

# COURT OF LAW

Forensic medicine is the application of medical knowledge for law.

It is also known as legal medicine.

Father of legal medicine → Paul Zacchias.

## Laws in India

00:01:03

IPC : Indian Penal Code.

Implemented in 1860.

Includes the definition and punishment of offences.

511 in number.

CrPC : Criminal Procedure Code.

Implemented in 1974, after being made in 1973.

484 in number.

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Any procedure for punishment of offences.

e.g. : Arrest, summons, warrant, court proceedings.

IEA : Indian Evidence Act.

All evidences and witnesses are part of it.

Implemented in 1872.

167 in number.

Oral evidences are more valid than documentary evidences.

Oral evidence can be cross examined, whereas that is not possible in case of documentary evidences.

Types of witnesses :

1. Common witness :

most common type of witness.

Has first-hand knowledge of the facts, as he has observed the crime committed.

They give direct evidence.

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Hear-say evidence is given when the witness recounts something they have not observed. This is **not valid** in court.

Exceptions are :

- **Res gestae :**

Acts (involuntary exclamations) made at the time the offence was committed, and are closely attached to the main fact (heat of the moment).

Comes under IEA sec 6.

- **Dying declaration :**

Comes under IEA sec 32.

Statement made by a dying person.

2. **Expert witness :**

Defined under IEA sec 45.

A **qualified person** who gives his opinion.

E.g. : Doctor, handwriting expert, finger print expert, firearm expert.

All expert witnesses can also be common witness.

They can volunteer the statement.

**Cognizable offence :**

An offence where an **arrest** can be made **without a warrant**.

Comes under CrPC a(c).

E.g. : mnemonic **RRRR**.

**Rape**, sexual offences.

**Ragging**, grievous hurt.

**Robbery**, dacoity.

**Rash and negligent act** leading to death, like death due to hit and run.

murder, attempt to murder.

Dowry death.

Indecent assaults done to females like stalking, voyeurism.

Stalking is following a female intrusively.

voyeurism is deriving sexual pleasure from watching others naked or engaged in sexual activity.



Non-cognizable offence :

An offence that needs a warrant for the arrest to be made.

Comes under CrPC 2 (1).

## Courts

00:15:21

The different courts in India according to hierarchy.

Court	Maximum punishment	Fine
<b>Supreme court :</b> Highest court in the country	Death sentence	Unlimited fine
<b>High court :</b> Highest court in the state	Death sentence	Unlimited fine
<b>Sessions court :</b> Highest court in the district	Death sentence	Unlimited fine
Additional sessions court	Death sentence	Unlimited fine
Assistant sessions court	10 years imprisonment	Unlimited fine
Chief judicial magistrate	7 years imprisonment	Unlimited fine
1 <sup>st</sup> class judicial magistrate	3 years imprisonment	10,000 fine
2 <sup>nd</sup> class judicial magistrate	1 year imprisonment	5000 fine

If the sessions court passes a death sentence, it is confirmed by the high court.

Supreme court is an appellate court.

The final appeal is to the president who can pardon death sentence → amnesty.

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If a pregnant female is convicted to death sentence by the sessions court, it is converted to life imprisonment by the High court → 416 CrPC.

Juvenile court :

Juvenile is < 18 years.

The maximum sentence is 3 years of juvenile home.

Tried by the chief judicial magistrate.

## Inquest

00:24:17

Any investigation or inquiry to know the cause of death.

Two kinds of inquests are done in India.

Police inquest	Magistrate inquest
<p>CrPC sec 174.</p> <p>Most common type of inquest done. Done in case of unnatural deaths :</p> <p>Accidental, suicidal, homicidal or indeterminant cause.</p> <p>Minimum rank of police officer is head constable.</p>	<p>CrPC sec 176.</p> <p>Conducted by a 1<sup>st</sup> class judicial magistrate, district magistrate, sub-divisional magistrate, additional district magistrate or tehsildar as an executive magistrate.</p> <p>Deaths investigated by the magistrate are : mnemonic : ABCDEF. In mental asylum. By police beating. In police custody. Dowry death/death of any woman within 7 years of marriage. Exhumation.</p> <p>Police firing.</p>

The police or the magistrate visit the crime scene and observe it, along with the dead body.

**Inquest report/Panchnama** is made based on the findings from the crime scene and the dead body.

The body is taken for post-mortem examination to a medical officer.

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After post-mortem examination, the body is handed back to the investigating officer.

Judicial magistrate looks into death by police beating, in police custody and in police firing.

Death in mental asylum, dowry death and exhumation is presided over by executive magistrate.

Exhumation is digging out a buried body.

medicolegal autopsy : Post-mortem examination after an inquest. most common kind of autopsy done in India.

Inquests absent in India :

Coroner's inquest.

No longer used in India.

Last coroner's inquest in India was in July, 1999 at Mumbai.

Jury system was used.

medical examiner's inquest :

used in USA, not prevalent in India.

Best inquest system.

## Court procedure

00:35:17

Summons :

Given by the court to a witness.

Part of CrPC 61- 69.

The date, time and place is mentioned, where the witness has to appear.

Also known as subpoena (sub = under, poena = penalty).

If the witness fails to attend court, the court issues a notice under CrPC sec 350, after which it is decided to punish the witness or not.

Punishment is defined under IPC sec 174, with maximum of 6 months imprisonment or fine up to 1,000, or both.

If a witness receives summons to appear at a criminal court and a civil court on the same day → criminal court takes priority.

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If summons are from same kind of court (e.g. both are criminal courts), the higher court takes priority.

If both summons belong to same level, the summons to the court which was received first takes priority.

Two types of subpoena.

**Subpoena ad testificandum** : Attend and testify at court → common witness.

**Subpoena duces tecum** : Attend the court with the required relevant documents → expert witness.

## Oath

00:43:34

Oath is defined under IPC sec 51.

Refusal to take an oath is punishable by IPC 178, with up to 6 months imprisonment and 1,000 fine.

Oath is not required if < 12 years of age.

Usually oath is taken under the name of god.

Those who don't take oath under the name of God are atheists or expert witnesses.

Hostile witness :  
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One that changes the statement.

This is brought to light by implementing cross examination according to IEA sec 154.

IPC 193 : Punishment for false evidence.

Known as perjury. It is defined under IPC 191.

IPC 197 : Punishment for false documentation.

Gap of 4 : 193, 197, 201
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IPC 201 : Punishment for disappearance of evidence.

All have 7 years of imprisonment as punishment.

## Examination of witness

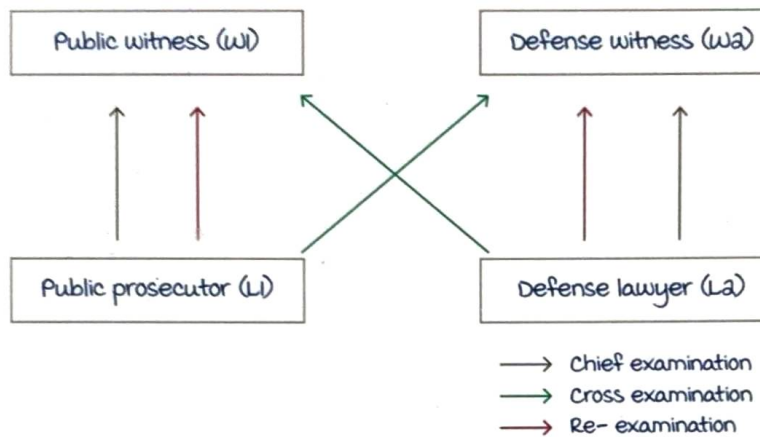
00:49:52

1. Chief examination of witness :

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- Done by the lawyer of the same party.  
Described in IEA sec 137.
2. Cross examination of witness :  
Done by the lawyer of the opposite party.  
Described in IEA sec 145.
3. Re- examination of witness :  
Done by the lawyer of the same party.  
The order of examination is described under IEA sec 138.



For example :

Consider a scenario where W1 is the public witness and L1 is the public prosecutor. And W2 is the defense witness and L2 is the defense lawyer.

L2 is the defense lawyer.

Chief examination involves :

L1 examining W1.

L2 examining W2.

Cross examination involves :

L1 examining W2.

L2 examining W1.

Re- examination involves :

L1 examining W1.

L2 examining W2.

Cross examination :

Toughest examination.

No time limit.

Leading questions can be asked.

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- Questions with yes or no answers.
- Defined in IEA sec 141.
- E.g. : Was Ram wearing white shirt ?

Magistrate can ask questions at any point of time.  
When the witness has become hostile witness, leading questions can be asked in chief examination as well.

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## Conduct money

00:57:13

Also known as **diet money**.

Paid to the witness to meet their expenses.

Paid only in civil cases, by the party that calls the witness.

Except in expert witness, conduct money can be paid in criminal cases as well, which is paid by the court.

Documentary evidence is accepted in court only after oral testimony of the concerned person who prepared the document. Exceptions to this are :

- Dying declaration.  
Statement given by a person who is dying.
- Expert opinions expressed in treatise.
- Evidence of a doctor recorded in a lower court.
- Reports of certain government specific experts like chemical examiner, chief inspector of explosives, serologists etc.
- Evidence given by a witness in previous judicial proceeding.
- Public records.
- Hospital records.

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Dying declaration	Dying deposition
Practiced in <b>India</b> .	Practiced in the <b>USA</b> .
Part of IEA sec 32. Oral or written statement. Regarding homicide or suicide attempts. Taken by the <b>magistrate</b> . If magistrate is not available the doctor, police or any other person can take the same. Valid only if the <b>person dies</b> . If the person survives, the oral evidence is taken and the dying declaration is taken as corroborative evidence (defined under IEA sec 157).	Taken <b>always by magistrate</b> .
Oath is <b>not required</b> .	Oath is <b>required</b> .
Cross examination is not needed.	Cross examination can be done. Accused can prove his innocence → makes it superior.
<b>No</b> leading questions.	Leading questions can be asked.

Age limit for testifying : **No age limit**.

Under **IEA 119**, a dumb person can give evidence in writing or by signing.

Evidence given by an **insane person** or an **intoxicated person** is **invalid**.

Under CrPC.312, the expert witness is paid travel allowance (TA) and dietary allowance (DA) in criminal cases, by the court.

Recall and re-examination of the witness is defined under **CrPC 311**.

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# SEXUAL OFFENCE, PERVERSION, RAPE AND RECENT AMENDMENTS

## Sexual perversion

00:00:18

It is also known as paraphilia.

Person obtains sexual gratification by abnormal acts.

Types :

- Sadism/algolagnia : Sexual gratification by giving pain.
- masochism/passive algolagnia : Sexual gratification by suffering pain.

**Bondage** : Combination of sadism and masochism in a single person.

Dippoldism : Teacher is satisfied after beating a student.

60c6b3eeaa8ded0e7e5ea7 A type of sadism.

Necro means dead body.

Necrophilia : Sex with dead body for gratification.

Necrophagia : Eating dead body for gratification.

Both these are punishable under 297 IPC (1 year).

Excessive sexual desire in males : Satyriasis.

Excessive sexual desire in females : Nymphomania.

Sexual satisfaction from urine : Undinism.

Sexual satisfaction from feces : Coprophilia.

Uranism : Licking, sucking, fingering or fondling with genitalia or other body parts.

Oral sex :

Oral stimulation of male genitalia : Fellatio.

Oral stimulation of female genitalia : Cunnilingus (tongue).

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Sexually attracted towards child : Pedophile.

Sexually attracted towards old people : Gerontophile.

**Transvestism/eonism** : Sexual satisfaction by wearing clothes of opposite sex.

Fetichism : mainly seen among males.

Sexual satisfaction by opposite sex articles.

Scatologia : Sexual satisfaction by obscene telephone calls.

Caprolalia : Sexual satisfaction by obscene language.

**Ecouterism** : Sexual satisfaction from sex sounds.

Bobbit syndrome : Female is sexually satisfied by cutting the penis.

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Exhibitionism : Showing private parts in public places.

Punishable under **294 IPC (3 months)**.

Further categorised into :

1. Steaking : Running naked in public places.
2. mooning : Showing buttocks in public places.
3. Flashing : Temporary exposure of private parts.

masturbation/onanism/ipsation in public places is also punishable under **294 IPC**.

voyeurism/scotophilia/peeping Tom : Sexual satisfaction by watching a nude girl or a girl engaged in sexual activity (mixoscopia).

**Frotteurism** : male rubbing his body parts to female's breast or thigh. Punishable under **290 IPC (3 months)**.

Pyromania : Sexual satisfaction by fire.

Troilism : Sexual satisfaction from three-some.

Lust murder : Killing the partner after sexual activity.

Partialism : Sexual satisfaction by particular part of the body.

Klismaphilia : Sexual satisfaction by enema.

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Playing with bag pipe : Sexual satisfaction by inserting penis into the armpits.

**Sexual offences**

00:23:52

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Classified into :

Natural	Un-natural
Peno-vaginal route	Any other route
	Punishable under 377 IPC (10 years) (TEEN SAAT SAAT)
<p>RIA</p> <p>R : Rape.</p> <p>I : Incest (Sexual activity between blood relatives, No IPC, not a crime).</p> <p>A : Adultery (extramarital sexual affair), was punishable under 497 IPC. It is Decriminalised. Now it is non punishable from 27/09/2018.</p>	

Incest complexes :

1. mother + Son = Oedipus.
2. Daughter + Father = Electra.
3. Brother + Sister = Pharoan.

377 IPC : un-natural sexual offences.

It is only punishable without consent, < 18 years.

It is punishable with an animal (bestiality).

1. Lesbianism/tribadism : If two females are having sexual activity.

Active partner : Butch/dyke.

Passive partner : Femme.

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2. Anal sex/sodomy/buggery.
3. Oral sex/sin of Gomorrhoea.

Pedarasty : If sodomy is between an adult (pedrast) and a children (catamite).

Examination of sodomy victim : **Knee elbow position.**

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Habitual passive agent of sodomy :

- Perianal hair is generally shaved.
- Funnel shaped anal canal.
- Thickening of perianal skin.
- Loss of mucosal rugosity.
- Rectal prolapse.
- Lateral buttock traction test is positive.

## Rape

00:40:25

Definition of rape : **375 IPC.**

Punishment of rape : **376 IPC.**

Rape is considered only with a female in india.

Definition of rape : when penis/penis like part goes inside vaginal, oral, anal or urethral orifices under few circumstances.

It can be **natural/un-natural sexual offences.**

Circumstances of rape :

- Against will (ready with heart).
- Against consent (phenomenon with/without will).
- Consent obtained under fear.
- Consent obtained from fraud activity.
- Consent obtained under intoxication.
- With consent when age of girl < 18 years (**statutory rape**).
- If she is not able to give consent.

Impotency is **not a defence for rape.**

Age limit of a boy below which he is incapable of performing

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sex : No such age limit.

114 A IEA : Presumption of absence of consent.

Burden of proof : male.

113 B IEA : Presumption of dowry death (within 7 years of marriage).

113 A IEA : Presumption as to be abetment of suicide by a married woman.

112 IEA : Period of legitimacy. If any child is born within 280 days of dissolution of marriage. male is considered as legal

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376 IPC : Punishment is for 7-10 years.

ComA : Any vegetative state.

Punishment : Life imprisonment (LI)/death sentence.

Bride : Wife/after divorce/legal separation.

Punishment : 2-7 years.

Custodial : Police/hospital/public servant.

Punishment : 5-10 years.

Do :  $\geq$  2 people (gang rape).

Punishment : 20 years to LI.

Excessive heinous crime : Repeat rape/gang rape.

Punishment : Life imprisonment (LI)/death sentence.

## Criminal law amendments

00:57:01

Criminal law amendments act 2018 :

- This act was amended after hue and cry following UNNAO and KATHUA rape cases.
- This followed the Criminal Law (Amendment) Act, 2018

In 2013 amendment : Nirbhaya rape case.

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major changes proposed in criminal law  
(amendment) act, 2018

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Age of woman	Offence	Section of IPC	Criminal law (amendment) act, 2018
Below 12 years	Rape	376AB	Minimum : 20 years Maximum : Life imprisonment or death
	Gang rape	376DB	Minimum : Life imprisonment Maximum : Life imprisonment or death
Below 16 years	Rape	376 (3)	Minimum : 20 years Maximum : Life imprisonment
	Gang rape	376DA	Minimum : Life imprisonment Maximum : No provision
16 years and above	Rape	376	Minimum : 10 year Maximum : Life imprisonment

Protection of children from sexual offence (POCSO)

act-2012 : Changes in 2019.

Evidence of the child to be recorded within a period of 30 days and complete the trial within a period of one year, as soon as possible.

Sexual harassment :

Bullying or coercion of a sexual nature and the unwelcome or inappropriate promise of rewards in exchange for sexual favors.

It includes sound and gesture, child pornography, make child exhibit body part or show his body part.

Sexual assault :

It is an act in which a person touches another person, with sexual intent, without that person's consent or coerces or physically forces a person to engage in a sexual act against their will without penetration.

Penetrative sexual assault :

Penetrate the penis into any orifices of a child.

Penetration with any object into the vagina, urethra, anus.

Applies mouth to the penis, vagina, urethra, anus of a child.

Aggravated penetrative sexual assault-sexual assault by :

- Police officer.
- Armed/security forces.
- Public servant.
- management/jail staff of jail, remand home, protection home.
- Hospital staff.
- Staff of educational or religious institute.
- Using deadly weapon.
- Causing grievous hurt.
- makes child mentally ill or pregnant or transmit HIV (IPC 269 : Negligently/without intention and IPC 270 : malignant with intention).
- Act done on disabled child/pregnant child.
- With attempt to murder or during communal violence.
- By guardian : Repeatedly on same child.

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Punishment of POCSO

01:06:10

Offences	Punishment (POCSO-2012)	Punishment (POCSO bill-2019)
Penetrative sexual assault	7 years to life imprisonment plus fine	If child below 16 years -20 years to life term plus fine
Aggravated penetrative sexual assault	10 years to life imprisonment plus fine	20 years to death penalty plus fine. It adds two more grounds in the list of aggravated sexual assault 1. Assault resulting in death of child. 2. During natural calamity.
Sexual assault without penetration	3-5 years imprisonment plus fine	Same
Aggravated sexual assault without penetration	5-7 years imprisonment plus fine	Added two more offences : 1. During natural calamities. 2. Administering any chemical or hormones for cervical maturity.
Sexual harassment	0-3 years imprisonment plus fine	
use of child for pornographic purpose	0-5 years imprisonment (7 years for subsequent offence) plus fine	minimum 5 years imprisonment
Storage of child for pornography	0-3 years plus fine	Add two more offences : 1. Failure to destroy or delete such. 2. made for transmitting.

Active space



Examination of rape :

Accused examination :

Consent is not required.

53 (1) CrPC.

Preserved samples : Clothes, hairs, saliva, penial swab or blood stains.

minimum rank of police officer for examination is **sub-inspector**.

Penal swabs :

To identify vaginal cells :

- Lugol's iodine.
- Papanicolaou stain.

Smegma should also be examined.

If present indicates no sex in last 24 hours.

Should be examined within 24 hours of filing the case.

Identity should not be disclosed (Punishable under **IPC 228**).

Victim examination :

164 A CrPC.

Consent is a must.

It is under 53 (2) CrPC.

Female's refusal should be informed/documental refusal.

Can start treatment for STD, pregnancy, injuries.

Examination of female should be under the female doctor/female nurse.

Done in lithotomy position.  
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Preserved samples : Clothes, blood, vaginal swabs & hairs.

Female SI to be present.

Ask her to remove clothes in females.

4 vaginal swabs are preserved.

Micro injuries can be detected by **ortho toluidine test**.



**SAFE Kit** : Sexual Assault Forensic Evidence Kit.

It contains :

- Bags and sheets for evidence collection.
- Swabs present for collecting fluids from lips, cheeks, thighs, vagina, anus and buttocks.
- Sterile urine collection containers.
- Sterile sample containers.
- Blood collection devices.
- Comb used to collect hair and fiber from victims body.
- Clear glass slides.
- Self sealing envelopes for preserving the victims clothes, head hair, pubic hair & blood samples.
- Nail pick for scraping debris from beneath the nails.
- White sheets to catch physical evidence stripped from the body.
- Documentation forms.
- Labels.
- Sterile water and saline.

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# TRACES OF EVIDENCE

Evidences left in the crime scene such as blood stains, semen, hair.

## Bloodstain

00:00:39

Screening tests : (sensitive not specific)

Based on **peroxidase** enzyme present in blood.

1. Benzidine test : Blue colour.  
most sensitive test capable of detecting very old stains.  
Not used (carcinogen).  
False +ve : saliva, milk, pus, rust, plant juices.
2. Phenolphthalein test : Pink colour.  
a/k/a Kastle-meyer test.
3. Leucomalachite test : Peacock blue colour.
4. Ortho-toluidine test : Blue-green colour.

Confirmatory test/ specific test :

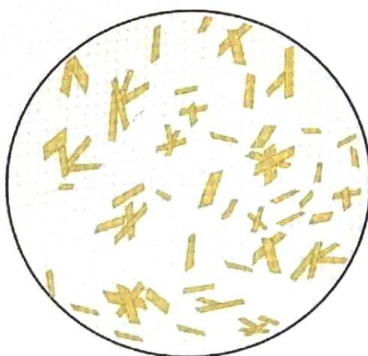
Teich-mann stain < Takayama < Spectroscopy  
(NaCl + Acetic acid) (NaOH + Glucose + (most specific)  
60c6b3eeaa8ded0e4e7e5ea7  
Pyridine)



Hemin crystal  
(Brown rhombic)



Hemochromogen  
Pink feathery crystal



Teichmann test



Takayama test

For species identification : **Precipitin test**.

## Seminal stain

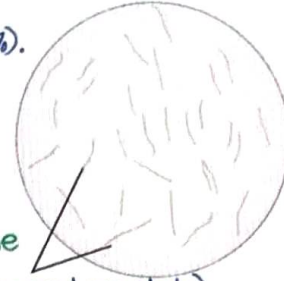
00:10:10

Semen : Sperm (10%) + seminal fluid (90%).

### 1. Barberio's test :

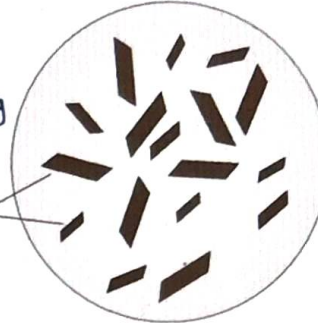
Detects spermine crystals.  
(prostatic secretion)

Picric acid used leading to **spermine picrate** formation (yellow needle shaped crystals).



### 2. Florence test :

Detects choline crystals.  
mixed with choline iodine leading  
to **choline iodide** formation  
(Brown rhombic crystals).



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- Aspermia/ absence of sperm :  
Acid phosphatase test.
- For old semen : CPK test (creatine phosphokinase).  
Can detect 6 month old semen.
- UV rays : Detects choline crystals.  
Semen turns **white blue**.
- **most specific test** : Lactate dehydrogenase (LDH) test.
- **Glycoprotein P30** : Quantitative test.
- MHS SI.
- Phadebas test (amylase test) : Detects saliva (oral sex).

## Hair

00:20:37





Trichology : Study of hair.

Growth rate :

Scalp : 0.4 mm/day (3mm/week).

Best test/ Confirmation : **Precipitin test**.



Featrues	Human hair	Animal hair
Size	Cortex >> medulla	Cortex < medulla.
Pigment	Periphery (cortex). 	Centre (medulla). 
Cuticular scale	Small & thin. 	Large & thick. 
medullary index = $\frac{\text{width of medulla}}{\text{width of shaft}}$	<0.33 (1/3)	>0.5 (1/2)
medulla	Discontinuous/ continuous	Continuous
Scaling pattern	Imbricate (overlapping)	Coronal (thick)

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For paternity/ maternity dispute :

- DNA fingerprinting (best).  
Allec Jeffery : Father of DNA fingerprinting.
- HLA typing.
- Blood grouping (present in all body fluids except CSF).  
Best/ most specific test for blood grouping : Acid elution test.



Best method for identification of criminals : Dactylography /  
finger printing.

### Contributions of Edmund Locard

00:32:10

French criminologist.

Discovered

- Poroscopy : Study of skin pores.  
used for identification.
- Locard exchange principle : Exchange of material  
between criminal & crime scene. Very important for  
crime scene examination/ investigation.

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# FORENSIC PSYCHIATRY

## History

00:00:13

Paul Zacchias :

- Father of forensic psychiatry.
- Father of legal medicine.

Crime by Insane : Insane gets advantage of section 84 IPC as they have an unsound mind.

Every crime has 2 components :

- Criminal intention : *mens rea* (guilty).
- Criminal act : *Actus rea*.

There is no *mens rea* component in crime committed by the insane. Hence, they not responsible for the crime.

## Laws of insanity

00:03:48

1. 84 IPC : Unsound mind due to mental disease.

60 of 300 words on 17/5/2021

Also known as *Legal test/right or wrong test*.

Implemented in 1843.

McNaughten himself was insane and was suffering from *paranoid schizophrenia*.

A person is not responsible for the crime, if at the time of committing the crime, he/she is having *defect of reason* due to diseases of the mind.

3. Curren's rule :

A person is not responsible for the crime if he/she does not know about the nature and quality of the act due to loss of *capacity to regulate conduct* because of mental disorders.

4. Durham's rule :

Also known as *product test*.

A person is not responsible for the crime, if at the time

of committing the crime, it's a **product of mental disease/defect**.

5. Irresistible impulse test :

AKA **Hampshire test**.

A person is not responsible for the crime, if at the time of committing the crime, the **free agency of will** is lost.

6. Brawner's rule :

A person is not responsible for the crime, if at the time of committing the crime, the **substantial capacity to regulate conduct** is lost.

7. American law institute test :

A person is not responsible for the crime, if at the time of committing the crime, the **adequate capacity to appreciate the criminality/adjust the conduct** is lost.

## Lucid interval

00:13:27

The **period of sanity** between two periods of insanity.

A person who commits criminal act during lucid interval is held liable for that.

Can act as **witness** and **testify** during lucid interval.

It's also seen in head injury, where lucid interval refers to period of consciousness between two periods of unconsciousness (EDH).

Diagnosis of insanity :

- At least after **3 observations**.
- By single magistrate order : Checkups should be completed within 10 days (minimum period).
- On magistrate order, the involved can be detained to maximum period of **30 days**.

Oldest law : **Lunacy act 1912**.

mental health act : Implemented in 1987.

Amended in 2017 to become **mental health care act**.



## Mental health care act

00:18:08

Amendments includes :

- Psychiatric hospital renamed to **mental health establishment center/hospital**.
- **309 IPC** : Decriminalization of suicide attempt.
- Prohibition of **Electroconvulsive method (ECT)** without muscle relaxants and analgesics.
- Prohibition of **sterilization** as a method of treatment in mentally ill.
- Prohibition of **chaining** of persons.
- **Advance directive** : A person will be authorized for determining the course of treatment or will act as caretaker.

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Civil components of insane :

1. Will :

For writing will, there are 2 criteria :

- Should be  $\geq 18$  years of age.
- Need a **sound mind** (compos mentis).

2. **Testamentary capacity** :

mental capacity to make a valid will.

Defined under 31 IPC.

**Holographic will** : Will in own handwriting.

## Juvenile

00:25:24

Aged  $< 18$  years.

Juveniles committing crime : Kept in **juvenile homes** for a maximum period of **3 years**.

If juvenile between 16-18 years of age, **committing heinous crime** can be sentenced to period of **7 years** (trial just like adults).

82 IPC : Child **below 7 years** of age is not responsible for any crime.

83 IPC : Child between **7-12 years** is not responsible for crime, if not able to appreciate the nature and

consequence of crime.

84 IPC : Protection of insane.

85 IPC : Involuntary intoxication (not responsible for crime).

86 IPC : voluntary intoxication (responsible for crime).

minimum age of criminal responsibility : 7 years.

minimum age for full criminal responsibility : 18 years.

### Conditions in which a person is not responsible for crime

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00:33:41

mnemonic : TOPSID.

Twilight state.

Oneiroid state.

Post traumatic automatism.

Somnambulism.

Involuntary drug intoxication (advantage of 85 IPC).

Delirium tremens (acute alcohol withdrawal/datura  
intoxication).



m'Naughten

# IMPOTENCY, STERILITY & OTHER DEFINITIONS

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## Definitions

00:00:08

Impotency :

Inability to perform sexual act, by a male.

Sterility :

If either of the partners have an issue that leads to an inability in producing children.

Causes of impotency :

Temporary causes include →

- Fear or emotional cause leading to impotency, also known as honeymoon impotency or psychogenic impotency.
- Alcohol consumption.
- Cannabis usage.

Permanent causes include :

- Lead neuropathy (commonly seen in painters).
- Hypertension.
- Diabetes mellitus.

Impotency is tested by Bulbocavernosus reflex →

The test is positive if squeezing the glans penis leads to anal contraction.

An absent reflex could indicate impotency.

## Quad

00:03:47

A male who is impotent in relation to a particular woman only.

Frigidity :

Refers to a women who fails to respond to sexual stimulation. There is lack of sexual desire.



Grounds for divorce (in order of preference)

1. Impotence after marriage.
2. Frigidity.
3. Impotency before marriage is technically a null/void marriage.

Posthumous child :

A child born after the death of the father.

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Supposititious child / Fictitious child :

If a woman is pregnant with child of X, but blackmails Y saying that the child is his, then the child is a fictitious child of Y.

## Twin Pregnancy

00:09:20

Twin pregnancy is the pregnancy that occurs in **one menstrual cycle, by one act of coitus.**

It could be monozygotic or dizygotic.

Superfetation vs. Superfecundation :

SuperfeTation (2 Ts)	SuperfecundaTion (1 T)
Pregnancy that occurs in <ul style="list-style-type: none"> <li>• Two menstrual cycles.</li> <li>• By 2 separate acts of coitus.</li> <li>• 2 ova are fertilized.</li> </ul>	Pregnancy that occurs in <ul style="list-style-type: none"> <li>• One menstrual cycle.</li> <li>• 2 separate acts of coitus.</li> <li>• 2 ova are fertilized.</li> </ul>

Pseudocyesis / spurious pregnancy or phantom pregnancy :  
Subjective symptoms of pregnancy are present although no pregnancy exists.

Seen in females who are :

1. Desperate to get pregnant.
2. Females close to menopause.

Causes :

1. Emotional problem.
2. Hormonal problem.

Fecundation ab extra :

Rare condition where semen deposited on thigh or vulva leads to a pregnancy.

### Sterilization

00:14:14

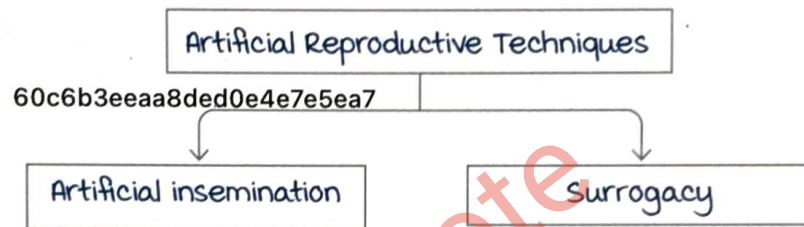
Done on a voluntary basis.

Written consent required from both the partners.

After vasectomy patients advised to abstain from sex for 3 months or till the absence of spermatozoa in semen sample.

### ART

00:15:24



Artificial Insemination (AI) :

Needed when :

- Husband is impotent.
- Husband is sterile.
- Any penile abnormalities.
- Rh incompatibility.
- Genetic disorders.

Types :

1. AIH → Husband's semen sample used.
2. AID → Donor's semen sample used.
3. AIHD → pooled/ mixed sample of husband and donor used.

Semen requirement for AI is 1 mL.

A single donor can produce a maximum of 10 children by AI.

Delhi Artificial insemination Act (1995) :

Purposes of the act are :

- To control the spread of HIV.

- To regulate the donation, storage, sale of human semen/ovum.
- To ensure the non-disclosure of the identities of donor/recipient.
- To ensure that there is no segregation of the XX or XY chromosome.

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## Surrogacy

00:22:23

In India, **Altruistic Surrogacy** is legally allowed.

It means that the surrogate is given only medical expenses and not money.

Salient Features of Surrogacy (Regulation) Bill-2016/2020 :  
Surrogate mother must be :

- A **married woman** who is a **close relative** to the intended couple.
- Ideally between **25-35** years of age.
- Having a child of her own.
- She can be a surrogate **only once** in her life.

Intending couple should be :

- Both Indian citizens.
- **married for at least of 5 years.**
- Have a proven case of infertility.

Violation of any section of bill is **punishable with imprisonment of 10 years and a 10 lakh fine.**

Post Conception by an Artificial Reproductive technique →

**The child becomes a legal child only after adoption.**

If AID is because of impotency → The wife can file a case for divorce.

Consent is required from both husband and wife.

Tests for impotency :

1. Papaverine injection.
2. Pudendal arteriography.
3. Cavernosography.
4. Rigi-scan.



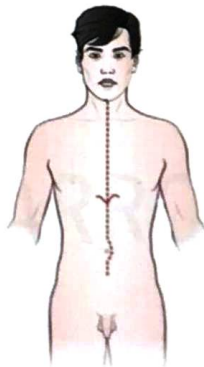
# POSTMORTEM TECHNIQUES

Also known as autopsy/necropsy (necro = dead body).

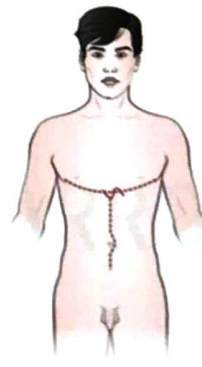
## Incisions in postmortem

00:01:03

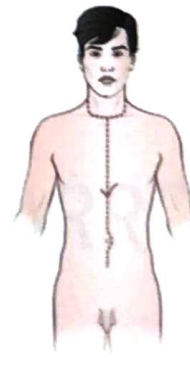
1. I shaped incision :
  - most common type.
  - From neck to pubic symphysis through midline.
2. Y shaped incision :
  - Starts from acromion process, goes below mammary line to xiphoid process and then to pubic symphysis.
  - Commonly used in females.
3. modified Y shaped incision :
  - Also called as u-shaped incision.
  - Incision taken from mastoid tip (behind the ear) to suprasternal notch and then to pubic symphysis through midline.
  - Done mainly in asphyxial death (hanging, strangulation, drowning).
4. Inverted Y shaped :
  - Done in infants.
  - Incision drawn from midline and bifurcates just above umbilicus.



I shaped incision



Y shaped incision



modified Y shaped incision

Active space

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First medicolegal autopsy was conducted in **Chennai** by Edward Buckley on dead body of wheeler.

Presumed to be a case of **arsenic poison** death.

First case in world was done at Varignana, Italy in 1302.

## Types of autopsy

00:07:07

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1. Medico legal autopsy :
  - most common.
  - under the request of police/magistrate.
  - Done in **unnatural deaths** (homicide, suicide, accident, sudden deaths).
  - Relatives' consent is not necessary.
  - whole body autopsy.
2. Pathological autopsy :
  - Also called as **clinical autopsy**.
  - Done in **natural death**.
  - To identify pathology of death.
  - **Consent of relative** is must.
3. Psychological autopsy :
  - Done **after suicide**.
  - To identify mental status of deceased during the period.
  - Questions regarding mental status are asked to family members and friends.
4. Virtual autopsy :
  - AKA **Virtopsy**.
  - **Non-invasive**.
  - uses CT/MRI for identifying cause of death.
5. Negative autopsy :
  - **2-5%** of total autopsy.
  - Cause of death : **Negative**.
  - Findings :  
Gross findings → Negative.  
Dissection findings → Negative.

Toxicology analysis → Negative.

Histopathology → Negative.

- Causes include :

vagal inhibition.

Laryngospasm.

Thyrotoxicosis.

Cardiac arrhythmia.

Adrenal insufficiency.

6. Obscure autopsy :

- minimal findings.
- Cause of death is undetermined.
- E.g. Head injury with no other findings (diffuse axonal injury).

## Postmortem techniques

00:16:46

1. Virchow's method :

- One by one organ removal.
- most common method.

2. Ghon method :

- En block dissection.
- Cervical block, thoracic block, abdominal block and pelvic block are taken separately.

3. Lettulle method :

- En masse dissection.
- All organs connected to each other are taken out simultaneously (to preserve blood supply).
- Evisceration is carried out.
- Done when vessels are intact.

4. Rokitsansky method :

- In situ method.
- Organs are not taken outside body.
- Used in infants.
- Used in transmissible diseases (HIV, Covid etc).



## Order of opening cavity in various conditions

Cause of death	1 <sup>st</sup> cavity to be opened	Last cavity to be opened
Poisoning	Cranium	-
Asphyxial death	Cranium	Neck (To achieve neck as <b>bloodless field</b> ).
Head injury	Thorax	Head (for bloodless field).
Neonate	Abdomen (to see position of diaphragm)	-
Air embolism	Brain	-
Pulmonary air embolism or pneumothorax	Thorax Water test : Bubbles coming from pulmonary alveoli. Pyrogallol test : Pyrogallol gives color when it comes in contact with air.	

**Dissection of organs**

00:27:07

1. Heart :
  - Inflow-outflow technique.
  - Dissected along blood flow (RA - RV - LA - LV).
2. Spinal cord :
  - Dissected posteriorly.
  - Best approach.
3. Stomach :
  - Sealed by double ligature method.
  - Opened from greater curvature.
  - **magen Strasse** : maximum damage occurs to lesser curvature in corrosive poisoning.
  - Dissected through greater curvature to preserve lesser curvature.

## 4. Skull :

- Dissection from posterior part of ear to the opposite part.
- After opening skull, we take coronal section.

## Postmortem fracture :

- Also known as **undertaker fracture**.
- Fracture of **C6-C7**
- Occurs during transportation of dead body.

**Antemortem thrombus vs post-mortem clot**

00:33:27

Antemortem thrombus	Post-mortem clot
Firm, dark red, <b>striae of Zahn</b> (fine white line of fibrin), coralline platelet thrombus (alternate layers of <b>platelets and fibrin</b> ).	Red currant jelly ( <b>blood clots rapidly</b> ), <b>chicken fat clot</b> (clotting process is slow).

## Sudden death :

- When a person not known to have been suffering from any dangerous disease, injury, poisoning is **found dead** or dies within **24 hours** after the onset of terminal illness.
- **m/c cause** : **Left anterior descending artery (LAD)** within 2 cm of its origin is the most affected. (LAD is also called widow artery).

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## IMPORTANT IPC SECTIONS

### Assault

00:00:20

Attack with criminal force on a party with weapons, by means of threats, gestures or other methods, which generate fear.

Defined and punishable under **351 IPC**.

Indecent assault :

An attack to outrage the modesty of a female.

Punishable under **354 IPC**.

354 IPC :

354 A : **Sexual harassment** (e.g. boss harassing his secretary in the office)

Punishment → Imprisonment of **1-5 years**.

354 B : **Public disrobing** (e.g. undressing the female in a public place).

Punishment → Imprisonment of **3-years** (may extend to 7 years and fine).

354 C : **voyeurism (See)** (e.g. watching a female naked while having bath/sex).

Punishment → Imprisonment of **1-year** (may extend to **3 years with fine**, repeat offence has imprisonment of **3-7 years**).

354 D : **Stalking** (e.g. following a female).

Punishment → Imprisonment of up to **3 years** for first offence and up to **5 years** for repeat offence.

**354 A/B/C/D** all are **cognizable** offences (arrest without warrant).

Bailable offences → If these offences have been done for the first time in life.

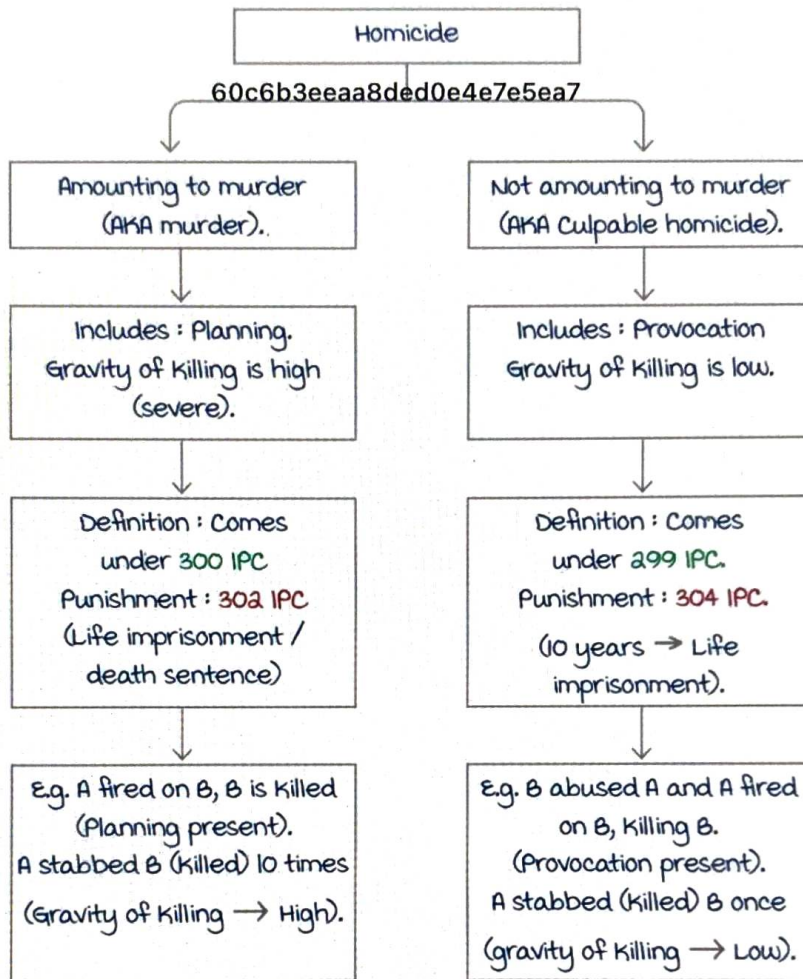
Non-bailable offences → If these offences have been repeated for a second time.



## Homicide

00:07:31

Definition : Killing a human.



Punishment for murder by a convict serving life imprisonment to death under **303 IPC**.

Punishment for culpable homicide not amounting to murder is under **304 IPC**.

**304A** : Any kind of accident leading to death/death by negligence (rash actions) including all hit and run cases and medical negligence.

Punishment : Imprisonment of 2 years ± Fine.

**304B** : Dowry death /Bridal death.

Punishment : Imprisonment of 7 years → Life imprisonment.

**306 IPC** : Related to **abetment of suicide** (e.g. if name is mentioned in the note).

305 IPC : Related to abetment of suicide of a child or insane person.

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If the person survives, it becomes an attempt.

- Attempt to murder: Punishable under 307 IPC.
- Attempt to culpable homicide : Punishable under 308 IPC.
- Attempt to suicide : Punishable under 309 IPC.

Now, no punishment under 309 IPC, according to the **mental Health Care Act.**

E.g. :

A fires at B but B survives → Punishable under 307 IPC.

But B dies after 2-3 days → Converts to 302 IPC post death.

Similarly, if A survives an attempt to culpable murder → Punishable under 308 IPC.

But if A dies, 308 IPC converts to 304 IPC post death.

## Injury

00:20:50

Injury : Comes under 44 IPC.

Any illegal harm to :

- Body.
- mind.
- Property.
- Reputation.

Hurt is a type of injury that involves the body.

Defined in 319 IPC.

Life : Defined under 45 IPC.

Death : Defined under 46 IPC.

Grievous hurt : Defined under 320 IPC.

1. **Emasculation** means deprivation of a male of his masculine vigour by cutting penis, castration or any spinal injury resulting in erectile dysfunction.

2. Permanent privation of sight of either eye in the form of impairment of visual field and loss of visual acuity.  
Corneal abrasion is a grievous hurt, even if post-surgery recovery occurs, still considered grievous hurt.
3. Permanent privation of hearing of either ear due to injury to tympanic membrane, ear ossicles, auditory nerve (which is not going to heal in ordinary course of nature).  
Even if post-surgery recovery occurs, still considered grievous hurt.
4. Privation of any member (any part/organ of the body having independent function) or joint.  
Avulsion of nail is not considered as grievous hurt.
5. Destruction or permanent impairing (loss) of powers of any member or joint.
6. Permanent disfigurement of the head or face (e.g. acid attack).
7. Fracture or dislocation of a bone or tooth.
8. Any hurt which endangers life (dangerous injury) or which causes the victim to be in severe bodily pain, or unable to follow his ordinary pursuits for a period of  $\geq$

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30 days.

Dangerous injury includes :

- Cutting of neck by knife.
- Head injury by a heavy stone.
- Stab injury to abdomen.
- Bullet injury to abdomen etc.

Hospitalization for 21 days with no mention of body pain or other clauses mentioned above would be considered as hurt (not grievous hurt).

321 IPC  $\rightarrow$  If hurt is produced voluntarily.

322 IPC  $\rightarrow$  If grievous hurt is produced voluntarily.



## Dangerous weapon

00:35:17

Dangerous weapon (DW) → Any weapon causing endangerment of life.

Include :

- Weapons which cut, stab & shoot.
- Poison.
- Weapons causing burns.
- Blast weapons
- Animals used to kill someone.

Punishment depends on the type of weapon used (dangerous/non-dangerous).

Punishment :

323 IPC → Hurt by a non-dangerous weapon → 1 year.

324 IPC → Hurt by a dangerous weapon → 5 years.

E.g. A slapped B (323 IPC), B fired a gun on A causing a scratch (324 IPC).

325 IPC → Grievous hurt by a non-dangerous weapon → 7 years.

326 IPC → Grievous hurt by a dangerous weapon → 10 years.

E.g. A punched B on the face causing fracture of tooth (325 IPC), B fired on A causing lodging of the bullet in abdomen (326 IPC).

## Vitriolage

00:43:19

326 IPC : Grievous hurt by dangerous weapon includes corrosives.

326A : Acid attack → Punishable minimum for 10 years of imprisonment.

326B : Acid attempt → Punishable up to 7 years.

Strongest acid : Sulphuric acid.

## Enzymes markers for injuries

00:45:00

Raiekilo first discussed about these markers.

Mnemonic : **TSH AAAA**.

Tissue cathepsin → Appears in body by 5 mins  
(first to rise).

Serotonin → Appears in body by 10 mins.

Histamine → Appears in body by 20-30 mins.

Esterase /ATPase → Elevated in body by 1 hour.

Amino Peptidase → Elevated in body by 2 hours.

Acid Phosphatase → Elevated in body by 4 hours.

Alkaline Phosphatase → Elevated in body by 6 hours.

Ewing postulate :

Relation between trauma & new growth → Persistent trauma at a single site leading to a tumor like new growth.

## Torture

00:48:08

Defined under 330 IPC.

Guidelines for doctors concerning torture was given in Declaration of Tokyo.

Examination of tortured patients was given in Istanbul protocol.

Parrot perch :

Hands and ankles are tied together.

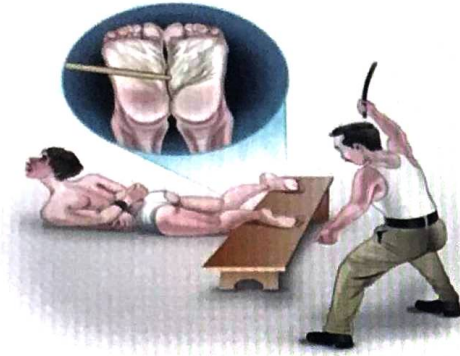
The person is suspended by a pole with knee.



Parrot's perch/jack

Falanga /Bastinado :

Defined as **beating on sole**.



Falanga/ Bastinado

Crucifixion :

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AKA **Palestinian hanging.**

Fatigue sets in while the body is hanging which brings the neck down compressing the trachea leading to **positional asphyxia** (cause of death).



Crucifixion

Planton :

Forced standing for long hours.



Planton



Cattle prod :

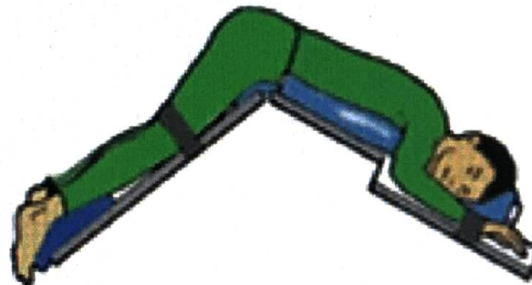
Electric torture device especially used to shock genitalia.



Cattle prod

Jack knife position :

Chest is fixed in the same position (jack-knife) for a long period causing positional asphyxia (cause of death).



Jack Knife position

Picana :

Electric torture



Picana

Dry submarine :

Suffocation by plastic bag/cloth.



Dry submarine

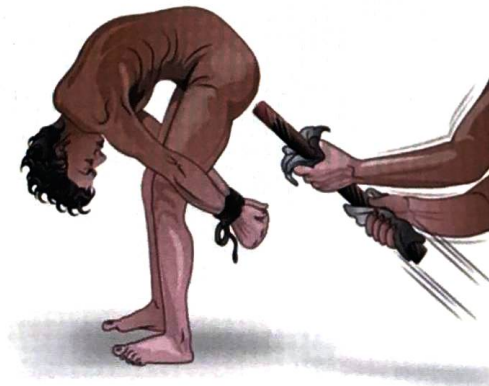
Wet submarine :  
Suffocation by water/wet substances.



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Wet submarine

Black slave :  
Hot metallic rod in anal canal.

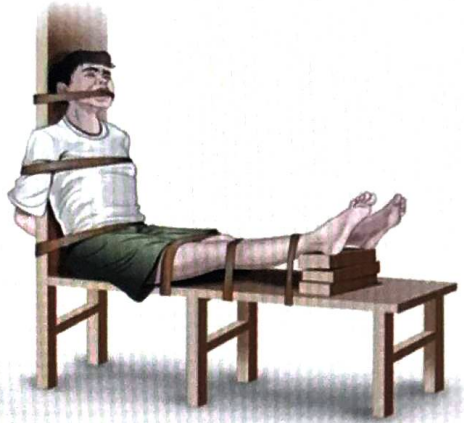


Black slave

Bellary :  
Chili pastes in anal canal.

Quirofano :  
Hitting on abdomen.

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Quirofano/ Operating table

Telefona :  
Slapping/pulling /beating of the ear.



Telefona

Belana :  
muscle injury is produced by the rollers as the body is  
being rolled over.

The rolling over is also known as **ghotna**.



Belana



Caning :

Cane is hit on the buttocks.



Caning

Passing on the board :

Injury to different parts.

Hog tie is used to tie hand & legs behind the back while the person is lying in prone position.

La-Bandera / Strappado : Hands are tied above the body and the body is suspended.

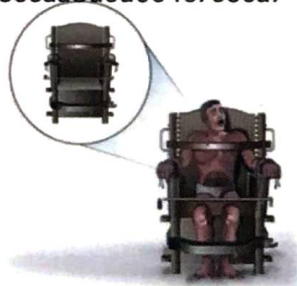


Passing on the board

Iron/ confession chair :

Sitting in the same position on a chair.

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Active space

Saw horse :

Leading injury to anal area due to sharp margins.



Saw horse

Chepuwa :

Thighs are bound with bamboo /bamboo-like material & pressurized.

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Chepuwa

Carotid sleeper :

Bilateral compression of carotid artery.

Carotid hold : Compression of neck/trachea causes compression of carotid artery.

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# INFANT DEATH

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Infanticide → Killing **infants** (< 1 year of age).

Neonaticide → Killing a child **within 24 hours** of birth.

Filicide → Child is killed by **parents**.

All are covered under the IPC defining murder.

Defined under **300 IPC** & punishable under **302 IPC**.

Age of viability for fetus → **≥ 28 weeks**.

Viable fetus can survive outside the uterus.

If the fetus dies after 28 weeks :

	Dead born	Still born	Live born
Place of death	Fetus dies <b>inside the uterus</b> . Also known as <b>intra-uterine death (IUD)</b> .	Fetus dies in <b>the birth canal/</b> during the process of labor.	<b>Respiration</b> was present (+) after delivery. Fetus respired at least once before dying.

## Findings (postmortem) of dead born

00:07:35

Rigor mortis present (absent below 28 weeks).

Robert's sign :

**Earliest** sign of dead born.

Seen within 12 hours.

Presence of **gas/air** in heart chambers or great vessels like **aorta**.

**maceration** : most important finding.

Also known as **aseptic autolysis** of internal organs.

Dead fetus surrounded by **amniotic fluid** with intact membranes (no air inside).

**Soft & flaccid** body with hypermobility of joints.

**Sweetish disagreeable** smell is seen.

Active space

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Skin is peeled off → Seen within 1 hours if body stays in amniotic fluid → **Earliest sign.**

**Blisters** may also be present containing **red serous fluid.**

### mummification :

Occurs when

Liquor amnii is scanty.

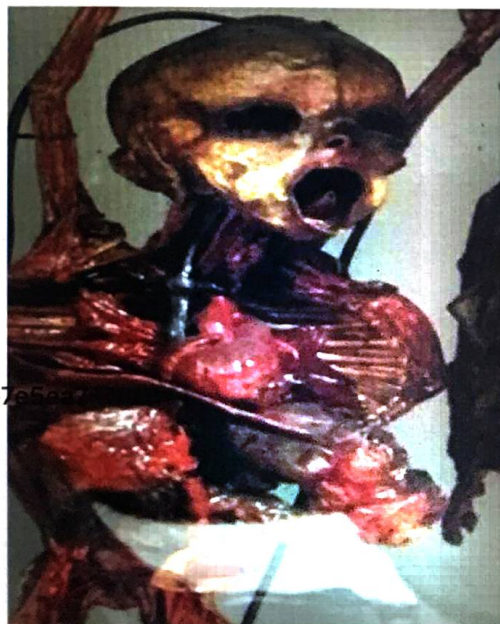
The blood supply to the fetus is lacking.

No air enters the uterus.

Fetus gets converted into a shrunken mass → mummified fetus.



maceration



mummification

Radiological findings :

1. Robert's sign.
2. **Spalding sign** :  
Occurs due to liquefaction/shrinkage of brain →  
Overriding of cranial bones seen.  
**Pathognomonic** radiological sign of IUD.  
Sometimes seen in 7 days, but often after 2-3 weeks.
3. Hyperflexion of spine & over-crowding of ribs.
4. **Deuel's halo sign** :  
Seen as a halo on fetal scalp due to separation of  
subcutaneous fat from cranial bones.  
Can be seen within 3 days of death.

### Live born

00:20:18

Lungs :

They are inflated → Come at the position of 6-7<sup>th</sup> ribs.

Volume of lungs increases.

Weight of the lung also increases.

Color changes from bluish-violet to red.

Margins become round, from sharp.

Lungs become soft in consistency.

Tests to confirm if fetus was live born :

- **Wreden test** : After respiration → Ear contains air.
- **Fodere test** :  
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On respiration the lung weight becomes 2 fold of the  
weight when no respiration occurs.  
Goes from 30gm of non-respired lung to 60gm, after  
respiration.
- **Ploquet test** : The ratio of lung weight to body weight  
before (1/70) and after respiration (1/35)  
becomes 2-fold.

$$\frac{\text{Lung weight}}{\text{Body weight}} = \frac{1}{70} \text{ (Before respiration)} \rightarrow \frac{1}{35} \text{ (after respiration)}$$

- Breslau second life test : Air present in the stomach & intestines after respiration.
- Breslau first life test : Air present in the lungs .  
AKA Raygat test/Hydrostatic test.  
Specific gravity of water = 1.  
Tested by placing pieces of lung in water.  
Lung pieces float → Positive hydrostatic test.  
Lung pieces sink → Negative hydrostatic test.

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Positive hydrostatic test	Negative hydrostatic test
Presence of residual volume. Specific gravity of respired lung $< 1$ (0.94).	Absence of residual volume. Specific gravity of lung which has not respired is $> 1$ .

False negative hydrostatic test :

Respiration present but still lung pieces sink.

- Pneumonia → Consolidation patches.
- Alveolar duct membrane → Obstruction.
- Acute pulmonary oedema → Fluid in lung.
- Complete absorption of air from lungs .
- Feeble respiratory effort.

False positive hydrostatic test :

No respiration but still lung pieces float due to some air inside the lung.

- Putrefaction (decomposition of internal organs → Formation of gas).
- Artificial respiration (mouth to mouth given).

Umbilical structures (mnemonic → AVC)

- Umbilical Artery.  
Closes on the 3<sup>rd</sup> day of birth → Forms medial umbilical fold.
- Umbilical Vein.  
Closes on the 4<sup>th</sup> day of birth → Forms ligamentum



teres.

- Umbilical Cord

Falls on the 5<sup>th</sup> - 6<sup>th</sup> day of birth.

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Caput succedaneum	Cephalhematoma
Edema & congestion of scalp	Sub periosteal hemorrhage
Can cross suture line	Doesn't cross suture line

## Battered baby syndrome (BBS)

00:39:36

AKA Caffey syndrome.

Physical torture done to a child by the parents/guardians.

Inconsistency in history given by parents/guardians & the physical findings present on the body.

Common in male child.

Tear/laceration inside the lips (frenulum) → most characteristic feature.

most common cause of death → Head injury.

Diagnosis of BBS by complete body X-ray → Baby skiagram.

Other findings :

- Rib fracture → String of bead appearance/ knobbing #.
- Constant pinching → Butterfly bruise.
- metaphyseal fractures → Bucket handle # / Corner #.
- Skull # → Eggshell #.
- Shaking baby syndrome.

Subdural hematoma (SDH) and intra ocular bleeding (dot & blot hemorrhages in retina) can occur due to constant shaking of the baby.

AKA Infantile whiplash syndrome.

## Sudden infant death syndrome/SIDS

00:48:51

AKA Crib death/cot death.

Cause of death is **not one causative factor**.

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It is generally accepted that multiple factors all culminate to the **terminal acute cardiorespiratory failure**.

Sleep apnea was believed to be one such cause.

**Negative autopsy** seen → No cause of death found after autopsy.

## Munchausen syndrome of proxy

00:50:38

Child is brought to hospital with **repeated frivolous complaints** by the parents.

Unnecessary investigations and treatment are done.

**Alleged illness** is produced by parents.

Rosenberg criteria is used for diagnosis.

**Regression of symptoms** when separated from parents.

Vagitus uterinus → **Intra-uterine cry** of unborn foetus.

Vagitus vaginalis → unborn foetus cries from the **vaginal canal**.

Section 317 IPC →

Abandoning a child under 12 years of age by the parent or person taking care of the child.

Sec 318 IPC →

**Concealment of birth**.

maximum punishment of 2 years and/or fine.

# VIRGINITY, ABORTION AND PREGNANCY

Defloration → Loss of virginity.

## Hymen

00:01:08

A fold of mucus membrane usually 1 mm thick.

Types of hymen :

- Semilunar/Crescentic hymen → MC, seen in 70% of population.
- Septate hymen.
- Fimbriated hymen.
- Imperforate hymen.
- Vertical type of hymen.
- Annular hymen.

MC site of rupture of hymen :

During masturbation : 11-1 o'clock/anterolateral position.

During intercourse : 5-7 o'clock/posterolateral position.

In female child rape case, the hymen **does not rupture** because, the hymen is **deep seated** in children.

**Aptaeviris** (young girls) :

Sola pith is inserted into the vagina of young girls to dilate it to prime them for sexual intercourse.

Can cause rupture of hymen.

Sola pith is a spongy plant stick.

Carunculae hymenalis/myrtiformis :

Fleshy projections (healed hymen) of ruptured hymen in a sexually active and parous female.



Carunculae hymenalis

Active space



Principal signs of virginity :

Hymen is not always indicative of virginity.

- Disappearance of *fossa navicularis*.
- *Posterior commissure* and *fourchette* are in normal condition.
- Narrow vagina with *rugosity* (lost after 15-20 sexual intercourse).

Causes of rupture of hymen :

- Intercourse.
- *Infections* (diphtheria infection).
- *Surgeries*.
- Sanitary tampons.
- Trauma.

True virgin :

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Female who has *never* participated in intercourse.

The hymen *may or may not* be intact.

False/pseudo virgin :

Female who *has had intercourse*.

Hymen is still *intact* → Hymen is elastic, thick and fleshy.

Fimbriated hymen :

Appears like a hymenal tear but in reality, are *natural notches*.

Fimbriated hymen	Ruptured hymen
Natural notches	Artificial tear
Symmetrical	Asymmetrical
Occurs <i>anteriorly</i>	<i>Posteriorly</i> along the midline, or on both sides
<i>Does not</i> extend till the vaginal wall	Can reach up to the <i>vaginal wall</i>
Covered by <i>mucous</i> membrane	<i>Not covered</i> by mucous membrane

Active space

416 CrPC :

If a pregnant woman is *sentenced to death*, the High court can convert it to *life imprisonment*.

	Nulliparous	Parous female
uterine cavity	Triangular	Round
Inner wall of uterus	Convex	Concave
External Os	Circular	Transverse slit
Internal os	Circular, well defined	Ill-defined

## Abortion

00:22:45

Abortion is classified into 2 categories :

- medical abortion (legal).
- Criminal abortion (illegal).

medical abortion :

**MTP Act** : Law concerning medical termination of pregnancy in India.

**Implemented** in 1971 but came into **action** in 1972.

mother > 18 years of age can give consent for undergoing MTP.

< 18 years of age, consent is acquired from the parents/ guardian.

The medical records of the cases (with confidentiality) need to be maintained for 5 years.

Indications of MTP :

- Social indication → Contraceptive failure.
- Eugenic → malformed child.
- Therapeutic Indication → If mother's life is in danger if pregnancy is continued. kumarankitindia1@gmail.com
- Humanitarian → If pregnancy is a result of rape.
- Environmental factors.

Changes in 2021 amendment :

- The upper limit of gestational age has been made to 24 weeks.

From 12-20 weeks, MTP can be done by the opinion of one medical practitioner.

From 20-24 weeks of gestation, MTP can be done

according to the opinion of 2 medical practitioners.

The increase of upper limit to 20-24 weeks of gestation is keeping in mind the survivors of rape, victims of incest and other vulnerable women (like differently-abled women, minors) etc.

- In case of **substantial fetal abnormalities**, the abortion can be done, **without upper gestational age limit**, after seeking advice of a **state medical board**.

medical board consists of :

Obstetric doctor.

Pediatric doctor.

Radiologist/sonologist.

Any other medical doctor or member if needed.

- Name and other particulars of the women who underwent MTP cannot be disclosed except to a person authorized by law.

**Breach of confidentiality** warrants a punishment of imprisonment for 1 year with or without fine.

- The ground of failure of contraceptive has been extended to **women and her partner**.

If mother's life is in danger, MTP can be done **at any time**.

Qualification required for MTP :

- RMP (Registered Medical Practitioner) and has gone through or assisted **25 MTPs**.
- Practitioner who has completed housemanship for **6 months** in obstetrics and gynecology department.
- Holder of MD/MS/Diploma in Obstetrics and Gynecology.

## Criminal abortion

00:35:12

Abortions done illegally and not following the MTP act.

Criminal Abortion : **IPC 312**.

The doctor responsible for abortion and consent giving relatives would be punishable under this offence.



IPC :

312 : Abortion with mother's consent.

313 : Abortion without mother's consent.

314 : Due to criminal abortion, mother dies.

315 : Abortion when fetus >28 weeks, i.e. kills a viable fetus.

316 : Attempting to kill mother but fetus dies instead  
(culpable homicide).

## Abortifacient

00:40:07

Ecbolics :

Increase uterine contraction.

E.g. Ergot, quinine, strychnine, estrogen.

Emmenagogues :

Increase menstrual blood flow leading to abortion.

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Borax.

Oestrogen.

Sanguinarine.

Senecio.

Abortion stick :

12-18 cm plant sticks that causes irritation of vagina.

Plants used involve :

- Plumbago.
- Ergot.
- Calotropis/madar/Akro.
- Oleander (cerebra - yellow, nerium - white).
- Abrus.

metal sticks used involve :

- Lead.
- Arsenic.
- Antimony.

which lead product is used as an abortifacient ?

- Diachylon.

- KI + I<sub>a</sub> : **Utus-paste** (Interupptin).

Cause of death in criminal abortion :

**MC** immediate cause of death → Air embolism.

Other immediate cause of death → Fat embolism,  
hemorrhage.

Delayed causes of death (female dies in 2-3 days) :

**Septicemia.**

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Active space

# MEDICAL JURISPRUDENCE : PART 1

It is the application of law during medical practice (the legal responsibilities of a doctor).

Forensic medicine : Application of medicine during law.

## National Medical Commission(NMC)

00:02:25

MCI act was implemented in 1956 (now known as NMC).

Functions :

medical education.

maintaining registration of doctors.

Foreign medical graduates' (FMG) examination.

The NMC has 3 schedules :

- Schedule 1 : Indian medical graduates.
- Schedule 2 : Foreign medical Graduates..
- Schedule 3 :
  - Sub-clause 1 : Indian medical graduates not included in schedule 1.
  - Sub-clause 2 : FMGs not included in schedule 2.

medical ethics	medical etiquette
moral principles of a doctor towards everyone.	Professional courtesy among doctors, towards each other.
Decided by MCI.	Not punishable.
Self-imposed.	
Punishable	

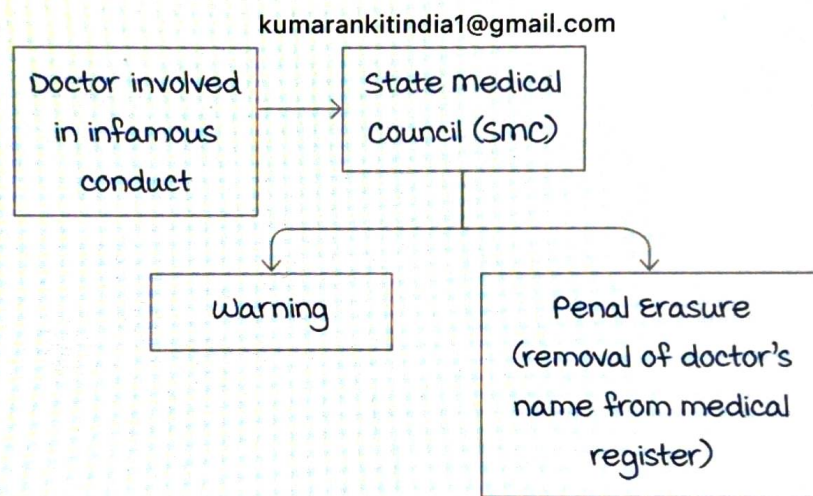
Infamous conduct :

Serious professional misconduct by a doctor. It includes [ankitindia1@gmail.com](mailto:ankitindia1@gmail.com)

- Alcoholism.
- Addiction.
- Adultery.
- Criminal Abortion.



- Advertisement (fake degrees).
- Association (giving/taking commission).
- Bribe.
- Covering (taking help from a non-medico in a medical procedure).
- Dichotomy (fee splitting, giving commission to medical representatives, pharmaceuticals).
- Active Euthanasia.
- False certificates (punishable under 197 IPC).
- Disclosing confidential patient information.
- Accepting Gifts from patients.
- Religious discrimination.



Penal erasure also called professional death sentence.

Penal erasure confirmed by MCI.

Appeal can be made at health ministry.

### Professional secrecy

00:22:22

Doctor should not disclose confidential patient information

Exceptions : Known as Privileged communication include :

(mnemonic → CIVIC SIN)

- Criminal case : In case of gunshot injuries/stabbing, Inform police/magistrate → 39 CrPC.
- Infectious disease : Inform relatives.
- Venereal disease (STD) : Inform partner.

- Interest of patient : Suicidal tendency in a psychotic patient should be informed to the relatives.
- Court of law.
- Servant/employees with disease endangering the life of others should be informed to the employer.  
(E.g., color-blindness in a train driver should be reported to the railway department).
- Interest of self (consent required to use patient's name in newspaper/publications).
- Negligence by doctor : Inform patient/relatives.
- Notifiable diseases (TB/cholera/plague) : Inform health department.

### Medical negligence/malpraxis

00:33:10

Omission : Failure to do the right thing.

E.g. Administration of fluid not done in dehydration/ TT injection not administered in injury.

Commission : Done the wrong thing, leading to damage.

E.g. Forgotten instrument/swab in the body during surgery.

Civil and criminal negligence :

Civil negligence	Criminal negligence
Also known as <b>tort</b> . Lack of care/skill causing mild damage.	Gross negligence/willful negligence causing gross damage/death.
monetary compensation only.	monetary compensation + 304a IPC.
Burden of proof <b>on the patient</b> .	Burden of proof <b>on doctor</b> .
E.g.- wrong drugs/dose/prescription.	E.g.- Forgotten swab in body during surgery/ amputation of wrong limb.

Active space



**RES-IPSA loquitur:**

- Facts sufficient to prove negligence of doctor.
- Any things/facts which speak for itself.
- Eg. Wrong dose in prescription card, presence of swab in the patient's body following surgery.
- Can be a proof of civil and criminal negligence.

**Novus actus interveniens :**

New intervening act leading to damage/loss/death.

Eg. A patient of RTA after admission dies of septicemia/drug allergy/fluid overload.

**4Ds to prove negligence :**

- **Duty** : Prove doctor was on duty.
- **Dereliction** : Duty done wrong.
- **Damage**.
- **Direct causation** : Eg Nerve injury occurred after

Eg : Doctor gave IM injection to a patient (duty), but gave injection at wrong site (dereliction). Patient develops nerve injury (damage) after the IM injection (direct causation).

**Defence available for doctor :**

- Doctor not on duty at the time of negligence.
- Written informed consent obtained from the patient  
Eg in case of known surgical complication.
- Error of judgement.
- Time limitation : Case should be filed **within 2 years of damage (Res indicata)**.
- **Res judicata** : Question of negligence case once decided by the court, cannot be refiled in the same court. Can be used in civil cases only.
- **Contributory negligence** : Negligence contributed by doctor and patient.

Eg. Doctor prescribed wrong drug + patient does not follow up.

Can be used in civil cases only.



Partial defense only.

Burden of proof on doctor.

Exceptions of contributory negligence :

**Last clear chance doctrine** : If the doctor misses the last chance to communicate about the complications that could cause damage to the patient, the patient doesn't follow up and later develops a complication; doctor is more responsible.

E.g Failed to inform patient about dressing.

**Avoidable consequence doctrine** : Even after providing information, patient did not follow instructions from the doctor.

Patient is more responsible.

- Therapeutic/diagnostic/experimental misadventure :

Any accidental/unintentional complication/mischance event during treatment, diagnosis or experiment.

Civil + Criminal defense.

Burden of proof on doctor.

**Medical-maloccurrence** :

Adverse effect/damage to the patient despite good medical attention or care.

E.g : Accidental damage to ureter in hysterectomy.

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Active space

## MEDICAL JURISPRUDENCE : PART 2

### Vicarious liability

00:00:15

Respondent superior.

For e.g. :

If a doctor (employee) working under the scope/power of a hospital (employer) commits an act of negligence, the liability falls on the hospital under whom they work.

The hospital is answerable for their actions as well as the doctor's actions.

- The doctor is not working independently, but under them.
- The answerability for the negligence falls back to the doctor if the hospital clears themselves from their role in the negligence.

Let master answer.

Borrowed servant doctrine :

The person answerable for the negligence from a borrowed servant, is the person who borrowed the person.

For e.g. :

If the medicine department HOD borrows a resident from the surgery department, to handle shortage of staff, a negligent act by the surgical resident is answerable by the HOD and not the resident.

### Euthanasia

00:05:09

Also known as mercy killing.

Giving a painless death to a person suffering from an incurable terminal disease.

Active euthanasia	Passive euthanasia
<p>Inducing death in a person with the help of <b>drugs</b>.</p> <p>Drugs used :</p> <ul style="list-style-type: none"> <li>• Phenobarbitone (most common).</li> <li>• Thiopentone sodium.</li> <li>• K<sup>+</sup> compounds.</li> <li>• Opium.</li> <li>• Insulin.</li> </ul>	<p>Inducing death in a person by <b>removing the life supporting mechanisms</b> like ICU care, ventilators.</p> <ul style="list-style-type: none"> <li>• Only form of euthanasia <b>approved in India</b>.</li> <li>• Need permission from the Supreme court to conduct it.</li> <li>• <b>1<sup>st</sup> country</b> to introduce : <b>Netherlands</b>.</li> <li>• Other countries : Belgium, Sweden, Thailand, Luxembourg.</li> </ul>

voluntary euthanasia is not legalized in India.

## Consent

00:09:21

Part of **Indian contract act of 1872**.

Contract between the doctor and patient.

Types of consent :

Expressed consent.

Consent expressed either **verbally, or in writing**.

Implied consent :

**No verbal or written form** of consent given.

**Implied agreement to the procedure**

For e.g :

- Patient reporting to the OPD and measurement of BP. The measurement of BP is implied consent.
- Female patient going to male gynecologist chamber implies that she consents to the pelvic examination by a male gynecologist.



**Substituted consent :**

When consent is given by someone else, in place of the concerned person, like parents, relatives, friends or police.

**Informed consent :**

Written informed consent is the best form of consent, where patient tells everything to doctor & doctor explains everything about the procedure to the patient.

**Open/blind/blanket consent :**

Not valid in India.

Valid in countries like USA.

Consent for multiple procedures taken in a single consent form.

e.g.: If patient gives open consent on admission, it is taken that the patient is ready to undergo all/ any procedure that can take place in the hospital.

The doctor operating for cholecystectomy, can remove another diseased organ, found while doing cholecystectomy, under the blanket consent.

**Laws related to consent**

00:17:48

351 IPC : Examination of a patient without consent is considered an assault.

53 CrPC : In the examination of an accused or convicted person, the doctor can apply reasonable force.

54 CrPC : An accused can request for examination/ re-examination.

Consent required from both husband and wife for artificial insemination.

Consent from the mother taken in case of MTP (mother > 18 years of age).

In loco parentis :

Consent given by warden/police/guardian when parents of a minor (< 18 years) is not present.

87 IPC : Anyone  $\geq 18$  years of age can give consent to suffer any harm.

Can give consent for surgery if the person is above 18 years of age.

89 IPC : Consent given by parents or guardians valid for children  $< 12$  years of age.

90 IPC : Consent not valid, if given by a child  $< 12$  years, an insane person, a person who gave it in fear, or if given in misunderstanding.

Someone  $\geq 12$  years can give consent for general physical examination.

92 IPC : In case of a life threatening condition like a road traffic accident, the doctor can start the treatment without written consent, when the patient is unconscious and no responsible adult is present to give consent.

If patient is stable but unconscious, wait for him to be conscious to start treatment (non life threatening).

### Medical records

00:27:29

Indoor patient records must be maintained for 3 years.

Routine cases records must be maintained for 6 years after completing treatment.

In case of patient's death, records must be maintained for 3 years after death.

medicolegal documents should be maintained for 10 years.

### Negligence

00:29:10

Elements of negligence : 4D

1. **Duty** : Existence of duty of care by the doctor.
2. **Dereliction** : Failure on the part of the doctor to maintain applicable standard of care and skill.
3. **Direct causation** : Failure to exercise a duty of care must lead to damage.
4. **Damage** : which a reasonable physician can anticipate.

Doctrine of res ipsa loquitur :

The **thing or fact speaks for itself.**

Applied in both **civil and criminal cases.**

Sufficient to prove negligence.

Calculated risk doctrine :

The injury reported about is a type that may occur **despite reasonable care** has been taken.

Important defense for any doctor.

Doctrine of common knowledge :

Patient must prove the **act of omission.**

E.g.: Failure to give fluids in case of dehydration.

Failure to give TT injection following injury.

Bolam test :

If a doctor has acted according to **proper and accepted practice**, he is **not guilty** of medical negligence.

Practice that is accepted universally.

Bolitho test :

Legal test.

**Defense and its body of opinion must be reasonable and responsible.**

Composite negligence :

Injury due to negligent act of **more than one person.**

Therapeutic misadventure :

Injured or died due to some **unintentional act** by the doctor or agent of the doctor or hospital.

Corporate negligence :

Typically applied in cases involving **hospitals and their staff physicians.**

Product liability :

Any surgical or medical **injury or damage**, the **liability** goes to the **manufacturer** of the instrument.



# MECHANICAL INJURIES

Injury produced by mechanical trauma, force or pressure.

## Types of mechanical injuries

00:00:40

### 1. Abrasion :

Also called **gravel rash**.

Superficial destruction of epidermis.

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**Corneal abrasion** : Only abrasion which is **grievous injury**.

Types of abrasions :

1. **Scratch abrasion** (linear) : Nail or thorn.
2. **Grazed abrasion** (sliding on a rough surface) : Friction.  
(Road traffic accident/RTA → Bike slide).

m/c abrasion in RTA.

AKA Brush burn (burning sensation present).

Epidermis heap up at the ends.

- Direction of force can be determined.



Scratch abrasion



Grazed abrasion



### 3. Patterned abrasion → Form object pattern :

- a. **Pressure abrasion** (crushing abrasion) : Crushes skin at  $90^\circ$  + **Contusion** (ligature mark in cases of hanging/strangulation or a bite mark).

b. **Impact abrasion** (imprint/contact abrasions) : Impact by **rough moving object** (tyre mark by a rough moving vehicle).



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Pressure abrasion



Tyre mark (imprint abrasions)

Aging of abrasion :

Abrasion → Scab : Dry blood/lymph (bright red) in **12 hours**.

Brown color in **2-3 days**.

Dark brown to black color in **4-5 days**. Epithelial covering seen under it.

Scab falls after **7 days**.

Antemortem vs Postmortem abrasion :

Post mortem abrasion	Antemortem abrasion
<p>Inflicted while <b>transporting the body</b>.</p> <p><b>Yellow</b> in colour.</p> <p>Seen over <b>bony prominences</b>.</p> <p><b>Vital reaction and enzymatic reactions are absent.</b></p> <p>Serous fluid/ exudate is <b>less</b>.</p>	<p>Blisters.</p> <p>Vital reaction and enzymatic reactions :</p> <ul style="list-style-type: none"> <li>• Positive in periphery.</li> <li>• Negative at the center.</li> </ul>

## Contusion

00:14:46

Also called **bruise**.

Can be on skin, internal organs.

Force responsible : **Blunt force**.

Blunt force → Injury to **dermis** and **subcutaneous layers** →  
 Blood vessels **rupture** → Clotted blood (hematoma) →  
 Impregnated in tissues → Swelling → **Contusion**  
 margins : **Ill-defined/irregular.**



Contusion

Well visible contusion seen in :

- Face, vulva, scrotum, any skin which is thin.
- In children, females, old people.

Less visible in : **Thick skin** (palm, sole), abdomen.

Contusion can be produced by stomping  
 (Jumping + Kicking).

Has color changes : Start from **periphery** (first) → **Center**  
 (due to hemoglobin changes).

- Subconjunctival ecchymoses, meningeal hemorrhages  
 → **Color changes not seen** ( $O_2$  supply compromised).
- Color changes :

Mnemonic → **R-VIBGYOR.**

**Red** (1-2 hours) : **Hemoglobin** (fresh color).

**Violet/blue** (3 hours - 3 days) : **Deoxyhemoglobin.**

**Brown color** (4<sup>th</sup> day) : **Hemosiderin.**

**Green color** (5<sup>th</sup> day) : **Hemosiderin** → **Hematoidin.**

**Yellow color** (7-13<sup>th</sup> day) : **Hematoidin** → **Bilirubin.**

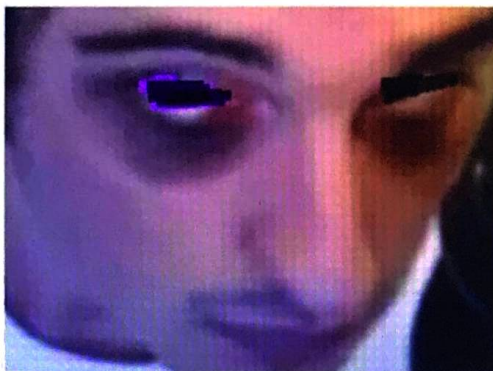
**OR**iginal color (in 2 weeks).



Ectopic bruise :

AKA migratory bruise.

Impact & bruise are on different sites.



Raccoon sign



Battle sign

Example :

- Anterior cranial fossa fracture → Bruise surrounding eye / Peri-ocular bruise : Black eye/ raccoon's eye.
- Middle cranial fossa fracture → Bruise at mastoid tip (Battle sign).

Patterned bruise :

- Hit with a rod/lathi → Tramline bruise/railway line bruise.
- Battered baby syndrome (BBS) : Pinch mark on baby's skin → Butterfly bruise.
- Throttling → Constriction of neck by hand → Pressure by finger tips → Six penny bruise (coin shaped).



Tramline bruises

Delayed bruises :

Ruptured blood vessels → **Percolation** → Delayed bruise.

AKA come out bruise.

Can be identified by **infrared photography**.

Bruise visible after some time after injury.

Artificial bruise :

Rubbing some **irritant substances** like plant products :

mnemonic → **PSM**.

- **Plumbago** plant.
- **Semicarpus anacardium** plant.
- **madar** (akar/calotropis).

In **accessible parts** of body.

**Well-defined/Regular margin** with irregular shape.

Over the margin : **Blister, itching, chemical reaction** may be present.

Single color → **Brown** (no color changes).

	Bruise	Post mortem stain
Site	<b>Any part</b> of the body	Dependent part
Skin	<b>Elevated</b> due to swelling	Flat
margins	<b>Ill-defined</b>	well defined
Location	Seen at <b>pressure points</b>	Not seen at pressure areas
Incision test	Blood is <b>not</b> washed away	Blood is washed away

**Incision test** is used to differentiate between bruise & postmortem staining.

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The area is incised and water is gently poured.

Bruise : **Clotted blood** in bruise → Blood not washed away.

Post mortem staining : **Blood in blood vessels** → Blood washed out.

## Laceration

00:39:26

Caused by heavy blunt force (heavy stone/instruments).

3-dimensional injury : Length, width and depth present for the injury.

Involves epidermis, dermis and subcutaneous tissue.

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Margins : Irregular.

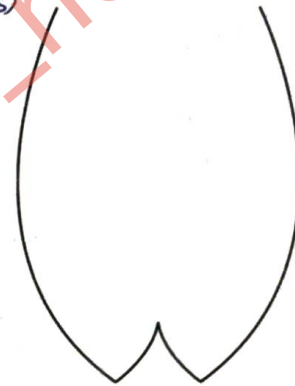
Confirmation of injury by magnifying lens :

Crushed tissue fibers (tissue bridges)  
and crushed hair bulb seen.

End of laceration : Swallow tail  
(splitting and divergence).

Direction of force :  
towards convexity.

Bleeding comparatively  
low as it is a crush injury.



Swallow tail

Types of laceration :

1. Tear : E.g door handle impact.
2. Stretch : Tangential force (run-over vehicle → stretching of skin).
3. Avulsion :

AKA shearing laceration.

RTA/any accident → Hits at acute angle → detachment/separation of skin /surface → Avulsion.

- Flaying : Skin detached, but attached with a margin.
- Degloving : Skin detached like gloves taken off.



Avulsion



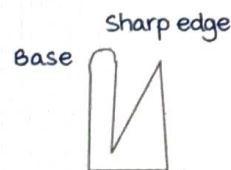
Chop wound



## 4. Cut laceration :



- AKA **Chop wound** (axe, chopper, hatchet).
- **Sharp edge with heavy base.**  
Heavy base → Laceration.  
Sharp edge → Cut.
- Depth is more at the lower end.
- **Gaping** of wound seen.
- margins → Sharp margins (clean cut).
- Base → Crushed tissue & cut tissue.



## 5. Split laceration :



Split laceration

- **Hard weapon/object** (stone) impacts on **hard surface** (skull).
- Sites : Scalp, forehead, eye brow, chin, iliac crest, perineum, shin.
- Skin thickness is minimum.
- margins : **Regular and clean cut.**
- AKA **Incised looking laceration.**
- But on magnifying lens, crushed tissue & crushed hair bulb can be seen → Differentiate from incision.

## Incision

00:56:14

Cut injury caused by sharp edged weapon (knife, blade, scissors).

When sharp edged weapon is stroked parallel to any surface.

maximum dimension : Length.

Tailing :

- Starting point : Depth is more.
- End point : Depth is less.

Tailing decides the direction of weapon.



Incised wound (with tailing)

Age of incision :

- If fibroblasts seen in incision : 48-72 hours.
- If collagen fibers seen : 3-5 days.
- Scar : 1-2 weeks.
- Endothelial cell appearance : 24 hours.
- Capillary network : 36 hours.



Self inflicted incised wound

margins : Clean cut, sharp and regular.

Confirmation :

- magnifying glass : Cut tissue & hair bulb.
- Exception :

Incised wound at axilla and scrotum have lacerated appearance → Laceration looking incision.

Types :

1. Homicidal : Incised wounds on genitalia.
2. Suicidal/tentative/trial/hesitation cut : multiple superficial incised wounds on wrist/ forearm.
3. unintentional cut (mistake) e.g. razor blade on finger.

## Stab

01:09:43

Stab or puncture wound :

Sword/knife hit **perpendicular** to the skin surface.

maximum dimension : **Depth**.



Stab (puncture wound)

- Puncture wound : Stab injury of **skin** and **soft tissues**.
- Penetrating injury : Stab injury **into body cavity**.
- Perforating injury : Stab injury that **goes through and through**.

Length of the injury < width of the weapon.

When weapon is released → **Contraction** of skin due to fibrosis → Length of injury decreased.

Shape :

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Line of Langer (cleavage lines) : According to **pattern of collagen fibers** of dermis or **underlying muscle fibers**.

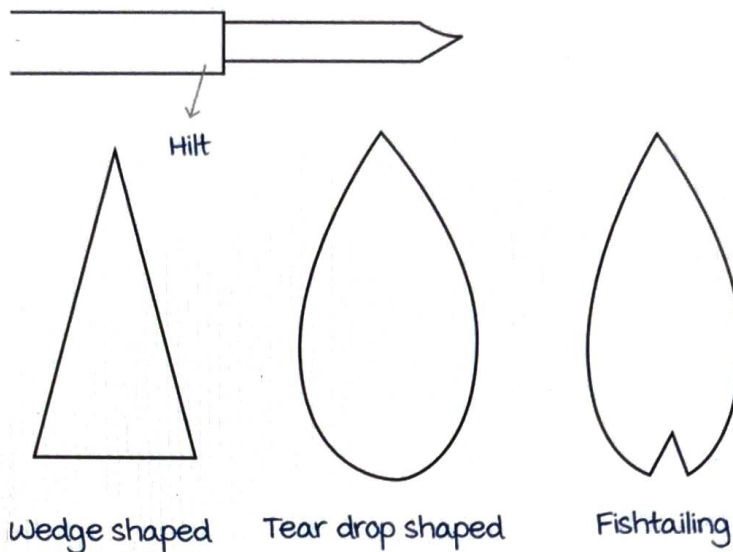
If the stab is parallel to the lines of Langer → No splitting.

If the stab is **perpendicular** to the lines of Langer → **Splitting/gaping**.

Depends also on weapon's edge (sharp/blunt) :

Both edges sharp → **Spindle shaped wound**





One edge sharp :

- Wedge shaped (blunt edge) wound.
- Tear drop shaped.
- Splitting on blunt side (fish-tailing).

Hilt produces : Hilt abrasion, hilt contusion, hilt laceration →  
Stab wound has irregular margins.

Suicidal method in Japan : **Hara-kiri/seppuku**  
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- Sword to abdomen.
- Cause of death : Evisceration → **Cardiac collapse**.

Concealed punctured wound : Nostrils, ear, vagina, anal region, nape of the neck.

Concealed puncture wounds at nape of neck : **Pithing**.

Multiple brutal stab injuries : Over-killing.

Defense wounds :

Sustained while **defending oneself**.

Sites : **Extensor surface of forearms**, wrist, knuckles, inner aspect of forearm.

Fabricated/forced wounds :

Self-inflicted wounds → **Hitting oneself**.

Self-suffered wounds → **Someone else hits you with your consent**.

# THERMAL INJURIES

## Hypothermia

00:00:13

Hypothermia is when temperature of the body is  $< 35^{\circ}\text{C}$ , which may be due to :

- moist cold : At 5 to 8 C.

Produces a condition known as Trench foot (Immersion foot).

- Dry cold : At  $-2.5^{\circ}\text{C}$ .

Produces a condition known as frostbite.

MC affected areas in frost bite : Nose > ears, fingers, face.

Skin changes from red to black in around 2 weeks.

Digital gangrene are an important finding.

Treatment : Rewarming ( $42$  to  $44^{\circ}\text{C}$ ).



Trenchfoot



Frost bite

Postmortem findings in hypothermia :

1. Color of the postmortem staining is bright pink.
2. Fat necrosis of the pancreas (seen only in 50% cases).
3. Lipid depletion in adrenal gland.
4. Stomach mucosa shows black colored necrosed spots : Wischnewski spot.

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Three phenomena can be seen in hypothermic deaths :

- Erythema pernio :  
Red colored erythema which occurs due to inflammation.  
It is A.K.A chill blains.
- Paradoxical undressing :  
Due to cutaneous vasodilation and shifting of the core blood to the cutaneous vessels which leads to the feeling of warmth and removal of clothes by the person.  
Removal of clothes before a hypothermic death appears like the death has occurred due to murder or a sexual assault.
- Hide and die phenomena :  
It is due to mental disorientation/confusion which makes the person to hide themselves in some corner areas like cupboard or almirahs etc.  
This leads to the appearance of death due to murder and robbery.

## Hyperthermia

00:10:33

Hyperthermia is when body temperature increases.  
Sweating is activated in hyperthermia as a protective mechanism.

Types of hyperthermia :

Heat cramps/fireman cramps/miner's cramps :

muscle cramps due to excessive sweating.  
Loss of water and electrolytes from the body.

Heat stroke/sun stroke/thermic fever/heat hyperpyrexia :

Precipitating factors :

1. Working in sunlight.
2. Humid weather.
3. Infection.
4. Increased muscle activity.

This leads to increase in body temperature and sweating



mechanism is activated.

When the body temperature exceeds  $41^{\circ}\text{C}$ , sweating mechanism fails and the person goes into heat stroke.

Symptoms :

- Dry and hot skin.
- Constriction of pupil.
- Disorientation/delirium.

**Heat stroke** is the MC type of hyperthermia.



Postmortem finding : Edema and reduction of Purkinje fibers of cerebellum.

### Burn vs scald

00:18:28

Burn	Scald
Due to dry heat. Example : Flame.	Due to moist heat. Application of liquid/steam of temperature $> 60^{\circ}\text{C}$ . Full thickness scald occurs if temperature is $> 70^{\circ}\text{C}$ .
Blisters are present only over the edges of the affected area.	Blisters are present all over the affected area.
Burnt clothes may be found.	Wet clothes are seen. Wet clothes will worsen the scald.
Thick scar.	Thin scar.
Burns are at/above the level of the flame.	Blisters are at/below the level (due to splashing).
Soddening and bleaching of skin is absent.	Soddening (thick moist skin) and bleaching (color changes in skin) of the skin is present.
Line of redness is present.	Line of redness is present.

Active space

Blackening and singeing of the hair is present.	Burning/singeing is absent.
Soot particles are present inside the trachea (increase CO levels in blood).	Soot particles are absent.
	

Burn from a corrosive :

- An ulcerated patch with no blisters.
- Line of redness is absent.
- Blackening and singeing are absent.

## Burn

00:28:07

Minimum temperature required to produce burn is  $44^{\circ}\text{C}$ .

Neck lacing : A homicidal method, in South Africa, where a tyre is used to produce burn around the neck.

Classification of burn : Given by Dupuytren (six parts) and Wilson (3 parts).

Wilson's classification of burns : 60c6b3eeaa8ded0e4e7e5ea7

- $1^{\circ}$  : Epidermal burn.  
Erythema, blisters are present.  
Painful burns.  
No scars.  
Includes  $1^{\circ}$  and  $2^{\circ}$  of Dupuytren's classification.
- $2^{\circ}$  : Dermo-epidermal burn.  
most painful type of burns.  
Scars are present.

Includes 3° and 4° of Dupuytren's classification

- 3° : Deep burn.

**Relatively painless** → Since the nerve endings which transmit pain are lost due to 3° burns.

Includes 5° and 6° of Dupuytren's classification

most common cause of death in acute burns : **Neurogenic shock**.

most common overall cause of death in burns : **Hypovolemic shock**.

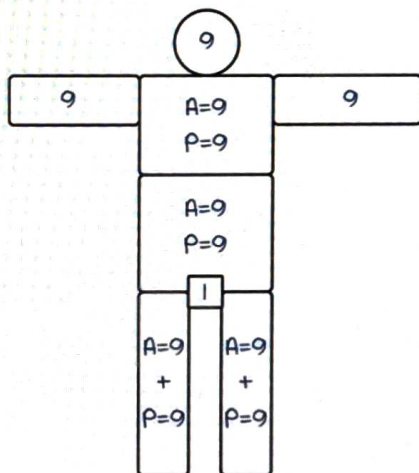
Other causes of death in burns : Renal failure, septicemic shock.

Calculation of Body surface area (BSA) in burnt cases :

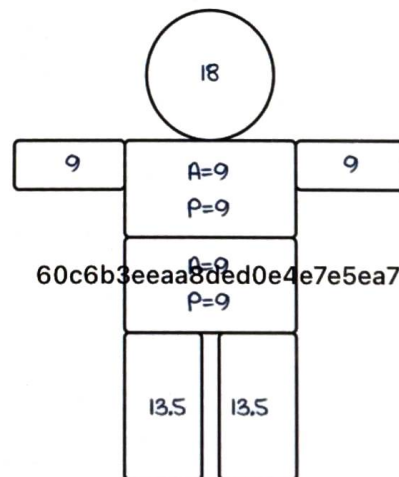
**Rule of palm** : 1 % BSA is covered by palm.

**Wallace rule/rule of 9** : 11 areas × 9% = 99 % and 1% for genitalia.

**Lund and Browder chart** : For children of 1 to 5 years of age.



Wallace rule of 9



Lund and Browder chart

If 33% BSA is burnt, it is considered as a **grievous hurt**.

If 50 % BSA is burnt (even if it's a 1° burn), it is considered as a **fatal burn**.



## Antemortem burn vs Postmortem burn

00:41:06

	Antemortem burn (Before death)	Postmortem burn (After death)
Line of redness	Present.	Absent.
Vital reaction	Present.	Absent.
Enzymatic reaction (positive enzymatic reaction in the peripheral part and negative enzymatic reaction in the central part)	Present (includes both positive and negative positive enzymatic reaction).	Absent.
Blister	Present.	Present.
Composition of blister	Albumin + Chloride (exudate).	Air + thin fluid.
Cyanide level in blood (flame)	Increased.	Absent.
CO level in blood (Smoke)	Increased.	Normal (no inhalation).
Smoke (carbon particles/soot particles)	Present in trachea (most characteristic finding).	Absent.

Non specific findings in burn cases :

- Pugilistic attitude/defense attitude/boxing attitude/fencing attitude :

Contraction/shrinkage of the body due to coagulation of muscle proteins.

It can be seen in antemortem /postmortem burn.



Pugilistic attitude

- **Heat rupture :**

Rupture of skin on the extensor surfaces/ joints of the body.

Due to drying and splitting of the skin.

This appears like incised wound/lacerated wound.

Blood vessels, nerves and lymphatics are intact near the area of the split.



Heat rupture

- **Heat hematoma :**

It is the hematoma of brain due to heat.

It is of extradural/epidural type.

Chocolate-brown in color.

It shows honeycomb appearance.

- **Thermal fracture/heat fracture :**

Splitting of bones due to dryness.

It is seen mostly in skull bone.

They don't involve suture line but they may cross suture line.

- **Puppet organ :** Shrinkage of the internal organs due to dryness.

- **Street Avenue fracture :** These are the fractures

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Active space



of the long bones which are perpendicular to each other.

## Electrocution

00:56:20

The most resistant structure of the body : **Bone** > skin.

most common cause of death : **ventricular fibrillation**.

Judicial electrocution (in few states of USA).

**AC** (Alternate current) is 4 to 5 times more dangerous than

**DC** (Direct current) because it causes tetanoid contraction.

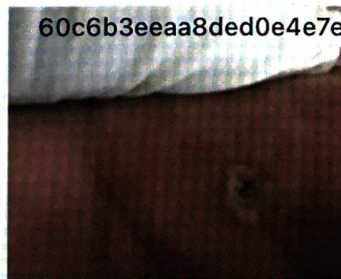
For the metal, which was present inside the skin :

**Acro-reaction test** is done.

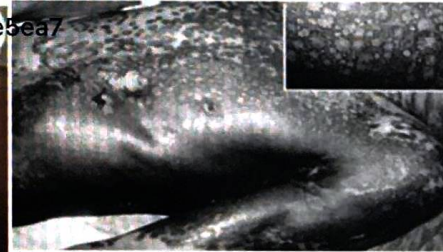
most important parameter for fatality : **Ampere** > voltage.

In electrocution, there are three types of mechanisms :

- Firm contact with low voltage :  
Produces an entry burn/endogenous burn known as **Joule burn**.  
It is round to oval shape, pale, with blanching seen.
- Loose contact with high voltage :  
Produces **crocodile burn**.
- Loose contact with air gap :  
**Flash burn/spark burn**.



Joule burn



Crocodile burn

Postmortem findings in electrocution :

Rigor mortis comes **early**.

Petechial hemorrhages are present in the muscles/body.

**Pit like defect** of hair (due to arching of the current).

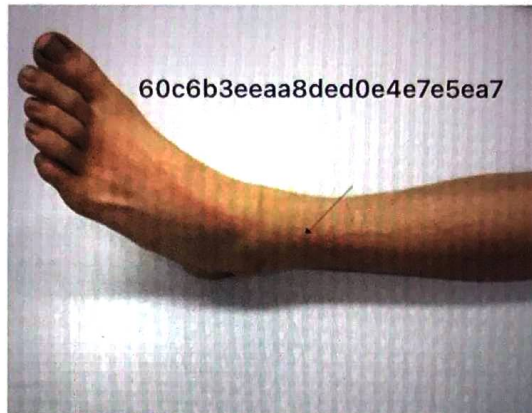
The molten metal from the wire which goes deep in the tissues, is known as **current pearl**.

The molten  $\text{Ca}^{2+}$  and  $\text{PO}_4^{3-}$  deposited in the bone is known as **bone pearl/wax dripping**.



## Lightening

01:06:44



Lightening injury

Electric discharge from the clouds. (mnemonic : FAL)

Filigree burn.

Arborescent burn.

Lichtenberg flower petal burn.

Keraunographic burn.

MC area affected : **Shoulder flanks** > skin creases > long axis of the body.

The injuries will disappear in 24 hours if a person survives a lightening.

Lightening injury has a **branching tree pattern** which occurs due to **denaturation of erythrocytes** and the **staining by hemoglobin**.

These branching patterns do not correspond to the vascular channels.

mechanism of lightening injury :

- Super heated air.
- Air compression :

Seen behind the lightening injury.

This effect is known as **sledgehammer effect** which was given by Spencer.

Active space

# REGIONAL INJURY

## Skull fracture

00:00:20

Skull has inner table and outer table.

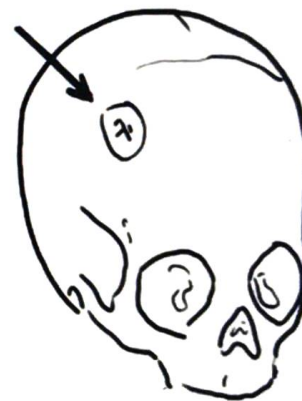
Thickness of outer table is 2 times that of inner table.

most common bone to fracture in skull → Temporal bone  
(thickness : 4 mm).

Occipital bone → 15 mm

Parietal/ frontal bone → 6 -10 mm.

Linear fracture



Depressed fracture

Types of skull fracture :

Linear fracture :

most common type.

Also known as fissured fracture.

Depressed fracture :

2<sup>nd</sup> most common type.

Also known as signature fracture/fracture a la signature.

Caused by heavy weapon like hammer.

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Even though the weapon might be heavy, the striking surface will be small → leaving a signature depression on the skull surface.

Diploic veins of outer table and inner table will be injured.

Pond fracture :

Also known as **indented fracture/ping-pong fracture**.

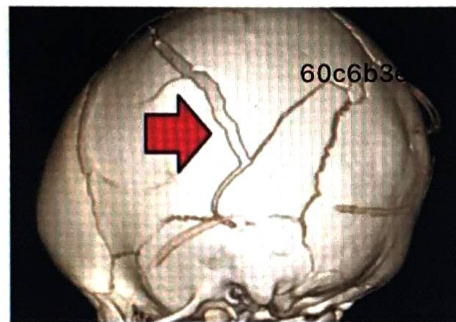
usually seen in **infants skull** → Bones are **elastic**.

Commonly seen in delivery done with **obstetric forceps**.

Diastatic fracture :

If **sutural separation** is seen due to fracture.

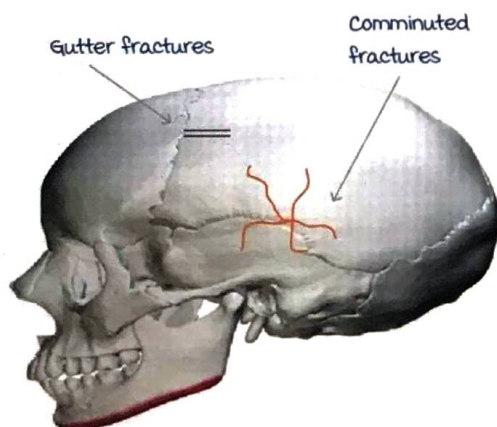
Commonly seen in **young adults (age < 30 years)**.



Diastatic fractures

Gutter fracture :

Caused by a **tangential/oblique (glancing) bullet**.





Comminuted fractures :

multiple blows (heavy) at a single time.

Also known as spider-web fractures.

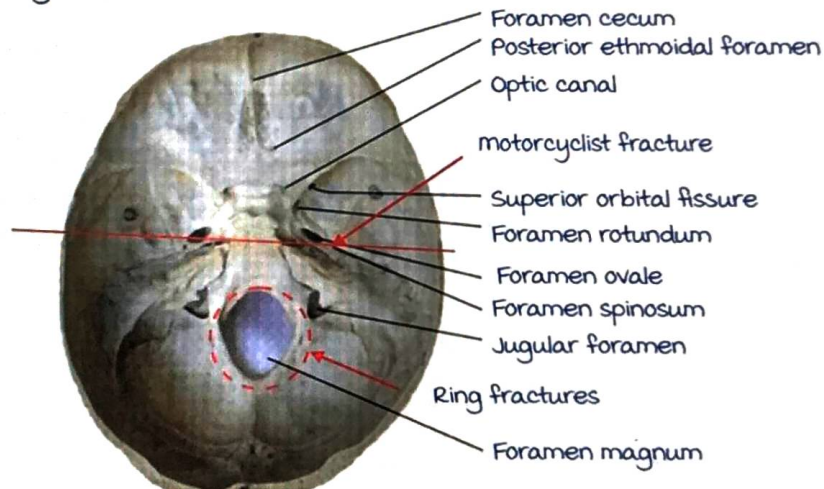
Starting from a single point and radiating to many directions.

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Base of skull fractures

Ring fracture :



Seen in posterior cranial fossa.

The fracture line surrounds foramen magnum.

Commonly seen in falls on their feet, from height (> 5 storeys).

Calcaneal fractures → most common fractures in fall from height.

Fall from height → Transmission of force of fall via spinal column → Pressure of cervical vertebra onto foramen magnum → Ring fracture of the skull.

motorcyclist fracture :

Fracture of the base of skull, commonly seen in middle cranial fossa.

The fracture line goes from **one petrous part to another** passing **through sellaturcica**.

It is a **hinge type I fracture** → Showing **nodding face sign**.

### Coup & counter coup injury

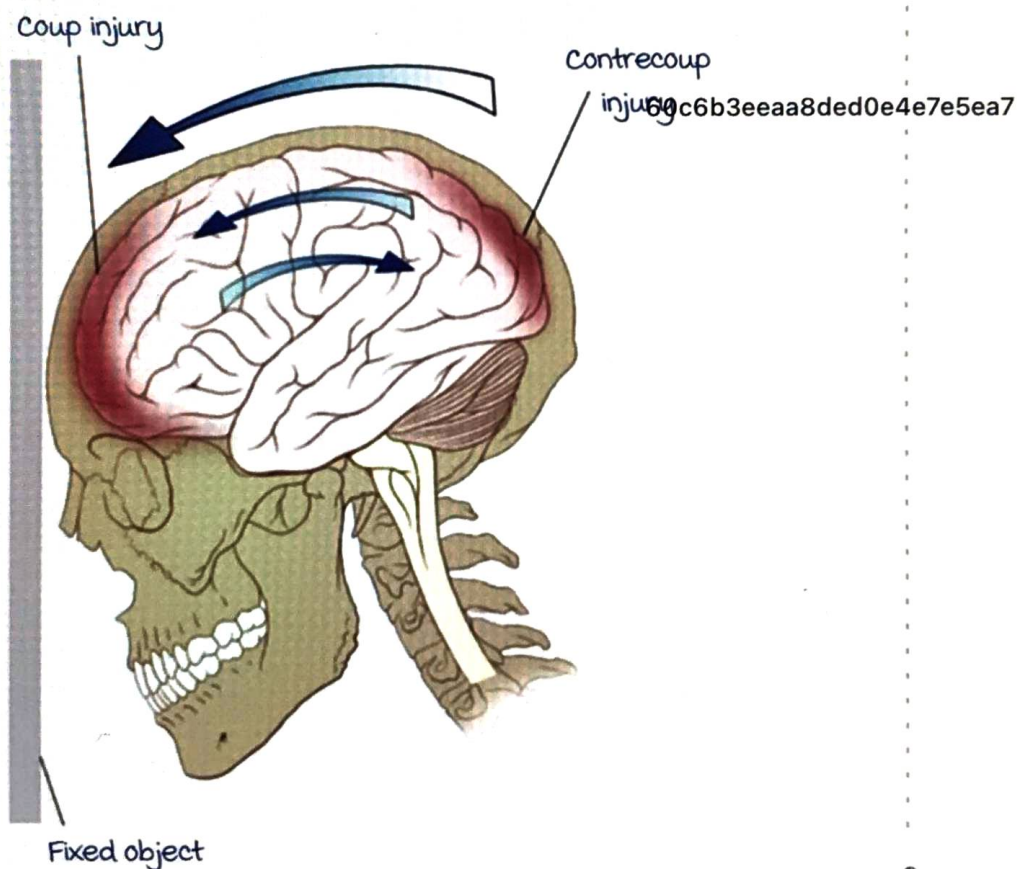
00:15:54

Commonly seen in **brain**, usually produced when **head/skull** is **mobile**.

Injury **at site** of impact → **Coup injury**.

Injury **at the opposite site** of impact → **Counter coup injury**.

mechanism of action → **Shearing strain theory**.



Common site of counter coup injury production :

- **Frontal region** is m/c site.
- **Temporal region**.

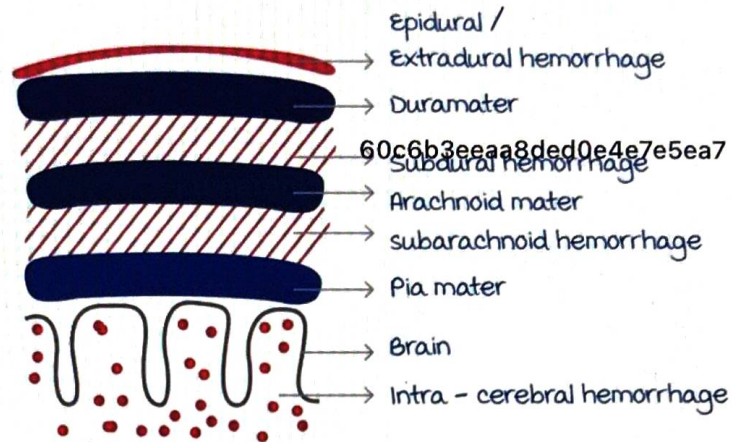
These injuries occur due to **irregular inner surface**.



The occipital fall will cause the coup injury → Frontal region will have counter coup injury.

### Intracranial haemorrhages

00:19:43



m/c traumatic intracranial haemorrhage → Subarachnoid haemorrhage (SAH).

m/c non-traumatic intracranial haemorrhage → Intracerebral haemorrhage (ICH).

Epidural/extradural haemorrhage (EDH) :

Rupture of middle meningeal artery in case of trauma to temporal region.

Exclusively traumatic injury above duramater.

mostly occurs as coup injury.

100 ml of EDH → Fatal.

Shape : Bi-lenticular (lens)/bi-convex shaped.

In burns cases, heat hematoma appears like EDH.

Lucid interval is seen in EDH.

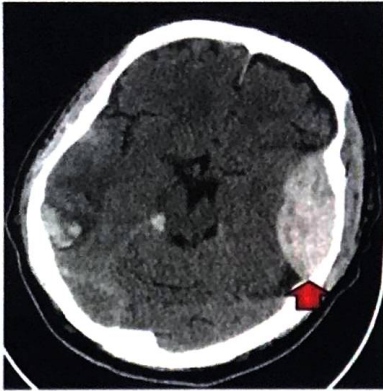
The period of consciousness between 2 periods of unconsciousness is known as lucid interval.

The patient can write their will or provide evidence during the lucid interval.

The patient will be held responsible for any crime committed during the lucid interval.

A doctor can be charged for medical negligence if the doctor fails to diagnose the lucid interval and the patient dies after becoming unconscious again under 304A IPC.





EDH

Subdural hematoma/haemorrhage (SDH) :

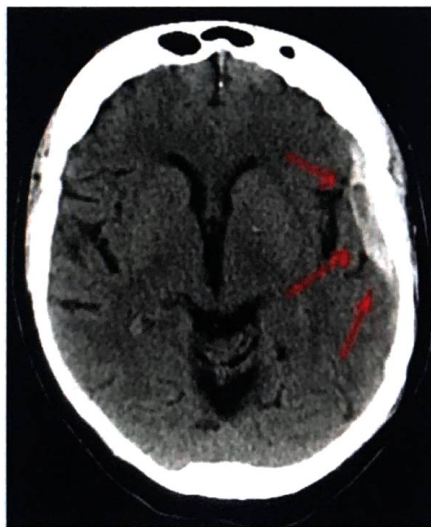
Shape : *Sickle/banana shaped* or *concavo-convex shaped*.

It occurs due to *rupture of bridging veins*, commonly seen

in :

- Alcoholism.
- Boxing injuries.
- Shaken/Battered baby syndrome/infantile whiplash syndrome.
- Old age (even minor trauma can cause SDH).

100-150 ml of SDH → Fatal.



SDH

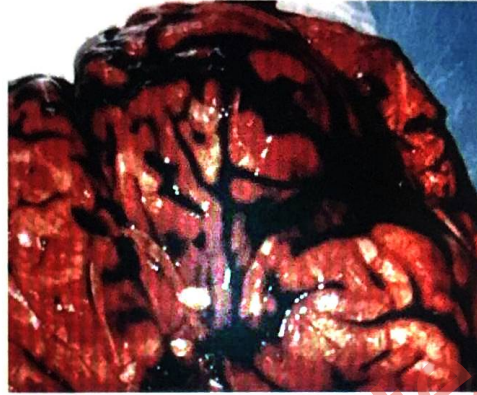
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Further classification :

- Acute : Diagnosed *immediately*.
  - Subacute : Diagnosed within *hours-days/weeks*.
  - Chronic : Diagnosed after *months*.
- Can be a finding of *punch drunk syndrome*.

Active space

## Subarachnoid haemorrhage/SAH :



SAH

most common traumatic intracranial haemorrhage is SAH.

most common cause of SAH is trauma.

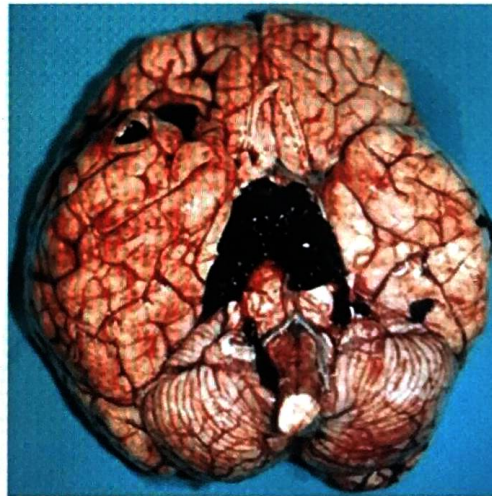
Non-traumatic spontaneous cause is rupture of saccular Berry aneurysm.

Thunderclap headache is present.

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Occurs mainly due to rupture of anterior communicating artery.

## Intracerebral hemorrhage/ICH :



ICH

most common cause of non-traumatic intracranial bleed.

most common cause of ICH is hypertension.

most common site is putamen.

Occurs mainly due to rupture of lenticulostriate branch of middle cerebral artery.

m/c cerebral injury after trauma → Cerebral contusions.

## Inside a vehicle / accident injuries

00:41:37

Dashboard injury :

- Patellar fracture.
- Distal end of femur fracture.

Steering wheel injury :

- Sternum fracture.
- Rib fracture.
- Internal organ damage.
- Aortic tear → Transverse tears in aorta are known as ladder pattern.

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m/c aorta getting affected → Descending aorta.

Neck injury :

Rapid deceleration of vehicle causes hyperflexion of neck.

Abrupt stopping after deceleration caused hyperextension of neck.

Both occurring sequentially causes whiplash injury → contusions and lacerations in spinal cord.

Single best answer for whiplash injury : Hyperextension of neck.

Facial injury :

Punctate laceration by the shattered glass/windshield → Sparrow-feet mark.

Airbag injuries :

Commonly seen on eyes and face.

Seat-belt injury :

m/c site → mesentery.

Other sites include intestine, spleen. liver.

Seat belt fracture → Also known as chance fracture.

It is the transverse # of lumbar vertebrae.



Front seat occupant injury :

Head and shoulder injury during the collision of a car/ motorcycle behind a truck (tailgating). Front of the car can get crushed in the impact.

Decapitation can also occur.

Pedestrian injuries :

Primary impact injury :

m/c site → Legs.

The bumper of the vehicle hit the legs → **Bumper**

**fracture** → wedge shaped fracture of tibia/fibula bone.

Secondary impact injury :

Rolling over the car may induce abrasions/contusions over the body.

Rolling under the car produce tyre marks.

Tertiary impact injury :

Also known as secondary injuries.

The body gets thrown away and hits the ground/any object.

multiple fractures, blood loss, shock & haemorrhage might occur → most dangerous injury.

multiple abrasions are also present all over the body due to grazing on the ground → **Grazed abrasions**.

## Blast injury

00:58:05

Primary blast injury :

mechanism of action → wave/air compression.

1<sup>st</sup> structure to be damaged in primary blast injury →

**Tympanic membrane**.

1<sup>st</sup> organ to be damaged in primary blast injury → Lungs.

Secondary blast injury :

mechanism of action → Flying objects/missiles will hit the body.

Causes **marshall's triad** :

1. Patterned abrasion.
2. Patterned contusion.
3. Patterned laceration.

Fractures may also be seen.

Tertiary blast injury :

mechanism of action → The body gets thrown away and hits the ground leading to **skeletal/bony fractures**.

Quaternary blast injury :

mechanism of action → Other injuries due to burning or a building collapsing.

m/c organs injured :

In blunt trauma	<b>Spleen.</b> Encapsulated in tight capsule → chances of rupture more.
In penetrating injury	Liver
In seat belt injury	<b>mesentery</b>
In blast injury	<b>Lung</b>
In underwater blast	<b>GIT, especially small intestine</b>

Berlin's edema is seen in concussion injury (edema of brain).

Comotio cerebri : **Shearing stresses** in the brain leading to numerous small, **punctate haemorrhages** throughout the brain.

Diffuse Axonal Injury (DAI) : **Axonal bulb/retraction bulb** (transected axon).

usually visible after 12 hours.

Duret haemorrhage : **Haemorrhage of midbrain and pons.**

Kernohan's notch : Notches formed in the **cerebrum** as a result of raised intracranial pressure.

Plaque jaune : **Healed cerebral contusions**

Railway spine injury : Concussion of the spine commonly seen in **railway/motor vehicle accidents**.

# FIRE ARM INJURY (BALLISTICS) : PART 1

Father of ballistics : Calvin Goddard.

## Firearm

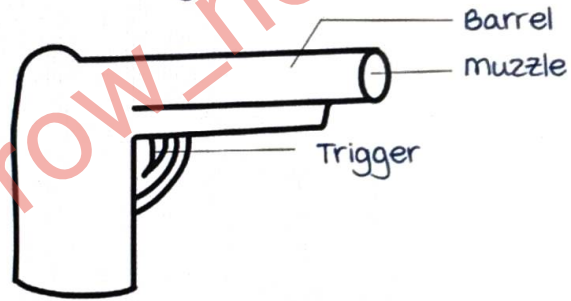
00:00:35

A firearm consists of a trigger, barrel and muzzle end.

Internal ballistic : Study of bullet behavior/motion inside the gun.

External ballistic : Study of bullet behavior/motion outside the gun.

Terminal/wound ballistic : Study of bullet behavior when it hits the target.



Classification of weapons based on cross section of the barrel :

Rifled firearm	Smooth bore firearm
Rifling is present inside the barrel	Inner surface is smooth all over E.g., Shot gun
Projectile is a <b>bullet</b> . Single projectile.	Projectile are <b>pellets</b> . multiple projectiles.
Due to rifling, there'll be : <ul style="list-style-type: none"> <li>• Spinning.</li> <li>• Rotation.</li> <li>• Accuracy.</li> <li>• ↑ Penetrating power.</li> <li>• Fine gyroscopic movement.</li> <li>• ↑ velocity.</li> <li>• Fatality propotional to velocity.</li> </ul>	Pellets strike each other and have comparatively <b>decreased</b> velocity, penetrating power, rotation and spinning.
Better range	Decreased range

Active space



Examples include : Revolver (200 yards), pistol (400 yards), military rifle (1000-3000 yards), air rifle (40 yards)	Example : Shot Gun (50 yards)
Cartridge has single bullet.	Cartridge has multiple lead shots/pellets.

Rifling : Elevations and depressions on the inner surface of the rifle.

Elevations are known as lands and depressions are known as grooves.

Caliber : Distance between 2 opposite lands.

Bore/gauge : Diameter of the smooth shotgun bore.

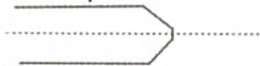
Fatality of the bullet is directly proportional to the velocity of the bullet.

The range of a shotgun can be improved by :

- Choking phenomenon :

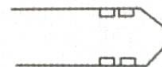
When terminal end is constricted, the dispersion of the pellet would be reduced.

Choking can be full or half choke or modified cylinder bore.



- Paradox gun phenomenon :

Shot gun in which the terminal end is rifled → increases range.



Bore/gauge :

The gauge of a shotgun depends on the division of a 454gm lead sphere.

12 bore shotgun → 454 g lead divided into 12 parts → Each pellet size  $1/12^{\text{th}}$  of sphere.

24 bore shotgun → 454 g divided into 24 parts → Each pellet  $1/24^{\text{th}}$  of sphere.

Therefore, ↑ Bore : ↓ Pellet size.

Bore is inversely proportional to pellet size.

Cartridge :

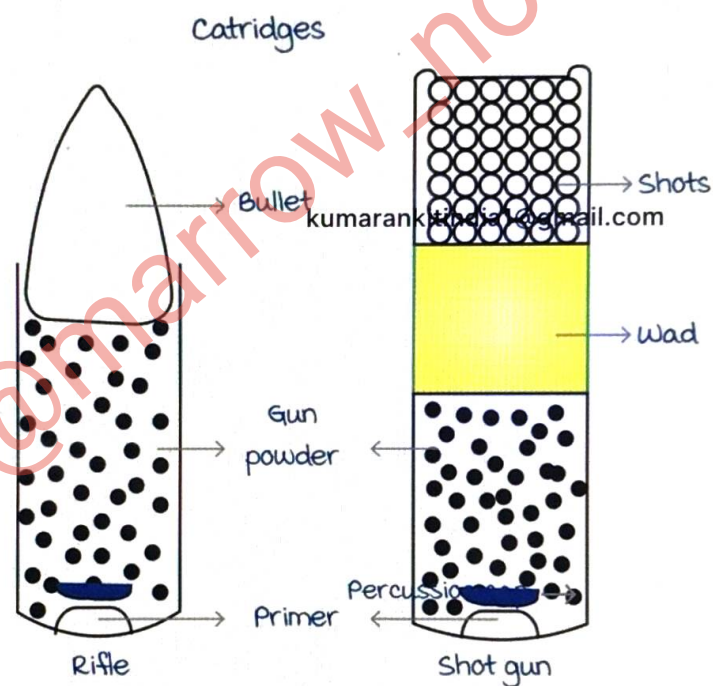
In rifles :

Consists of one bullet with gunpowder, primer, firing pin & percussion cap/detonator cup.

In shotgun :

Consists of pellets, WAD/felt, gun powder, primer and detonator cup.

WAD acts as a lubricant/piston and separates the pellets from the gun powder. Can produce minor bruises.



Primer is composed of (mnemonic **BLAST**) :

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

When a trigger is fired, the pin moves forward, removing the detonator/percussion cap → Primer ignites → Followed by gunpowder → Pressure increases → Firing of bullet/pellets.

## Gun powder types

00:26:14

Black gun powder :

- Potassium nitrate (75%).
- Charcoal (15%).
- Sulphur (10%).

Smokeless gun powder is a better gun powder.

3 types :

- Single base :  
Consists of only **nitrocellulose** base.
- Double base :  
**Nitrocellulose** and **nitroglycerine** base.
- Triple base :  
**Nitrocellulose**, **nitroglycerine**, **nitroguanidine** base.

Semi-smokeless gunpowder :

Consists of **80% black** gunpowder and **20% smokeless** gunpowder.

Gunpowder can be FG, FFG or FFFG, where F stands for fineness and G for grains.

Increase in F denotes finer nature of the gunpowder.

Gun powder residues :

Tests are done to detect gun powder residues in crime scenes or forensics.

These tests include :

Mnemonic : **HANDS**.

- **Harrison-Gilroy** test.
- **Atomic absorption spectroscopy**.
- **Neutron activation analysis**.
- **Dermal nitrate test** (also known as paraffin test) → obsolete now.
- **SEM-EDXA** (most specific and qualitative test).

**SEM-EDXA** : Scanning Electron microscope Energy Dispersive Xray Absorption Spectroscopy.

Active space



effects seen surrounding the entry wound :

- Flame along the bullet → Burning of hair (singeing of hair)/charring of skin.
- Smoke → **Blackening** surrounding the entry wound.
- Unburnt gun powder → Gets impregnated in the skin causing **tattooing**.
- Blackening and tattooing might appear the same but with a wet cotton swab, **blackening** can be wiped out but not tattooing.

Entry wound :

**Dirt or grease collar** is seen around the entry wound.

**Abrasion collar** is seen outside the entry wound.

Abrasion collar :

Determines the direction of the bullet.

**Perpendicular** bullet forms **circular** entry wound.

Bullet from an **angle** forms an **elliptical/oval** wound.

At a crime scene bullet should be picked by **gloved hands** and not using any instruments, to **avoid further marking** of the instrument.

Primary marking :

Determines the class of the bullet, **manufacturing specification**.

Due to rifling of weapon.

markings are **not microscopic**.

Secondary marking :

**Individual or accidental** marking because of **irregularity** inside the **barrel**.

These irregular markings are **microscopic**.

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Bullet fingerprint :

**Secondary marking** > primary marking.

Both markings are considered as bullet fingerprints.

metal fouling :

metal particles of the interior of the barrel get deposited on the bullet.

Comparison microscope is used to view bullet fingerprints.

## Types of bullets

00:46:34

- Dum-Dum bullet :  
Semi jacketed bullet with chiseled out terminal end causing maximum damage.
- Express bullet :  
High velocity bullet with a hole in the base.
- Tracer bullets :  
Glowing bullet, because of the powder burning brightly, it leaves as a visual trail along its path.
- Incendiary bullet :  
Contains phosphorus and causes explosion.
- Frangible bullets :  
Bullet divides into fragments and disintegrates without penetration.
- Glancing bullet : Oblique bullet that touches and goes. It causes gutter fracture.
- Souvenir bullet :  
Bullet which remains in skin and subcutaneous tissue. This causes fibrosis and chronic lead poisoning.
- Tumbling bullet :  
Rotates and enters body.
- Yawning bullet :  
Slow and irregular moving bullet.  
The entry wound of the bullet is keyhole in shape.
- Tandem bullet :  
Also known as piggy back bullet, one bullet pushes another bullet out.  
2 entry wounds created simultaneously, due to 2 bullets exiting the barrel.

Tandem cartridge : 2 bullets in **one cartridge**.

- Ricochet bullet :

This bullet is **deflected** and **then hits target**.

**Oblique shaped** or **irregular entry wound**.

All features of entry wound are absent → Bullet is deflected prior to hitting its target.

- Plastic bullet/ Baton bullet :

Baton bullets composed of **Poly vinyl chloride (PVC)**.

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used in riots.

Character	Entry wound	Exit wound
Size	Small, except in contact shots. <b>Stellate</b> or <b>cruciate</b> shaped if over bony prominence. ✦	Large
margins	<b>Inverted</b>	<b>Everted</b>
Abrasion collar & grease collar	Present	Absent
Burning, blackening & tattooing	Present	Absent
Bleeding	<b>Less</b>	<b>Profuse</b>
Cherry red color due to CO	maybe	<b>Not seen</b>
Fat and soft tissue expulsion	Absent	<b>Present</b>



Firearm entry wound



Blackening



## FIREARM INJURY BALLISTICS : PART 2

### Entry wound

00:00:15

Contact shot :

Large **stellate/ cruciate** shaped. 60c6b3eaa8ded0e4e7e5ea7

Singeing, blackening and tattooing are present.

These 3 present inside the tract.

Flame range / close range :

Singeing, blackening and tattooing present.

Within the range of smoke and flame.

Smoke / near range :

Blackening and tattooing present.

**Outside** the range of smoke and flame.

Gun powder / intermediate range :

Only tattooing present.

Distant range :

Singeing, blackening and tattooing **absent**.

### Range of different weapons

00:06:01

Type	Burning and Singeing (close)	Blackening (x2 of close range) (near)	Tattooing (x2 to x3 of near range) (intermediate)
Pistol and revolver	3"	6"	12" to 18" or 30 to 45 cm.
Rifles	6" or 15 cm.	12" or 30 cm.	24" to 36" or 60 to 90 cm.
Shotguns	12" or 30 cm.	24" or 60 cm.	24" to 36" or 60 to 90 cm.



1 inch = 2.5 cm.

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After gun powder range it is distant range.

WAD injury : Produces minor bruises → 2m to 5m .

Short gun entry wound features :

	Contact Shot	Close Range (< 1 m)	Near Range (1-2 m)	Inter-mediate Range (2-4 m)	Dis-tance range (> 4 m)
Appear-ance	✦ Stellate/ cruciate when over bony area. Oth-erwise round.	Oval/ round	Rat hole shaped/ nibbled margin. ✦	Satellite wound + 	Indi-vidual pellets entry wound.  
muzzle impres- sion	Present	Absent	Absent	Absent	Absent
Singeing, blacken- ing and tattooing	SBT +	SBT +	BT +	T+	SBT -

**Range of different weapons**

00:14:22

Puppe's rule : Given by George Puppes.

used to find the order of bullets fired, in case of multiple bullets.

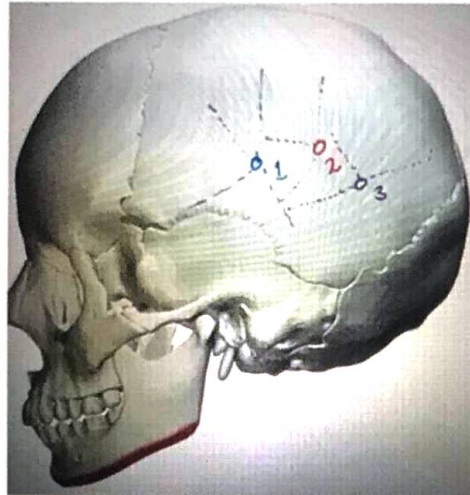
Fracture lines present → Sequence of bullets.

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1<sup>st</sup> bullet fracture line : Wide.

Subsequent fracture lines : Never crosses previous fracture lines.

Active space



Bevelling of skull bone :  
Bursting/cratering or slopping.

In entry wound :

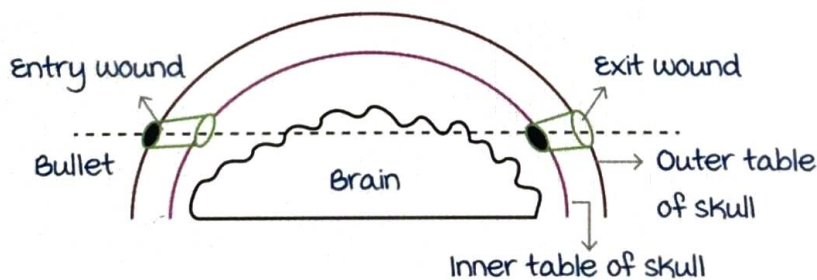
Small circular hole at outer table of the skull → Conical plug removed at inner table causing bigger wound →  
Larger hole at inner table.

In exit wound:

Small hole at inner table of the skull → Wound bevels  
→ Larger hole on exiting the skull.

In entry wound : Bevelling is seen at inner table of the skull.

In exit wound : Bevelling is seen at outer table of the skull.



**Butterfly fracture** is seen in tibia due to firearm injury.

Determination of range in shotgun :

Range in cylinder bore gun (yards) = Dispersion of pellets (in inches) × 1.5.



Range in full choke gun (yards) = Dispersion of pellets (in inches)  $\times \frac{3}{4}$ .

Range in half choke gun (yards) = Dispersion of pellets (in inches).

### Special phenomena/ effects

00:26:23

Difficulty to identify the gun shot wound, entry and exit wounds, due to surgical alteration.

Rayalaseema effect :

In stab injury, bullet is implanted.

Kronlein shot :

Contact shot in which brain is eviscerated.

Skull is bursted out.

Fouling :

Tiny fragments of metal which are surrounding the entry wound.

Could be part of interior of barrel or projectile.

metal fouling :

Accumulation of bullet material in the bore of the firearm due to passage of bullet.

marking on the bullet.

60c6b3eeaa8ded0e47e5e87 Secondary marking or individual or accidental characteristic.

Revolver is the only weapon which never ejects cartridges automatically. Has to be removed manually.

# ASPHYXIAL DEATH : PART 1

## Asphyxia

00:00:20

Asphyxia :

Occurs when the oxygen supply stops.

The word means **pulselessness**.

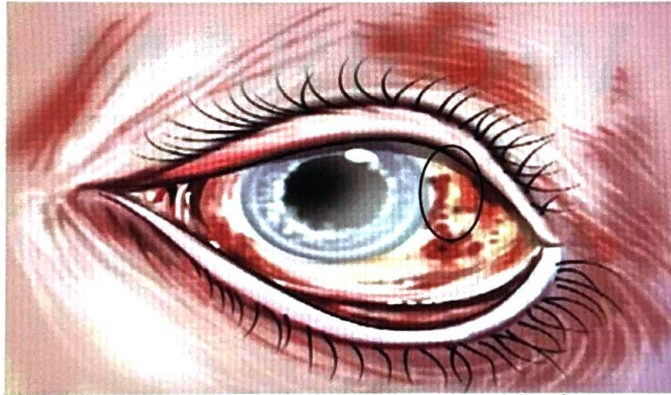
Hypoxia : **Lack** of oxygen.

Fatal Hypoxia : **Reduce** in normal oxygen level by **20%**.

Classical triad of asphyxial death (post mortem changes) :

- **Cyanosis** : Blue skin/ mucous membranes.
- **Petechiae** Haemorrhages
- **Congestion** in various parts of body due to stasis of blood (**redness**).

Tardieu spots :



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**Not characteristic** of asphyxia death.

Due to **venous obstruction** → Capillaries are ruptured.

Seen in asphyxial deaths with **neck/chest compression**.

Not seen in suffocation/drowning.

Seen in other deaths also like **electrocution**.

Petechiae with size : **0.1 to 2 mm**. (> 2mm : Ecchymosis)

Region involved : Conjunctiva, mucous membranes, epiglottis.

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**Brouardel** formulated that the pressure needed in kgs to obstruct the 4 vital neck structures are :

Structure	Pressure required (in kgs)
Jugular vein	2
Carotid artery	5
Trachea	15
vertebral artery	30

In postmortem examination of asphyxial death :  
modified Y neck dissection is done (Behind the ears → suprasternal notch).

**Cranium** is opened first.

Neck dissection should be done at last → To examine neck in bloodless field.

Also done to avoid **Prinsloo Gordon artifact** :

- Supposed haemorrhage seen in neck, in the anterior aspect of cervical spine, posterior to trachea and oesophagus.
- Seen if neck dissection is done earlier, than last.

### Asphyxial death : Hanging

00:11:26

Hanging is suspension of body with compression of neck.

Types of hanging :

- Complete hanging : No part of the body touches the ground.
- Incomplete / partial hanging : Some part of the body is touching the ground.

On the basis of position of knot :

- Typical hanging : knot is present at occiput.
- Atypical hanging : knot is present at any other place.





### methods of hanging :

#### Suicidal hanging :

most common type of hanging.

most common method of suicide in India.

Fatal period is 3 to 5 minutes.

#### Other modes of hanging :

Homicidal hanging.

Judicial hanging.

Accidental hanging.

most common cause of death in hanging : **Asphyxia**  
and **venous congestion**.

most common delayed cause of death in hanging : **Hypoxic**  
**ischemic encephalopathy**.

#### Post-mortem findings in hanging :



Hanging  
ligature mark

- **Classical triad** of asphyxia → Cyanosis, petechial haemorrhages, congestion.

- Tardieu spots +/-.
- Protrusion of tongue +/- due to pressure on mandible by the ligature.
- Hyoid bone fracture : Anteroposterior fracture, also known as **abduction fracture** is seen in 10-15%.  
more common > 40 years of age.
- Ligature mark : **most specific**.  
V-shaped pressure abrasion above the thyroid cartilage.  
It is **incomplete** as it is absent at the site of the knot.  
Dissection of the ligature mark shows a **dry, white and glistening area**.
- Facial congestion is seen in partial hanging due to **venous obstruction**.

### Antemortem hanging

00:25:15

Antemortem hanging is death due to hanging, characters are :

- Dribbling of saliva opposite to the side of knot.  
Due to **compression** of opposite **submandibular gland** (area of maximum pressure by the noose) and **activation** of **pterygopalatine ganglion**.
- **La-facie sympathetique** : On the same side of the knot, the **eye** remains open with **dilated pupils**.  
Due to **stimulation** of **cervical sympathetic ganglion**.

Simons haemorrhage :

Haemorrhage into the outer layer of the **intervertebral disc** of the **lumbar and lower thoracic vertebra**.

Only seen in 15 - 20%.

Complex suicide : use of **more than one** method of suicide.

E.g : Poison intake + hanging.

Complicated suicide : use of one method of suicide, but

**death** is due to an **unintentional trauma**. E.g. : Death due to head injury after attempting to hang on a branch.

Para suicide : An **attempted suicide**, most common method is **drug ingestion/poisoning**.

Homicidal hanging :

Done by **lynching**.

was practised in North America.

Sexual asphyxia :

Also known as **autoerotic asphyxia**, **Kotzwarrism**.

This is an **accidental hanging**.

Seen in sexual perversion → masochism/transvestism.

**Young males** attempting partial hanging for hallucinations caused due to **cerebral anoxia**.

A crime scene examination for erotic/pornographic material is important for detection.

Judicial hanging :

Hangman's knot is on the **left side below/ at the level of angle of mandible (Left sub-aural)** → **Atypical hanging**.

It is a type of **complete hanging**.

Caused by sudden drop.

Hangman's fracture : **Fracture /dislocation of C2-C3** vertebra → It causes brain stem damage.

Amussat sign : **Horizontal tear in the intima of carotid artery**, due to sudden drop.   
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In other countries, the knot is placed below the chin. It is more efficient.

## **Strangulation**

00:40:43

**Compression of neck only.**

**Homicidal** > accidental > judicial.

**Types of strangulation :**

Ligature Strangulation : mostly **homicidal**, can be accidental as well.

manual strangulation/**throttling** : Always **homicidal**.

mugging : Strangulation with bend of **elbow/ forearm**.





Ligature Strangulation



mugging

Bansdola : Strangulation using stick.

Garrotting :

Judicial strangulation in Spain/ Turkey.

Also known as Spanish windlass.



Garrotting

Post-mortem findings in ligature strangulation :

Tardieu spots.

Classical triad of asphyxia is more prominent than in hanging (as more force is applied in strangulation due to victim's resistance).

Ligature mark is specific :

It is complete, horizontal/transverse at or below the level of the thyroid cartilage.

On dissection of the mark : Hematoma, haemorrhage, bruising in neck tissue, glands and muscle.

Peri-ligature injuries : Surrounding the ligature marks, due to resistance.

Thyroid fracture is most commonly seen.

**Throttling :**

Thyroid fracture.

**Hyoid fracture :** most common (in 50% of cases).

- It is an adduction /inward compression fracture.

Post-mortem findings of throttling :

Classical triad of asphyxia are intense.

Tardieu spots.

Neck : **Finger nail abrasions.**

- Fingertip pressure causes multiple six penny bruises  
→ Coin-shaped.
- Dissection : Hematoma, haemorrhage of neck tissue and muscles.



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## Suffocation

00:55:12

Suffocation is a lack of oxygen.

The cause of death is always asphyxia → The purest form of asphyxia.

Types of suffocation :

- Environmental lack of oxygen → CO poisoning.
- Choking : Food particle in trachea, bronchi, bronchiole (respiratory passage).
- Gagging : Cloth piece goes into oropharynx/nasopharynx. Always homicidal.
- Smothering : mouth and nose blocked simultaneously. Homicidal with multiple contusions (outside and inside the lips) and fingernail abrasions on lips. Hematoma found on dissection.

### Smothering



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Pillow



Hand



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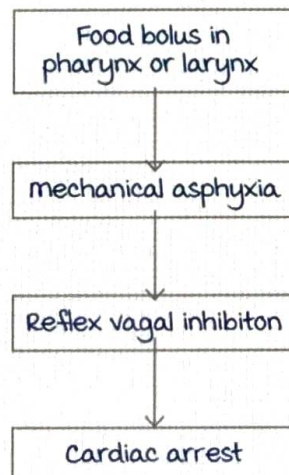


- Traumatic asphyxia : Possible in building collapse, stampedes, motor vehicle accidents.  
Chest is fixed.  
Also known as **Perthes syndrome**.  
**Intense cyanosis** and **congestion** above the level of compression are a characteristic findings.  
**masque ecchymotiqueline** is a feature of traumatic asphyxia → Demarcation line between compressed and non-compressed areas.
- Burking :  
Traumatic asphyxia and **homicidal smothering**.



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- Overlaying :  
Traumatic asphyxia and **accidental smothering**.  
E.g mother lying on the child.
- Café coronary :  
The term was given by Roger-Haugen.  
In a **grossly intoxicated person**, the bolus of food causes mechanical asphyxia by lodging in larynx or pharynx.



## ASPHYXIAL DEATH : PART 2

### Drowning

00:00:16

Body inside the water or any liquid.

It is **mostly accidental** > suicidal and homicidal.

Fatal period : 5-8 min.

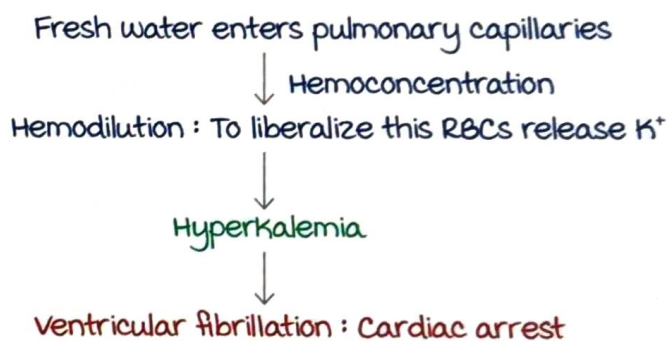
Types :

Typical drowning

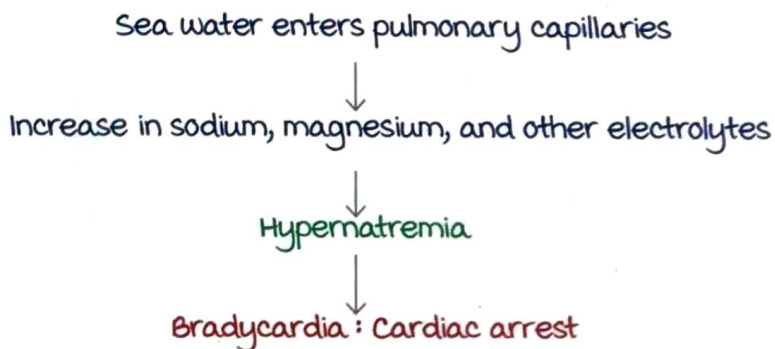
Wet drowning : Water enters the lungs. Death is due to **cardiac arrest**.

It is of 2 types : Fresh and seawater drowning.  
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Fresh water drowning :



Seawater drowning :



Faster cause of death : Fresh water drowning.

In both the cases :

main cause of death is **loss of pulmonary surfactant**.

## Atypical drowning

00:05:55

- Dry drowning : No water enters lungs.  
Death is due to **laryngospasm** (asphyxia).
- Cold water drowning/submersion syndrome/  
hydrocution/immersion syndrome :  
Cold water touches nose, ear and epigastrium  
↓  
Reflex vagal inhibition  
↓  
Cardiac arrest
- Delayed/near/secondary/post immersion drowning :  
Death is delayed (1-2 days).  
Cause of death is due to pneumonia, metabolic acidosis,  
and encephalopathy.

## Ante-mortem changes of drowning

00:11:21

Antemortem drowning : Death in water.

MC characteristic finding of antemortem drowning :

**Cadaveric spasm.**

Cadaveric spasm

Water and mud particles in GIT.

Water entry in the lungs  
(conscious) :

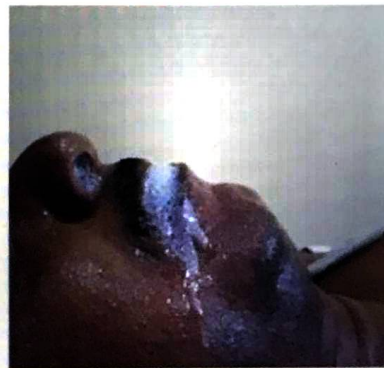
White leathery copious **mucoïd**  
**frothing.**

It is known as **emphysema aquosum.**

After death, it flows out through nose and mouth.



Washer woman hand



Antemortem drowning

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Active space



**Non mucoid frothing :**

Snake bite, electrocution, epilepsy, strangulation, decomposition, pulmonary edema, and putrefaction.

Water entry in the lungs (Unconscious: Passive entry) :

**Edema aquosum.**

mud particles entry into trachea and up to secondary bronchioles.

Because of **forceful hemorrhage** : Alveolar rupture.

It causes subpleural hemorrhages known as **Paltau's hemorrhage** (common in anterior surfaces of lower lobes).

**Gettler test :**

Chloride ion estimation test in heart chambers.

Normally, chloride ion concentration of right and left chambers is equal. [kuniasanku1@gmail.com](mailto:kuniasanku1@gmail.com)

Chloride ion concentration in :

Sea water drowning : Left chamber > right chamber.

Freshwater drowning : Right chamber > left chamber.

>25% difference : Antemortem drowning.

Strontium ion in **left** heart chamber : **Sea water drowning.**

**Diatom test**

00:22:32

Diatoms are unicellular algae. They are covered by silica.

In antemortem drowning : **Diatoms (<60 micron)** from lungs goes to distant organ (max concentration is in bone).

Best bone : **Femur** (not used as it causes disfigurement of the body).

MC used bone : **Sternum.**

2<sup>nd</sup> best organ : **Spleen.**

For detection of diatoms : **Acid digestion test** (nitric acid is used).

Diatoms are of 2 types :

Oligo halophilic : Fresh water.

Poly halophilic : Sea water.

Nonspecific findings (present in antemortem or postmortem drowning) :

### 1. Washer woman hand :

Skin of palms and soles :

- Wrinkling (3-4 hours),
- Bleaching (12 hours),
- Soddening (24-48 hours),
- Cuticle peeled off (3-4 days).

### 2. Floatation of body :

Because of decomposition (gas formation).

Time in summer: 24 hours.

Time in winter: 1-2 days (decomposition rate is slow in winter).

### 3. Cutis anserina : Skin shows puckered/granular appearance because of piloerection.

- Higher level of serum **strontium** & **magnesium** in the left ventricle are useful for the diagnosis of sea water drowning.
- Finding of diatoms in the tissues.
- **Sehrt's sign** :  
microrupture of stomach mucosa due to over stretching of mucosa as a result of swallowed liquid.
- **Wydler's sign** :  
If entire gastric content is put in a beaker, solid, liquid and foam are arranged from bottom to top in that sequence (foam in top, liquid in middle, solid in lower).
- **Sveshnikov's sign** :  
Free liquid in the paranasal sinuses (most commonly in maxillary and sphenoid).
- **Sabinsky's sign** :  
Small and anemic spleen found in especially in drowning.

# IDENTIFICATION : PART 1

60c6b3eeaa8ded0e4 Identification

00:00:11

## Corpus delicti :

Also known as **Body of offense** or **essence of crime**.

The factors/circumstances needed to prove a crime.

Components :

- **Dead body** (identification).
- **Weapons**.
- **Blood stain** on cloth.
- **Crime scene**.

Best identification method overall : **Fingerprint**.

Identification methods :

### 1. Poroscopy :

Discovered by **Edmund Locard**

Skin has pores (sweat glands) and are characteristic for each individual.

In 1 mm of ridge : **9-18** pores are present.

### 2. Cheiloscopy :

**Study of lip prints**.

Discovered by **Suzuki**.

He classified the lip prints into 7 types :

**Stains** used to develop lip prints :

- **Aqua print**.
- **Cyano acrylate**.

### 3. Palatography :

Anterior  $\frac{1}{3}$ <sup>rd</sup> of **hard palate** is specific for every person.

Palate has **rugae**, used in identification.

Also known as **rugoscopy**.

Classified by **Allen**.

- **1° Rugae** : > 5 mm.



- 2° Rugae : 3- 5 mm.
- 3° Rugae : < 3 mm.

#### 4. Superimposition technique :

Skull x ray is super imposed on the negative of a photography of person.

used if body is being decomposed.

Only a screening test, not confirmatory. Can be used to exclude the person.

#### 5. Tattoo marks :

used to identify in decomposed (best), live or dead.

Dyes used include :

- Carbon.
- Prussian blue.
- Vermillion.
- Cinnabar.
- malachite green.

Dye that impregnates the skin goes to the level of lymph node. Hence, for identification of person should be at the level of lymph node.

Infrared rays : used for old tattoo marks.

UV rays : used for faded tattoo marks.

Sydney shark arm case was associated with tattoo marks.

#### 6. Retina scan :

Best biometric method.

#### 7. Anthropometry :

Discovered by Bertillon.

Hence called Bertillon system.

Also known as portrait parle.

Identification criteria for missing person by :

- Body mass.
- Body measurement.
- Descriptive data.

Can be used even if there is **no biological specimen**.

## Finger printing

00:15:48

Also known as **dactylography** or **Galton system**.

Best identification method.

Discovered by William Herschel in 1858.

Dermal papillary ridges.

Starts formation in **12 weeks** of fetal life and completed by **20-24 weeks**.

Not inherited.

Not same even in identical twins : **Quetlet rule**.

minimum points to be similar to the crime scene print should be **10-12 points**.

First fingerprint bureau in world was in **Kolkata (1897)**.

Types of fingerprints :

- Latent :

**Barely visible** or invisible.

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Luminol spray, **electron microscope**, silver nitrate, iodine vapor, osmium tetra oxide can be used for identification.

- Visible : **Stains**.
- Plastic fingerprint : On **soft surface** like soap/cheese.

**Permanent loss** of fingerprints :

- Radiation.
- Charring.
- Leprosy.

Ridge atrophy :

- Dermatitis.
- Coeliac disease (associated with loss of pattern).

Ridge alteration (distance between ridges can be changed):

- Scleroderma.
- Acromegaly (intact pattern).

Best finger for fingerprinting : **Left thumb**.

most accepted method for taking fingerprint :

- Optical Frustrated Total Internal Reflection (O-FTIR).

Henry classification of fingerprint :

- L = Loop :

1 delta + 1 core.

most common : 65%.

- W = Whorl :

2 delta + no core.

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- A = Arch :


No delta + one core.

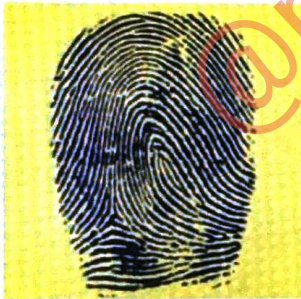
- C = Composite :

mixed pattern.

Least common : 1-3%.

Core : Converging circular curves. 

Delta : meeting point of curves,  
where they form a triangle. 



Loop : like a hairpin



Arches : like a mountain



Whorl : like  
a circle

## Stature identification

00:30:54

Stature of a person identified by bones.

Length of bone : Hepburn osteometric board.

Stature = multiplication factor X length of bone.

Discovered by Karl-Pearson, Trotter-Glessor,

Dupertuis-Haddin, Jit-Singh.

Bone	multiplication Factor
Femur.	3.7
Tibial & fibula.	4.5

Active space



Humerus.	5.3
Ulna.	6.1
Radius	6.5

mnemonic : FeTHUR.

Q. Length of humerus bone is 30 cm. what's the stature of deceased?

$$\text{Stature} = 30 \times 5.3 = 159 \text{ cm.}$$

Determination of age of fetus :

Rule of Hasse.

- up to first 5 months of age :

$$\sqrt{\text{Age (months)}} : \frac{\text{Crown heel length (cm)}}{5}$$

- For next 5 months : Also called as Morrison rule.

$$\text{Age (months)} : \frac{\text{Crown heel length (cm)}}{5}$$

### Determination of age in child

00:39:24

Dentition (Teeth) :

Two types :

- Temporary teeth (T) : 20 in number.
- permanent teeth (P) : 32 in number.

Temporary teeth :

T=20	5	5			
			I	C	Pmm
2	0	2	2	1	0
2	0	2	2	1	0

Sequence of eruption :

1. Lower central incisor (6 months) → molar (12 months)  
→ Canine (18 months) → 2<sup>nd</sup> molar (24 months).
- When child becomes 2-2.5 years, he will have 20

permanent teeth.

- These 20 temporary teeth remain same till 6 years of age.
- At 6-7 years of age, permanent teeth eruption occurs (total number remain 24). Known as **mixed dentition** and this lasts up to 11-12 years of age.
- Number of permanent teeth between this age :  $(\text{Age}-5) \times 4$ .

Permanent teeth :

T=32	8	8
3	2	1
2	1	C
2	2	Pmm
2	1	2
3	2	3
3	2	2
2	1	2
2	2	3
kumarankitindia1@gmail.com	8	8

### Sequence of eruption of permanent teeth

00:47:59

Mnemonic : **M**amma **I**s **I**n **P**ain, **P**apa **C**an make **M**edicine

	Teeth	Age of eruption (in years)
<b>M</b> amma	M1 : 1 <sup>st</sup> molar	6-7
<b>I</b> s	I1 : Central incisor.	7-8
<b>I</b> n	I2 : Lateral incisor.	8-9
<b>P</b> ain	P1 : 1 <sup>st</sup> premolar.	9-10
<b>P</b> apa	P2 : 2 <sup>nd</sup> premolar.	10-11
<b>C</b> an	C1 : Canine.	11-12
<b>M</b> ake	M2 : 2 <sup>nd</sup> molar.	12-14
<b>M</b> edicine	M3 : 3 <sup>rd</sup> molar.	18-25

- 2-2.5 years : 20 temporary teeth.
- 2-6 years : 20 temporary teeth.
- 6-11/12 years : **24 teeth** (mixed).

- 12-14 years : 28 permanent teeth.
- 18-25 years : 32 permanent teeth.

Successional teeth :

- Permanent tooth which erupts in space of temporary tooth.
- Total 20 (2 incisor, 1 canine, 2 premolars in each quadrant).

Supra added teeth :

- Permanent teeth for which extra space is created.
- Total 12 (3 molar in each quadrant).

### Calculation of age from teeth

00:55:00

1. Stack method :

- used for infant.
- Weight of tooth/height of tooth.

2. Boyde's method :

- used for dead infant.
- By counting incremental lines on enamel.
- Incremental lines start from 2<sup>nd</sup>-3<sup>rd</sup> day after birth with increase of one line every day after that.

3. Gustafson method :

used > 25 years of age.

6 X-ray criteria used : mnemonic : SCRIPT

- Secondary dentin (2<sup>nd</sup> most important).
- Cementum opposition.
- Root resorption.
- Attrition.
- Parodontosis.
- Transparency/translucency of root (most important).

4. Lamendin method :

- Gum regression.
- Transparency/translucency of tooth.



## Dental formula

01:01:10

1. Palmer notation :

R	L
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8

missing teeth is crossed off/vacant space allotted.

2. Haderup formula :

R	L
+8 +7 +6 +5 +4 +3 +2 +1	+1 +2 +3 +4 +5 +6 +7 +8
-8 -7 -6 -5 -4 -3 -2 -1	-1 -2 -3 -4 -5 -6 -7 -8

upper teeth : + (plus), Lower teeth : - (minus)

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3. Universal formula:

1 2 3 4 5 6 7 8	9 10 11 12 13 14 15 16
32 ←	17

4. Anatomical chart : Image of tooth is given.

5. FDI : First digit of tooth is the number of the quadrant.

R	L
1	2
18 17 16 15 14 13 12 11	21 22 23 24 25 26 27 28
48 47 46 45 44 43 42 41	31 32 33 34 35 36 37 38
4	3

6. modified FDI :

R	L
1	2
18 17 16 15 14 13 12 11	21 22 23 24 25 26 27 28
38 37 36 35 34 33 32 31	41 42 43 44 45 46 47 48
	3   4

Active space

## IDENTIFICATION : PART 2

### Determination of age by bones

00:00:08

Ossification centers in bone.

Specific ages for appearance and fusion.

Ossification centers in intrauterine life (IUL) :

1<sup>st</sup> ossification center to appear → clavicle at 5-6 weeks.

7<sup>th</sup> month → 2<sup>nd</sup> and 3<sup>rd</sup> pieces of the body of sternum, talus.

9<sup>th</sup> month → Lower end of femur, cuboid, capitate.

10<sup>th</sup> month → upper end of tibia.

Fusion of bones :

14 years of age : Patella.

40 years of age : Xiphoid.

Mnemonic : IIT.

20 years of age : Iliac crest.

21 years of age : Inner end of clavicle (medial).

22 years of age : Ischial Tuberosity.

Carpel bones :

1<sup>st</sup> to fuse : Capitate at 2 months.

Last to fuse : Pisiform at 12 years.

Mnemonic : upper limb starts with higher number (18-16-16-18)

and lower limb starts with lower number (16-18-18-16).

Upper end of humerus : 18 years.

Lower end of humerus : 16 years.

Upper end of radius and ulna : 16 years.

Lower end of radius and ulna : 18 years.

Upper end of femur : 16 years.

Lower end of femur : 18 years.

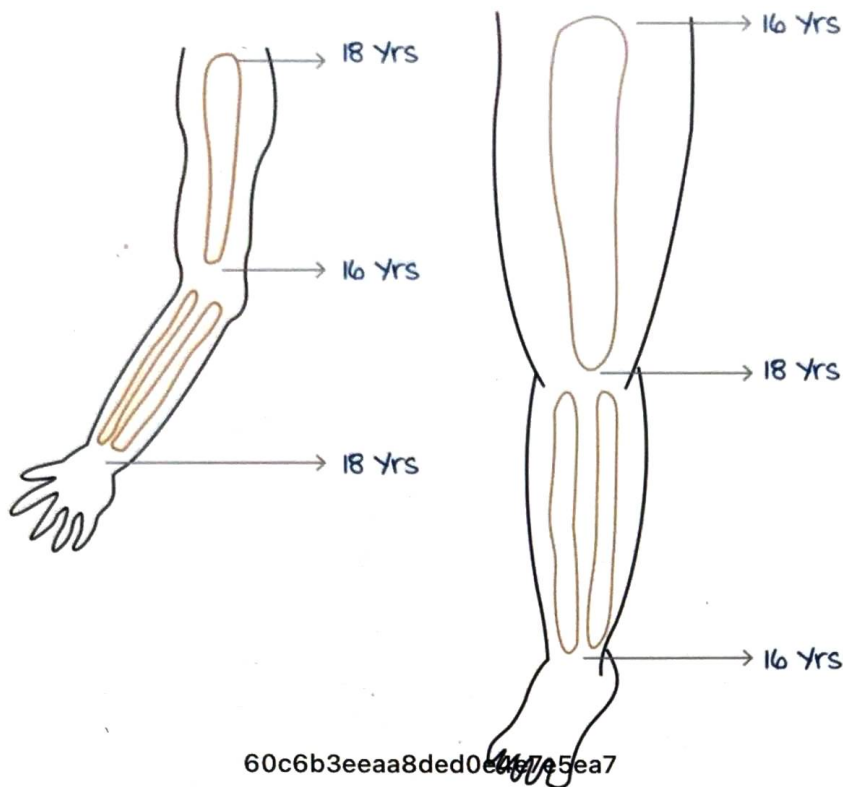
Upper end of tibia and fibula : 18 years.

Lower end of tibia and fibula : 16 years.

In females the fusion is 1-2 years earlier than males.

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Active space



### Sternum :

Appearance of ossification centers		Fusion of epiphyses
<p>manubrium and 1<sup>st</sup> piece of body of sternum → 5<sup>th</sup> month of IUL.</p> <p>2<sup>nd</sup> and 3<sup>rd</sup> pieces of body of sternum → 7<sup>th</sup> month of IUL.</p> <p>4<sup>th</sup> piece of body of sternum → 10<sup>th</sup> month of IUL.</p> <p>Xiphoid → 3 years of age.</p>	<p>manubrium</p> <p>1<sup>st</sup> piece</p> <p>2<sup>nd</sup> piece</p> <p>3<sup>rd</sup> piece</p> <p>4<sup>th</sup> piece</p> <p>Xiphoid</p>	<p>Fusion between :</p> <ul style="list-style-type: none"> <li>• manubrium and 1<sup>st</sup> piece of body → 60 years of age.</li> <li>• 1<sup>st</sup> and 2<sup>nd</sup> pieces of the body → 25 years of age.</li> <li>• 2<sup>nd</sup> and 3<sup>rd</sup> pieces of the body → 20 years of age.</li> <li>• 3<sup>rd</sup> and 4<sup>th</sup> pieces of the body → 15 years of age.</li> <li>• 4<sup>th</sup> piece of the body and xiphoid → 40 years of age</li> </ul>

Active space



## Skull suture fusion

00:10:52

1<sup>st</sup> to fuse : metopic suture at 12 months.

Last suture to fuse : Squamosotemporal suture after 18 years of age.

Lambdoid suture fuses at 45 years.

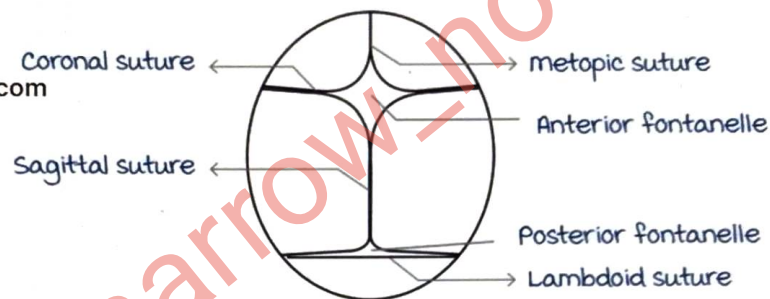
Coronal and sagittal sutures fuse at 30- 40 years of age.

- Best suture for age estimation is sagittal suture.

Anterior fontanelle closes at 18 months.

Posterior fontanelle closes at birth.

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Basisphenoid of skull fuses with basiocciput at 18-21 years of age.

Both halves of mandible fuses at 2 years of age.

- Lateral skiagram is taken to see the fusion to assess the age.

Pterion of skull fuses at 65 years of age.

Hyoid bones fuses at 40-60 years of age.

Sacrum becomes a single bone at 21-25 years of age.

## Estimation of race

00:16:14

Cephalic index :

using the skull.

$$\text{Cephalic index} = \frac{\text{Breadth of skull}}{\text{Length of skull}} \times 100.$$

Mnemonic : DUMB.

Dolico-cephalic.

Mesati-cephalic.

Brachy-cephalic : Early fusion of coronal suture.

Cephalic index	Type of skull	Race
70 - 74.9	Dolico-cephalic	Negro, pure Aryans
75 - 79.9	mesati-cephalic	Indians, Chinese, Europeans
80 - 85	Brachy-cephalic	Mongols

In mongols :

Face is round.

Orbits are rounded.

Palate is parabolic.

Shovel shaped incisors.

Congenital absence of 3<sup>rd</sup> molar.

Bull tooth/taurodontism.

Enamel pearls may be seen.

Orbits :

Square shaped in Negroes.

Triangular in Caucasians.

Teeth :

Caucasians have Carbelli's cusp in the lingual surface of maxillary molar.

Indices for estimation of race : mnemonic : BCCI for Humans.

Brachial index

Crural index.

Cephalic index.

Intermembral index.

Humero-femoral index.

$$\text{Brachial index} = \frac{\text{Length of the radius}}{\text{Length of the humerus}} \times 100.$$

$$\text{Crural index} = \frac{\text{Length of the tibia}}{\text{Length of the femur}} \times 100.$$

Intermembral index :

$$= \frac{\text{Length of the radius} + \text{Length of the humerus}}{\text{Length of the tibia} + \text{Length of the femur}} \times 100.$$

Includes both upper limb and lower limb.

Hair analysis to assess race :

Mongolian hair medulla is non-fragmented.

Cross section of medulla :

Circular → Mongolian.

Ovo-circular → Caucasians.

Elliptical/ kidney shaped → Negroes.

Cuticle of hair absent in Negroes.

### Differentiation of sex

00:26:38

Barr body :

Number of x chromosomes minus 1 (x-1).

Commonly seen in females.

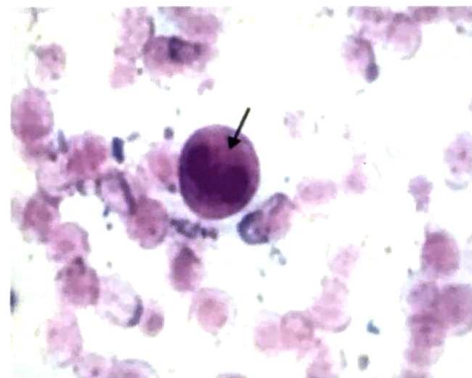
Buccal mucosa is used as the site to extract cells to assess Barr bodies.

Planoconvex mass.

Davidson body :

Present in 6% of female neutrophils.

Drumstick shaped body





Feulgen reaction :

To assess **X-chromosome**.

**Acridine stain** is used.

Quinacrine reaction :

To assess **Y-chromosome**.

Assessment via bones :

According to [kumarajindia1@gmail.com](mailto:kumarajindia1@gmail.com), the accuracy of the identification is achieved according to the skeletal remains acquired for examination.

Accuracy (in %)	Bones
100	Complete skeleton
95	Pelvis
90	Skull
80	Long bones

**Pelvis and skull** would give **98%** accurate identification.

Characters	male bones	Female bones
All bones in general	Large and heavy	Small and light
Bony prominences	<b>more pronounced</b> except frontal and parietal eminences.	<b>Frontal and parietal eminences</b> are pronounced in females.
Forehead	Sloping	Vertical
Chin and orbit	Squared	Rounded
Length of sternum	more > 149 mm	Less < 149 mm
<b>Ashley rule</b>		

## Differences in male and female pelvis

00:34:36

Shape of pelvis	Deep funnel, triangular	Flat bowl, square
Pelvic inlet	Heart shaped	Circular shape
Obturator foramen	Oval	Triangular and small
Angles	Less in general	more in general. Suprapubic angle > 90°. Angle of mandible is 125°.
Bony indices	Less in general	more in general.
Sciatic notch index (Best bony index to differentiate)	4-5	5-6
Corpo- basal index of sacrum $= \frac{\text{Breadth of 1st sacral vertebra}}{\text{Breadth of base of sacrum}} \times 100$	more 45	Less 40
Washburn index/ ischio-pubic index	Low	High
Pre-auricular sulcus in pelvis (tertiary sexual character)	Rare	Frequent and deep
Chielotic line	Prominent in sacral bones	more prominent in pelvis
Greater sciatic foramen (best parameter)	Narrow, small, deep	Wide, large and shallow
Ischial tuberosity	Inverted	Everted

**Ashley's rule :**

Length of the sternum is > 149 mm in males and < 149 mm in females.

Hyrthl law :

In males, the body of the sternum is longer and more than twice the length of manubrium.

In females, the body of sternum is shorter and less than twice the length of manubrium.

Colonel Victor Barker case → Concealed sex.

### Age of scar

00:46:06

5- 6 days : Red inflammatory scar → Angry scar.

2 weeks to 2 months : Pale, soft and tender.

Vascular → Causes it to be soft.

2 - 6 months : Brown, glistening and tough.

> 6 months : White, non-tender.

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Active space



# POST MORTEM CHANGES & TYPES OF DEATH : PART 1

Taphonomy : Study of post mortem changes.

Thanatology : Study of death and its aspects.

46 IPC defines death.

Death was defined first at the Declaration of Sydney.

## Types of death

00:01:35

1. Somatic death.
2. Cellular/molecular death.

Somatic death :

Cessation of vital processes with extinction of personality.

Bishop's tripod of life is lost.

Stoppage of vital organs i.e., lung, heart and brain.

Called *atria mortis* or *death's tripod of life*.

Cellular death :

Death of all molecular and cellular elements.

Occurs after somatic death.

Supravital interval → Time between somatic death and cellular death.

Cadaveric organ harvesting best done at this time.

Zasko's phenomenon/ Tendon reaction :

- Tendon reflexes seen after 1-2 hours of somatic death.
- Striking lower 1/3<sup>rd</sup> of quadriceps tendon elicits upward movement of patella.

Brain stem death :

Minnesota criteria is used for the determination.

Brainstem reflexes remain absent for 12 hours.

Plays a role in live organ donation.

Cortical death :

Harvard criteria is used for determination.

Xenograft : Transplant of tissue from a different species.

e.g. : From animals to humans.

Isograft : Transplant of tissues between identical twins.

Allograft : Transplant of tissues between same species.

Autograft : Transplant of tissues from the same person.

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Older (now obsolete) tests for the assessment of respiration and circulation :

Tests to assess circulation :

Magnus test → Finger ligature test.

Diaphanous test → Transillumination of web spaces.

I-card dye test → Fluorescent dye used.

Tests to assess respiration :

Winslow test → movement of chest.

Mirror test.

Feather test.

Suspended animation :

The person is alive, but looks dead.

Decreased metabolic activities → Cannot assess respiratory or circulatory signs.

The patient needs to be resuscitated.

Conditions showing suspended animation : ABCDE HST.

After prolonged anesthesia.

Newborn Babies.

Cholera.

Concussion.

Drowning.

Electrocution.

Hypothermia.

Hyperthermia.

Shock.

Sunstroke.

InSanity.

Trance → Voluntary suspended animation, like in people practicing yoga. No role of doctors in trance state.

## Post-mortem changes

00:17:25

**Immediate** signs of death :

Insensibility and loss of voluntary power → Earliest sign.

Cessation of respiration.

Cessation of circulation.

**Early** signs of death :

Eye changes.

Post-mortem staining.

Rigor mortis.

Algor mortis.

**Late** signs of death :

Decomposition.

Putrefaction.

## Eye changes

00:20:32

Rail roading phenomenon → Earliest eye change.

**Kevorkian sign.**

Retinal vessels are fragmented or segmented, giving a trucking appearance.



Tache noire

**Intraocular tension** becomes nil in 2 hours after death.

**Tache noire** → Deposition of cellular/epithelial cell debris in sclera.

Starts as yellowish triangular discoloration in the sclera.



Seen after 3 hours of death.

Later becomes brownish-black in colour.

Increase of potassium ions in vitreous humor.

Cornea becomes opaque in 6 hours.

Hypoxanthine increases and glucose decreases in vitreous.

## Temperature changes

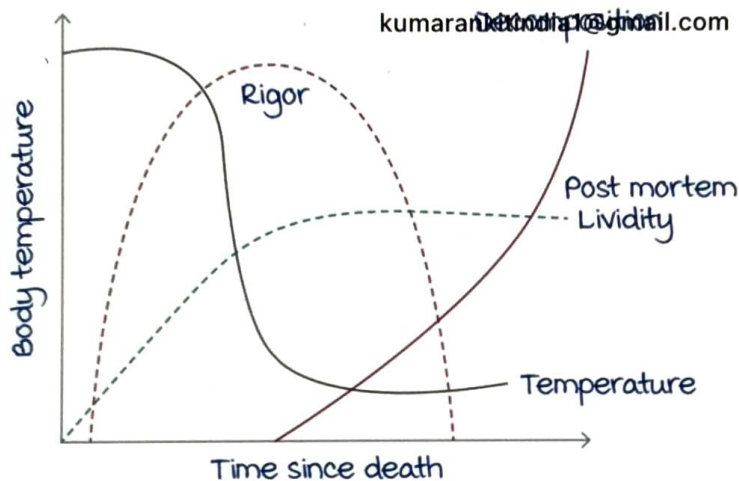
00:25:20

Algor mortis → Decrease in temperature after death.

The graphical representation is a sigmoid curve.

Initial isothermic phase.

Followed by rapid decline & isothermic phase at low temperature.



Ideal site to record body temperature : Rectum.

Denotes the core body temperature → 98.5°F.

Thanatometer is used.

25 - 30 cm long.

0 - 50°C can be measured.

Inferior surface of liver can also be used to measure the body temperature.

Rate of fall of temperature :

0.4 - 0.6°C/hour : Tropical climates.

1°C/hr : Temperate climates.

Summer : 0.5 °C or 0.75°F/hour.

Winter : 0.7 °C or 1.5°F/hour, rate of fall is more as atmospheric temperature is less.

Time since death :

$$\text{Normal body temperature (}^{\circ}\text{F)} - \text{Rectal temperature (}^{\circ}\text{F)} \\ = \frac{\quad}{\text{Rate of fall}}$$

Example : A dead body was found to have rectal temperature of 91 °F in June. What is the time since death?

$$\text{Ans. } \frac{98.5^{\circ}\text{F} - 91^{\circ}\text{F}}{0.75} = 10 \text{ hours.}$$

Post-mortem caloricity :

Temperature of the body **remains raised for the first 2 hours** after death.

Seen in :

- Conditions with increased bacterial activity → Septicemia, cholera.
- Failure of heat regulation → Sunstroke, pontine hemorrhage.
- Increased muscle activity due to convulsions → Strychnine poisoning, tetanus.

### Post mortem lividity

00:37:10

AKA Post-mortem staining/hypostasis/vibices/ suggillation.

Staining of skin after death. 60c6b3eeaa8ded0e4e7e5ea7

On a body lying supine :

The part of the body touching the surface/ground are pressure areas.

Part of the body that is not in contact with the surface/ground, but is facing the ground are dependent areas.



Post-mortem lividity

**Loss of circulation** → Pooling of blood in the toneless capillaries and venules of the dependent parts by the **action of gravity** → Bluish purple colour staining due to deoxyhemoglobin.

- Staining of the **dermal blood vessels of rete mucosum layer**.
- Develops shortly after death (1-2 hours).
- Becomes well visible by 4 hours.
- **Maximum by 6-12 hours**.
- **Fixation happens by 7-8 hours**.

If the position of the body is changed before 7-8 hours, the hypostasis that developed earlier would be shifted according to the new position → 2° lividity.

Persists till decomposition.

Cannot be assessed afterwards as decomposition causes green discolouration.

If the body was in **flowing water**, no post-mortem lividity is seen.

Body in **hanging position** → Lividity seen at distal ends of upper and lower limbs, the lower part of face and in external genitalia → **Glove and stocking pattern** of post-mortem staining.

Cause of death	Colour of post-mortem staining
Carbon monoxide (CO)	Cherry red
Cyanide (CN <sup>-</sup> )	Bright red/brick red
H <sub>2</sub> S	Blue-green
Opium	Black
Hypothermia	Bright pink
Aniline, nitrites, benzene, phosphorus, chlorates → methemoglobin production	Chocolate colour/dark brown



Clostridium perfringens

Bronze

**Rigor mortis**

00:50:20

Stiffening and shortening of muscles in a cadaver.

AKA Cadaveric rigidity.

Mechanism : ATP depletion.

Initiated when the ATP levels are 85% of normal.

Maximum when the ATP levels are 15% of normal.

Seen in all muscles, voluntary and involuntary muscles.



Rigor mortis

Before rigor mortis sets in, the body is in the state of 1° relaxation.

2° relaxation occurs when decomposition starts and breaks the stiff actin-myosin bonds.

1<sup>st</sup> muscle involved is myocardium → Starts in involuntary muscles.

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1<sup>st</sup> external muscle involved is that of upper eyelids.

Nysten's law :

Upper eyelid → Jaw → Neck → Face → Chest →  
Upper limbs → Abdomen → Lower limbs → Feet →  
Toe

Rule of 12 :

Within first 12 hours of death : Rigor mortis appears in all the muscles of the body.

Remains in all muscles for the next 12 hours.

Disappears in the next 12 hours.

Rigor mortis appears and completely disappears within

36- 48 hours after death.

Can be used to assess time since death.

Condition	Rigor mortis
Fetus < 7 months	Not appreciable
Violent death like cut throat	Early and short
Strychnine poisoning mnemonic : <b>StEaL</b>	Early and long
Arsenic poisoning mnemonic : <b>ALL</b>	Late and long
Organophosphorus poisoning	Early
Anemia, hemorrhage, shock	Late

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Other causes of stiffening :

Heat stiffening → Temperature surrounding the body is  
>65°C.

mechanism is coagulation of muscle protein.

Cold stiffening → Temperature < -5° C.

mechanism : frozen body fluids.

Gas stiffening → Due to gases released during  
decomposition.

Seen 2-3 days after death.

Cadaveric spasm :

Seen in : mnemonic → **ABCDEF**.

**A**sphyxial death.

**B**rain injury.

**C**erebral injury.

**D**rowning.

**D**initro ortho cresol poisoning.

**E**xhaustion.

**F**ire arm injury.

**F**ear.

Involves only few muscles of the body, mostly voluntary small group of muscles (like small muscles of hand).  
Seen in few types just after death.  
1° relaxation is absent.



Cadaveric spasm

Example : In a person who committed suicide by shooting himself on the head, the hands which held the gun will be in cadaveric spasm.

AKA Instantaneous rigor/Cataleptic rigidity.

Cellular death has not occurred → Responds to electric stimuli.

Gives an idea of manner > mode of death.

manner of death :

Natural, accidental, suicidal,

homicidal or undetermined.

modes of death :

According to Bichat is asphyxia (lung), syncope (brain) and coma (brain).



## POST MORTEM CHANGES & TYPES OF DEATH : PART 2

### Postmortem changes

00:00:12

Late changes :

Decomposition → External changes of the body.

Putrefaction → Internal changes of the body.

Autolysis → Lysis of the body by body's own enzymes.

E.g : Cornea becomes opaque.

Surest signs of death → Decomposition and putrefaction.

m/c bacteria → Clostridium welchii.

m/c enzyme involved → Lecithinase (lytic enzyme).

Putrefaction :

Clostridium welchii.

Lecithinase (lytic enzyme).

1<sup>st</sup> organ to putrefied → Larynx and trachea.

Followed by liver and lungs.

Decomposed liver has gas formation & therefore it is called as foamy liver or honeycomb appearance.

Foamy liver → Seen in 24-36 hours after death.

Overall 1<sup>st</sup> internal change → Brownish discoloration of aortic intima > color change of under surface of liver (greenish).

Followed by (BHU) : Brain, Heart & Uterus (non gravid).

In case of males → Brain, heart and prostate.

Last organ to decompose, overall → Bone.

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### Decomposition

00:07:39

Clostridium welchii.

Lecithinase (lytic enzyme).

1<sup>st</sup> change → Greenish discoloration of right iliac fossa.

Summer → 12-18 hours ; Winter → Around a day.

Active space



It is because of sulph-hemoglobin.  
maximum bacterial activity is present at **caecum**.

2<sup>nd</sup> → marbelling.

Starts in 24 hours and prominent in 36-48 hours.

Superficial veins are distended and prominent.

Especially chest, thigh, shoulder, and abdomen.

Colour → Bluish purple or reddish brown or reddish green.

Due to sulph-hemoglobin.

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maggot formation :

Flies are musca domestica or musca vincinia.

Summer → 5-6 days.

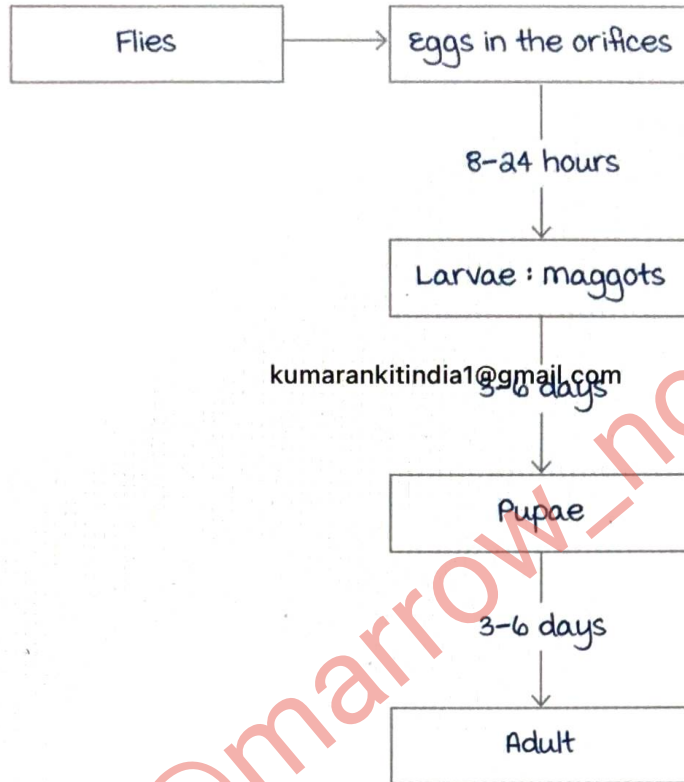
Winter → Around 10 days.

Generally maggot formation is seen in 48 hours around 2-3 days.

Rainy season → 1-2 days (24 hours).

Study of maggots and insects → entomology (time since death).

Study of poison in maggots → Entomotoxicology.



megnin studied different stages of maggots and flies.



4<sup>th</sup> change → After 2-3 days.

Gas stiffening.

Facial distension or abdominal distension.



Pm purge : mouth and nose → Regurgitation.

- mouth → vomit or discharge of gastric contents from the mouth.
- Nose → Frothing.

Skin slippage.

Uterine & anal prolapse.

Hair and teeth become loose.

5<sup>th</sup> change → After 3-5 days.

Skin → Come off specially in glove and stocking pattern.

Ununited sutures of skull bone are separated.

After 5-10 days → Colliquative necrosis.

In bone 1<sup>st</sup> amino acid that disappears : Proline & hydroxyproline.

Last amino acid that disappears → Glycine.

Poison delaying decomposition :

mnemonic : **SMC**.

Strychnine.

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Metallic poison (arsenic, antimony, thallium).

Carbon mono oxide, cyanide and carbolic acid.

### Casper-dictum

00:22:32

Given by Taylor.

Rate of decomposition.

Air > Water > Soil.

Maximum bacteria is present in air.

E.g., Air in 1 week > Water in 2 weeks > Soil in 8 weeks.

**Pink teeth phenomenon** → Due to decomposition of gums.

**Post mortem luminescence** → Light coming out from dead body.

Due to photobacteria and fungus like armillaria and Ramsbottom.

## Modification of decomposition

00:26:12

1) Adipocere : AKA **grave-wax** (saponification).

Seen in warm or humid climate or the body is in water.

Fatty acid change → *Clostridium welchii*.

Enzyme → Lipase.

Hydrolysis of fatty acid and hydrogenation of fatty acid.

Time required → **3-4 days** in India due to humidity and **3 weeks** in other countries.



Fresh → Soft, moist and white

(sweetish or offensive smell → **Rancid butter** smell).

Old → Yellow, hard and brittle.

Seen in face, breasts, abdomen, thigh, buttocks.

Smell of the body → Remains even in clothes of doctor performing post-mortem.

This smell is known as **pseudo** smell.

Offensive smell is due to palmitic acid, oleic acid, stearic acid and hydroxy stearic acid.

In **foetus** below 7 months of age adipocere changes are **absent**.

medicolegal significance :

- Climate of the body.
- Time since death (TSD).
- Lysis of the body is slow → Identification of the body is for longer period.

Active space

a) Mummification :

Seen in dry and hot climates.

Dehydration of the body.

AKA desiccation.

Odourless.

Natural features of the body are preserved.

Time required → 3 months - 1 year.

If antimony and arsenic are present in the soil :

Increases or favours the rate of mummification.

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It is a sign of **intra uterine death**.

medico legal advantage :

- Climate.
- Time since death.
- Identification of body is easy or for longer duration.

Food in stomach is an important criteria to decide time since death.

Stomach emptying time :

Light meal → Leaves the stomach within 2 hours.

medium sized meal → 3-4 hours.

Heavy meal → 5-8 hours.

### **Embalming fluid**

00:39:07

Transportation of dead body is preserved with the help of embalming fluid.



2 methods of embalming :

1. Arterial injection → **Femoral artery**.  
Known as Injection and drainage method.
2. Cavity method.

medicolegal advantage :

- Should be done within 6 hours of completing post mortem.
- **Embalming** should be done after knowing the cause of death or after issuing death certificate after **post-mortem**.

If embalming is done before post-mortem findings may be changed.

**Doctor is punishable under 201 IPC** → Disappearance of evidence.

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Constituents of embalming fluid :

- Formaldehyde.
- methanol.
- Phenol (germicide).
- Glycerine (lubricant).
- Sodium chloride.
- Sodium citrate.
- Water.

**107 IEA** : Presumption of survivorship.

No evidence of death → Presumed as alive for next 30 years.

**108 IEA** : Presumption of death.

Not heard for last 7 years.

Unknown dead body or unclaimed dead body → Dead body should be preserved in mortuary.

**minimum time** of preservation is 72 hours.

If 2 or more family members died in same accident or causality → **Commorientis**.

Presumption of survivorship : **Young > old person**.

## Starvation

00:50:13

Post mortem changes :

most characteristic is gall bladder distension with bile.

Brown atrophy of the heart.

Stress fracture.

All organs : Decrease in size, shape and weight (except : brain).

Fats are reduced : Last site is breast and orbital fat.

mucosa of intestine → tissue paper like.

New bone can survive upto 7-10 days while starvation.

Normal person can survive upto 10-12 days without food and water.

Normal person can survive upto 6-8 weeks without food.

Children starved by parents : Baby farmers.

Declaration :

- Declaration of Geneva : Oath defined.
- Declaration of Tokyo : Torture defined.
- Declaration of Sydney : Death defined.
- Declaration of Munich : medicine defined.
- Declaration of Helsinki : Human experimentation defined.
- Declaration of Oslo : Therapeutic abortion defined.
- Declaration of Lisbon : Rights of different patients described.
- Declaration of Washington : Biological warfare defined.
- Declaration of Ottawa : Child health defined.
- Declaration of Hong-Kong : Old person abuse.

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# TOXICOLOGY : PART 1

## Toxicology

00:00:10

Study of poison.

Father of toxicology : **Orfila**.

**Toxinology** : Study of living toxins (snake, spider, scorpion, plant, bats).

Acts and rules in toxicology :

Drug and cosmetics act 1940.

Drug and cosmetics rule 1945 :

Certain drugs are classified under schedule :

- C → Biological products.
- E → **Poison**. 60c6b3eeaa8ded0e4e7e5ea7
- F → Vaccines, sera.
- G → Hormones.
- H → All drugs prescribed by a registered practitioner.
- X → **Drugs with abuse potential**.

Narcotic Drugs & Psychotropic Substances (NDPS) Act 1985 :

- **Narcotics** → Cocaine, cannabis, opium.
- **Psychotropic substances** → LSD, amphetamines.

## Laws related to toxicology

00:04:57

326 IPC (Related to vitrolage).

- A → Punishment for Acid attack.
- B → Punishment for Acid attack attempt.

357 CrPC : No acid attack victim will be denied treatment by any hospital, public or private, under any pretext.

166 B IPC : Punishment for delayed/denied treatment to acid attack victim.

154 CrPC : Police bound to file FIR.

166A IPC : Punishment to police for non-filing of FIR.

328 IPC → **Hurt by poison**.

284 IPC → Poisoning due to negligence.

274 IPC → Adulteration of drug.

Active space



39 CrPC → Every medicolegal case should be informed to police/magistrate.

176 IPC → Non-compliance to informing of a medicolegal case.

175 CrPC → Bound to give all information to the investigating officer.

201 IPC → Disappearance of evidence.

202 IPC → Concealed information.

32 IEA → Dying declaration.

### Poison categories

00:12:54

#### 1. Stupefying agents :

- Datura.
- Cannabis.
- Chloral hydrate.

#### 2. Cattle poison :

- Calotropis.
- Abrus.
- Arsenic.
- Aconite.
- Oleander.
- Strychnine.

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#### 3. Aphrodisiac :

- Cantharides.
- Cocaine.
- Cannabis.
- Arsenic.
- Opium.
- Strychnine.

#### 4. Arrow poison :

- Abrus.
- Curare.
- Snake.
- Calotropis.
- Strychnine.

#### 5. Abortifacient (mnemonic : PECOLA)

- Plumbago.

- Ergot.
- Calotropis.
- Oleander.
- Lead.
- Arsenic, Aconite, Abrus.

#### 6. Household poisons :

- Nail polish remover : Acetone.
- Disinfectant : Phenol.
- Drain cleaner : Sodium hydroxide.
- Ink remover : Oxalic acid, sodium hypo chloride.
- Shoe polish : Nitro benzene.
- Paint remover : Sodium hydroxide, lead acetate.

#### Ideal homicidal poison : Thallium.

- No smell.
- No taste.
- Not detectable in postmortem.
- mimic natural disease.
- No color.
- No changes in dead body.

most common homicidal poison : Arsenic and aconite.

#### Ideal suicidal poison : Cyanide.

- Fatal dose should be less.
- Fatal period should be less.

most common used suicidal poison : Insecticide :

Organo-phosphorous > celphos.

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### Treatment regime

00:20:58

#### Activated charcoal :

- used as an antidote in many cases of poisoning.
- Physical/mechanical antidote.
- mechanism : Adsorbs poison on surface.
- Dose : 1 g/kg body weight.
- Children : 0.5-1 g/kg body weight.
- Chemical antidote : Acid/alkali.
- Pharmacological/physiological antidote.

Active space

Universal antidote :

Mnemonic : **ATM**.

- Activated charcoal.
- Tannic acid.
- Magnesium oxide.
- A : T : m = 2 : 1 : 1.



Treatment in comatos Activated charcoal

1. Coma cocktail :

Ethanol and opium intoxication.

Composition : (Mnemonic : **DNBI**)

- Dextrose → 100 mL.
- Naloxone → 2 mg.
- Vitamin B<sub>1</sub> (Thiamine) → 100mg.

2. Scandinavian regime : **ABCDE**

- Airway.
- Breathing.
- Circulation.
- Drug (depression of CNS).
- Evaluation.

### Gastric lavage

00:26:46

A.K.A stomach wash.

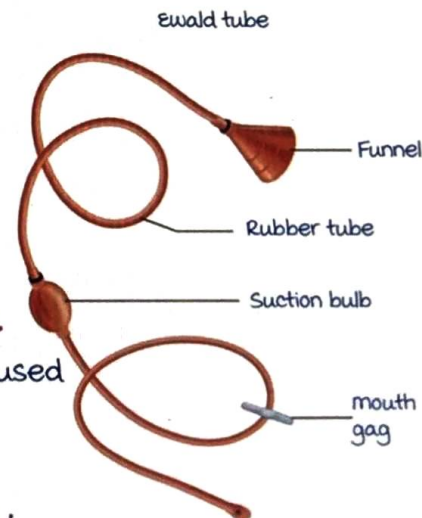
Done within 3 hours of ingestion.

**Ewald's tube :**

150 cm long tube.

Ideal tube : **Lavacuator tube**.

Potassium permanganate is used in 1 : 5000 concentration.



Other materials used include :

- Sodium bicarbonate.
- Tannic acid for precipitation.



- Sodium iodide.
- Calcium.

Specific antidotes :

- Copper poisoning → Potassium ferrocyanide.
- Arsenic poisoning → Hydrated ferric oxide.
- mercury poisoning → Sodium formaldehyde sulfoxylate.

Contraindications of gastric lavage :

- Corrosive (chances of perforation)

Only corrosive where gastric lavage can be done : Carbolic acid (leathery mucosa).

- Convulsant.
- Comatose.
- Hemorrhagic diathesis.
- Esophageal varices.
- Volatile poison.
- Pregnancy (advanced cases).

Emetics

Plant product : Ipecac ; Dose : 30 mL.

Contraindications :

- Corrosive.
- Convulsant.
- Comatose.

Diuresis

1. Alkaline diuresis :

- Phenobarbitone.
- Sulfonamide.
- methotrexate.

2. Acidic diuresis :

- Amphetamine.
- Cocaine.
- Quinine.

Hemodialysis : Contraindications (mnemonic : KBC HERO).

- Kerosene.
- Benzodiazepines.

- Copper sulphate, Chloroquine.
- Heroin.
- Organophosphorus.

## Diagnosis by postmortem findings

00:49:55

### 1. Postmortem staining :

- Cherry red → CO poisoning.
- Brick red → Cyanide poisoning.
- Blue green → Hydrogen sulphite poisoning.
- Chocolate brown → Phosphorous / aniline poisoning.
- Black → Opium poisoning.

### 2. Smell of poison :

During postmortem → First cavity to be opened → #

Cranium → Brain → Smell.

- Garlicky smell : Celphos, Arsenic, Phosphorous, Thallium.
- Kerosene like smell : OP poisoning.
- Rotten egg smell : Hydrogen sulphite (sewer-like).
- Bitter almond smell : Cyanide.
- Fruit like smell : Ethanol.
- Fish like smell : Zinc phosphide.
- Burnt rope smell : Cannabis.
- Acid smell : Paraldehyde.
- Carrot like smell : Conium maculatum (Hemlock).
- Shoe polish smell : Nitro benzene.

### 3. Color of stomach mucosa :

- Black : Sulphuric acid.
- Yellow : Nitric acid (yellow color because of xantho-proteic reaction)
- Green : Ferrous sulphate.
- Blue green : Copper.
- Buffy white : Carboic acid.
- Grey, white/yellow : Phosphorous.

### 4. Teeth :

- Chalky white teeth : Sulphuric acid.
- Black teeth/ tongue : Cocaine.

## 5. Pattern of mucosa :

- Leathery mucosa : Carbolic acid
- **Red velvety mucosa** : Arsenic.
- Diphtheric colitis (dysentery symptoms) : mercury.

## 6. Subendocardial hemorrhage : Arsenic poisoning.

## 7. Subendocardial infarction : Aluminium phosphide poisoning.

## 8. Proximal convoluted tubule necrosis :

- Carbon tetrachloride.
- Phenol (carbolic acid).
- Lysol.
- mercuric chloride.

**Never seen in lead.**

## 9. Delayed decomposition :

- Strychnine.
- **metallic poison** (Arsenic, antimony, thallium).
- Cyanide, carbolic acid.

**Postmortem examination of poisoning**

00:36:58

## Common preservatives :

Sample	Preservative
Blood (100 mL)	Sodium fluoride.
Urine (100 mL)	Thymol > Toluene.
Viscera <ul style="list-style-type: none"> <li>• Stomach with contents.</li> <li>• Intestine (30 cm) with contents.</li> <li>• Liver (&gt;300g) + gall bladder.</li> <li>• Half kidney each.</li> <li>• Half spleen.</li> </ul>	Best preservative : <b>Rectified spirit.</b>  most used : Saturated solution of common salt.

Rectified spirit → 90% ethanol.

Rectified spirit contraindicated in (mnemonic : **PAPA**).

- Phosphorous, Phenol.
- Alcohol.
- Para aldehyde.



- Acetic acid.

For Histopathology of organ : Formalin.

For virology of organ : Glycerol.

### Organs specifically preserved for poisons

00:54:23

Poison	Specific organ
Organo phosphorous.	Brain (alkaloids).
Gaseous poison.	Lungs (in nylon bags).
Heavy metals.	Bones.
Endrin (organo-chlorine).	Subcutaneous fat.
Glutathione. Barbiturates. methadone. Cocaine. Nicotine.	Gall bladder and bile.
Cyanide.	Spleen.

Best specimen for all poisons :

- Vitreous.
- Synovial fluid.
- Bile.

Best specimen in decomposed body : Buttock muscles.

Best organ for DNA extraction : Spleen.

Best organ for DNA extraction in a decomposed body : Brain.

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## TOXICOLOGY : PART 2

Agricultural poisons :

1. Insecticides :

Organophosphates, celphos, organochlorines.  
most commonly used as suicidal poison in India.

2. Rodenticides.

### Organophosphorus (OP) poisoning

00:01:20

There are two types :

Alkyl phosphates → malathion.

Aryl phosphate → Parathion (follidol), diazinon (Tik 20).

Organophosphates	Carbamates
malathion, parathion, diazinon.	Aldicarb, D carb, Baygon, propoxur.
Irreversibly inhibits acetyl choline esterase.	Reversible inhibition of acetyl choline esterase.
Antidotes are atropine and oximes.	Atropine can be used, but oximes are contraindicated.

Smells like kerosene (due to aromax).

Effect is cholinergic.

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- muscarinic effect : mnemonic → BSC.

Bradycardia.

Secretions are increased → Red tears due to secretion of porphyrins into tears →

Chromolacryorrhoea.

Constriction of pupil (miosis).

- Nicotinic effect :

muscle weakness, muscle fasciculations leading to paralysis.

Active space

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- Central effects :

Tremor, headache and confusion.

Drug of choice : Atropine, inhibits both the central and muscarinic effects of organophosphates.

Oximes inhibit the formation of nicotinic effects predominantly.

Investigations :

IOC is RBC cholinesterase → most specific.

< 50% indicates poisoning.

Plasma cholinesterase test → most sensitive test.

P nitrophenol test → Confirmatory test.

Post mortem examination :

Shows signs of asphyxia.

Congestion of organs.

Pulmonary edema.

Treatment :

Gastric lavage with potassium permanganate at a concentration of 1 : 5000.

Antidotes are atropine and oximes.

Carbamates have nearly absent CNS toxicity, as it cannot penetrate CNS.

## Endrin

00:10:29

Belongs to organochlorine compounds.

Other organochlorine compounds are aldrin, DDT, lindane.

AKA Plant penicillin.

Acts by the inhibition of GABA mediated chloride channels.

CNS stimulant.

Causes incoordination, ataxia and convulsions.

Kepone shakes, which is the tremor of the head and hands, are seen in chlordane poisoning (trade name is Kepone, another organochlorine compound).



No specific antidote.

Treated with gastric lavage.

## Celphos

00:13:08

Aluminium phosphide ( $AlP_3$ ).

It liberates phosphine gas ( $PH_3$ ).

Phosphine inhibits the cytochrome oxidase enzyme.

Garlicky smell.

Fatal dose : 1 to 3 tablets.

Cause of death : Cardiogenic shock.

Centrizonal necrosis is seen in liver.

Has no specific antidote.

Gastric lavage is done.

Magnesium sulphate is given to neutralize the poisoning.

Zinc phosphide :

Used as a rodenticide.

Similar to aluminium phosphide, but slower in action.

## Corrosive poisons

00:16:27

Acids → Causes coagulative necrosis.

Hydrofluoric acid causes liquefactive necrosis.

Alkali → Causes liquefactive necrosis.

Causes more damage.

e.g. : Ammonia, sodium hydroxide (lye).

Inorganic acids :

Sulfuric acid → Oil of vitriol.

Nitric acid → Aqua fortis.

Acts locally, systemic effects are absent.

Sulfuric acid ( $H_2SO_4$ ):

Strongest acid.

Fatal dose : 5 to 10 mL.

Fatal period : 18 to 24 hours ( can be remembered as 15 to 20 hours).

Earliest symptom is pharyngeal spasm / pain.

Immediate cause of death : Circulatory collapse.

Delayed cause of death : Perforation → Peritonitis.

Starvation and dehydration due to stricture formation.

Chalky white teeth due to erosion.

mucosa and organs are black and necrosed.

Gastric mucosa → Blotting paper mucosa.

Treatment :

magnesium oxide is applied topically over the skin burns after washing thoroughly with water.

Gastric lavage is contraindicated.

Alkaline carbonates generate  $\text{CO}_2$  → Not used as it can cause perforation.

IV fluids.

Vitriolage :

Acid throwing.

Comes under IPC 326A (acid attack) and 326B (attempt to throw acid).

Some plant juices are also used → Semicarpus anacardum.  
Calotropis.

Alkali can be used to neutralize the acid in the burn.

## Nitric acid ( $\text{HNO}_3$ )

00:25:54

AKA Aqua fortis/Tezaab.

Causes yellowish discolouration of skin, mucosa, teeth and tissue.

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Due to formation of picric acid from tyrosine.

This reaction is known as Xanthoproteic reaction.

mucosa and urine can become brown colored → Hematin production.

## Organic acids

00:28:09

Organic acids act locally and systemically.

### Oxalic acid :

Also known as acid of sugar.

used as an ink remover.

Seen in some vegetables like spinach, cabbage, tomato.

Fatal dose : 15 to 20 g.

In the body, it forms calcium oxalate → Symptoms of hypocalcemia.

Coffee ground vomitus (brown colour) is seen → Hematin formation.

Treatment :

- Calcium lactate.
- Calcium gluconate 10%.
- Chalk powder / wall scraping (contains calcium) is used to neutralize.

Oxaluria, oxalate crystals in urine seen, which causes :

Renal stones.

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Renal failure.

PCT necrosis.

### Carbolic acid :

AKA Phenol.

It is an antiseptic.

Clinical features are :

Acute poisoning → Carbolism.

Constriction of pupil.

Carboluria with dark green coloured urine.

Chronic carbolic acid poisoning → Phenolic marasmus.

Deposition in cartilages → Ochronosis.

Causes PCT necrosis.

Pyrocatechol and hydroquinone are the cause for dark green urine and ochronosis.

Ochronosis is also seen in alkaptonuria.

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Leathery mucosa.

Delays decomposition of body.

Treatment :

Gastric lavage can be done.

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Olive oil can be used for gastric lavage.

Boric acid :

Causes **boiled lobster syndrome** → Desquamation of skin.

### Alkali poisoning

00:40:08

more dangerous.

Charring/Eschar formation is **absent** or less.

Esophageal spasm is more common.

# TOXICOLOGY : PART 3

## Metallic poisons

00:00:08

Arsenic :

metal is non-poisonous but the compounds are poisonous.  
most commonly used homicidal poison.

1. Copper arsenite/Scheele's green.
2. Copper acetoarsenite/Paris green.
3. Arsenic trioxide/white arsenic/Sankhya/somalkar :  
most poisonous arsenic compound.  
used in the treatment of acute promyelocytic leukemia (AML- m3).
4. Arsine gas.

## Presentation of Arsenic poisoning

00:01:13

Mnemonic : ARSENIC.

Aphrodisiac : When taken so for prolonged periods, it causes tolerance → arsenophagist.

Aldrich mees line (Or the nail bed)

Single transverse white line.

Rash.

Red velvety mucosa of stomach/strawberry mucosa.

Rain drop pigmentation.

Reinsch test/marsh test.

Atomic absorption spectroscopy  
(another important test).

Sub-endocardial hemorrhage/Sheehan's hemorrhage.

Excessive hyperkeratosis of palms and soles.

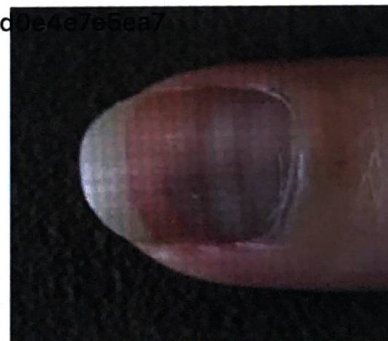
Peripheral Neuropathy : Sensory > motor.

Iron oxide i.e., Hydrated ferric oxide : Chemical antidote.

Imbibition : Arsenic can be absorbed into the body after death, from the soil → Post mortem imbibition.

Cholera like clinical features.

Golden hair (also seen in Cadmium toxicity).



Active space

Garlicky smell present.

Fatal dose : 100 - 200 mg.

Target tissue of arsenite :

vascular endothelium (Pyruvate oxidase) → Hemorrhage  
→ edema.

Attacks enzymes that have sulfhydryl (-SH) group  
(Pyruvate oxidase, respiratory enzymes, mitochondrial en-  
zymes).

Types of arsenic poisoning :

A. Fulminant type : massive dose of arsenic intake →

Peripheral vascular failure/ Shock : Cause of death.

B. Gastro enteritis type : mimics cholera. Acute arsenic  
poisoning and features rice water stool. MC type.

Symptoms : 1. Throat pain (T).

2. Vomiting (V).

3. Purging (P)

Additional features :

Earliest symptom of chronic arsenic poisoning :

Leucomelanosis (depigmentation of malar area).

Very commonly used as homicidal agent.

(Ideal homicidal poison : Thallium).

Acute poisoning : Commonly affects the liver.

Does not cross blood brain barrier.

Chronic poisoning : Affects skin, bone, hair, nail.

Black foot disease :

Thrombosis of peripheral artery → gangrene.

Causes delayed composition.

ATO (White arsenic) : used in Acute promyelocytic leukemia  
(AML - m3).

Treatment :

Antidote : Hydrated ferric oxide along with gastric lavage.

Chelating agent for arsenic : BAL (British Anti Lewisite)/

Dimercaprol.



## Mercury (Hg)

00:16:50

Also called **quick silver**.

Seen in liquid form.

Poisonous forms of mercury :

**Organic forms** > mercuric form > mercurous form.

**mercuric chloride** is a most common /poisonous mercuric form, that is a corrosive sublimate.

Fatal dose : 1 - 2 g.

Donovan's solution : mixture of **arsenic** and **mercury** compounds.

used for the **treatment of STDs**.

Acute poisoning : Breathing difficulty, pain.

Causes **PCT necrosis**, Diphtheria like membranous colitis.

Chronic mercury poisoning : **Hydrargyris**.

Features of chronic mercury poisoning :

- **minamata disease** : Japan.  
Ingestion of shell fish.
- **mercuria lentis** :  
mercury deposition in **anterior lens capsule**.  
**Brown malt reflex** is seen.  
Visual acuity is normal.
- **Gingivostomatitis**.
- **Tremor** :  
**Danbury tremor** → coarse tremor of hand, difficulty in writing occurs.  
**Hatters shake** and **glass blowers shake** are seen in advanced stage.  
**Concussion mercurialis** : most advanced stage.
- **Erethism** :  
**Psychiatric symptoms** like shyness, anxiety, develops depression, lack of confidence, irritability.
- **Acrodynia** :  
Seen in children.  
**mercurous chloride** is responsible.  
**Limbs become pink, painful, puffy**.  
Also known as **Pink disease** or **Swift disease**.

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- Greyish white mucosa is seen.

Treatment :

Gastric lavage.

Chelated by BAL.

Chemical antidote : Sodium formaldehyde sulfoxylate.

EDTA is contraindicated.

## Lead

00:29:58

metal and salts are poisonous.

Common lead salts :

Lead acetate : Fatal dose is 20gm.

Lead tetroxide → in vermilion (sindoor).

Lead carbonate → paint.

Fatal dose is 40gm.

Lead sulfide is less toxic.

Tetra ethyl lead → anti-knock agent present in petrol.

Acute lead poisoning :

Irritant poison causing throat pain, nausea, vomiting, difficulty in breathing.

Chronic poisoning : Plumbism.

Also known as Saturnism.

Clinical features : mnemonic ABCDEF.

Anemia → microcytic hypochromic anemia.

Inhibition of enzymes : ALA dehydratase, ferrochelatase.

Amenorrhoea (sterility in both sexes).

Blue line on gums, especially upper jaw → Burtonian line.

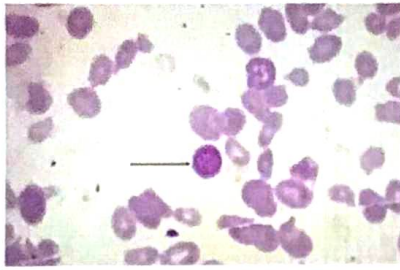
Deposition of lead sulfide.

Blue dot in RBC → Basophilic stippling.

Inhibition of pyrimidine 5' nucleotidase.

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Basophilic stippling



Burtonian line : Lead poisoning

Constipation.

Abdominal Colic → dry belly ache.

Drop → wrist drop and foot drop.

Encephalopathy → common in children.

Facial pallor due to vasospasm :

**Earliest and most consistent symptom.**

Opaque dense bands at the metaphyseal ends of long bones (after ~4 weeks of exposure).

Treatment :

BAL along with DMSA > EDTA.

Urine ALA and porphyrin levels are estimated for the diagnosis.

Serum zinc protoporphyrin can also be used.

## Copper

00:40:08

metal as such is not poisonous.

Poisonous compounds are :

Copper sulphate → blue vitriol.

Copper subacetate → verdigris.

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Clinical features :

**Clapton line** on gums → blue green line.

Vomiting and frothing also have bluish green colour.

Chalcosis → deposition of copper in tissues and skin.

Wilson's disease.

Vineyard sprayer lung disease → involvement of lungs.

Increased salivation → **Ptyalism**.

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Blue-green discoloration of hair seen when swimming in a pool treated with algicidal copper compounds.

Treatment :

Penicillamine → chelating agent used in the treatment of copper. **Treatment of choice.**

Potassium ferrocyanide → antidote of copper.

## Thallium

00:44:19

**Ideal** homicidal poison.

Classical triad.

- Painful peripheral neuropathy → resembles Guillain-Barré syndrome.
- Alopecia.
- Skin rash.

**Signe de sourcil** : Loss of lateral 2/3<sup>rd</sup> of eyebrows.

Toxicity	mimics
magnesium	Parkinsonism
Cadmium	Brittle bone disease

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Cadmium toxicity causes Itai-itai disease/Ouch-ouch disease.

Zinc, copper and selenium causes **metal fume fever.**

Also known as smelter fever.

Has flu like symptoms.

mimics malaria.

Also called Monday morning fever.

## Phosphorus

00:49:48

Non-metallic poison.

Protoplasmic irritant poison.

Types of phosphorus.

Two types : white and red phosphorus.

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White phosphorus	Red phosphorus
Toxic. Fatal dose is 60- 120 mg.	Non-toxic
Garlicky odor	Odorless
Luminous → phosphorescence	Non-luminous
Has a typical morphology	Has no typical morphology
Kept in water	Can be kept open
Diwali poison → used to make crackers	Used at the side of matchboxes

White + red phosphorus → Yellow phosphorus

Acute poisoning :

Symptoms of gastroenteritis.

Vomiting and stool are luminous.

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Smoking stool syndrome.

This is diagnostic.

Asterixis → flapping tremor of hand.

Chronic phosphorus poisoning :

Involvement of jaw bone → necrosis with multiple sinuses.

Phossy jaw.

First discussed by John Syer Bristowe.



Phosphorus burn

Treatment :

Phosphorus burn → copper sulphate is used.

Antidote for phosphorus is copper sulphate.

It is a poison → only topical application used.

Phosphorus poison by ingestion :

Gastric lavage with potassium permanganate.

Vitamin K.

Peritoneal hemodialysis.

match stick : Potassium chlorate and antimony sulphide.

### Spinal cord poisons

00:58:17

Strychnine :

Acts on the anterior horn cells of spinal cord.

Inhibits glycine → excitatory effect.

Convulsions are initially clonic and then tonic.

Clinical features similar to tetanus.



Strychnine seeds

Fatal dose is one crushed seed.

Seeds → concave on one side and convex on the other.

Also known as :

Kuchila.

Nux vomica.

Dog button.

used as arrow poison and aphrodisiac.

Toxins :

- Brucine.
- **Strychnine** : 10- 20 times more potent.

Cause of death : Asphyxia due to respiratory muscle spasm.

Antidote : Diazepam.

Electric stimuli increase the intensity of convulsions.

Complete relaxation seen between two convulsions.



Test :

Wenzel test.

Sonnenschein test.

Spasms seen :

**Opisthotonus** : Hyper extension of the back.  
most commonly seen.

**Emprosthotonus** : Hyperflexion of the back.

**Pleuronotus** : ~~muscular~~ **lateral** bending.

**Trismus** : Lock jaw.

**Risus sardonicus** : Grimacing face.

Treatment : Acidification of urine.

## Nerve poison

01:05:29

Conium maculatum :

Also called as hemlock.

used to kill socrates.

Causes **motor paralysis** of the body.

**Carrot like** smell.

## Cardiac poison

01:06:47

e.g.: mnemonic : DONH as A Queen.

**Digitalis**.

**Oleander**.

**Nicotiana tabacum** (tobacco).

**Hydrocyanic acid** (HCN).

**Aconite**.

**Quinine**.

**Cerebra odallam** → **suicidal tree**.

Contains the toxin **cerberin**, **odelin**.

**Tobacco** :

most common substance **used** and **abused** in India.

**Aconite** :

Also known as **metha zehar**, **monk hood** and **blue rocket**.

**Roots** are most **poisonous** and looks like **horse radish**.

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Roots of aconite



Aconite flowers

mechanism of action of aconite :

Stimulates the sodium gated voltage channels initially then it blocks.

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Causes slow repolarization of the cardiac muscles by prolonged sodium current.

most characteristic symptom is tingling and numbness.

Paresthesia of face, especially peri-oral area, and fingers.

Other symptoms :

Nausea, vomiting, increased salivation.

Hippus : Alternate contraction and dilation of pupil.

Effect on heart :

Bradycardia & Tachycardia occurs.

Bradycardia : Treated by Atropine.

Tachycardia : Treated by Amiodarone/Flecainide.



Cause of death : Ventricular arrhythmia.

used as homicidal poison :

Odorless.

Sweet taste.

Destroyed during putrefaction and hence not detected in post mortem.

white/pink oleander	Yellow oleander
Nerium odorum. Toxin is nerine.	Cerebra thevetia. Toxin is thevetin. Cause hyper & hypokalemia. Cause hyperkalemia
	

Active space



## TOXICOLOGY : PART 4

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**Asphyxiant gases**

00:00:09

Carbon monoxide (CO) :

Odorless gas.

Causes suffocation.

Forms **carboxyhemoglobin (COHb)**.Causes **anoxic anoxia** or **anemic hypoxia**.Hemoglobin has **200-300** times more affinity to CO than  $O_2$ .Safety limit in air  $\rightarrow$  **0.01%**.COHb in blood is **10-20%**  $\rightarrow$  **muscle weakness**.COHb in blood is **40-50%**  $\rightarrow$  Symptoms resemble **alcoholic intoxication**.

Tests for CO detection :

Kunkel test.

Wetzel test.

Hoppe-Seyler test.

Post mortem findings :

- **Skin blisters**.
- **Petechial hemorrhages** in internal organs.
- **Cherry red colour** post mortem staining.
- **Bilateral symmetrical hemorrhagic necrosis or cavitation** of **basal ganglia**, especially **putamen** and **globus pallidus**.

Treatment :

**100% oxygen** via a tight-fitting mask.**Hyperbaric oxygen** is used as an antidote for the treatment of **severe CO poisoning**.**Vitamin E**.Hydrogen sulfide (H<sub>2</sub>S) :**Sewer gas**  $\rightarrow$  **H<sub>2</sub>S**, **methane**, **ammonia**.Smells like **rotten eggs**.

Also a knockdown gas.

Japanese detergent suicide → Formation of  $H_2S$  by mixing bath salts and bowl toilet cleaner.

Treatment: Amyl nitrite.

Post mortem staining is bluish green.

Cyanide ( $CN^-$ ):

most potent is hydrocyanic acid (HCN).

AKA Prussic acid.

When dissolved in water, it is called Scheele's acid.

Gaseous form is called cyanogen.

Mechanism:

Inhibition of cytochrome oxidase enzyme → histotoxic anoxia (hypoxia).

Also inhibits carbonic anhydrase, superoxide dismutase.

Fatal dose of HCN is 50-60mg.

Fatal period is 2-10 minutes.

Smells like bitter almonds.

Treatment:

Vitamin B12 can be given.

Antidote kit is Eli Lilly's antidote kit (triple antidote).

Contains: Amyl nitrite.

Sodium nitrite.

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Sodium thiosulphate.

Amyl nitrite and sodium nitrite converts methemoglobin to cyanmethemoglobin.

Sodium thiosulphate converts to thiocyanate which can be excreted through urine.

Amyl nitrite is given via inhalational route.

Test to determine cyanide in the body → Lee Jones test.

## Deliriant poisons

00:12:04

Datura:

Anticholinergic action → dilation of pupils seen.

The anticholinergic agents present are hyoscyine, scopolamine, and atropine.



Datura stramonium and its seeds

Datura stramonium → Also known as thorn apple.

Fatal dose is 100-125 seeds.

Resembles chilly seeds.

Datura seeds are :

Large seeds.

Brown in colour.

Embryo curves outwards (in chilly seeds curve inwards like the figure of 6).

Datura alba :

White flowers.

Datura niger :

Purple flowered plant.



D's in Datura :

Dryness of mouth and throat, bitter taste → earliest sign.

Dilation of pupil.

Diplopia

Dysarthria.

Drunken gait.

Delirium → muttering delirium.

Depression of respiratory centers.

Drowsiness.

Dry and hot skin.

Death.



mydriatic test :

The solution to be tested is instilled in the eye of a cat  
→ Dilation of pupil is indicative of the presence of datura.

Corn picker's pupil :

Exposure to the pollen of Datura causes mydriasis (mydriatic test).

**Carphologia is seen.**

(Picking up imaginary threads from bed sheets or clothes).

Commonly used as roadside or railway side poison.

- Causes delirium.

Antidote of datura : **Physostigmine** > Pilocarpine.

## Cannabis

00:19:46

CNS stimulant.

**9- tetrahydrocannabinol (9THC)** is the main toxin responsible for the effects.

Preparations from cannabis :

- Bhang.  
Prepared from dried leaves.  
Fatal dose is **10gm/kg body weight**.
- Ganja.  
made from the female flower tops.  
Cigarettes made are called reefer.  
Also called as weed, joint.  
Fatal dose is **8 gm**.
- Charas.  
Resin exudate of root and leaves.  
Also known as Hashish.  
most potent form of all the formulations.  
Fatal dose is **2gm**.
- majoon.  
Sweet preparation.
- marijuana is the dried form of any part of the plant.
- sinsemilla → **Seedless** marijuana.

Chronic intoxication features :

- **Hashish insanity**  
Visual and auditory hallucinations.
- **Run amok**  
Develops the **homicidal tendency** → impulse to kill someone. If the person kills someone when in this state, they are **not responsible** for their actions under **IPC 84**.
- **Amotivational syndrome**.
- **Flashback phenomenon** → Re-experiencing the past. Patient feels that they have taken cannabis despite not taking it.  
Also seen with LSD.
- **Koro syndrome**.  
Patient believes that the size of the penis/ breast is decreasing.  
Culture based phenomenon. 60c6b3eeaa8ded0e4e7e5ea7  
Antidote used is **Diazepam**.
- **Love boat** :  
marijuana in formaldehyde/phencyclidine (PCP).

## Cocaine

00:27:46

Obtained from the leaves of **Erythroxylon coca**.  
Inhibits the **reuptake** of neurotransmitters like epinephrine, norepinephrine and serotonin → Increasing their concentration.

Also known as **crack, coke, cadillac, snow, white lady**.

Crack house : Place that sells cocaine.

Shooting gallery : Place that sells heroin.

Stimulation of the CNS initially, followed by CNS depression.

Clinical features :

Dilation of pupil.

Vasoconstrictor action can cause **gangrene**.

Most common mode of taking cocaine is **snorting**.

Classical triad of cocaine :

- **Black tongue and teeth**.
- **Nasal septal perforation**.

- Peripheral gangrene.

Sample best taken would be nasal swab.

Fatal dose : 1gm orally.

Antidote used is Amyl nitrite.

magnan symptom → Tactile hallucination.

Also known as Formication.

Complaints of insects creeping on the skin.

## CNS depressants

00:33:53

Alcohol :

Chloral hydrate is known as dry wine/ knockout drops.

Combined with alcohol → Mickey Finn.

The types of alcohols are :

Ethanol.

methanol.

Isopropyl alcohol → most potent.

In case of ethanol intake.

For the same amount taken, the females would have higher

blood alcohol levels → enzyme responsible for metabolizing

alcohol is lesser in females than males.

maximally absorbed from small intestine.

metabolized at the rate of 15mg%/ hour.

Follows zero order kinetics.

Concentrations of ethanol :

- Absolute alcohol → 99.95%.
- Rectified spirit → 90%.
- Denatured/methylated spirit → 95%.
- Proof alcohol → 50%.

Relative concentrations :

Specimen	Relative concentrations
Blood	1
urine	1.3
Vitreous	1.2
CSF	1.1 to 1.2

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Alveolar air	0.0021
--------------	--------

Alveolar concentration is used by Henry's law in breath analyze/drunkometer.

Infrared rays are used.

Factors increasing blood alcohol levels.

- Carbonated drinks → Increased surface area of bubbles.
- Empty stomach.
- Warm drink.
- After gastrectomy.

Arrack :

Alcohol distilled from palm/rice/ jaggery.

Contains 40-50% of ethanol.

Tests for ethanol :

Kozelka and Hine test.

Cavett test.

Gas chromatography → most specific.

Widmark's formula :

$$a = pcr.$$

Where, a is the weight of the alcohol.

p is the body weight of the person.

c is the concentration of alcohol in blood.

R is the constant → In males : 0.68, females : 0.55.

Blood concentrations of ethanol :

30mg% → Driving limit according to section 185 of MACT act.

80mg% → Nystagmus develops.

150mg% → motor incoordination sets in.

400mg% → Coma and death can occur.

Stages of intoxication by alcohol :

- Stage of excitement.  
Pupils are dilated.  
Reaction time is hampered at 50mg%.  
Feeling good about oneself.
- Stage of incoordination.

Seen at 150- 200mg% concentration.

- Stage of coma.

Pupil becomes constricted.

McEwan sign → Pupils dilate on pinching. Seen at 300mg%.

There is no specific antidote for ethanol poisoning.

Acute alcohol withdrawal causes delirium tremens.

Seen in 2- 3 days.

A person is held not responsible for the crime

committed during this state under IPC, 1860. [kumarajitindia1@gmail.com](mailto:kumarajitindia1@gmail.com)

Detoxifying agent for alcohol :

Benzodiazepines like oxazepam, lorazepam.

Wernicke's encephalopathy : Vitamin B<sub>1</sub> deficiency.

Clinical features (mnemonic → GOA)

- Global confusion.
- Ophthalmoplegia.
- Ataxia.

Thiamine is included in coma cocktail to combat the deficiency in alcoholism.

## Methanol

00:50:01

Fatal dose is (80-120)mL.



methanol is added to adulterated liquor → Can cause death as in Hooch tragedy.

Clinical features :

Abdominal cramps → Earliest feature.

metabolic acidosis.

Optic neuritis that causes snowfield vision.

Treatment of methanol poisoning :

Ethanol is the drug of choice.

Treatment of choice is hemodialysis.

Fomepizole is also used → Inhibits alcohol dehydrogenase.

Folinic acid → Decrease formic acid.

## Hallucinogens

00:53:49

LSD : Lysergic acid diethylamide.  
Produced by a fungus that infects the rye plants.  
Causes **psychological dependence**.  
mimics **serotonin** structurally, and acts via the serotonin receptors → Patient gets high (trip).  
**Flashback phenomenon** is seen.  
Also known as **acid/battery**.

MDMA : methylene dioxymethamphetamine.  
Also known as **ecstasy**.  
Also known as **love drug/hug drug**.  
**Tactile hallucination** caused by cocaine and ergot.  
MDMA + marijuana is called **love boat**.  
Liquid gold :  
Urine of amphetamine user.

## Somniferous poisons

00:58:02

Causes sleepiness.  
Opium :  
Commonly called as **a-feem, kasoomba, madak, chandu**.  
Unripe capsules of the poppy fruit are incised vertically, and **afim** is extracted.  
Fatal dose of afim is **2gm**.  
Natural products :  

- morphine → Fatal dose is **0.2gm**.
- Codeine.



Poppy fruit

Semisynthetic occurring :  
Heroin → Diacetyl morphine.  
Fatal dose is **50mg**.

Poppy seeds are **non-toxic**.  
Also known as **khas khas**.

Stages of opium toxicity :  
1. Stage of excitement.



Poppy seed



2. Stage of stupor.
3. Stage of coma.
  - Pinpoint pupil.
  - All secretions **except sweat** are suspended.
  - Heart rate is low.
  - BP is decreased.

Opium withdrawal :

- Dysphoria.
- Insomnia.
- **Increased secretions.**
- Increased heart rate, BP and respiratory rate.

Tests for detecting opium : (mnemonic : MDH.)

Marquis test.

Deniges test.

Husemann's test.

Antidote is **naloxone**.

Heroin :

Diacetyl morphine.

**Semi-synthetic** product of morphine.

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Also known as **junk, dope, smack, brown sugar.**

Fatal dose is **50mg.**

mainly taken via **IV route** (mainlining).

In case it is smoked → **Chasing the dragon.**

Strychnine + heroin → **Hot shot.**

Cocaine + heroin → **Speed ball.**

Adulterated by adding another substance → **Cutting in.**

Substances added on **Cutting in** : **Fructose, quinine, mannitol, chalk powder.**



Brown Sugar



method of heroin abuse

Active space

## Plant irritant poisons

01:07:52

Contain toxalbumin → Causes RBC agglutination.

Castor seeds :

Castor plant is also known as arandi.

Fatal dose is 10 seeds.

Mechanism of action of Toxalbumin is similar to ricin.

Inhibits protein synthesis by the inhibition of the RNA polymerase enzyme.

Causes gastroenteritis.

Scientific name is Ricinus communis.



Castor seeds



Croton seeds

Croton tiglium :

Also known as jamalgota.

Toxalbumin is crotin.

Also contains crotonoside.

Fatal dose is 4 seeds.

Abrus precatorius :

Also known as gunja, Indian liquorice, ratti or jequirity.

Toxalbumin is abrin, which acts like viper venom.

Other toxic compounds are abrine, abralin.

Used as cattle poison, arrow poison, abortifacient.

15mm needles/ sui are made.

Fatal dose is 1-2 seeds.

Fatal dose of abrin : 90-120mg.

Treatment of poisoning :

Gastric lavage.



Antiabrin.

Dissection of Sui/needle.

Ratti seeds



Ergot :

Claviceps, a fungus, infects rye grains to produce ergot.

The toxins are **ergotamine**, **ergotoxine**.

Tactile hallucinations/formication is seen.

Saint Anthony's fire : Inflammation of palms and soles.



Rye grains with ergot

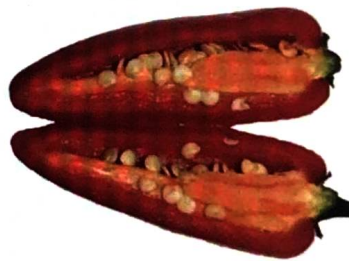
Chilli seeds :

Capsicum seeds.

Small and yellow colored.

Embryo curves inwards giving a figure of 6 appearance.

Causes dermatitis → **Hunan hand**.



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Semicarpus anacardium :

Also known as marking nut.

Two toxalbumins seen.

- **Semecarpol.**
- **Bhilawanol.**

Also known as **bhilawa**.

The juice from the nuts is used to mark clothes.

**Heart shaped seeds.**

used to manufacture **artificial bruising**.





Semicarpus anacardium



Calotropis

Calotropis :

Also known as *akdo/madar*.

Toxalbumins are *calotoxin, uscharin*.

Also known as *rubber bush*.

used to make *artificial bruises*.

Root of the plant toxic to *cobras*.

Increased salivation and dilatation of pupils seen.

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## TOXICOLOGY : PART 5

### Irritant poisons

00:00:14

Blister beetle :

AKA Spanish fly.

Causes cantharide poisoning.



**Cantharidin** → Active compound.

- External contact causes blisters and vesicles over skin.
- Ingestion causes severe inflammation of the GI tract and genitourinary tract.

Priapism (painful erection of penis) maybe seen in males.

Scorpion bite :

Hemotoxic or neurotoxic.

Pharmacological agents given (mnemonic : ABC).

Atropine. 60c6b3eaaa8ded0e4e7e5ea7  
Barbiturates.  
Calcium.

Prazocin is another drug given.

Spider bite :

**Black widow** → most poisonous.

Neurotoxic poison.

Treated using antivenin and Dapsone.

### Snake bite

00:03:18

Ophiology : Study of snakes.

Ophiotoxemia : Poisoning by snake venom.

Some families of poisonous snakes are :


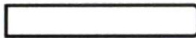


- **Elapidae** → Cobras, King cobra, common krait.  
King cobra is **Ophiophagus** → Eats other snakes.  
Scientific name for cobra → *Naja naja*.

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Scientific name of common krait →

Bungarus caeruleus.

- Viperidae → Vipers.
- Hydrophidae → Sea snakes.

Characteristic	Poisonous snake	Non-poisonous snake
Head scales	<p>Small.</p> <p>Except in :</p> <p>Cobra → Large 3<sup>rd</sup> supra labial/labial scale that touches the eye and nasal shield.</p> <p>Common krait → Large 4<sup>th</sup> infralabial scale.</p>	Large scales.
Belly scales	Large, covers the entire breadth of belly	Small, do not cover the entire breadth of the belly.
Tail	Compressed 	Not compressed 
Teeth mark	<p>Two fang marks (modified canine) that look like hollow hypodermic needle marks.</p> 	<p>Multiple small marks in a semi-circle.</p> 
Habit	Nocturnal	Not nocturnal

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Cobra and common krait are neurotoxic.

Fatal dose of common krait venom is 6 mg.

Fatal dose of cobra venom is 12 mg.

Common krait is more poisonous than cobra.

Cobra is more dangerous than krait → Amount of venom injected in a bite is 40 times more than the fatal dose of krait.

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king cobra



Clinical features of cobra and krait bite :

Ptosis.

Paralysis → Descending paralysis.

Cause of death : Respiratory muscle paralysis.

King cobra	Cobra
Ophiophagus	Naja naja
Longer	Shorter than king cobra
Hood size is small	Hood size is bigger
No spectacle mark on hood	Spectacle mark on hood present

Common krait's venom contains bungarotoxin, which is a neurotoxin.

Local symptoms :

Swelling, ecchymosis, gangrene.

more pronounced in case of viper bite.



Common krait

Absent or minimum in case of common krait.

There might be no obvious symptoms for a few minutes in case of cobras → Dry bite.

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Vipers :

Vipers are vasculotoxic.

Hemolysis, hemorrhage, hematuria.

Can cause disseminated intravascular coagulation.

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Test to assess DIC :

2 mL of blood taken in a test tube → Coagulation is assessed for 20 mins → No clotting at the end of 20 mins points to DIC.

Cause of death is shock.

Fatal dose is 15 mg.



Russel's viper



Saw scaled viper

Sea snakes :

They are toxic to the skeletal muscles → myotoxic.

Can cause muscle paralysis and renal failure.



Sea snake



Non-poisonous rat snake

## Treatment of snake bite

00:17:40

Mnemonic : RIGH T.

Reassure the patient.

Immobilization of the affected limb.

Sutherland wrap can be used.

Go to a hospital as soon as possible.

Treatment : Anti snake venom can be used.

Active space

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Anti snake venom (ASV) :

Prepared against 4 snakes.

Cobra.

Common krait.

Russel viper.

Saw-scale viper.

Dose : 8- 10 vials of antivenom → 20 mL IV.

Should be given within 4 hours of snake bite.

Discovered by Albert Calmette.

Prepared in Haffkine institute, Mumbai.

Neostigmine can be used to reverse the neurotoxicity.

Body packer syndrome :

Seen in drug smuggling.

Large quantities of drug are placed in a polythene bag/  
condom and swallowed.

Also known as surgical mule syndrome.

60c6b3eaa8ded0e4e7e5ea7

Rupture of these bags can cause death → Large quantities  
of drug.

Body stuffer syndrome :

Drug hidden for personal use.

Smaller quantity of drug.

Drug in polythene bag/ condom placed in cavity.

Anal canal, vagina, ear or any surgically created  
cavity.

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