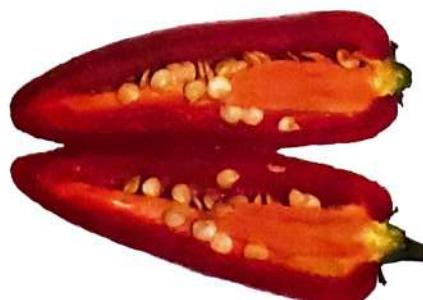
CAPSICUM ANNUM

- Aka chilli mirch.

Active principles : Capsaicin, Capsaacin.

medicolegal significance :

- Seeds resemble datura seeds → Accidental poisoning of datura.
- Torture/robbery of chilli powder.
- Hunan's hand syndrome : Contact dermatitis on chilli powder exposure.



Capsicum annum

NEUROTOXIC POISONS : DELIRIANTS

----- Active space -----

Deliriants :

- Datura.
- Atropa belladonna.
- Cocaine.
- Cannabis.

Datura

00:00:52

Species :

- D. alba (white flowers).
- D. niger (purple/black flowers).
- D. stramonium (Gimson's weed).
- D. Fastuosa.

Parts :

All parts of plant are toxic.

- Thorn apple (fruit) can mimic castor fruit.
- Seeds mimic chilli seeds → accidental poisoning.



Devil's trumpet

Dose :

Fatal dose : 100-125 seeds.

Stupefying dose : 50 seeds.

Active principle :

- *myoscine* (Anti-cholinergic properties).
- Atropine.
- Hyoscyamine.



Thorn apple

Signs and symptoms :

- Dry skin/mouth.
- Dysarthria.
- Dysphagia.
- Dilated pupils (U/L dilatation : Cornpickers pupil).
- Dysuria (urinary retention).
- muttering delirium : A/w Carphologia (picking or grasping at imaginary objects).
- Constipation
- Drunken gait.
- Death.

----- Active space -----

Management :

- Physostigmine.
- Decontamination.
- Symptomatic measures.

Autopsy :

Seeds present (resist putrefaction).

medicolegal importance :**1. Stupefying agent :**

used to facilitate crime (railway/roadside poison).

2. Accidental poisoning :

Features	Datura seeds	Chilli seeds
Colour	Dark brown	Yellow
Thickness	Thicker	Thinner
Surface	Rough (depressions +)	Smooth
Shape	Kidney shaped	Oval shaped
Embryo	Opening outwards	Curved inwards



Datura seeds



Chilli seeds

3. Sui needles :

made of :

- Datura
- Obiu
- Abrus precatorius

} used as cattle poison

Cannabis

00:16:28

Psychoactive substance.

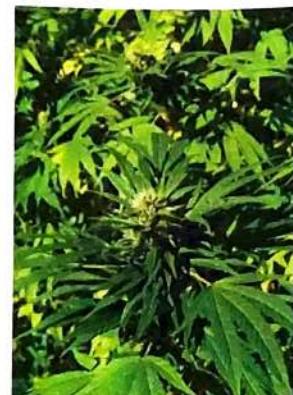
Street names : Grass, rope, hash, joint, weed, Indian hemp, marijuana, m.j.

Active principle :

Cannabinoids (most potent : Tetrahydrocannabinol).

Parts :

- Flowers & stem are most potent.
- Roots & seeds are least potent.



Cannabis

Preparations :

----- Active space -----

Name	Source	Active principle	Usage	Fatal dose	Image
Bhang	Dried leaves	< 15%	• Juice, milk. • majoon (sweet).	10g/kg	
Ganja	Dried flowers of female plants	15-25%	Joint/reefer	8g/kg	
Hashish/ charas	Dried resin	25-40%		2g/kg	
Hash oil	Resin	60-70% (most potent)			
Sinsemella	Seedless cannabis				

Effects :

Acute usage :

- ↓ ↓
- Low moderate doses
- Euphoria.
 - Excessive laughter.
 - Talkative (flight of ideas).
 - False sense of self-confidence.
 - Feeling of slowing of time.
 - Spatial disorientation.
- High doses
- Visual hallucinations (erotic).
 - Red shot eyes.
 - Reduced concentration.
 - memory loss.

Chronic abuse :

1. Flashback phenomenon :

- Aka Hallucinogen persisting perception disorder.
- Recurrence of effects of cannabis without its use.
- Seen with other hallucinogens, m/c LSD.

----- Active space -----

2. Hyperemesis syndrome :
- Excessive nausea/vomiting episodes.
 - Typically relieved by hot showers.

3. Amotivational syndrome :

- Lack of motivation (Loss of interest in day-to-day activities).
- Social withdrawal.
- may develop suicidal tendencies.

4. Hashish/Hemp insanity :

- Psychosis (a/t disintegration of brain cells)
- Hallucinations.
- Run amok (Delusion of persecution) :
 - Episodes of homicidal impulse.
 - Tendency to kill (stabbing, shooting).
 - Followed by phase of depression → suicide.
 - Not liable for punishment (it is a disorder of mind, not intoxication).

medicolegal importance :

1. Drug of addiction :

m/c illicit substance used.

2. NDPS act :

Cultivation, preparation, storage, possession, sale is punishable.

3. Stupefying agent :

To facilitate rape robbery.

4. Aphrodisiac/Love filter.

Diagnosis :

mnemonic : FAVORITE

- Flashback phenomenon
- Amotivational syndrome
- Vomiting
- Run amok
- Insanity
- Reduced Testosterone (sterility, loss of libido)

Note :

Aphrodisiac drugs :

mnemonic : COCCA

- Cantheride
- Opium
- Cannabis
- Cocaine
- Arsenic

Usage	Blood	Urine
Single	upto 3 hrs	upto 3 days (prolonged presence d/t storage in lipids)
Repeated	Thicker	1-2 months

Cocaine

00:38:14

----- Active space -----

CNS stimulant & deliriant.
covered under NDPS act.

Street names : Coke, Crack, Charlie, Snow, She, White lady, Bazooka.
Source : Leaves of *Erythroxylum coca* (PYT).

Route :

- Snorting.
- Smoking.
- IV.
- Oral.



Snorting

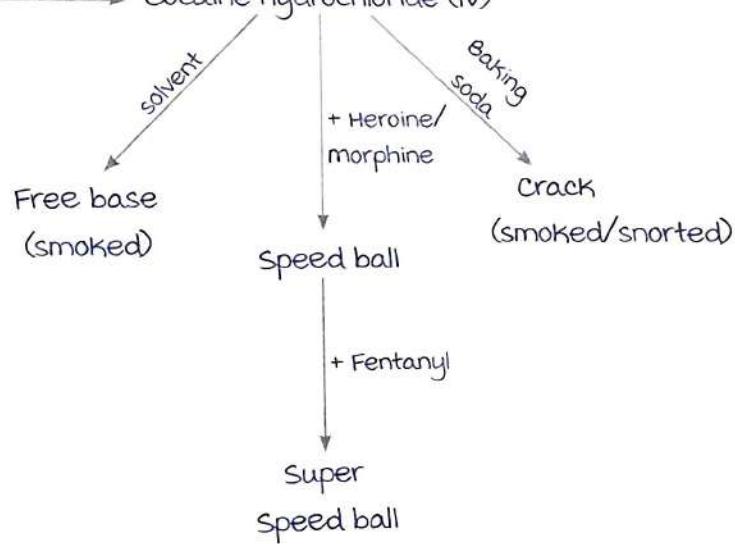


Erythroxylum coca

Preparations :

1. Chewing of leaves.

2. Coca paste $\xrightarrow{\text{HCL}}$ cocaine hydrochloride (IV)



Mechanism of action :

- Inhibits reuptake of noradrenaline, dopamine, serotonin from synaptic cleft \rightarrow
 \uparrow sympathomimetic activity.
- Local anesthetic action.

Half life :

- 30-60 mins.
- metabolised by plasma esterase.

Effects :

----- Active space -----

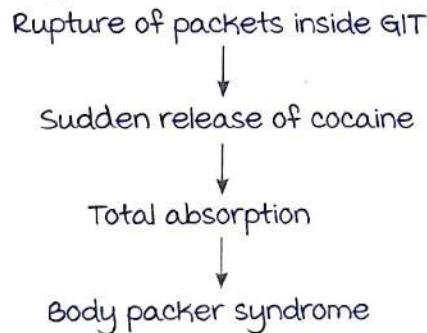
	mild-moderate doses	Severe intoxication (d/t High dose, Body packer syndrome)
CNS	Euphoria, hyperalert, excited, ↑ motor activity	<ul style="list-style-type: none"> Excited delirium. Convulsions (crack dance). Bruxism. Agitation.
Heart rate	↑	Cardiac arrhythmia
Blood vessels	Vasoconstriction	Peripheral gangrene
Blood pressure	↑	SAH, stroke, MI
Respiratory Rate	↑	↑
Sweating	↑	↑
Pupils (mydriatic)	Dilated	Dilated & fixed

Body packer syndrome :

Body packers :

- Smuggle packets of cocaine by swallowing.
- Aka mules.

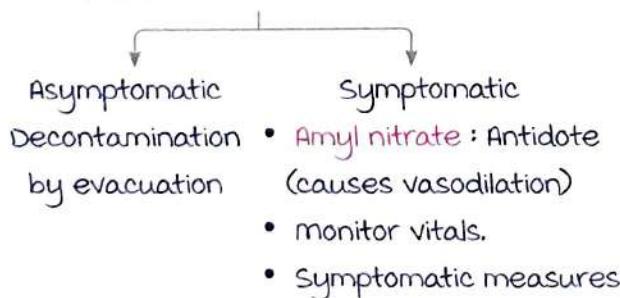
Pathogenesis :



x-ray showing packets

packets

Treatment :



Diagnosis :

- CT scan : Best investigation (cocaine packets seen).
- Urine (contains metabolites of cocaine) > Blood
- Gold chloride test.

chronic cocaine abuse :

Aka Cocainomania/cocainism.

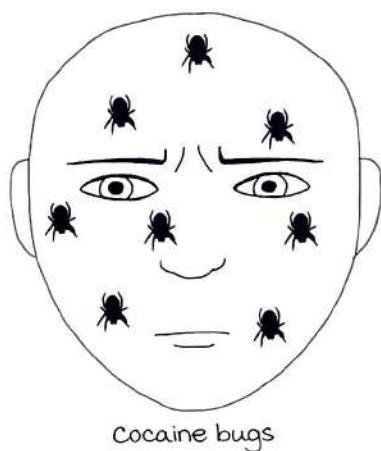
characterised by :

- Irresistible urge to take cocaine.
- Tolerant up to 10 g/day.
- Rush followed by crash.

Features :

- Black staining of tongues teeth.
- Septal ulceration → perforation.
- Peripheral gangrene
- cocaine - induced psychosis :
 - Delusions.
 - magnan's symptom/cocaine bugs/formication : Tactile hallucination of insects crawling on skin.
 - Delirium.

----- Active space -----



----- Active space -----

NEUROTOXIC POISONS : INEBRIANTS

Any substance that causes intoxication.

Alcohol

00:00:32

Forms of alcohol :

1. Ethanol.
 2. methanol.
 3. Isopropyl alcohol.
- ↓ Increasing toxicity

ETHANOL

Types of alcohol :

1. Absolute alcohol : 99.95 % concentration.
2. Rectified spirit : 95 % concentration.
3. methylated/denatured spirit : 90 % ethanol + 10 % methanol.

Production :

Fermentation of sugar by yeast (up to 15 % concentration).
+
Distillation (To ↑ conc. of alcohol)

Alcoholic drink :

Alcohol + water + congeners



- Byproducts of fermentation.
- Provide distinctive smell.

Commercial preparation	Concentration
Beer	6-10 %
Wine	15-20 %
Whiskey, brandy	45 %
Rum	50 %
Vodka	60 %

Absorption :

- 20 % → Stomach.

↑ Alcohol absorption on consumption :

- On an empty stomach.
- with warm water.
- with carbonated drinks
(↑ surface area of stomach).

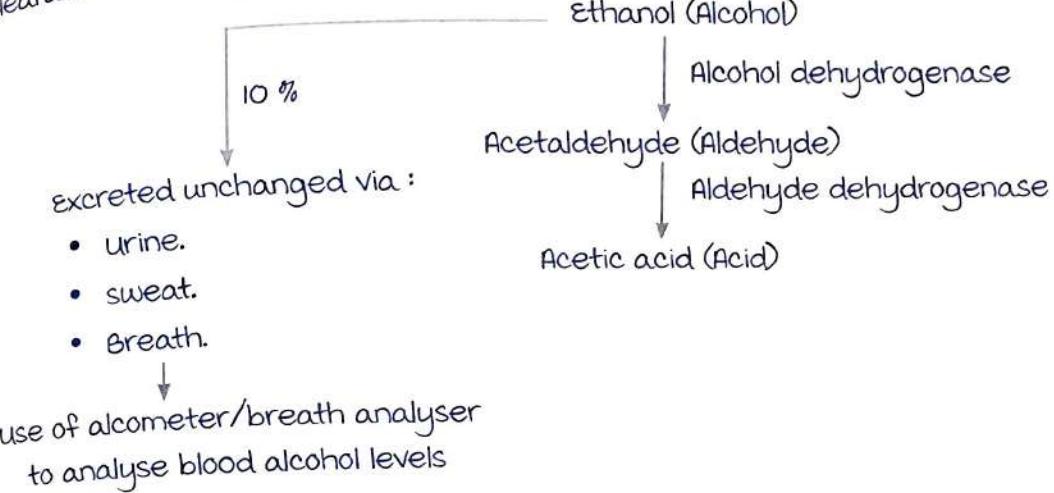
- 80% → Small intestine.

↓ Alcohol absorption on consumption with :

- Fatty meal.
- Cold water & ice.
- High protein meal.
- Full stomach.

metabolism :

Clearance 15-20 mg alcohol per hour.

**Alcohol distribution :**

- Distribution of alcohol into tissue \propto water content of tissue.
- \uparrow Distribution = \downarrow Levels in blood.
- Effect of alcohol : Females (\uparrow Fat, $\downarrow H_2O$) $>$ males.

Levels in different compartments :

- Blood : CSF \rightarrow 1 : 1.1
- Blood : vitreous \rightarrow 1 : 1.2
- Blood : urine \rightarrow 1 : 1.3
- Blood : Alveolar air \rightarrow 1 : 0.0021 (Used in breathalysers).

Effects of alcohol :

CNS depressant.

- Effects depend upon quantity of alcohol consumed.
- Effects can vary from person to person (Based on their metabolism).

Stages :

	Stage of excitement	Stage of muscle incoordination	Stage of coma
Blood levels	50 - 150 mg %	150 - 250 mg % <ul style="list-style-type: none"> motor incoordination slurring of speech ataxia \downarrow visual acuity \uparrow RTA risk	$> 250 \text{ mg \%}$ Comatose
Features	<ul style="list-style-type: none"> Loss of inhibition. \uparrow Confidence. \uparrow Talkativeness. 		<ul style="list-style-type: none"> Constricted mc Ewan's sign.
Pupils	Dilated	Dilated	Painful stimulus \downarrow Dilates and constricts slowly

----- Active space -----

Note :

- Alcoholic gaze nystagmus (Lateral gaze).
- mc Ewan's sign : Differentiates alcoholic coma from morphine.

Tests for ethanol :

1. Kozelka and hine test
 2. Cavett test
 3. Gas chromatography : Quantitative (Specific).
- } Qualitative test

Conditions a/w alcohol intake :

1. Pathological intoxication : Small dose of alcohol → Abnormally excessive effects.
2. Alcoholic blackout : Anterograde amnesia.
3. Neuropsychiatric conditions :

a. Wernicke's encephalopathy : Acute. b. Korsakoff's psychosis : Chronic.

mnemonic : GOA.

- Global confusion.

- Ophthalmoplegia

- Ataxia

- Amnesia (Anterograde & retrograde).

- Confabulation : Gaps in memory filled with unconsciously fabricated information.

4. marchiafava bignami syndrome : Degeneration of corpus callosum.

Issue of drunkenness certificate :

Opinion is based on :

Smell of alcohol	motor coordination tests	Opinions
Absent	Normal	Not consumed alcohol
Present	Normal	Consumed alcohol but not under the influence
Present	Abnormal	Consumed alcohol and under the influence

Alcoholic withdrawal syndrome :

Time since last drink	Features
6 - 12 hrs	Abstinence syndrome : <ul style="list-style-type: none"> • Tremor (m/c feature).
12 - 24 hrs	Alcoholic hallucinosis : visual hallucinations with clear consciousness (can resolve spontaneously)
24 hrs - 48 hrs	Rum fits : Convulsions
2 - 5 days	Delirium tremens : <ul style="list-style-type: none"> • Acute insanity. • Altered sensorium. • Agitation. • Tremor. • Clouding of consciousness. • Persecutory delusions. • Hallucinatory. • Suicidal & homicidal impulses.

Note : Suicide/homicide committed under influence of alcohol is not liable to be punished.

sections a/w alcohol :

----- Active space -----

22 BNS : If a person commits a crime under delirium tremens, he is not liable for punishment as it is a state of acute insanity.

23 BNS : Crime committed under involuntary drunkenness is not liable for punishment.

24 BNS : Crime committed when under voluntary drunkenness is liable to be punished.

355 BNS : Punishment for causing public misconduct under alcohol influence.

- 24 hours imprisonment/1000 rupees fine/community service.

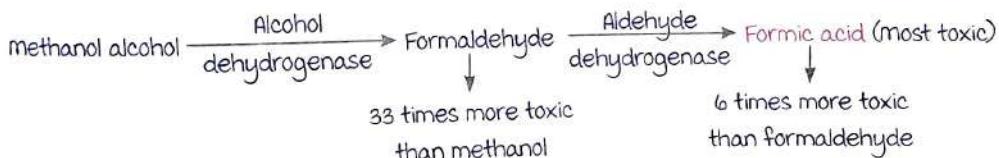
185 motor Vehicle Act (MVA) :

- Legal limit for blood alcohol levels for drivers in India : 30 mg %.
- Beyond 30 mg % : Fine is levied with suspension of license.
- 1st offence : 10,000/- fine.
- 2nd offence : 15,000/- + Suspension of license.

METHANOL

- AKA wood alcohol/illicit liquor.
- Hooch tragedy : mass consumption of methanol → Poisoning.

metabolism :



Symptoms :

D/t formic acid accumulation.

- Abdominal pain.
- Nausea/vomiting.
- High anion gap metabolic acidosis (HAGMA).
- Optic neuritis → Optic atrophy.
(blurring of vision) (blindness)
- Retinal involvement : Snow field vision.

Treatment :

1. Ethanol : Alcohol dehydrogenase is diverted towards metabolism of ethanol
↓
↓↓ methanol metabolism
2. Fomepizole/4-methylpyrazole : Direct inhibitor of alcohol dehydrogenase.
3. IV Sodium bicarbonate.
4. Hemodialysis.

----- Active space -----

ETHYLENE GLYCOL

Anti-freeze solution with fluorescent property.

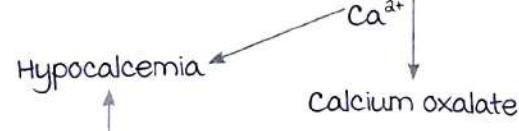
metabolism :



Treatment :

- Fomepizole
- Ethanol
- Calcium gluconate

Correction of



----- Active space -----

NEUROTOXIC POISONS : SOMNIFEROUS AND SPINAL POISONS

Somniferous Poisons

00:00:42

OPIOIDS

- Sleep inducing (E.g : Opium, morphine).
- Source :
 - Opium/poppy plant (*Papaver somniferum*).
 - Slitting unripe poppy capsule → milky exudate (Toxic)
 - Allowed to dry → Dark, brown exudate (crude opium).
 - Cultivation : Punishable under NDPS act.
- Poppy seeds (Inside capsule) : Non toxic.



Poppy plant



Juice from capsule



Poppy seeds

Morphine

00:03:53

Natural derivative.

Potent drug of addiction (causes physical dependence).

- Can lead to withdrawal if stopped abruptly.

Ideal suicide poison (causes painless death).

Aphrodisiac.

CHARACTERISTICS

Mnemonic → MORPHINES :

- miosis.
- marquis test (detection of morphine).
- Orthostatic hypotension.
- Respiratory depression (cause of death).
- Pain relief (Gold standard), physical dependence, pinpoint pupils.
- Hypotension & hypothermia.
- ↑ Intracranial tension.
- Naloxone (Antidote).
- Emesis, euphoria.
- Sedation.

Note :

- Codeine (Natural derivative) : Can be abused through cough syrup.
- McEwan's sign : used to differentiate between alcoholic coma from morphine coma (Both present with miosis).

----- Active space -----

MORPHINE POISONING

Stages :

1. Euphoria/Excitement.
2. Stupor.
3. Coma.

Triad :

Coma + Pinpoint pupils + Respiratory depression.

Fatal dose :

Opium : 2gm.

morphine : 0.2gm.

morphinism/morphinomania :

urge to take morphine in excess dose.

(D/t tolerance → Require increasing doses to achieve euphoric effects).

Treatment :

1. Stabilization.

2. Decontamination by gastric lavage : Done even if route was parenteral.

3. Antidotes :

- Naloxone sodium (Best) :

- Adverse reaction :

Rebound toxicity d/t short half-life → Doctor is liable if patient is discharged.

- Nalmefene.
- Naltrexone.

4. Symptomatic Rx

Effects of morphine withdrawal :

Opposite to that of poisoning, Yawning and increased secretions.

Heroin

00:13:44

more potent, addictive and semi-synthetic derivative of morphine.

Chemical name : Diacetylmorphine/diamorphine.

Street names : Tar, smack, junk, brown sugar, dope.

ROUTES OF ABUSE

- IV injection : mainlining.
- Skin injection : Skin popping.
- Inhalation of vapour : Chasing the dragon.

COMBINATIONS

----- Active space -----

1. Speed ball :

- Heroin (CNS depressant) + Cocaine (CNS stimulant) → Nullify each other.
- Amphetamines + morphine.

2. Hot shot : Heroin + Strychnine (Can cause accidental death).**Spinal Poisons**

00:20:16

STRYCHNOS NUX-VOMICA (SNV)/KUCHILA

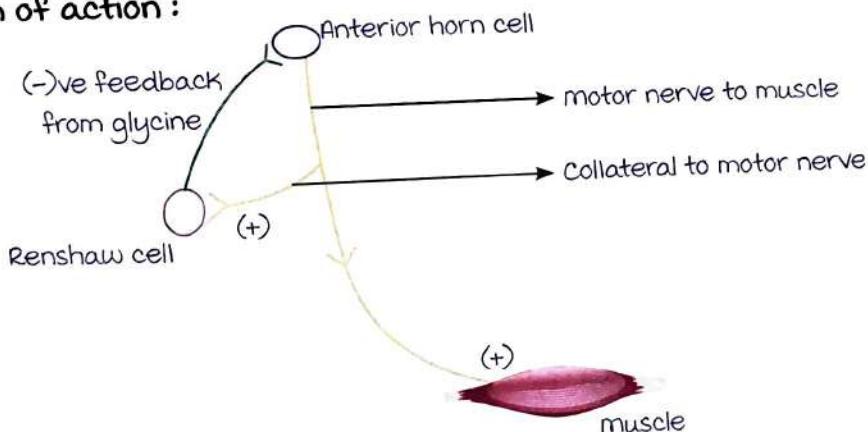
- Fruit : Orangish white pulp with 4-5 seeds.
- Seeds :
 - Kuchila seeds/dog's button/quacker's button.
 - Intact : Non-toxic.
 - Crushed : Fatal (Even one).



SNV : Seeds

Active principle :

- Alkaloids : **Strychnine** and brucine.
- Glycoside : Loganin.

mechanism of action :

Strychnine $\xrightarrow{(-)}$ Glycine from Renshaw cell \longrightarrow Uninhibited muscle contraction

Note : Poisons resembling tetanus

- Strychnine poisoning.
- Oxalic acid poisoning.

----- Active space -----

Clinical features :**1. Seizures :**

- Conscious seizures (d/t toxin not crossing blood brain barrier).
- Duration of convulsion ↑ & relaxation phase ↓ during each phase of convulsion.
- Death can occur d/t continuous muscle convulsions.

	Strychnos nux vomica	Tetanus
State of muscle relaxation in between convulsions	complete	Incomplete
Involvement of muscles	Complete	Sequential

2. Risus sardonicus (Smile of grinning) :

- Facial muscle spasm.
- Elevated eye brows and angle of mouth.
- Protruding eyeballs.



Risus sardonicus

3. Postures seen :

- Opisthotonus : Hyperextension of the spine (m/c).
- Emprosthotonus : Hyperflexion of the body.
(Forward bending)
- Pleurosthotonus : Lateral bending.

Treatment :

- Control of convulsions : Barbituates, benzodiazepines, general anesthesia.
- Gastric lavage : Not usually done (might provoke convulsions).

Autopsy findings :

- early appearance of rigor mortis
(↑ muscle convulsions → Depleted ATP).
- Postmortem caloricity
(d/t excessive heat generation).
- Delayed putrefaction.



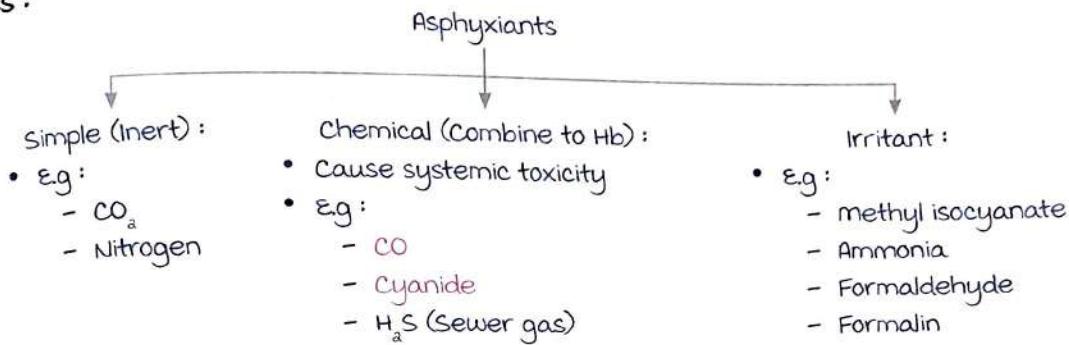
Strychnine poisoning : Features

ASPHYXIANTS AND CARDIAC POISONS

----- Active space -----

ASPHYXIANTS
mostly toxic gases.

Types :

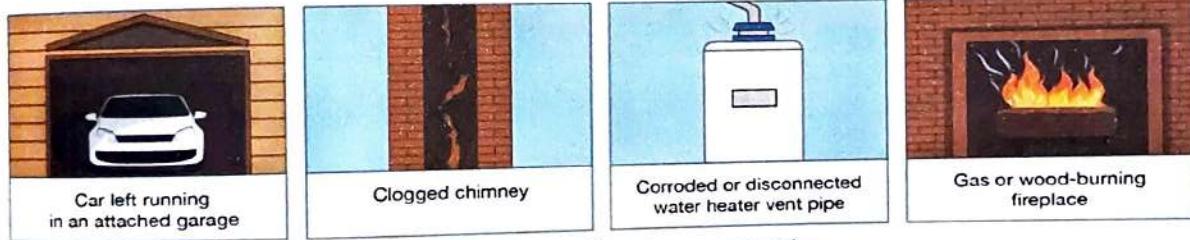


Carbon Monoxide

00:01:50

Produced by incomplete (Oxygen deficient) combustion of carbon.

Source :



Sources of carbon monoxide

Note :

- Garage death : Suicide by running car engine in closed garage.
- Sleeping in old car with AC turned on : Can cause CO poisoning.

Properties :

- Colourless
- Odourless
- Gaseous
- Lighter than air (Stay at top of room)

} silent killer.

Half-life :

Normal : 250-300 min

In presence of 100% O_a : 80 min

In presence of hyperbaric O_a : 20 min

} used in treatment.

----- Active space -----

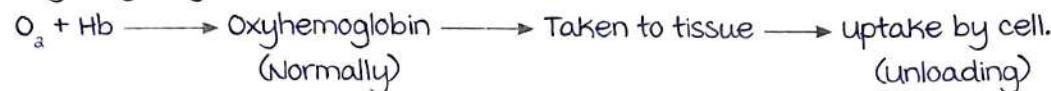
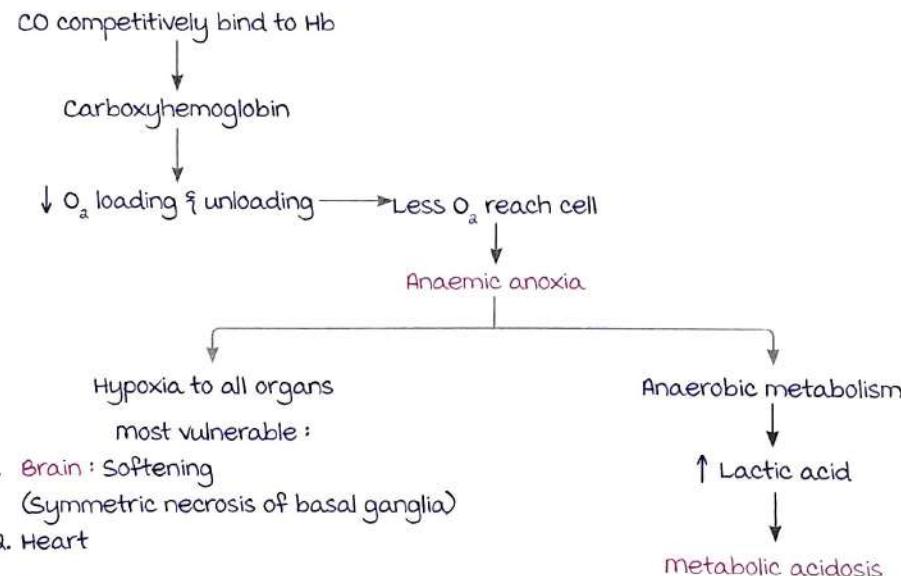
mechanism of action :

binds to heme and other iron containing hemoproteins.

- Hemoglobin (Hb)
- Competitive binding to Hb
(210 times more affinity to Hb than O₂)
 - Shift O₂ disassociation curve to left.

- Cytochrome C oxidase
(minor role)
- Present in complex IV of electron transport chain (ETC).

- myoglobin (15-20%)
- Can cause rhabdomyolysis
 - Rebound toxicity :
 - myoglobin bound CO can cause delayed CO toxicity.

Physiologically :**In presence of CO :****Clinical features :**

Carboxy Hb levels	Symptoms
0-10%	Asymptomatic (Difficult to identify in early stages)
10-20%	mild headache
20-30%	↑ Headache, emotional instability, irritability
30-40%	Confusion, ataxia
40-50%	↑ Confusion, incoordination, tremor (Resemble drunkenness, cherry red colour skin), amnesia, confabulation
50-60%	Arrhythmia, seizure, mi
>60%	Coma & death

Investigations :

1. Serum carboxyHb level :

----- Active space -----

	Normal person	Smoker
Normal level	≤ 5%	≤ 10%
Toxicity	> 5%	> 10%

2. Pulse oximetry : used in CO poisoning (Pulse oximetry not reliable).

Pulse oximetry gap : Difference in O₂ concentration of blood & oximetry reading.

3. Kunkel's test.

4. Katayama test.

5. Hoppe Seyler's test.

6. Spectroscopy (Best test).

Treatment :

1. Stop exposure.

2. 100% O₂.3. Hyperbaric O₂ :

• Indications :

- CarboxyHb > 25%.
- Pregnant female : CarboxyHb > 15% (Fetal Hb has more affinity to CO).
- Severe toxicity features : convulsions, coma etc.

Postmortem findings :

1. Cherry red hypostasis.

2. Cutaneous blisters : mainly in flexures
(Also in barbiturate poisoning).3. B/L symmetrical necrosis of lenticular nucleus
(Basal ganglia).

Cherry red colour in CO poisoning

Cyanide

00:21:29

Forms :

1. Hydrocyanic acid : (HCN)

- AKA Scheele's acid/prussic acid (2-4%).
- Pure form : Gas (most rapid poison) → Ideal suicide poison (Rapid death).
- Specific smell : Oil of bitter almond (50-60% can perceive smell : X-linked recessive trait).

----- Active space -----

2. Sodium cyanide and potassium cyanide :

- Salt form is non toxic.
- In stomach : Na/K cyanide + HCl → Hydrocyanic acid (Toxic).
- In achlorhydria : Usually no/mild symptoms
- Latest concept : Na/K cyanide + Water → Hydrolysis → Hydrocyanic acid (Small amount)

Sources :

Natural	Chemical (Occupational exposure)	Iatrogenic
<ul style="list-style-type: none"> • Bitter almond • Cherry • Apricot • Other fruit pits 	<ul style="list-style-type: none"> • Rodenticide, insecticide • Silver & metal polishing solution • Fumigating product • Photographic development solution • metallurgy : Jewellery 	<ul style="list-style-type: none"> • Sodium nitroprusside treatment

Note :

- 1 cigarette : 0.5 mg cyanide released.
- Zyklon B kit : Liberates cyanide (used in Nazi gas chamber).

Routes of absorption :

- Inhalation.
- Oral.
- Skin.

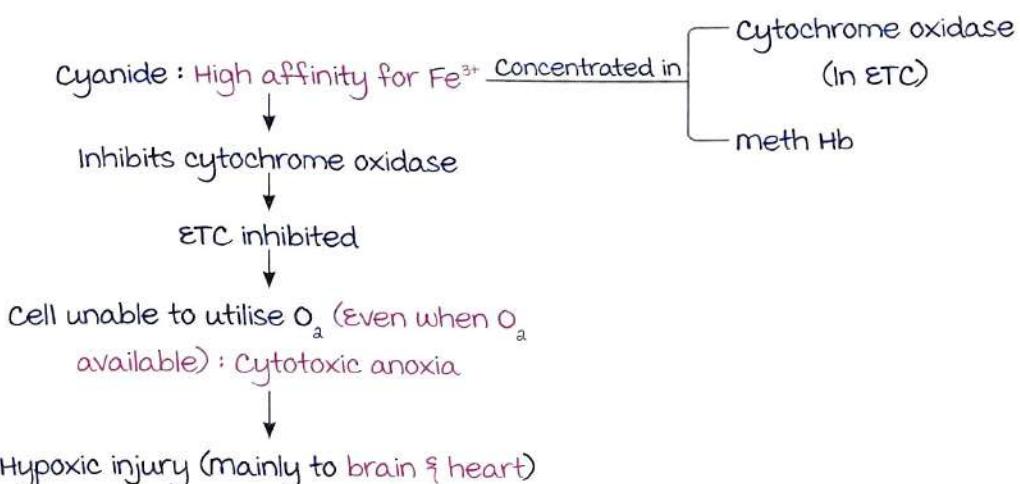
Clinical features :

mild concentration	High concentration	Very high concentration
<ul style="list-style-type: none"> • Headache • Vertigo • Restlessness • Palpitation • Weakness of legs 	<ul style="list-style-type: none"> • Throat constriction • Dizziness • Confusion • Decreased vision 	<ul style="list-style-type: none"> • Bradycardia (Asystole) • Loss of consciousness • Convulsion • Loss of corneal reflex • Death : cardiac/respiratory arrest

Fatal dose :

- HCN : 50 mg.
- Na/K cyanide : 200 mg.

mechanism of action :



Note :

$$\text{PaO}_2 \approx \text{PVO}_2 (\text{O}_2 \text{ not utilized}).$$

Treatment :

1. Stop exposure.
2. Remove clothing (cyanide is absorbed through skin).

3. Lilly's antidote :

- Sodium nitrite.
- Amyl nitrite.
- Sodium thiosulphate.
- mechanism of action : Sodium/amyl nitrite + Hb (Fe^{2+}) \rightarrow meth Hb (Fe^{3+}) + Cyanide \rightarrow Cyanometh Hb (Excreted in urine).
- Cyanometh Hb + Na thiosulphate \rightarrow Thiocyanate (\uparrow urinary excretion).
- Disadvantage : methemoglobinemia.

3. Hydroxocobalamin :

- mechanism of action : Hydroxocobalamin + Cyanide \rightarrow Cyanocobalamin (Excreted in urine).
- DOC : No risk of methemoglobinemia.

Postmortem findings :

- Bright red hypostasis.
- Bitter almond smell (Open cranial cavity first to perceive).
- B/L symmetric necrosis of lenticular nucleus (Basal ganglia).
- Rigor mortis : Starts early, persists longer.

Note :

Test to find cyanide poisoning \longrightarrow Lee Jones test.

----- Active space -----

Cardiac Poisons

00:38:30

	Nicotine	Digitalis	Oleander		Aconite
			Pink/white	Yellow	
Scientific name	Nicotiana tabaccum	Digitalis purpurea	Nerium odorum	Cerebra thevetia	-
Common name	Tobacco	Foxglove	Kaner	Pila Kaner	<ul style="list-style-type: none"> • Wolf's bane • meetha zehar/ Bish • Devil's helmet • Blue rocket • monk's hood
Toxic part	All except ripe seed	-	-	-	<ul style="list-style-type: none"> • All • most toxic : Root
Active principle	<ul style="list-style-type: none"> • Nicotine • Nornicotine • Anabasine 	<ul style="list-style-type: none"> • Digoxin • Digitoxin • Digitalis • Digitonin 	<ul style="list-style-type: none"> • Oleandrin (Similar action to digitalis) • Nerin • Folinerin • Karabin 	<ul style="list-style-type: none"> • Thevetin (Similar action to digitalis) • Thevetoxin • Nerifolin • Ruvoside • Peruvoside 	<ul style="list-style-type: none"> • Aconitine • Pseudoaconitine • Indaconitine
MOA	-	Inhibit Na ⁺ - K ⁺ ATPase pump			Act on voltage sensitive Na ⁺ channels (muscle, GIT, nerve, heart)
C/F	<p>a. Acute poisoning :</p> <ul style="list-style-type: none"> • Cardiac arrhythmia (ventricular ectopic) • GI irritant <p>b. Chronic (Occupational) :</p> <ul style="list-style-type: none"> • Acute symptoms + Respiratory : Cough, wheeze • Toxic amblyopia • Blindness 	<p>Cardiac toxicity :</p> <ul style="list-style-type: none"> • Arrhythmia • Hyperkalemia 	<ul style="list-style-type: none"> • Similar to digitalis • Risk of hyperkalemia 		<ul style="list-style-type: none"> • most characteristic : Perioral paresthesia • Cardiac arrhythmia • Hippus (Alternate dilation & constriction of pupil)
Rx	<ul style="list-style-type: none"> • Decontamination • Antidote : Inversine (mecamylamine) 	<ul style="list-style-type: none"> • Decontamination • Antidote : <ul style="list-style-type: none"> - FAB antibody : Digibind 	<ul style="list-style-type: none"> • Anti arrhythmic • Treat hyperkalemia 		<ul style="list-style-type: none"> • Decontamination • Anti arrhythmic
Additional features	Route of absorption : Oral, skin, inhalation		Lanceolate leaf		<ul style="list-style-type: none"> • Fatal dose : 1-2 gm of root • Bitter sweet taste

mnemonic : Car DONA

- **Cardiac poisons :**

- Digitalis.
- Nicotine.
- Oleander.
- Aconite.

Note :

- Amount of nicotine in a cigarette : 15-20 mg.
- Amount of nicotine absorbed from 1 cigarette : 1-2 mg.
- MLI of aconite :

- a. **Accidental poisoning** : Roots resemble horse radish.
- b. **Ideal homicide** :

- Cheap.
- Low fatal dose.
- Sweet taste (Can be added to sweet dishes).
- Destroyed by putrefaction (Not destroyed in autopsy).



Aconite



Aconite



Digitalis



Aconite root



Yellow oleander



white/pink oleander



Yellow oleander

----- Active space -----

AGRICULTURAL POISONS

Types	Organophosphorus compounds (OPC)		Carbamate	Organochlorine	Others
• mechanism of action	Phosphorylation of acetylcholine esterase (AChE). Irreversible inhibition		Carbamylation of AChE : Reversible inhibition	Inhibits Na^+ channels ↓ Inhibition of nerve impulses	-
• Examples	Alkyl	Aryl	<ul style="list-style-type: none"> • Carbaryl • Propoxur • Aldicarb (Baygon) 	<ul style="list-style-type: none"> • Endrin (plant penicillin) • DDT • GHBC 	Pyrethroid Herbicides.
mnemonic :	HOT mala • HETP • OMPA • TEPP • malathion				
Symptoms	Severe		mild	DDT : Only agricultural poison causing mydriasis.	

Organophosphorus Compound

00:04:33

Incidence :

- Suicidal poisoning : m/c.
- Accidental poisoning : common (As it is absorbed even through skin).
- Homicidal poisoning : uncommon (D/t strong smell).

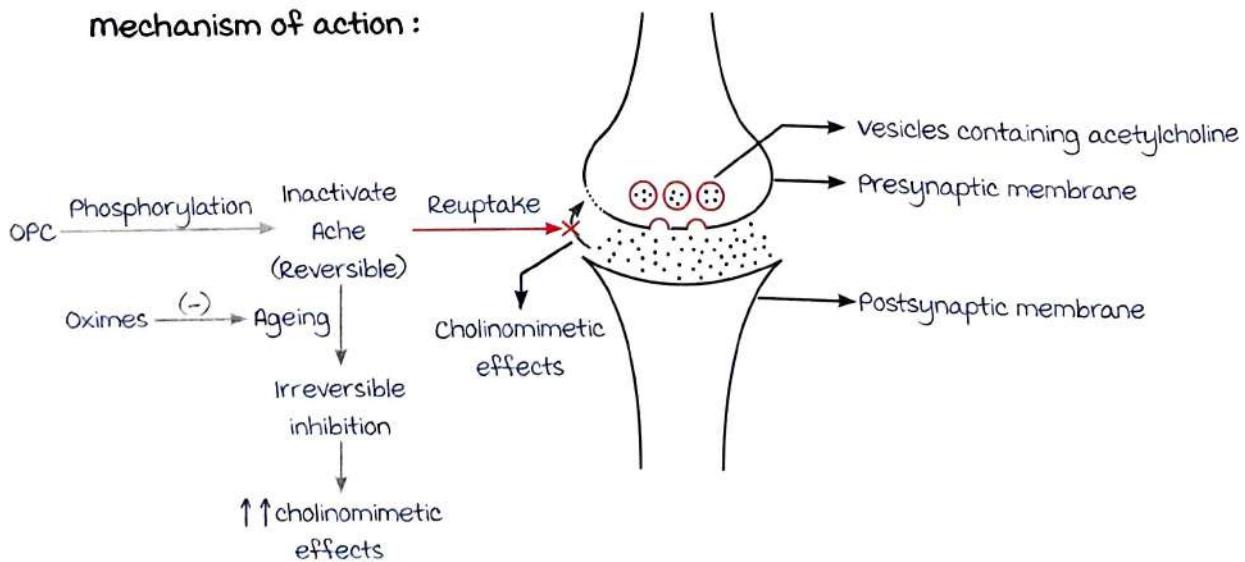
Odour :

- Kerosene (due to petroleum distillate aroma) / Garlic smell (Due to phosphorus).

Absorption :

- Through all routes (Intranasal, epidermal).
- Nerve gases like Sarin, Tabun, Soman.

mechanism of action :



Clinical features :

----- Active space -----

Syndromes	Features	
1. Acute Cholinergic syndrome (< 1 day) : Acute poisoning.	muscarinic effect mnemonic : DUMBELS Diarrhoea Urination miosis Bradycardia Bronchorrhoea Emesis Lacrimation (Chromodacryorrhoea / Red tears due to protoporphyrin excretion). Salivation	Nicotinic effect <ul style="list-style-type: none"> muscles : Fasciculation, weakness, paralysis → Respiratory failure (m/c cause of death). CNS : Irritability / Confusion, Convulsions, Coma.
2. Intermediate (1-4 days)	D/t release of stored OPC from fat tissue Symptoms : <ul style="list-style-type: none"> Proximal muscle weakness (Primarily neck flexors) Cranial nerve palsy 	
3. Delayed (1-4 weeks) : Organophosphorus induced delayed neuropathy (OPIDN)	Distal neuropathies (motor > sensory) : <ul style="list-style-type: none"> - Foot drop (Early features) - Symmetrical flaccid paralysis - muscle wasting 	

Diagnosis :

Based on :

- History of consumption.
- Clinical findings.
- Lab diagnosis
 - RBC Cholinesterase (\uparrow Specific) : Correlates to clinical toxicity.
 - Pseudo cholinesterase (\uparrow Sensitive / easy) : < 50%
 - Pseudocholinesterase level → Symptomatic.

Management :

For Cholinergic Syndrome :

- Stabilization : Securing of airway.
- Decontamination : (Based on route of entry).
 - E.g. : Gastric lavage, Fresh inhalational O₂, washing skin.

----- Active space -----

3. Antidotes :

- a. IV Atropine Sulphate : Acts on muscarinic receptors.
 - Continued until Atropinization
 - (↓ Secretions : Clear airway & lung → No crepts).
- b. Oximes aka Choline esterase reactivator : Acts on muscarinic & nicotinic receptors.
 - Eg : Pralidoxime (PAM), Obidoximes.
 - Given only in combination with Atropine d/t transient anti-cholinesterase activity of oximes.
 - Should be given before enzyme ageing (< 1 day).

For Intermediate & Delayed syndrome : Supportive management (No medication).

FORENSIC PSYCHIATRY

----- Active space -----

Application of psychiatry in administration of justice.

Symptoms of Psychiatric Disorders

00:00:39

DELIRIUM

Features :

- Clouding of consciousness.
- Impaired orientation.
- Blunted critical faculties.
- Irrelevant thought content.

Seen in :

- mental unsoundness.
- Drug intoxication.
- Datura poisoning.
- Continuous high temperature.

medicolegal importance : Not liable for punishment.

DELUSION

- False belief in something which is not a fact.
- Persists even after demonstrating falsity.

Types of delusions	Characteristics
Grandeur / exaltation	Imagination of being rich & powerful
Persecution / Paranoid	<ul style="list-style-type: none"> • Belief that someone is about to cause harm (kill, poison). • Suicidal / may harm innocent person.
Reference	Belief that everyone (all agencies, media, people around) is referring to the person.
Influence / control	Belief that one's own actions and thoughts are influenced/ controlled by external power (eg : radio, telepathy, hypnotism)
Infidelity / jealousy : Othello syndrome	<ul style="list-style-type: none"> • Belief that the spouse is not loyal. • m/c in males. • may commit crime.
Nihilistic delusion	<ul style="list-style-type: none"> • Does not believe in one's own existence or existence of world. • Suicidal or may kill others. • Commonly seen in depression.
Hypochondrial / somatic delusion	<ul style="list-style-type: none"> • Belief of having illness while he may be medically fit. • Frequent visits to hospital.
Capgras syndrome	A double replaces a close member & family
Fregoli's delusion	Familiar person disguises as different people

----- Active space -----

Types of delusions	Characteristics
Erotomania : De Clerambault syndrome	<ul style="list-style-type: none"> Person thinks a superior person is in love with her. She gets close to the person (Through phone calls, e-mails, letters, gifts, visits etc). Females > males.

HALLUCINATIONS

False sense of perception without an external stimulus.

Eg :

- Visual hallucination.
- Auditory hallucination.
- Gustatory hallucination.
- Olfactory hallucination (Unpleasant smell).
- Tactile hallucination :
 - a. AKA formication/magnan's symptom.
 - b. Seen in cocaine abuse.
 - c. Feeling insects crawling under skin.

ILLUSION

False interpretation of stimulus (In the presence of external stimuli).

IMPULSE

- Sudden and irresistible force compelling a person to do conscious performance of an action.
- No motive or forethought.

Name	Impulse to
Kleptomania	Steal things (usually of low value)
Pyromania	Set things on fire
mutilomania	mutilate animals
Dipsomania	Drink (Alcohol) at periodic intervals
Homicidal impulses	Kill other people
Suicidal impulses	Commit suicide
Trichotillomania	Pull out one's own hair
Oniomania	For shopping

PHOBIA

Excessive/irrational fear of a particular object/situation.

----- Active space -----

Name	Phobia of
Acrophobia	Heights
Agarophobia	crowd
Claustrophobia	Confined spaces
Nyctophobia	Night
Arachnophobia	Spiders
Nomophobia	Being without mobile phone
Phobophobia	Person with phobophobia experiences anxiety at the thought of being in a fearful situation.

LUCID INTERVAL

- Period of sanity / normalcy between periods of mental illness.
- medicolegal importance :
 - enjoys all civil rights.
 - Criminally responsible for unlawful acts.

	True insanity	Feigned Insanity
Onset	Gradual	Sudden
motive	usually absent	Always present
Predisposing factor	Always present	Absent
Signs and symptoms	Uniform, point towards a particular mental illness	Irregular and exaggerated
Facial appearance	Vacant look	voluntary exaggeration
Sleep	Insomnia for nights together	1 - 2 days without sleep (with difficulty)
Habits	Dirty, filthy	clean (usually)
Appetite and food	Can resist days together	Cannot resist
Frequent examination	Does not mind	Resents frequent examination for fear of detection

Civil & Criminal Responsibilities of Insane

00:21:00

CIVIL RESPONSIBILITIES

Civil responsibilities	Description
Testamentary capacity	Capacity of a person to make a valid will
management of property	<ul style="list-style-type: none"> • Property taken care by a court appointed manager during insanity. • The person can take charge of his/her own property after normalcy.
Consent	Consent of insane is invalid : Sec 28 BNS.
marriage	<ul style="list-style-type: none"> • Insanity at the time of marriage : Null / void. • Insanity (Incurables) after marriage : Grounds for divorce.
Contract	<ul style="list-style-type: none"> • Insanity at the time of contract : Invalid • Sane at the time of contract : valid.
witness	Insane person : <ul style="list-style-type: none"> • Able to understand & answer : Competent. • Does not understand & answer : Not competent.

----- Active space -----

CRIMINAL RESPONSIBILITIES**mc Naughten's rule :**

- AKA legal test of insanity / right-wrong test.
- Features :
 - At the time of committing the act.
 - Defect of reason due to disease of the mind.
 - Does not know the nature and the quality of the act.
 - If he did know it, he did not know that it was wrong.

Section 22 BNS :

- Drafted based on mc Naughten rule.
- Definition : "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 act or that what he is doing is either wrong or contrary to the law".

Durham's rule (1954) :

"An unaccused person is not criminally responsible, if his unlawful act is the product of mental disease or mental defect".

Curren's rule (1961) :

"An accused person is not criminally responsible, if at the time of committing the act, he did not have the capacity to regulate his conduct to the requirements of the law, as a result of his mental disease or defect".

The irresistible impulse act (New Hampshire doctrine) :

An accused person is criminally not responsible, even if he knows the nature and quality of his act and knows that it is wrong, if he is incapable of restraining himself from committing the act, because the free agency of his will has been destroyed by the mental illness.

The American Law Institute test (ALI) 1972 :

"A person is not responsible for his criminal acts, if at the time of such conduct, as a result of mental disease or defect, he lacks adequate capacity to appreciate the criminality of his conduct, or to adjust his conduct to the requirements of the law".

Note : mnemonic : Insane CAN Defend.

I : Insane : Irresistible impulse test.

C : Curren's rule.

A : American law institute test.

N : Naughten's rule.

D : Durham's rule.

criminal responsibility in other situations :

----- Active space -----

Situations	Liability
Somnambulism (Sleep walking)	Not liable
Somnolentia (Sleep drunkenness)	Not liable
Delirium tremens	Not liable
Run amok (Homicidal impulse in cannabis abuse)	Not liable
Kleptomania	Liable
Hypnosis	Liable

Mental Health Care Act (2017)

00:38:12

Not an amendment of mental health act (1987).

New terminologies :

- mentally ill person.
- mental health establishment.

mental illness :

- Definition : A substantial disorder of thinking, mood, perception, orientation or memory that grossly impairs judgement, behaviour, capacity to recognise reality or ability to meet the ordinary demands of life.
- Drug intoxication is excluded.

Advance directive (AD) :

Direction towards medical treatment even before the condition arises.

3 important components :

- The way he wishes to be cared.
 - The way he wishes not to be cared.
 - His nominated representative (Decides on behalf of the patient).
- } For a mental illness

Features :

- Duty of psychiatrist : to treat in line with AD.
- Not applicable in emergencies.
- Psychiatrist can apply to mental health review board if they do not want to follow AD.

Prohibited procedures :

- Electroconvulsive therapy (ECT) without use of muscle relaxants and anaesthesia.
- ECT for minors.
- Sterilisation of men or women intended as a treatment for mental illness.
- Compulsory tonsuring.
- Forcing to wear uniforms.
- Chaining.

----- Active space -----

Decriminalisation of suicide :

"Any person who attempts to commit suicide shall be presumed, unless proved otherwise, to have severe stress and shall not be tried and punished.

Note : Abetment to suicide is punishable.

Admission :

Independent admission :

- mentally ill person requests the medical officer in charge for admission.

- Admission of minors :

- a. Nominated representative (NR) applies to medical officer for admission of minor.
- b. Independent examination by team of 2.
- c. Incharge may admit the minor.
- d. NR may stay with the minor.
- e. Admission of minor informed to concerned board within 72 hrs.

Supported admission :

- Supported admission : Person with high support needs.
- NR may apply to medical officer for admission.
- 2 independent examinations to be done.

Emergency treatment :

- Any registered medical practitioner can initiate treatment if there is threat to :
 - a. Self.
 - b. Others.
 - c. Objects / property.
- Treat the person upto 72 hrs.

Rights of mentally ill person :

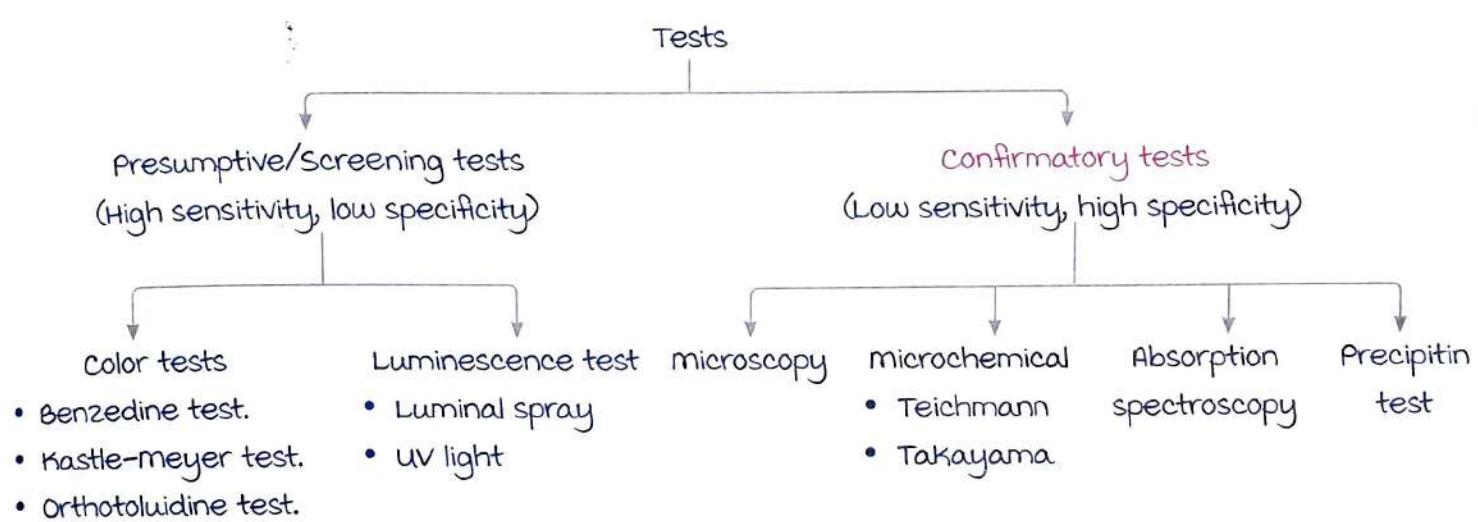
- Rights of confidentiality.
- Informed consent from the mentally ill person/ from the board for conducting research.
- Rights to access the medical records.

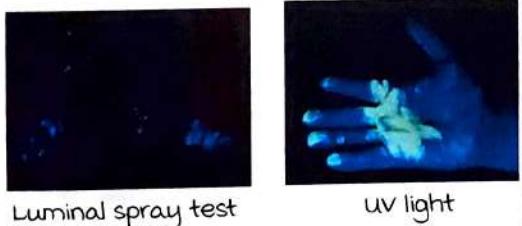
TRACE EVIDENCE

----- Active space -----

Test for Blood Stains

00:00:10



Test	Observation (+ve)	Notes
Color tests : Works with peroxidase activity of RBCs		
1. Benzidine test/ Adler's test	Blue color	<ul style="list-style-type: none"> • High sensitivity → Works with both old & recent stains. • Benzidine : Carcinogen → Not used now.
2. Kastle meyer test	Pink color	Aka Phenophthalein test
3. Orthotoluidine	Blue color	
Luminescence test	Glow +  Luminal spray test uv light	methods → Luminal spray → UV light High sensitivity → identifies : <ul style="list-style-type: none"> • very diluted blood. • Old washed stains.
microscopy	RBC cells +	• useful in recent stains. • For species identification
microchemical (Crystal formation by chemical reaction observed under a microscope)		
1. Teichmann test	Dark brown, rhombic crystals	Hemin crystals

----- Active space -----

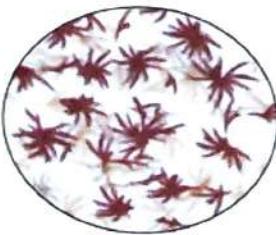
Test	Observation (+ve)	Notes
2. Takayama test	Pink, feathery crystals	Hemochromogen crystals
Absorption spectroscopy		<ul style="list-style-type: none"> most definite test. Identifies type of haemoglobin.
Precipitin test		For species identification using anti-human antiserum

Dark brown rhombic crystals



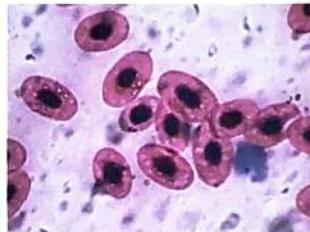
Teichmans test

Pink feathery crystals

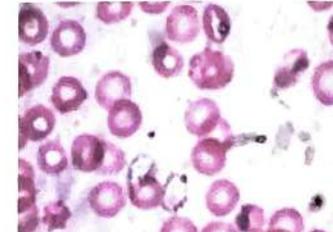


Takayama test

Luminal spray test



Non human RBCs

Biconcave, non-nucleated,
Circular

v/s Human RBCs

Seminal Stains

00:08:54

Specimens to be examined :

1. Objects : Clothes, towel, bedsheet, carpet.
2. Sample swabs : Vagina, perineum, upper part of thigh, matted hair.

Gross appearance of seminal stain :

Greyish-white, irregular, starchy (D/D : Starch, pus, leucorrhoea).

Under UV-light :

- Bluish-white fluorescence.
- A/t presence of choline.
- Non-specific : Also seen with Nasal/Vaginal secretions.

TESTS FOR IDENTIFICATION OF SEMINAL STAINS

Crystal/chemical tests :

	Barberio's test	Florence test
Crystals formed	Spermine picrate	Choline iodide
Appearance	Yellow needle shaped 	Dark brown rhombic

----- Active space -----

enzymatic tests :

	Acid phosphatase test	Creatine phosphokinase test
Normal levels/ml of semen	340-360 BU/ml	640 IU/ml
Significant level	> 100 (ejaculated within past 12 hrs)	> 400
Additional features	Highest conc. in prostatic secretion	<ul style="list-style-type: none"> • Non-specific. • Also identifies old stains (> 6 months)

Antigen tests :

- Advantages :
 - useful even in aspermia.
 - Highly specific.
- Antigens tested :
 1. P30 (PSA : Prostate Specific Antigen).
 2. Seminal vesicle specific antigen.
 3. mab4eb (Sperm surface coating antigen).



Spermatozoa

microscopy :

- Gold standard test.
- Just confirmed with a single intact spermatozoa.
- motility : Suggests recent activity.
- Staining technique weed : Christmas tree.

TESTS FOR SPECIES IDENTIFICATION OF SEMINAL STAIN

1. Precipitin test.
2. LDH-isoenzyme test.
 - LDH-C4
 - LDH-X

} specific for human origin.
3. Detection of X chromosome from head of spermatozoa.

Note : Single photon fluorimetry to differentiate semen from different individuals.

Study of Hair

00:16:20

K/A trichology.

- Parts of hair →
- macroscopic : Root, shaft, tip
 - microscopic : Cortex, medulla, cuticle

----- Active space -----

MEDICOLEGAL USES OF HAIR EXAMINATION**1. Animal v/s Human hair :**

	Animal	Human
medulla		
medullary index	> 0.3	< 0.3
Appearance	Coarse and thick	Soft and thin
Scales	Wavy	Imbricate
Precipitin test	Negative	Positive

2. male v/s Female hair :

- Bart bodies in the root of hair → Female hair.
- DNA from root of hair (Also to identify the person).

3. Type of trauma based on appearance of hair :

- Crushed : Blunt force, laceration.
- Sharply cut : Incised.
- Singed hair : Burn.

4. Approximate time of death :

Based on → Time since last shave
 → Rate of growth of scalp hair : 0.4 mm/day.

5. Heavy metal poisoning : D/t deposition of heavy metal in hairs.

ACTS AND LEGAL SECTIONS OF IMPORTANCE

----- Active space -----

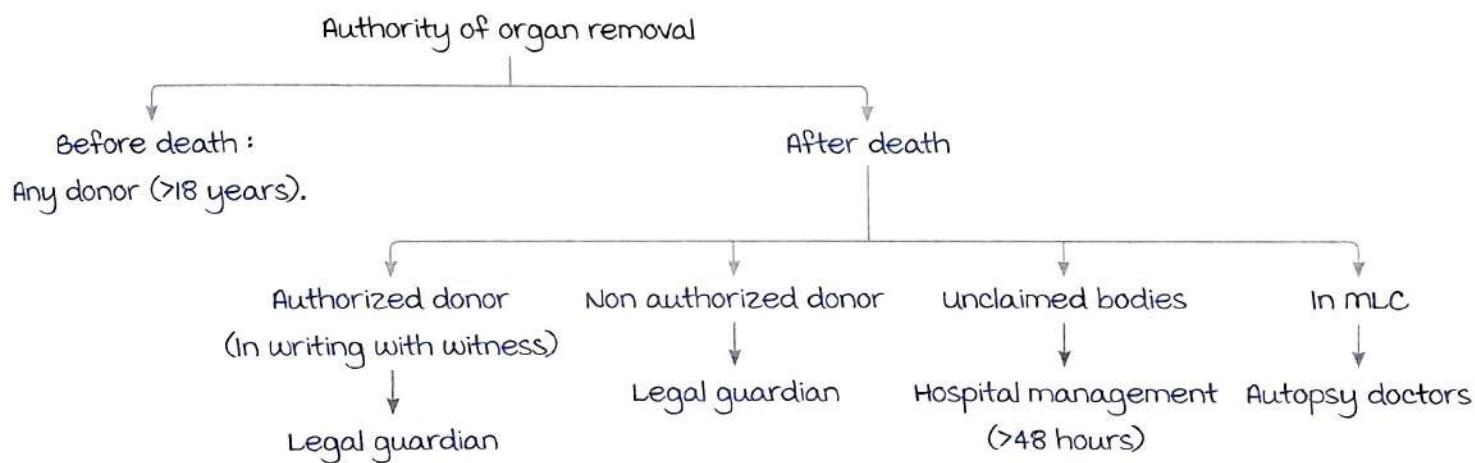
Transplantation of Human Organs Act 1994

00:01:20

Latest amendment : Transplantation of Human organs and tissue Act (2014).

regulates : Removal, storage and transplantation of human organs for therapeutic purpose.

Includes : Any body part with structured arrangement of tissue which if removed, cannot be replicated by the body.



Type of organ donation :

Live donation	Cadaveric donation	Swap transplantation						
<ul style="list-style-type: none"> Near relative : <ul style="list-style-type: none"> - No approval needed. - Eg : Parents/siblings/ grandparents/spouse/child. Non relative : <p>Approval from authorization committee required.</p> 	<p>After the declaration of brain death.</p> <p>Directed donation</p> <ul style="list-style-type: none"> Deceased donor's family decide to whom organ should be given. Illegal in India. 	<p>Donor</p> <table border="0"> <tr> <td>A₁</td> <td><u>Unmatched</u></td> <td>A_a</td> </tr> <tr> <td>B₁</td> <td><u>Unmatched</u></td> <td>B_a</td> </tr> </table> <p>Recipient</p> <p>If matched</p> <pre> graph TD A1[A1] --- U1[Unmatched] B1[B1] --- U1 A1 --- X1[Aa] B1 --- X1 Aa[Aa] --- U2[Unmatched] Ba[Ba] --- U2 Aa --- Y1[Ba] Ba --- Y1 Aa --- Y2[Ba] Ba --- Y2 style U1 fill:#ADD8E6 style U2 fill:#ADD8E6 </pre> <p>The swap transplantation diagram shows four individuals: A₁, B₁, A_a, and B_a. A₁ and B₁ are unmatched with each other. A₁ and A_a are connected by a double-headed arrow, indicating they are a match. B₁ and B_a are connected by a double-headed arrow, indicating they are a match. A_a and B_a are connected by a double-headed arrow, indicating they are a match. If there is a match between A_a and B_a, the organs will be swapped.</p>	A ₁	<u>Unmatched</u>	A _a	B ₁	<u>Unmatched</u>	B _a
A ₁	<u>Unmatched</u>	A _a						
B ₁	<u>Unmatched</u>	B _a						

----- Active space -----

Brainstem death :

Declaration by :

medical board (mnemonic : HINT)

- Hospital in charge RMP.
- Independent RMP specialist.
- Neurologist/neurosurgeon (if not available : Anesthetist/intensivist).
- Treating doctor.

Note : Transplant surgeon cannot be a part of medical board.

Criterias :

- All irreversible causes to be ruled out (e.g. Hypothermia/poisoning).
 - Tests :
 - Irreversible coma.
 - Absence of cranial reflexes.
 - Apnoea test.
- } Done twice with 6 hours gap.

Removal of organs :

- Registered hospitals.
- Exception : Eye donation (Any hospital).

Punishment for illegal organ donation :

Organ removal	Punishing body		Punishment
	Judiciary		10 years imprisonment +/- fine.
without authority	State medical council	1 st time offence	Penal erasure x 3 years.
		Repeat offence	Permanent removal (Professional death sentence).
Commercial dealing	Judiciary		5 - 10 year imprisonment +/- fine.

Protection Of Children from Sexual Offences**(POCSO) Act 2012**

00:14:24

Purpose :

To protect children (Age <18 years; Irrespective of sex) from offences of sexual assault, sexual harassment and pornography.

Types of offences :

----- Active space -----

penetrative sexual assault	Sexual assault	Sexual harassment
<p>Penetration of penis, any object or applying mouth ↓ To vagina, mouth, urethra or anus.</p> <p>Pornography use of child for pornographic purposes.</p>	<ul style="list-style-type: none"> Any act with sexual interest involving : <ul style="list-style-type: none"> - Touching private parts. - Physical contact without penetration. Hormones given to children for early sexual maturity. 	<p>Sexual intent :</p> <ul style="list-style-type: none"> utter any word/sound/make gestures. Exhibits any object. Expose body part. makes child to exhibit body. stalks the child (Directly or digitally). Shows any object to child for pornographic purpose.

Aggravated act : If act done (mnemonic : TRAIT)

- By person of trust (Public servant/police/army/staff in jail, hospitals, religious institute).
- By repeat offender.
- Victim age <12 years.
- Insane victim.
- By two or more people (Gang).

Legal responsibilities under POCSO :

Police intimation :

Failure to report : Punishable with 6 month imprisonment + fine.
(If head of institutions → 1 year imprisonment + fine).

Medical examination :

- As per section 184 BNS.
- Consent mandatory.
- In presence of parent or any other person of trust.
- If girl child, only female doctors can examine.

Judicial proceedings under POCSO :

- Special courts → Case disposed within 1 year.
- In camera trial of cases.
- No disclosure of identity of child.

----- Active space -----

Consumer Protection Act (CPA) 2019

Purpose :

To protect the interest of the consumers & resolve pending cases.

Key features :

- Establishment of central consumer protection authority (CCPA).
- The district forum renamed as district commission.
- E-filing of complaints enabled.
- Consumer can file a case wherever he resides.
- Product liability.
- Limitation period for filing appeals : 45 days.
- E-commerce included.
- Penalty for misleading advertisement.

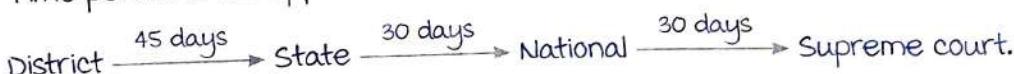
Revised limits :

Particulars	Value
District commission	<1 crore
State commission	1 crore - 10 crore
National commission	>10 crore

Limitation period : 2 years.

Time period : To dispose case in 3 to 5 months.

Time period to file appeal :



Liability under CPA, 2019 :

Patients	All patients	Some patients	All patients	Insured patients
Treatment mode	Free	Free	Paid	Insurance cover
Liability	Not liable	Liable	Liable	Liable

Narcotic Drugs and Psychotropic Substances Act 1985

Latest amendment : 2021.

Narcotic drugs :

- Cannabis : Ganja, hashish.
- Cocaine : Coca leaf, salts.
- Poppy/opium : All parts except seeds.

psychotropic drugs : Alters mind.

E.g. : LSD, MDMA, phencyclidine.

----- Active space -----

purpose :

prohibition of

- cultivation.
- manufacture.
- sale.
- Transport.
- Purchase.
- Possession.
- Usage.

punishment :

- Small quantity : 6 months - 1 year imprisonment.
- Commercial quantity : 10 - 20 year imprisonment.

Note : Addicts exempted for 1st offence if they volunteer for deaddiction treatment.

Legal Sections

00:33:25

BSA :

Injury :

- Section 2(14) : Defines injury.
- Illegal harm to body, mind, reputation and property.

BNS :

Criminal responsibility/liability :

BNS	Offence	Liability
18	<ul style="list-style-type: none"> • If done by accident/misfortune/without criminal intention or knowledge. • Lawful act in lawful manner by lawful means and with proper care & caution. 	Not liable
20	Child < 7 years	Not liable
21	7 - 12 years	Decided by court
22	mentally ill/unsound mind	Not liable
23	Intoxication caused against will /involuntary drunkenness	Not liable
24	Voluntary drunkenness	Liable

----- Active space -----

Consent :

BNS	Consent	Criteria
26	Consent given	Act done in good faith for person's benefit, not intended to cause death → Not an offence.
27	Consent given by guardian	<ul style="list-style-type: none"> • Child <12 years. • Insane. • Intoxication.
28	Invalid consent	<ul style="list-style-type: none"> • Due to fear of injury/misconception of fact. • Insanity/intoxication. • Child <12 years.
30	Without consent	Act done in good faith for person's benefit (Emergency procedure) → Not an offence.
31	Without consent	Communication made in good faith → Not an offence.

Offences against women & children :

- Rape definition : 63 BNS.
- Rape punishment : 69 BNS (Including custodial rape).
- Gang rape punishment : 70 BNS.
- Punishment for disclosure of identity of rape victim : 72 BNS.

Punishment for assault on female :

BNS	Criteria
74	With intent to outrage her modesty
75	Sexual harassment (Physical contact/sexual demand/ showing pornography/sexually flavoured comment without consent)
76	Disrobing forcibly
77	Voyeurism
78	Stalking
79	Insult modesty
80	Dowry death
85	Cruelty by husband/relative

miscarriage :

criminal abortion done against mTP rules.

----- Active space -----

BNS	Punishment for
88	Criminal abortion : <ul style="list-style-type: none"> With consent of woman. Without consent of woman. Resulting in death of woman.
89	
90	
91	Act done with intent to prevent live birth or to cause fetus death after birth.
92	Causing death of quick unborn child by act amounting to culpable homicide.

Homicide :

BNS	Defines
100	Definition of culpable homicide.
101	Culpable homicide : <ul style="list-style-type: none"> Amounting to murder. Not amounting to murder : <ul style="list-style-type: none"> - Provocation. - Self defence. - Public servant. - without premeditation.

BNS	Punishment
103(1)	murder
103(2)	mob killing (≥ 5 people)
106	Death due to medical negligence of RMP (2 years imprisonment ± fine)
108	Abetment of suicide

----- Active space ----- Hurt :

BNS	Defines
114	Anybody causing bodily pain, disease or infirmity to any person is said to cause hurt.
115	Voluntarily causing hurt.
116	<p>Grievous hurt :</p> <ol style="list-style-type: none"> 1. Emasculation. 2. Permanent privation of sight of either eye. 3. Permanent privation of hearing of either ear. 4. Privation of any member or joint. 5. Destruction or permanent impairing of power of member or joint. 6. Permanent disfigurement of head or face. 7. Fracture or dislocation of bone or teeth. 8. Any hurt which endangers life or which causes severe bodily pain or is unable to follow his ordinary pursuits for 15 days.

BNS	Punishment
117	Voluntarily causing grievous hurt.
118(1)	Voluntarily causing hurt with dangerous weapon/means.
118(2)	Voluntarily causing grievous hurt with dangerous weapon/means.
123	Hurt by means of poison etc.
125	Rash/negligent act endangering life.
125(1)	Negligent act → Hurt.
125(2)	Negligent act → Grievous hurt.
124	Vitriolage (Acid attack/attempt to acid attack).

Others :

- Assault : Any gesture or any preparation about to use criminal force.
 - 130 : Definition.
 - 131 : Punishment.
- 211 : Omission to give notice or information to public servant by person legally bound to give it.
- 212 : Furnishing false information.

Summon :

----- Active space -----

BNS	Punishment for
206	Absconding to avoid service of summons.
208	Non attendance of summons.
210	Omission to produce document to public servant.

Oath and evidence :

BNS	Punishment
213	Refusing oath of affirmation.
238	Intentional disappearance of evidence.

Negligent acts :

BNS	Punishment for
271	Negligent act likely to spread the fatal infection.
272	malignant/intentional act likely to spread the fatal infection.

minor offences :

BNS	Punishment
292	Public nuisance.
296	Obscene act/song.
301	Disrespect to human corpse.

BNSS

BNSS	Importance
33	Police intimation.
52	Examination of rape accused.
184	Examination of rape victim.
63-71	Summons.
456	Death sentence (Pregnant female) → Life imprisonment.
194	Police inquest.
196	magistrate inquest.

ENT

MARROW EDITION 8

