FORENSIC MEDICINE & TOXICOLOGY

- Forensic (Legal) Medicine: Application of medical knowledge to aid in the administration of justice
- Medical Jurisprudence: legal responsibilities of a physician, with reference to those arising from physician patient relationship (e.g. medical negligence cases)
- Medical ethics: moral principles which should guide the members of medical profession
- Medical etiquette: conventional laws of courtesy observed between the members of medical profession

HISTORY OF FORENSIC MEDICINE

- Oldest known medicolegal code: The Code of Hammurabi, King of Babylon
- First medicolegal autopsy was done in Bologna(Italy) in 1302, by Bartolomeo De Varignana
- First book of forensic medicine published by Fortunato Fedele
- The greatest of all works was the "Questions Medicolegales" (medicolegal questions) written by Paulus Zacchias
- Paulus Zacchias - Father of Legal Medicine and Father of Forensic Psychiatry
- Orfila - Founder of Modern toxicology

LEGAL PROCEDURES

- **Indian Penal Code(IPC) -** defines offences and prescribes punishments
- **Criminal Procedure Code (CrPC)**
  - Provides mechanism for punishment of offences
  - Deals with police duties in arresting offenders, in production of documents, investigating offences
  - Actual procedure in trials, appeals, references revisions and transfer of criminal cases.
- Indian Evidence Act(IEA) - categories of evidence, procedure of collection, preservation and use of different evidence
- Criminal law - offences against public interest
- Civil law - disputes between two individuals or parties
  - Plaintiff - party bringing the action
  - Defendant - the accused in civil and criminal cases
- Cognizable offence(S 2 (c) CrPC) - where a police officer can arrest a person without warrant from the magistrate. E.g. Rape, Murder, Dowry death, ragging, death due to negligence

INQUEST

- Inquiry or investigation into the cause of death
- Conducted in cases of unnatural deaths - suicide, homicide, accidents, occupational deaths, deaths due to medical negligence, deaths due to animal attacks, suspicious deaths etc

Police inquest

- Section 174, CrPC
- Usually by Sub Inspector or Inspector - Investigation officer
- Conducts the investigation, in the presence of two or more respectable persons (Panchas)
- Prepares the inquest report - Panchanama

Magistrate inquest

- Conducted by a District Magistrate - Collector, Tahsildar, Deputy Commissioner, Revenue divisional officer
- Section 20 - 23 CrPC
- In any case of death, Magistrate can conduct an inquest, instead of or in addition to police inquest
- **Done in case of**
  - 1%. Death in police custody and while under police interrogation
  - Death due to police firing
  - Death in prisons, reformatories, Borstal school
  - Death in psychiatric hospitals
  - Dowry deaths

- Exhumation
- Any person dies or disappears, or rape is alleged to have been committed on any woman, while such person or woman is in the custody of police

- Coroner's court is a court of inquiry and not a court of trial, which has some judicial powers + Medical
- Examiner's system - doctor visits the scene of crime and conducts the inquest, it is superior to Coroner's and Police inquest
- Coroner's inquest and Medical examiner's system - not followed in India

COURTS OF LAW

Court	Imprisonment	Fine
Supreme court	Any sentence	Any amount of fine
High court	Any sentence authorized by law	Any amount of fine
Sessions court	Any sentence authorized by law (but death	Any amount of fine
Assistant sessions court	10 years imprisonment	Any amount of fine
Chief Judicial magistrate **Chief Metropolitan Magistrate**	7 years imprisonment	Any amount of fine
First class Judicial magistrate **Metropolitan Magistrate**	3 years imprisonment	5000 rupees
Second class judicial magistrate	1 year imprisonment	1000 rupees

- Supreme Court and High Court usually hear referrals not trials.
- Courts below the rank on Sessions court cannot hear murder trials as they cannot award death sentence

Juvenile Magistrates

- **Juveniles**: Boys < 16 years; Girls < 18 years
- Juvenile Magistrates are generally women
- **Juvenile Justice board**
  - Metropolitan Magistrate or First class Judicial Magistrate
  - Two social workers (atleast 1 woman)
- Newspapers, magazines and visual media are prohibited to disclose particulars that can lead to the identification of the juvenile in conflict with law

MEDICAL EVIDENCE

- **Documentary**
  - **Medical certificates -** age certificate, death certificate etc.,
  - **Medicolegal reports -** wound certificate, postmortem certificate etc.,
  - **Dying declaration**
- **Oral**
- **Direct**: evidence of a person who has been seen, heard or perceived the fact
- **Indirect or Circumstantial**
- **Hearsay** : witness states what he has heard others saying

Oral evidence is more important than documentary evidence, because

- Oath administered
- Cross examination is done

WITNESSES

- Common witness: (Witness of fact or Occurrence witness) gives evidence about the facts observed or perceived by him (first-hand knowledge rule)
- Expert witness: a person who has training, skill or knowledge, experience in a subject and capable of drawing opinions and conclusions from the facts observed by him. E.g: doctor, firearms expert, fingerprints expert etc.

- Hostile witness: witness who conceals a part of truth or completely gives false evidence (S. 191 IPC)

- ❖ Perjury - Giving false evidence under oath (S 191, 192 IPC) Punishment 7 years imprisonment (S 193 IPC)

RECORD OF EVIDENCE IN A COURT OF LAW

Oath - child below 12 years is not required to take an oath

1. **Examination in Chief(Direct Examination)**
- Witness examined by public prosecutor and accused by defense lawyer
- To elicit all the relevant facts
- No leading questions
- Leading questions may be asked if the witness is hostile

2. **Cross Examination**
- Witness examined by defense lawyer and accused by public prosecutor
- To elicit facts favorable to the defence side
- To test the accuracy of the statements made by the witness
- To modify or explain what has been said
- The credibility and competence of the witness will be tested
- Leading Questions allowed
- No time limit

3. **Re-Examination (Re Direct Examination)**
- Similar to direct examination
- No leading Questions

4. **Questions by the Judge**
- Can ask questions at any time of proceedings

Dying declaration
- Section 32 IEA
- Magistrate should be called to record, if there is no time the doctor or any citizen can record in the presence of two witnesses
- Before recording it should be certified by the doctor that his mental functions are normal (compos mentis)
- Oath is not administered
- Leading questions are not allowed
- If the declarant survives, declaration is not admitted, but has corroborative value and the person is called to give oral evidence
- Police officer should not be present at the time of declaration

Dying deposition
- Not followed in India
- Oath administered
- Opposite lawyer present at the scene
- Cross examination allowed
- Recorded by Magistrate

- ❖ **Superior to dying declaration**
- ❖ **Not followed in India**

Presumption of death
- **Section 107 IEA:** a person is presumed to be alive, if there is nothing to suggest the probability of death within 30 years
- **Section 108 IEA:** if it is proved that the same person has not been heard for 7 years by them who are expected to hear about him if he would be alive, then such a person will be presumed dead

- Functions of Indian **Medical council**
- Maintenance of **Medical register**
- Maintenance of standards of **Medical education**
- Recognition of **foreign medical qualifications**
- **Appeal against disciplinary action**
- **Warning notice** - list of practices which are considered as professional misconduct

Foreign medical degrees

- **First schedule -** recognized medical qualifications granted by universities in India
- **Second schedule** - those granted outside India
- **Third schedule**
  - **Part I** - those granted by medical institutions not included in the first schedule
  - **Part II** - those granted outside India not included in second schedule

Functions of State Medical councils

- **Medical Register**
- **Disciplinary control - issues warning** to the person who has done professional misconduct

PENAL ERASURE/PROFESSIONAL DEATH SENTENCE

- Removal of the name of the doctor from the medical register
- Main cause-**Serious Professional Misconduct/Infamous conduct** (conduct of the doctor that is regarded disgraceful & dishonorable)
- Done by the **State medical council**
- Other instances of removal of name
  - **After death**
  - **Name entered by fraud, impersonation**

- **Dichotomy (fee splitting)** receiving or giving commission or other benefits obtained by a medical practitioner from a trader in drugs or manufacturer or labs
- **Adultery**- voluntary Sexual intercourse with a person other than his or her spouse
- **Covering**- Assisting someone who has no medical qualification to attend, treat or perform an operation

Six A's - Professional misconduct

- Adultery
- Advertising
- Abortion(unlawful)
- Addiction
- Alcohol
- Association(with unqualified persons)

PROFESSIONAL NEGLIGENCE (MALPRAXIS)

- Absence of reasonable care and skill or willful negligence of a medical practitioner in the treatment of a patient which causes bodily injury or death of the patient
- Doing something that one is not supposed to do or failing to do something that one is supposed to do
- Liability for negligence arises if the following conditions are satisfied (Elements of negligence)
- Duty: Existence of a duty of a care by the doctor
- Dereliction: Failure on the part of the doctor to maintain applicable standard of care and skill
- Direct causation: Failure to exercise proper care must lead to damage
- Foreseeability of the damage: The damage should be of a type that would have been foreseen by a reasonable physician

- The thing or fact speaks for itself
- Usually the professional negligence of a physician must be proved in the court by the expert evidence of another physician
- When this rule applies, the patient need not prove the negligence of the doctor

Examples:

- Failure to give ATS in cases of injury causing tetanus
- Burns from application of hot water bottles or from X-ray therapy
- Prescribing an overdose of medicine producing ill effect
- Breaking needles and leaving it at the site
- Blood transfusion misadventure
- Failure to remove swabs during operation which leads to complications or death
- Loss of use of hand due to prolonged splinting

Novus Actus Interveniens

- An unrelated action intervening
- The person is responsible not only for his actions but also for the logical consequences of all those actions

Medical Maloccurence or Act of God

- Inspite of good medical attention and care, in some cases, an individual fails to respond properly or may suffer from adverse reactions of drug
- Inevitable accident - not avoidable by any precautions
- Breaking of needle during intra muscular injections due to sudden muscular spasm
- Damage to RLN during thyroidectomy

Civil Negligence

- Patient/relatives may charge against the doctor for compensation or
- The doctor may charge against the patient for getting fees
- **Examples**
  - Failure to get informed consent
  - Failure to give proper instructions
  - Failure to warn the patient about side effects

Criminal Negligence

- Gross absence of skill or care of the doctor during treatment that resulted in serious injury or death of the patient
- When the doctor performs an illegal act
- Undue delay in treatment of an assault victim that resulted in death
- When the negligence of accused went beyond the matter of compensation
- Examples
  - Amputation of wrong finger or wrong limb
  - Leaving instruments or swabs inside abdomen
  - Performing criminal abortion

Contributory negligence

- The patient or his attendant is also negligent by not co-operating with the doctor
- His negligence along with doctor's negligence has resulted in the damage
- Without the negligence of the patient the damage would not have occured
- **Examples**
  - Not following the instructions
  - Not giving adequate medical history
  - Leaving the hospital against doctor's advise
  - Failure to seek further medical assistance if symptoms persist

Defenses against negligence

- No duty owed to the patient
- Duty discharged according to existing standards of medical practice
- Contributory negligence
- The damage is due to the intervention of a third person without the doctor's knowledge
- The damage is an expected outcome of the disease
- Therapeutic misadventure
  - A misadventure is an accident or disaster, in which an individual is injured or died due to some unintentional act by a doctor/hospital
  - Hypersensitivity reaction or anaphylaxis with drugs like penicillin, aspirin etc
  - Damage by radiation or radioisotopes
  - Death during blood transfusion

Medical Maloccurence

- Res-judicata - a matter [already] judged: once a lawsuit is decided, the litigant parties are barred' from raising the same issue again in the courts
- Time limitation (Res indicata) - within 2 years for criminal cases; 3 years for civil cases

❖ **Contributory negligence is not a defense against a criminal negligence**

Civil negligence	**Criminal negligence**
No specific and clear violation of law need be proved	Must have specifically violated a particular criminal law
Simple absence of care and skill	Gross negligence, inattention or lack of competency and disregard to the life and safety of the patient
Conduct of the physician is compared to generally accepted simple standard of professional conduct	Not compared to a single test
Consent for the act is a good defence	Consent is not a defence
Trial by civil court	Trial by criminal court
Strong evidence is sufficient	Guilt should be proved beyond reasonable doubt
Punishment: Liable to pay damages	Imprisonment

Vicarious Liability

- Liability for the act of another or Principle of Respondent Superior
- An employer is held legally responsible for the negligent acts of his/her employees appointed by him

Medical records

- MR of **indoor patients** - should be maintained for a period of 3 years from the date of commencement of the examination
- Routine case records - should be preserved upto 6 years after completion of treatment and upto 3 years after death of the patient
- Where there is a chance of litigation arising for medical purpose of negligence, record should be preserved for atleast 25 years specially in case of minors
- Medicolegally important record should be preserved upto 10 years, after which they can be destroyed after making index and summary of the case
- Records of public interest are transferred to public record library after 50 years for release to public and those involve confidentiality of the individuals are released only after 100 years

CONSENT

- Consent is defined as voluntary agreement, compliance or permission
- To examine, treat or operating a patient without consent amounts assault as per law, even if it is done in good faith

Types of consent

- **Implied consent** (e.g: when the person holds out his arm for injection)
- **Expressed consent**

- **Written consent**
- **Verbal consent**

Rules of consent

- **Oral consent** should be obtained in the presence of a disinterested third person. E.g. nurse
- **Written consent -** Necessary for anesthesia, diagnostic and surgical procedure. Should refer to one specific procedure
- **Blanket consent:** consent obtained at the time of admission to the hospital for all procedures after admission. Not valid
- A woman of **18 years and above** can give valid consent for sexual intercourse (Section 375 IPC, 2013 amendment)
- **A child under 12 years and an insane person cannot give valid consent**. Consent is obtained from the parent or the guardian
  - **Loco Parentis**: in an emergency situation, when the parent or guardian is not available, the person in-charge of the child can give consent
  - E.g: When a child of a residential school needs emergency Appendicectomy, the head master of the school can give consent

Informed consent - understanding by the patient of

- The nature of his condition
- The nature of the proposed treatment or procedure
- Expectations of the recommended treatment and the likelihood of success
- The details of the alternative courses of treatment that are available
- Risks and benefits involved in both the proposed and alternative treatment
- Relative chances of success or failure of both procedures
- All disclosures must be in the language the patient can understand

Consumer Protection Act, (CPA/COPRA) - 1986

- District consumer dispute redressal forum - upto 20 lakhs
- State consumer dispute redressai forum - > 20 lakhs upto 1 crore
- National consumer redressal commission - > 1 crore

The Transplantation of Human Organs Act - 1994

- Defines human organ as - any part of the human body consisting of a structured arrangement of tissues, which if wholly removed cannot be replicated
- Bone marrow transplant is outside the purview of this act
- Organs that can be donated after death: **kidney, heart, liver, lungs, pancreas, eyes, ear drums and ear bones**
- In case of unclaimed bodies in hospital or prison, organs can be removed after 48 hours
- **Live donor:** "donor" means any person, not **less than eighteen years of age**, who voluntarily authorises, the removal of any of his human organs for therapeutic purposes

Important years

- **Indian Medical Council Act - 1956**
- **The Workmen's compensation Act - 1923**
- **The Protection of Human Rights Act - 1993**
- **Declaration of Helsinki by World Medical association - 1964 (Code of ethics on Human experimentation)**

EUTHANASIA

- Mercy killing or Assisted suicide
- Painless killing of a person who is suffering from incurable disease, senility, permanent damage to the brain which cannot be repaired or cured
- Legally permitted in: USA, Uruguay, Poland, Australia, Switzerland, Nether lands
- Not legalized in India

Types

- **Active (Positive)euthanasia**
  - Act of commission
  - Death induced by direct/indirect action
  - E.g. giving large dose of a drug that hastens death
- **Passive (Negative)euthanasia**
  - Act of omission
  - No specific medicine or life supporting measures given
  - Death induced by discontinuation of life sustaining measures
  - E.g. stopping heart lung machines in a severely defective new born, disconnecting ventilator in a brain dead patient
- **Voluntary euthanasia**
  - Euthanasia induced at the will of an individual by his request
  - A patient suffering from an incurable disease requesting the doctor to terminate his life
- **In/Non voluntary euthanasia**
  - Induced in patients who are unable to express their wishes
  - E.g. a person with irreversible coma or a severely defective infant

❖ **Paternalism -** abuse of medical knowledge so as to distort the doctor-patient relationship in such a way the patient is deprived of his ability to take rational choice

Important sections related to Injury, Death, Murder, and Suicide

Section (IPC)	Offence
44	Injury
46	Death
299	Culpable homicide amounting to murder
300	Murder definition
302	Murder punishment
304	Culpable homicide not amounting to murder
304-A	Causing death by rash and negligent act
304-B	Dowry death
306	Abetment of suicide
309	Attempt to commit suicide
319	Hurt
320	Grievous hurt
351	Assault
326 A & B	Causing grievous hurt by throwing acid

Sections related to Sexual offences, Abortion, Pregnancy, and Infanticide

290 1PC	Frotteurism
294 IPC	Exhibitionism
297 IPC	Necrophilia, Necrophagia
312 314 IPC	Causing miscarriage
317 IPC	Abandoning a girl child
318 IPC	Concealment of birth of a girl child
354 IPC	Indecent assault
354 - A	Sexual harassment
354 - C	Voyeurism
354 - D	Stalking
370 (PC	Trafficking
375 IPC	Rape definition
376 IPC	Punishment for rape
377 IPC	Unnatural offences
497 (PC	Adultery

416 CrPC	High court has the power to postpone the execution of death sentence of a pregnant woman until 6 months after delivery or to commute it

Punishment for rape -Section 376 IPC

S 376 (1) IPC	Imprisonment > 7 years + fine
S 376 (2) IPC - rape committed • By Police officer • By Public servant taking advantage of his official position on a women working under him • By Member of armed forces • By Custodial rape • By Relative, guardian or teacher • During Communal violence • On pregnant women • Women < 16 years • On women suffering from mental or physical disability • Causes grievous injury, disfigures or endangers life of a • woman • Repeatedy on the same woman	Rigorous imprisonment > 10 years + fine
S 376-A IPC: Rape resulting in death or persistent vegetative state	**Rigorous imprisonment > 20 years or death**
S 376-B IPC: Sexual intercourse by husband upon his wife during separation	Imprisonment 2 - 7 years + fine
S 376-C IPC: Sexual intercourse by a person on authority	Imprisonment 5 - 10 years + fine
S 376-D IPC: Gang rape	**Rigorous imprisonment > 20 years**
S 376-E IPC: Repeat offenders	Imprisonment for life or death

Sections related to criminal responsibility & Consent

82 IPC	A child under 7 years of age is incapable of committing an offence
84 IPC	Criminal responsibility of mentally ill
85 IPC	An act done by a person, due to intoxication is not an offence, if he is intoxicated without his knowledge or against his will
86 IPC	An intoxicated (voluntary drunkenness) person is criminally responsible, if he had intention or knowledge of committing a crime
87 IPC	A person **above 18 years** of age can give **valid consent to suffer any harm**, which may result from an act not intended or not known to cause death or grievous hurt
89 IPC	**A child under 12 years and an insane person cannot give valid consent**
90 IPC	Consent given by a person under fear of injury, intoxication, misunderstanding of a fact is not valid
92 IPC	Any harm caused in good faith, even without the person's consent is not an offence

Sections related to poisoning

39 CrPC 176 IPC	Private practitioner should inform the police or magistrate, if he suspects homicidal poisoning
309 IPC	Private practitioner need not inform the police if he is sure that the poisoning is suicidal
201 IPC	Not preserving samples with the intention of protecting the accused

IPC section	Definition
52	Nothing is said to be done in good faith which is done without due care and attention
74	Nonattendance in obedience to summons from court
175	Omission to produce document to public servant
176	Omission to give notice or information to public servant
177	Furnishing false information
179	Refusing to answer public servant authorized to question
191	Giving false evidence (Perjury)
197	Issuing or signing false certificate
201	Causing disappearance of evidence of offence orgiving false information to screen offenders
204	Destruction of document to prevent its production as evidence
269	Negligent act likely to spread infection of disease dangerous to life
270	Malignant act likely to spread infection of disease dangerous to life
160	Police officer has the power to summon any witness (doctor) to police station for recording a statement
87 - 93	Legal protection to medical doctors

Other important sections

- **Section 53, CrPC:** A registered medical practitioner can examine a person who is arrested on a charge of an offence using **reasonable force**, if requested by a police officer not below the rank of Sub-Inspector
- **Section 53-A CrPC:** When a person is arrested on a charge of committing an **offence of rape** or an attempt to commit rape, and there are reasonable grounds to believe, that an examination will afford evidence as to the commission of offence, it shall be lawful for a registered medical practitioner employed in a hospital run by the government or a local authority and in the absence of such a practitioner within the radius of 16 km from the place where the offence has been committed, by any other RMP acting at the request of a police officer not below the rank of a sub-inspector to examine the arrested person with use of reasonable force as required
- S 363, 364, 366 IPC - kidnapping

Dowry Death

S 304-B IPC	Death of a woman caused by any burn or bodily injury or occurs otherwise than under normal circumstances within seven years of marriage Punishment: 10 years imprisonment which may extend to life + fine
S 498-A IPC	Whoever (husband or relative) subjects woman to cruelty shall be punished with 3 years imprisonment Cruelty - willful conduct that drives the woman to commit suicide or grave mental or physical injury to her or harassment with a view to coerce her for dowry
S 113-A & S 113-B IEA	Presumption as to abetment of suicide by a married woman and Presumption as to dowry death
S 174 (3) CrPC	Procedure in dowry death

MEDICOLEGAL AUTOPSY

Types of Autopsy

- **Clinical/Pathological autopsy** - consent of relatives needed
- **Medicolegal autopsy -** consent of relatives not needed
- **Virtual autopsy Nirtopsy** - a combination of CT & MRI
- **Psychological autopsy** - A procedure for investigating a person's death by reconstructing what the person thought, felt, and did before death, based on information gathered from personal documents, police reports, medical and coroner's records, and face-to-face interviews with families, friends, and others who had contact with the person before the death - to assess the mental status of the person at the time of death

- ❖ The PM examination should be conducted in daylight if at all possible because under artificial light jaundice, changes in bruise and changes in lividity cannot be appreciated accurately in artificial light

Method of removal of organs

VIRCHOW'S TECHNIQUE

- Individual organs are removed one by one
- Cranial cavity exposed first, followed by thoracic, cervical and abdominal cavities

ROKITANSKY'S TECHNIQUE

- In-situ dissection, combined with en block removal
- In bodies with highly transmissible diseases like HIV, hepatitis B

LETULLE'S TECHNIQUE

- En masse removal of cervical, thoracic, abdominal and pelvic organs and dissected as organ block
- Advantage - all attachments are intact

GHON'S TECHNIQUE

- Cervical, thoracic, abdominal and pelvic organs are removed as organ blocks

AIR EMBOLISM

- Head should be opened first and the surface vessels of brain examined for gas bubbles
- Left ventricle is filled with froth if air is present in sufficient quantity to cause death
- Pericardial sac opened and filled with water. Right heart is punctured with a scalpel and twisted -air bubbles escape in cases of air embolism
- Pyrogallol test: Air is brought in contact with alkaline Pyrogallol solution, which turns brown -indicates antemortem air embolism

Obscure autopsy

- Where a definite cause of death is not found
- There may be minimal, indefinite or obscure findings

Negative autopsy

- When the cause of death could not be found, even after gross and microscopic examination, toxicological analysis, histo-pathological examination and microbiological investigations

EXHUMATION

- Lawful digging out of a buried body from the grave for medico-legal examination
- Magistrate conducts the inquest
- Preferably done in daytime
- No time limit in India
- Autopsy (first or second) done

ARTIFACTS

- Artifact is any change caused or feature introduced in a body after death, that is likely to lead to misinterpretation of medico-legally significant (antemortem) findings

Artifacts introduced after death and before autopsy

- **Agonal artifacts:** Regurgitation, Esophago-gastromalacia
- **Resuscitation artifacts:** injuries due to defibrillator application, Cardiac massage, Central line, Positive pressure ventilation, Laryngoscope
- **Artifacts due to handling of the body:** Undertaker's fracture, Postmortem abrasions
- **Artifacts due to burns:** Heat ruptures, Heat hematoma

Artifacts introduced during autopsy: Skull fractures, Visceral damage, Hyoid bone fracture

CORPUS DELICTI

- Latin meaning - **body or essence of crime**
- The substantial and fundamental **evidence that a crime has been committed**
- Refers to the principle that a **crime must have been proven to have occurred** before a person can be convicted of committing that crime
- The corpse of a **murdered victim with injuries** indicate that a crime has been committed

RACE

Features	Pure Aryans (Indians) Aborigines, negroes	Chinese, Europeans	Mongols
Cephalic index	70-75	75-80	>80
Type of skull	Dolicocephalic	Mesaticephalic	Brachycephalic
Orbits	Square	Triangular	Round
Nasal opening	Broad	Narrow and elongated	Round
Palate	Rectangular	Triangular	Round or horse shoe shaped

Races indices

- Cephalic index = Maximum breadth of skull/ Maximum AP diameter of skull X 100
- Brachial index = Length of radius/Length of Humerus X 100
- Crural index = Length of tibia/Length of femur X 100
- Inter-membranal and Intra-membranal index

SEX

Barr body

- Barr body is the inactive X chromosome in a female somatic cells (Buccal smear)
- It is rendered inactive in a process called lionization
- Number of barr bodies = Number of X chromosomes - 1
- Absent in male

❖ **Davidson body:** small nuclear attachment in the neutrophils of females
❖ **Greater sciatic** notch is the ideal feature in pelvis to determine sex of a female child
❖ **Chilotic line -** anthropometric line in pelvis, the index of which is used in determination of sex

Sex indices

- Sciatic notch index = Width of notch / Depth of notch X 100
- Washburn ischiopubic index = Pubic length / Ischia(length X 100
- Corporbasal sacral index = Breadth of 1st sacral vertebra / Breadth of base of sacrum X 100
- Sternal index = Manubrial length / Body length X 100

Sex determination from skeleton

- Recognizable sex differences do not appear until after puberty in bones except pelvis
- Single best bone to determine sex (both in adult and child) - pelvis

Feature	Male skull	Female skull
Muscle ridges, Glabella, Supraorbital ridges, Zygomatic arch	More prominent	Less prominent or absent
Fore head	Steeper, less rounded	Vertical, round
Fronto-nasal junction	Distinct angulation	Smoothly curved
External acoustic meatus	Bony ridge along upper border	Absent
Frontal and parietal eminences	Small	Large

Mastoid process	Large, rounded	Small, smooth, pointed
Condylar facet	Long and slender	Short and broad
Palate	Large, U shape	Small, parabolic
Occipetal condyles	Large	Small

Feature	Male pelvis	Female pelvis
General	Deep funnel	Flat bowel
Ilium	Less vertical	More vertical
Preauricular sulcus	Not frequent, narrow, shallow	More frequent, broad and deep
Acetabulum	Large, directed laterally	Small, directed antero-laterally
Obturator foramen	Large, oval with base upwards	Small, triangular with apex forwards
Greater sciatic notch	Smaller, narrower, deeper	Large, wide, shallow
Ilieo-pectineal line	Well marked and rough	Round and smooth
Ischial tuberosity	Inverted	Everted
Subpubic angle	V shaped, angle 70-75	U shaped, (obtuse) angle 90-100
Pelvic brim	Heart shaped	Circular or elliptical, more spacious
Pelvic cavity	Conical and funnel shaped	Broad and round
Sacrum	Long, narrow, even curvature, promontory well marked	Short, wide, upper half almost straight, lower half curve forward

Krogman's degree of accuracy of sex determination with bones

- **Entire skeleton = 100%**
- **Pelvis alone = 95%**
- **Skull alone = 90%**
- **Skull and Pelvis = 98%**
- **Long bones alone = 80%**

AGE

DENTITION

- At the age of 3 years all the temporary teeth are erupted
- **Age 7 to 12 years** is the age of mixed dentition
- **Superadded permanent teeth** are those which don't have deciduous predecessors **(permanent molars)**
- Successional permanent teeth are those which erupt in the place of deciduous teeth.
- In some persons due to inadequate jaw space, the third molars never erupt into the oral cavity, particularly the mandibular third molars **(impacted teeth)** which can be visualized by **orthopantogram**

Temporary teeth	Age (months)
Lower central incisor	6-8
Upper central incisor	7-9
Upper lateral incisor	7-9
Lower lateral incisor	10-12
First molar	12-14
Canine	17-18
Second molar	20-30

Permanent teeth	Age(years)
First molar	6-7
Central incisor	6-8
Lateral incisor	7-9
First premolar	9-11
Second premolar	10-12
Canine	11-12
Second molar	12-14
Third molar	17-25

Age estimation in adults > 21 years can be done based on the physiologic changes of teeth - Gustafson's method.

Criteria

- **Attrition -** wear and tear changes of the incisal or occlusal surface of the teeth
- **Paradentosis** - regression of gums resulting in loosening of teeth and they fall off
- **Secondary dentin** - deposition of denting in the pulp cavity
- **Cementum apposition** - deposition of Cementum in the root forming incremental lines
- **Root resorption** - involves both Cementum and dentin
- **Root transparency** - canals of denting gets filled up by minerals after 30 years of age and the dentin becomes transparent. This is the most reliable criteria.

❖ **Boyde's method -** most accurate method of age estimation, based on incremental lines on teeth

X-Rays

- Number of ossification centres at 11th week of IU life - 806
- Number of ossification centres at birth - 450
- Number of bones in adult skeleton - 206
- Appearance & fusion of ossification centre in females can be in advance of the male upto 1 year

Pelvis

	Appearance	**Fusion**
Ischiopubic rami		6 years
Tri radiate cartilage	13 years	15 years
Iliac crest	14 years	18 - 20 years
Ischial tuberosity	16 years	20 - 21 years
Head of femur	1 year	17 18 years
Greater trochanter	4 years	
Lesser trochanter	12 - 14 years	

Shoulder

Head of the humerus	6 months to 1 year	18 - 19 years
Greater tuberosity	3 years	
Lesser tuberosity	5 years	
Coracoid process	Body: 5-6 years Tip: 10-11 years	16 - 17 years
Acromion process	14 - 15 years	17 - 18 years

Elbow

Lower end of humerus		
Capitulum	1 year	14-16 years
Lateral epicondyle	11 years	
Trochlea	9-11 years	
Medial epicondyle	6-7 years	16-17 years
Upper end of radius and ulna		
Radial head	5 years	16-17 years
Olecranon process	9 years	

Wrist: Appearance of carpal bones

Scaphoid	Lunate	Triquetrel	Pisiform	Trapezium	Trapezoid	Capitate	Hammat
4-5 yrs	4 yrs	3 yrs	11-12 yrs	6 yrs	5 yrs	2 months	2 years

Ossification centres	**A**	**F**
Epiphysis of base of 1st metacarpal	2-3 years	15 - 17 years
Radial styloid process	2 years	18-19 years
Ulnar styloid process	5 years	17-18 years

Age group		X-ray region
6 - 12 years		Elbow, Wrist
13	- 16 years	Elbow, Pelvis
16	- 17 years	Ankle joint
17	- 18 years	Hip joint
18	- 19 years	Knee, Shoulder, Wrist
20	- 21	Pelvis

Ossification centres present before birth

- 2 months - Upper segments of sacrum, Mandible
- 5 months - Middle segments of sacrum
- 6 months - Calcaneum
- 7 months - Talus
- 8 months - Lower segments of sacrum
- 9 months - Lower end of femur
- 10 months - Upper end of tibia

Age of the fetus - Rule of Hasse

- If the Crown-Heel length is 25 cm, then the square root of length gives age in months
- If the crown-heel length is > 25 cm, then the length divided by 5 gives age in months

Fusion of Skull sutures & Closure of fontanelles

Lateral and occipital fontanelles	< 2 months
Posterior fontanelles	6 - 8 months
Anterior fontanelle	1.5 - 2 years
Metopic suture	3 years
Basi-Occiput fusion with basi-sphenoid	18 - 21 years
Sagittal suture • Posterior 3rd • Anterior 3rd • Middle 3rd	30 - 40 years 40 - 50 years 50 - 60 years
Coronal suture • Lower half • Upper half	40 - 50 years 50 - 60 years
Lambdoid suture	45 years

Sternum

- Four pieces of the body of the sternum fuse with one another between 14 - 25 years
- Xiphoid fuses with the body - **40 years**
- Manubrium fuses with the body - **60 years**

- ❖ Closure of sutures begins 5-10 years earlier on the inner side than the outer side
- ❖ Most successful age estimation can be done from sagittal suture
- ❖ When the endocranium fuse and ectocranial suture does not fuse - lapsed union
- ❖ Sacral bones fuse and become a single bone between 21 - 25 years
- ❖ Gap may persist between S1 and S2 after 25 years- lapsed union
- ❖ The best single criteria to determine age from 3rd to 5th decade is the pubic symphysis

AGE	MEDICOLEGAL IMPORTANCE
7 months IU	**Viability attainted by the fetus -** killing after this age - **infanticide**
> 5 years	**Criminal responsibility** as per **Railways act**
< 7 years	**No criminal responsibility** as per **Section. 82 IPC**
7 - 12 years	Criminal responsibility if sufficient maturity of understanding the nature and consequences of act as per **Section. 83 IPC**

< 12 years	Consent to be obtained from parent/guardian for examination, surgery etc.
< 14 years	Cannot be employed in factory jobs
14 - 15 years	**Non-hazardous factory** jobs can be given in day time
> 15 years	Can be employed in any **factory job**
< 15 years	**Sexual intercourse** with a girt, **even his wife,** with or without consent amounts to **rape**
< 16 years	Convicted boys are sent for reformatory school for punishment
< 16 years	**Taking away a boy** without consent of the parent/guardian - kidnapping
< 18 years	**Juvenile (boy or girl)** **Taking away a girl** without consent of parent/guardian - **kidnapping** **Sexual intercourse** with a girl, with or without consent amounts to **rape**
> 18 years	**Valid consent** for any harm not known to cause death or grievous hurt **Valid consent given by a girl for sexual intercourse** Attainment of **majority** Can make **valid will**
> 21 years	Attainment of majority for those under the **guardianship of court**

- **No age limit to give evidence in a court**. A child of any age can give evidence if the court is convinced that the child is truthful

DACTYLOGRAPHY

- Fingerprint system was first used in India
- Sir Francis Galton systematized this method in 1892
- It is the study of epidermal ridges and their configurations (dermatoglyphics)
- Cannot be used to fix paternity as the patterns are not inherited and different even in identical twins
- They are broadly classified into 4 types
  - Loops - most common type
  - Whorls
  - Arches
  - Composite
- Final identification is made based on the comparison of characteristics like - ridge endings, bifurcations, lake formation, broken ridges, short ridges etc.,
- Permanent impairment of finger prints - leprosy, electric injury, radiation
- Atrophy of the ridges seen in coeliac disease, dermatitis

Poroscopy

- The papillary ridges of the epidermis of hand are studded with microscopic pores through which sweat exudes during life
- The number of pores, their size, shape, width, position over a region is individualistic
- This study of pores is called Poroscopy (Locard's method)
- Useful when only fragments of fingerprints are available

Formulas for stature estimation

- Pearson's formula
- Dupertuid & Hadded formula
- Trotter & Gleser formula
- Steele - stature estimation from fragmented bones

Rule of thumb

Bone	% of height
Humerus	**20**
Tibia	**22**
Femur	**27**
Spine	**35**

- Trichology - study of hair
- Hair grows at a rate of 0.4mm/day and nails at 0.1mm/day
- Human hair - fine and thin, cuticle scales are thin and short, thick cortex, thin medulla, evenly distributed pigment, medullary index <0.3
- Animal hair - coarse and thick, cuticle scales are large with wavy projections, thin cortex, thick medulla, pigment mostly near medulla, medullary index >0.5
- In human hair, Barr bodies are found in hair follicles (24-34% in females; 4-8% in males)
- Roots of hair from children will dissolve rapidly in a solution of caustic potash, but in older people roots will resist the treatment
- ABO blood groups can be determined in a single hair if hair bulb is present, from any part of the body
- Singeing of hair is seen in burns and close range firearm injury.
- Singeing is helpful in differentiating burns from scalds

- ❖ Cheiloscopy - lip prints
- ❖ Podogram - foot prints
- ❖ Rugoscopy - palatal rugae
- ❖ Calligraphy - study of handwriting
- ❖ Fragmented hair - Negroes, new born, fetus
- ❖ Non fragmented hair - Mongols, Caucasians
- ❖ Preauricular sulcus is used to determine sex
- ❖ Osteometric board: Used to measure length of a bone
- ❖ Anthropometry - Bertillon system
- ❖ Pink teeth - in decomposed or skeletonized body, pink teeth may be noted near the gum line
- ❖ Commonly used systems for dental charting (numbering) - Palmer's notation, Haderup system, Federation Dentaire Internationale system

- Thanatology - **deals with death in all its aspects**
- **Forensic taphonomy** - study and interpretation of postmortem processes of human remains in the dispositional context

BRAIN DEATH

UK criteria for diagnosis of brain death

Preconditions

- Patient deeply comatose
- Patient on ventilator (spontaneous respiration had ceased)
- Diagnosis of the disorder leading to brain death has been firmly established

Exclusions

- Hypothermia (rectal temperature >35° C)
- Coma not due to depressant drugs (narcotics, hypnotics, tranquilizers)
- Neuromuscular blocking agents, excluded as a cause for RS failure
- No profound abnormality of serum electrolytes, acid base balance, glucose concentrations and any metabolic and endocrine cause of coma has been excluded

Tests for confirming brain death

- Pupils fixed and unreactive to light
- Corneal reflexes absent
- Vestibulo-ocular reflexes absent
- No motor responses to adequate stimulation
- No gag reflex
- No respiratory movement after ventilator is discontinued

MINNESOTA CRITERIA (criteria for brainstem death formulated by **Mohan Dass and Chou**)

- Known but irreparable intracranial lesion
- No spontaneous movement
- Apnea when tested for a period of 4 minutes
- Absence of brainstem reflexes (Dilated and fixed pupils and absence of corneal reflex, Doll's eye phenomenon, ciliospinal reflex, gag reflex, vestibular response to caloric stimulation, tonic neck reflex
- EEG not mandatory
- Spinal reflex not important
- All the above findings remain unchanged for atleast 12 hours

HARVARD CRITERIA

- Unreceptivity and unresponsivity
- No spontaneous muscular movements
- Apnea
- Absence of elicitable reflexes
- **Isoelectric EEG**

SUSPENDED ANIMATION or APPARENT DEATH

- Signs of life are not present as the functions are interrupted for some time or reduced to minimum
- Voluntarily produced by yoga practitioners (death trance)
- Involuntary suspended animation is seen in

• New born infants • Drowning • Electrocution • Sunstroke	• Insanity • After anesthesia • Narcotic poisoning • Hypothermia

• Cholera • Shock	• Concussion of brain

POSTMORTEM CHANGES

Immediate changes (Somatic death)		Early changes (Cellular death)		Late changes (Decomposition)	
•	Cessation of brain function	•	Changes in the skin	•	Putrefaction
•	Cessation of respiration	•	Changes in the eye	•	Mummification
•	Cessation of circulation	•	Algor mortis	•	Adipocere
•	Primary flaccidity of muscles	•	Livor mortis		
		•	Rigor mortis		

HANGES IN THE EYE AFTER DEATH

- Pupillary dilatation
- Cornea: dull, hazy. opaque and wrinkled
- Tache noir: if the eyelids are open after death, desiccation of conjunctiva and deposition of cell debris and mucus forms two yellow triangles on either side of cornea in 3 - 4 hours
- Flaccidity of the eye ball: due to fall in intraocular pressure. Within 2 hours, 10P falls to zero
- Retina: If the retina is viewed through and ophthalmoscope, there will be fragmentation or segmentation (rail-road or tram-track appearance) of blood columns in retinal vessels (Kevorkian sign)
- Increase in potassium concentration in vitreous

LGOR MORTIS or POSTMORTEM COOLING

- It is the cooling of the body after death
- After death, heat is lost by
  - **Radiation** (transfer of heat to the surrounding air by infrared rays)
  - **Convection** (transfer of heat through moving air currents)
  - **Conduction** (transfer of heat by direct contact with another object)
- Body loses heat by 2 - 3°C in 1st hour
- Then 1 - 1.5°C for each subsequent hour until the body reaches the environmental temperature
- Initial maintenance of body temperature which may last for some hours - the so-called **"temperature plateau"**
- Followed by a relatively linear rate of cooling
- Subsequently slows rapidly as the body approaches the environmental temperature.
- The preferred site for measuring temperature is either the rectum or the abdominal cavity
- A chemical thermometer with graduations from 0 to 50° C is used

Time since death = $\frac{\text{Normal body temperature - Rectal temperature}}{\text{Rate of temperature fall per hour}}$

Rate of cooling is affected by

Difference in temperature between the body and the environment:

- Larger the difference, faster the cooling rate

Surface area of the body:

- Larger surface area: speeds up cooling rate.
- Children: increase surface area gives rapid heat loss.

Body weight: Larger body weight (due to excess fat): slower cooling and vice versa
Edema: Slower cooling rate.
Clothing: Thick clothes slows down cooling rate
Environmental temperature: Higher humidity and rapid air velocity: rapid cooling rate
Water: Rapid cooling rate; More rapid in flowing water than still water

Postmortem caloricity

- In few cases, there is a slight rise in body temperature after death - **postmortem caloricity**
- **Seen in the following cases**
- **~~Violent muscular contractions before death~~**

- **Tetanus**
- **Strychnine poisoning**
- **Seizures**

- **Asphyxial deaths - strangulation**
- **Septicemic deaths - cholera and other infections**
- **Death due to temperature regulation disorders**
- **Sun stroke**
- **Pontine** haemorrhage

POSTMORTEM HYPOSTASIS

- Synonyms: Livor Mortis, Post Mortem Staining, Post Mortem Lividity, Darkening Of Death
- Blood gradually settles down in the toneless capillaries in the dependent parts of the body
- Seen externally as patches of purple or reddish purple discoloration of the skin

Sites of hypostasis: Depends on the position of the body before death:

- **Supine**: Lividity is seen on the back
  - The areas which are in direct contact with the surface such as the shoulder blades, buttock & calves → discoloration will be pale (contact pallor)
- Vertical: e.g. hanging. PM staining seen on legs, feet, forearm and hands (glove and stocking hypostasis)
- Drowning: face, upper limbs and abdomen
- Face-down death: as in epilepsy, drunken victims - whitening around nose Et tips.
- Hypostasis of Viscera:
  - Heart: mistaken for MI
  - Lungs: mistaken for pneumonia
  - Intestine: mistaken for hemorrhagic infarction

Timing

- Begins as mottled patches between 1 to 3 hours after death
- Gradually increase in size and coalesce with each - uniform area of staining in 5 to 6 hours
- If the body is left undisturbed for 6 to 8 hours, lividity becomes fixed and does not alter in position even if the position of the body is altered
- May not develop at all if the position of the body is continuously changed as seen in fast flowing waters of rivers

PM staining does not develop in

- Drowning in running water
- Areas of contact flattening
- Severe anemia
- Heavy blood loss
- Body refrigerated immediately after death

Poison/Condition	Postmortem staining
Phosphorus, Copper	Yellow or dark brown
Carbon monoxide	Cherry-red
Nitrites, aniline, chlorates	Chocolate or copper brown
Hydrogen cyanide	Pink/Bright red
Refrigerated bodies, hypothermia	Bright pink
Opium	Black
Hydrogen sulphide	Bluish green
Clostridium perfringens septicemia	Bronze or greenish brown

(RIGOR MORTIS or CADAVERIC RIGIDITY

- Rigor mortis is the **stiffening and shortening of muscles after death**
- Affects all muscles of the body, **both skeletal and smooth**
- When the **ATP level falls to 85%** then the muscle becomes rigid

- When the **ATP level fails to 15%** the myocardium

Order of appearance

- Does not start in all the muscles simultaneously **(Nysten's rule)**
- It becomes most evident in the smaller muscles early (less reserve glycogen)
- **Myocardium** is the first involuntary muscle to become rigid
- **Eyelids face → jaw → neck → upper limbs → thorax → abdomen → lower limbs → fingers and toes** (Proximo-distal progression)
- Passes off in the same order as it appeared

	India		Temperate countries
Time of onset	1 - 2 hours		3 - 6 hours
Duration	Summer	18 - 36 hours	2 - 3 days
	Winter	24 - 48 hours	

Rule of 12 or Rule of Dozen or March of Rigor

- First 12 hours after death: Rigor mortis affects the whole body
- Next 12 hours: retained
- Next 12 hours: passes off

Conditions affecting Rigor mortis

- **Age**
  - Extremes of age rapid onset
  - Does not occur in fetus < 7 months
- **Environmental temperature:**
  - Cold and wet → onset slow, duration longer
  - Hot and dry → onset fast, duration shorter
- **Cause of death:**
  - Asphyxia, pneumonia, nervous disease with muscle paralysis & dehydration → slow onset
  - Septicemia & poisoning → rapid onset, may even be absent
  - Excessive physical work before death → **rapid onset**

<u>Conditions simulating Rigor mortis</u>

HEAT STIFFENING

- Occurs due to exposure of body to intense heat (burning, high voltage electrocution)
- Due to heat, coagulation of muscle proteins occur
- When the body is recovered and kept in normal temperature - Rigor mortis does not occur
- E.g. Burns - pugilistic attitude

COLD STIFFENING

- Occurs due to exposure of the body to extreme cold (< minus 5°C)
- Solidification of subcutaneous fat and muscles occurs
- Freezing of synovial fluid in joints and other body fluids
- If the body is kept in a warm temperature, Rigor mortis develops very rapidly and passes off quickly

GAS STIFFENING

- During putrefaction, due to the gases liberated, the entire body is bloated and stiffened
- When the gases escape, again the body becomes flaccid

CADAVERIC SPASM

- Synonyms: Instantaneous rigor, Cataleptic rigidity, Death clutch
- Rarely seen
- Seen immediately after death (no primary flaccidity)
- Small groups of muscle which were already in a contracted state at the time of death, remains contracted after death, till molecular death occurs

- Usually associated with violent death, developed with emotional disturbance at the time of death
- Mechanism not clearly understood

Examples

- Drowning: grass and weeds caught in the hands during struggle, will be seen clutched in the hand after death
- Suicidal cut throat/gun shot: the weapon will be firmly grasped in the hand

RIGOR MORTIS	**CADAVERIC SPASM**
Freezing and exposure to temperature above 65°C will produce rigor	Cannot be produced by any other method
Onset 1 - 2 hrs after death	**Instantaneous**
All muscles of the body both voluntary and involuntary are involved	Restricted to a single group of voluntary muscles
Moderate force can overcome rigor	Very great force required to overcome it
Molecular death occurs	Does not occur
Muscles do not respond to electrical stimuli	**Respond**
Body temperature - cold	Warm
Indicates time of death	Indicates manner of death
Occurs after primary flaccidity	No primary flaccidity

DECOMPOSITION

Involves two processes

- Autolysis
- Putrefaction

AUTOLYSIS

- Self-digestion of tissues due to **lysosomes and their digestive enzymes (Hydrolases)**
- Earliest autolytic changes occur in parenchymatous and glandular tissues and in the brain.
- Earliest external sign is a whitish, cloudy appearance in cornea

PUTREFACTION

- The chief destructive agent of Putrefaction is Clostridium welchii
- Lecithinase is the most important enzyme causing hemolysis, liquefaction of clots, gas formation and disintegration of tissue.

Color changes

- First external sign - greenish discoloration of skin over the region of caecum
- First internal sign - discoloration in the under surface of liver
- Color Change is due to conversion of Hb to sulfamethemoglobin
- Color change appears 12-18 hours in summer and 1-2 days in winter
- Marbling of skin - greenish pattern in the skin resembling braches of a tree, starts at 24 hours; becomes prominent in 36-48 hours
- Marbling is due to staining of superficial veins with sulpha-methemoglobin

Foul smelling gases

- Blisters 18-24 hours; first seen on the lower surface of trunk and thighs
- Maggots 1- 2 days
- Skin slippage; anus and uterus prolapse 2- 3 days
- Separation of skull sutures children 3-5 days
- Postmortem luminescence is usually due to contamination by bacteria (Photobacterium fischeri) or fungi (Armillaria mellea)

As a general rule, the organs undergo putrefaction in the following order:

Larynx & trachea → Stomach, intestines & Spleen → Liver (foamy liver) lungs → Brain → Heart Kidneys, bladder → **Prostate, uterus** Skin, muscle, tendon → Bones

- **Virgin uterus is the last organ to putrefy**, gravid uterus and uterus soon after delivery putrefies rapidly
- Optimum temperature for putrefaction **21 °C. putrefaction arrested below 0°C and above 48°C**

Rapid putrefaction	Delayed putrefaction
• Peritonitis • Sepsis • Asphyxia • Intestinal obstruction • Abortion • Clostridia) infections	• Anaemia, Debility, Wasting • Severe hemorrhage • Carbolic acid poisoning • Strychnine poisoning • Heavy metal poisoning (Arsenic) • Zinc chloride poisoning

MUMMIFICATION

- A modification of putrefaction occurs in dry climate
- **Dehydration/drying, desiccation and shriveling** of the cadaver occurs due to evaporation of water
- Skin becomes dark and tightly adherent to skeleton
- Mummification requires 3 - 6 months
- A mummified body is odourless

Prerequisites

- Absence of moisture in the air
- Dry or warm air currents
- Chronic arsenic and antimony poisoning favors antimony poisoning

Medicolegal importance

- Features of the body like wounds, tattoo marks are preserved
- Face is distorted due to shrinkage of soft tissues

ADIPOCERE or SAPONIFICATION or GRAVE WAX

- Modification of putrefaction
- Due to **hydrolysis and hydrogenation** of body fats
- Commonly seen in **bodies immersed in water or in damp, warm environment**

Prerequisites

- **Abundant body fat**
- **Moisture**
- **Still air**
- **Warm temperature**
- **Bacteria producing fat splitting enzymes like Cl.welchii**

Features

- Seen over **face, breasts, buttocks or limbs**
- It takes **atleast 3 weeks** for adipocere formation
- Smells like ammonia

Medicolegal importance

- **Facial features** are preserved and helps in **identification**
- **Wounds** are also preserved well and helps in determining **cause of death**

Casper's dictum

- Body decomposes in air twice rapidly as in water and eight times as rapidly as in soil

Embalming

- Treatment of the dead body with antiseptics and preservative to prevent putrefaction
- **The three goals** of embalming are **sanitization, presentation and preservation (or restoration)**
- Causes **chemical stiffening** similar to rigor mortis
- **Normal rigor mortis does not develop**
- Rigidity is permanent
- **Blood grouping cannot be made out**
- **Typical embalming fluid** - formalin, sodium borate, sodium citrate, glycerine, sodium chloride, eosin, soluble wintergreen, water
- **Cavity embalming fluid** - formalin, methanol, liquefied phenol, sodium lauryl sulphate, mercuric chloride, eucalyptus oil

MECHANICAL INJURIES

Injury (Section 44 IPC) - Any harm illegally caused to any person in body, mind, reputation or property

Blunt force injuries	Sharp force injuries	Firearm injuries
• Abrasions • Contusions • Lacerations • Fractures	• Incised wounds • Stab wounds • Chop wounds	• Rifled weapon wounds • Smooth bored weapon (Shot gun) wounds

ABRASIONS

- Wound caused by **superficial damage to the skin, no deeper than the epidermis**
- It can be caused by **friction against or fall on a rough surface, compression or by fingernails, thorns or teeth bite**

Scratch abrasion

- Synonym: **linear abrasion**
- **Sharp or pointed object** not sharp enough to cause incised wound, but pointed enough to scratch
- **E.g. thorn, fingernails, tip of knife**
- **Clean area at the start of the wound and tags at the end**
- Helps in determining the **direction of force**

Graze abrasion

- Synonyms: **grinding or sliding abrasions, brush burns**
- Most common type - Commonly seen in **road traffic accidents**
- Occurs when the **skin is rubbed (friction) against some rough surface**
- **Uneven, longitudinal parallel lines** of abrasion are seen
- **Epithelium heaped up at the end of these lines** which indicates the **direction of force**

Pressure abrasion

- Synonym: **crushing abrasion**
- **Sustained pressure of a rough object at 90°** - crushing of the superficial layers of the skin
- **No force on impact, but sustained pressure** after the object comes in contact with body surface
- **E.g. Ligature mark in hanging and strangulation**

Impact abrasions

- Synonym: **Contact abrasion or Imprint abrasion**
- There is a **moment of forceful impact,** after that no contact of the object with body
- E.g: **radiator grill mark, tyre tread marks seen in RTA**
- **Impact abrasions and Pressure abrasions - Patterned abrasions** (as the pattern of the object causing the abrasion is reproduced on the body surface)

Healing of a typical abrasion (Starts from the periphery)

- Fresh : bright red
- 12 - 24 hours : bright red scab
- 2 - 3 days : reddish brown scab
- 4 - 7 days : dark brown scab
- After 7 days : scab dries, shrinks and falls off

Antemortem abrasions	Postmortem abrasions
• Seen anywhere on the body	• Seen over bony prominences
• Bright red	• Yellowish, pale and translucent
• Scab slightly raised above skin surface	• Scab lies below the skin level

•	Vital reaction positive		Vital reaction negative

Medicolegal importance of abrasions

- Direction of force can be determined in scratches and grazes
- Pattern on the weapon is seen on the skin surface in pressure and impact abrasions
- Age of injury can be estimated by assessing the healing
- Manner of injury
  - Throttling - crescentic fingernail abrasions on neck
  - Smothering - finger nail abrasions around mouth and nose
  - Sexual assaults - abrasions over breasts, genitals, inside of thighs, around anus.
- In cases of rape and assault, the fingernails scrapings of the victim may contain the skin fragments of the assailant, from which DNA typing can be done

CONTUSION (BRUISE)

- Effusion of blood into tissues due **to rupture of blood vessels** caused by blunt trauma
- **Patterned bruise**
  - Hammer - round
  - Rod, stick or whip - **tram line bruise**
- **Delayed or Come-out bruise:** a deeply situated bruise may manifest externally only after several hours or days or after death
- **Migratory or Ectopic or Percolated contusions:** injury at one site, contusion at a remote site due to gravitation of blood
  - Fracture of floor of anterior cranial fossa - bruising around eye (black eye or spectacle hematoma)
  - Fracture of floor of middle cranial fossa - bruising over mastoid (battle's sign)
  - Fracture of jaw - bruising in the neck
  - Fracture of pelvis - bruising over thigh

Hypostasis	**Bruise**
Distension of blood vessels with blood in dermis	Due to ruptured vessels
Occurs on dependent parts	Occurs at the site of injury
No elevation of involved area	Involved area swollen
Clearly defined margins	Margins merge with surrounding area
Bluish purple in color	Color depends on the time
On incision blood is seen inside blood vessels which can be **easily washed away**	Extravasation of blood into the surrounding area which cannot be **easily washed away**

Artificial bruise	**True bruise**
Caused by Juice of marking nut, calotropis	Trauma
Dark brown color	Color changes
Well defined margins	Merge with surrounding areas
Vesicles present	Absent
Redness seen in the surrounding skin	Redness in the site of injury
Itching present	Absent

Time	**Color change**	**Pigment**
At first	Red	Hemoglobin
Few hrs to 3 days	Blue	Reduced Hb
4th day	Bluish black to brown,	Hemosiderin
5-6 days	Green	Hematoidin
7-12 days	Yellow	Bilirubin
2 weeks	Normal	---

LACERATIONS

- Laceration is an irregular open wound caused by a blunt force injury
- There will be rupture or tear of skin and/or deeper tissues
- Margins - irregular, uneven, ragged with torn edges
- Shelving - one margin over rides the other which indicates the direction of force
- Bruising of the margins and underlying tissues seen
- Pieces of tissues attached in between the edges - tissue bridges
- Hair bulbs are crushed
- Depth - varies with force and may contain foreign matter like dust, sand, paint of the vehicle involved etc.

Split laceration

- Skin gets crushed between two hard surfaces (weapon and bone) and splits
- Occurs when the bone is superficial and subcutaneous tissues are scanty
- Edges appear to be clean cut (incised looking lacerations)
- Commonly seen over - scalp, lower jaw, iliac crest, shin etc

Stretch laceration

- When the skin gets stretched beyond its limits of elasticity, stretch laceration occurs
- Occurs in vehicular run over accidents, when the skin is stretched
- Fractured segment of a bone pierces the skin and projects out

Avulsion

- When a shearing or grinding force is applied, the skin is separated from the underlying tissues
- Occurs in vehicular run over accidents, where skin flap is completely removed from the underlying tissues (flaying)

INCISED WOUNDS

- Clean cut through the tissues (skin, subcutaneous tissues, blood vessels) by a sharp weapon
- Shape - usually spindle shaped due to gaping by skin elasticity
- Margins - Regular, clean cut and well defined
- Margins - usually everted except sites like neck, scrotum and axilla because of underneath muscles adherent to skin
- Length - no relationship with the length of cutting edge of the weapon
- Breadth - Much wider than the cutting edge, because of the retraction of divided tissues with everted margins - gaping
- Depth - towards the termination depth becomes progressively shallow - tailing of wound
- Cut injuries over face, nose, ears, genitals are usually homicidal

Incised wounds	**Lacerated wounds**
Caused by sharp weapon	Caused by blunt weapon
Margins: Regular, clean cut, everted	Margins irregular
Shape: spindle shaped	Irregular
Length is greater than width Et depth	Wounds may be of any length, breadth and depth
No abrasions on edges	Abrasions seen on edges
No contusion of adjacent tissues	Contusion of surrounding and underlying tissues
Underlying tissues cleanly cut	Deeper tissues unevenly divided - tissue bridging across the margins
Hair bulbs - cleanly cut	Hair bulbs - crushed
Foreign particles - absent	Foreign particles - present
Tailing indicates direction of force	Shallow tails seen, but not related to direction of force
Circumstances: usually homicidal or suicidal, rarely accidental	Usually homicidal or accidental, almost never suicidal
Tentative cuts - suicidal Beveled cuts - homicidal	Split laceration & tears: mostly homicidal Stretch laceration & Avulsion: accidental

Chop wounds

- Wounds produced by fairly heavy weapons like Axe, Hatchet, Big sword
- Abrasions and bruising seen at the margins and underlying tissues
- Margins - ragged abraded and contused

STAB WOUNDS

- Produced when a **pointed weapon** or object or instrument is forcibly thrust into the body
- **Length**
  - May be **same as the breadth** of the blade of weapon or
  - **Slightly smaller** because of elasticity of skin or
  - **Larger** because of the lateral movement of the victim or assailant
- **Breadth** - may not approximate with each other because of gaping
- **Depth** - greatest among the 3 dimensions
  - No relationship with the length of the weapon
  - Wound should not be probed to find the length in a living person as it may dislodge a blood clot and result in fatal hemorrhage
- **Margins** - regular and clean cut
- **Shape** - depends on the type of weapon and site of injury
  - **Single edged weapon - wedge shaped or triangular.** Blunt end of the wound may have small splits in the skin at each end of the corner - fishtailing
  - **Double edged weapon** - spindle shaped or elliptical
- **Direction**
  - Indicated by the track of wound
  - Helps to determine the relative position of the victim and assailant at the material time

Hesitation/Tentative cuts

- Multiple, Parallel, Superficial cuts
- **Accessible and vital sites** - neck, wrist, ankle, chest, abdomen
- Usually in **suicidal cuts**
- Inflicted by the victim before the final fatal deep cut

Suicidal cut throat	**Homicidal cut throat**
• In a right handed individual – above downwards, from left to right side	• Usually on both sides
• **Multiple, superficial, parallel wounds.**	• Single or multiple.
• **Only one wound is deep.**	• If multiple, many wounds are deep
• Superficial wounds merge with the single main wound	• Wounds cross each other at deep level
• **Hesitation or tentative cuts present**	• Absent
• **Tailing present**	• **Absent**
• Wounds may be seen on other accessible Parts of the body - wrist, chest, groin, ankles etc	• Severe injuries may be seen on head, face and neck
• Defence wounds - absent	• **Defence wounds present**
• Weapon firmly graspedin hands due to cadaveric spasm	• Weapon is usually absent at the scene of crime
• Clothes are usually not damaged	• Cuts in the cloth corresponding to injury over the body seen
• Circumstantial evidence: room locked inside, Stains on the mirror if the person was standing in front of it, suicidal note etc	• Disturbance of the scene, disarray of furniture, foot prints, tears and loss of buttons in the cloth etc

DEFENCE WOUNDS

- Injury received by the victim of an attack while trying to defend himself against the assailant
- Often found on the hands and forearms, where the victim has raised them to protect the head and face

- Present on the feet and legs where a victim attempts defense while lying down and kicking an attacking assailant
- The presence of defense wounds is highly suggestive of homicide
- Defence wounds are absent: if the victim is unconscious, taken by surprise, attacked from the back, under the influence of alcohol or drugs

FABRICATED WOUNDS

- Fabricated, fictitious, **forged or invented wounds** are those which may be
  - Produced by a person on his own body (self-inflicted), or
  - Occasionally, caused by another person with his consent (self-suffered)
- **Motive** - To bring false charges against enemies, Fictitious sexual assault by women to bring a rape charge against enemy

Characteristics

- Usually caused by a **sharp weapon**
- Usually superficial wound - **abrasions or incised wounds**
- Wound over accessible parts
- Tears in the clothes don't correspond to those in the body.
- Age of wound doesn't coincide with the history given by the person.

'SKULL FRACTURES

Fractures of vault of skull

- **Fissure # (linear #)**
  - Broad surface like ground, Weapon with broad striking surface, Fall on feet, buttocks
- **Depressed #(fracture a la signature)** - Heavy weapon with a small striking surface
- **Comminuted #**
  - Vehicle, railway accidents
  - Heavy weapon with broad striking surface
- **Pond #(indented #)**
  - Only in infants
  - Obstetric forceps cause injury to infant skull
  - Blow from blunt objects
- **Gutter #** - from oblique bullet wounds
- **Ring or foramen #** - fall from height on foot or buttocks
- **Diastatic or sutural #** - blunt injury

Undertaker's fracture

- Caused due to the head falling backwards forcibly after death, which tears open one of the inter vertebral disc usually around C-6 and C-7
- It is a postmortem artifact due to rough handling of the body

Fractures of base of skull

- **Ring fracture**
  - Fissured fractures around foramen magnum
  - Seen in fall from height when the person lands on feet or buttocks
- **Hinge fracture or Motor cyclist's fracture**

INTRACRANIAL HEMORRHAGES

EXTRADURAL or EPIDURAL HEMORRHAGE

- Between the skull and the dura mater
- Etiology: almost always traumatic
- MC source of bleeding - middle meningeal artery
- Other sources - diploic veins, transverse sigmoid sinuses, anterior and posterior meningeal arteries, anterior ethmoidal arteries

- It is the least common type of all intracranial hemorrhage
- The region most commonly involved is the temporal region (70-80%)
- Usually accompanied by a fracture of skull, most commonly fissured fracture
- The classic lucid interval occurs in 20-50% of patients with EDH
- CT scan: lenticular or biconvex appearance of hemorrhage
- EDH with volume greater than 30 mL need emergency surgical evacuation

SUBDURAL HEMORRHAGE / HEMATOMAI

- Etiology
  - Traumatic
  - Coagulopathy (hemophilia, liver disease, thrombocytopenia)
  - Anticoagulation therapy (warfarin, heparin)
  - Iatrogenic (lumbar puncture)
  - Spontaneous (cerebral tumors, AV malformation, and aneurysms)
- Source of bleeding: bridging veins (vein that connects cortical surface of brain to a dural sinus)
- Subdural hematoma is the most common type of traumatic intracranial mass lesion
- Acute subdural hematomas occur most commonly over the parietal region
- CT scan
  - **Acute subdural hematoma** (< 72 hours old) - **hyperdense, crescent-shaped mass**
  - **Subacute SDH (2nd and 3rd weeks) - isodense, lens shaped**
  - **Chronic SDH (after 3 weeks) - hypodense**

Duret hemorrhages

- Secondary herniation hemorrhages of midbrain and pons
- Occur in midline
- Commonly occurs after asymmetrical herniation of brainstem

LUCID INTERVAL

- Lucid interval is seen in
  - **Extradural hematoma**
  - **Subdural hematoma**
  - **Insanity**
  - **Heat stroke**
  - **Postictal phase after a seizure in epileptic patients**

COUP INJURY

- Injury to the skull and brain occurs at the site of impact
- Occurs when a moving object hits a static head

CONTRE-COUP INJURY

- Injury to the skull and brain occurs on the side opposite to the site of impact
- Occurs when moving head hits a stationary blunt surface

PEDESTRIAN INJURIES

Primary impact injuries

- Due to the first impact between the vehicle and the pedestrian
- In adults - usually seen on the legs (# tibia - bumper #)
- In children - usually seen in head or thighs (# femur - bumper #)
- Patterned abrasion or bruising produced by bumper, radiator grill, head lights etc.
- Helps in identifying the offending vehicle

Secondary impact injuries

- Caused by the subsequent impact of the body with the same vehicle after the primary impact
- Victim is thrown upwards after the primary impact and he falls against the hood, wind shield or roof
- Head injuries are common

- Seen on the same side as the primary impact injury

Secondary injuries or tertiary impact injuries

- Injuries caused when the victim falls on ground or any other object
- Graze abrasions and tire marks
- Base of skull fracture
- He may be run over and crushed against the ground resulting in flaying injuries
- Found on the parts opposite to the primary impact

Injuries to occupants of vehicle

- Sparrow foot marks or Dicing injuries - Multiple punctate lacerations or superficial cuts of the face due to shattering of the windscreen glass into multiple small cubical fragments with relatively blunt edges - seen in front seat occupants
- Steering wheel impact injury - seen in driver
  - Transverse fracture of the sternum
  - Contusion and rupture of heart
  - Rupture of aorta
- Transverse intimal tears of aorta - ladder tears

Motorcyclist's injury

- Motor cyclists fracture or Hinge fracture: Due to heavy impact on one side of the head, fracture is produced across the floor of the middle cranial fossa
- Tail-gating or Under running injury
  - Usually occurs in darkness
  - When the motor cyclist drives into the back of a large vehicle
  - Due to sudden and unexpected stoppage of the large vehicle moving in front

GRIEVOUS HURT (Section 320 IPC)

The following injuries constitute grievous hurt

1. Emasculation
2. Permanent privation of sight of either eye
3. Permanent privation of sight of either ear
4. Privation of any member or joint
5. Destruction or permanent impairment of powers of any member(organ or limb carrying out a distinct function) or joint
6. Permanent disfiguration of the head or face
7. Fracture or dislocation of a bone or tooth
8. Any hurt which endangers life or which causes the sufferer to be in severe bodily pain or unable to follow his ordinary pursuits for a period of 20 days

'PUNCH DRUNK SYNDROME

- Boxer's encephalopathy or dementia pugilistica or chronic traumatic encephalopathy
- A condition seen in boxers and alcoholics, who suffer repeated cerebral concussions due to repeated blows to the head
- In the initial stage there will be deterioration of speed and incoordination
- Later they develop weakness in the lower limbs, hand tremors, and mental dullness.
- Final stage is characterized by slurred speech, dementia, ataxia, broad based gait and Parkinsonism like facial appearance

- ❖ Retraction balls are seen in diffuse axonal injury
- ❖ Puppe's rule- determines the sequence of shots when several bullets have struck the cranium
- ❖ Whiplash injury - acute hyperflexion followed by acute hyper extension of spinal cord
- ❖ Stab injury to heart most common in - right ventricle
- ❖ Driver's injury, Horn boss injury or Steering wheel impact injury - buckled sternum
- ❖ Six penny bruise - bruises found in neck in throttling caused by finger tips
- ❖ Langer's line: gaping is more if the incision is made at right angles to Langer's line

Causes of death from wounds

Immediate or Primary causes	Remote or Secondary causes
• Hemorrhage (MCC) • Neurogenic Shock • Injury to a vital organ • Air embolism	• Infection/Sepsis (MCC) • Thrombo-embolism • Crush syndrome • Fat embolism • Acute Respiratory Distress Syndrome (ARDS) • Disseminated intravascular coagulation (DIC) • Miscellaneous

Antemortem wounds	Post mortem wounds
Edges are swollen and everted	No swelling of the edges
Gaping present	No gaping, edges are approximated
Abundant bleeding	Slight or no bleeding
Arterial bleeding	Venous bleeding
Evidence of spurting of blood seen	No spurting
Blood extravasated in the subcutaneous tissue	No extravasation of blood
Adjacent tissues are stained which cannot be removed by washing	Easily washed away
Coagulated blood seen in wounds	Not seen
Vital reaction positive	Negative
Increased enzyme activity	No enzyme activity

TORTURE

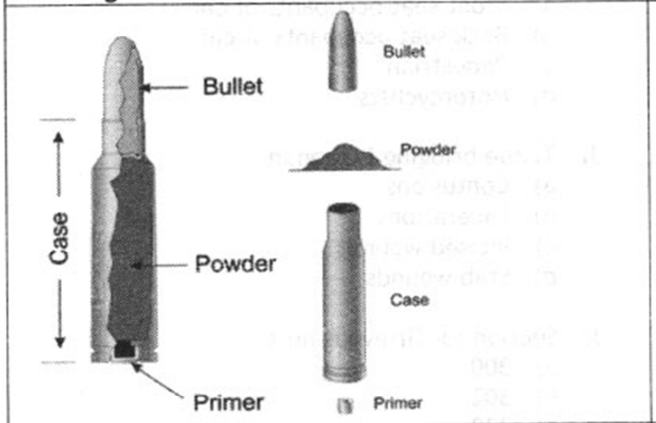
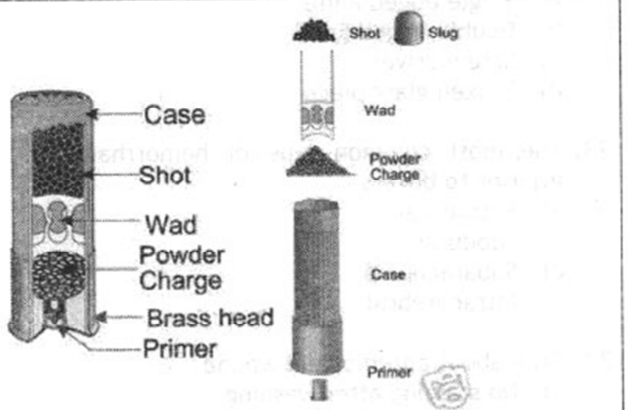
- Falanga (bastinado) - physical torture with canes or rods are used to beat on the soles
- Telefono - repeated slapping on the sides of head over ears
- Wet submarino(latina) - forced immersion of head in water contaminated with urine or feces
- Dry submarino - tying a plastic bag over the head until suffocation
- Parrot's perch - head down from a horizontal pole placed under the knees with wrists bound to ankle
- Cattle prod - electric shock especially over the genitals
- Chepuwa - the legs and thighs are tied very tightly with bamboo sticks to induce severe pain
- Ghotna - rolling a wooden log over the thighs up and down, while the log is weighed by one or two policemen standing on it
- Sham execution - victim is blind folded and asked to stand before a wall and then threatened that a vehicle is going to hit him. He hears the sound of a vehicle very near to him, causing fear and shock
- Dunking - victim is immersed into water, taken out after some time and given chance to confess

❖ Declaration of Tokyo by World Medical association in 1975 - guidelines for medical doctors concerning torture

- ❖ Proximal (Internal) ballistics: study of firearms and projectiles
- ❖ Intermediate (External) ballistics: study of motion of a projectile after being ejected from the firearm till the time it hits the target
- ❖ Terminal (Wound) ballistics: study of injuries produced by firearms

Rifling

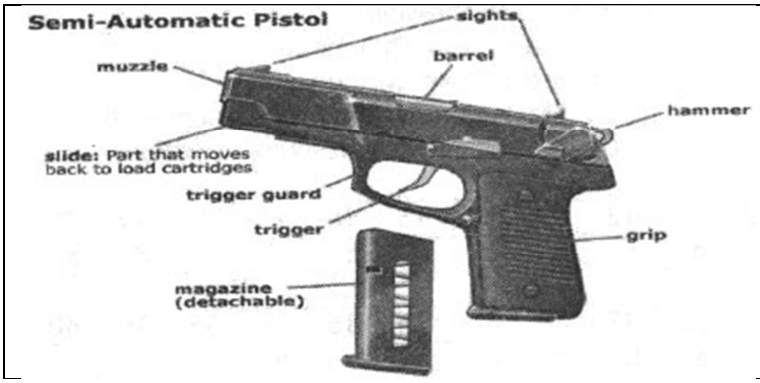
- In rifled firearms, the interior of the barrel - parallel, spirally twisted grooves
- In smooth bored firearms - interior surface is smooth
- Rifling imparts a spin or rotation to the projectile and it acquires a gyroscopic steadiness, preventing it from wobbling
- Paradox guns: if the barrel is partly smooth bored and partly rifled

Cartridge of a rifled firearm	Cartridge of a smooth bored firearm
	
Detonator or Primer: igniting chemical Propellant or Gun powder: explosive Projectile: bullet Case: which stores all the above	Cartridge case - made of paper, plastic or cardboard Projectile: Pellets or shot **Wad** ➢ Keeps the **shots in place** ➢ **Seals the bore effectively** - prevents the escape of the expanding gases ➢ Does not cause severe injuries

Tvoes of stun aowder

Black powder	Semi-smokeless powder	Smokeless powder
• 75% potassium nitrate • 15% charcoal • 10% sulphur • Single grain of black powder produces: 200 - 250 cc of gas	• 20% smokeless powder • 80% black powder	• Single base: nitrocellulose alone • Double base: Nitrocellulose + Nitroglycerine • Most effective type – capable of imparting high velocity to the projectile • Single grain of smokeless powder • produces 800 - 900 cc of gas

Parts of a firearm



Chamber - in which cartridge or magazine is lodged
Bolt - The part incorporating the trigger, spring and the firing pin
Cylinder - where explosion takes place Barrel - Hollow steel tube
Rear end of barrel - breech
Distal end of barrel - muzzle

Choking

- In smooth bored firearms the barrel becomes narrower towards the muzzle end to minimize the dispersion of pellets
- Cylinder bore: a barrel that is not choked

Caliber

- Calibre of a rifled firearms is measured between two diametrically opposite lands
- Calibre of a shot gun is expressed in terms of the number of balls of lead which can be made out of 1 pound of the metal, so that each fits exactly into the bore of the weapon
- Helixometer - instrument to examine the interior of the barrel

Fire arm	Firing range
Shot gun	30 - 40 m
Revolver, Pistol	100 - 300 m
Rifle	1000 m
Military rifle	3000 m

Component of explosion	Effects
Flame	Singeing, burning, blistering
Smoke	Blackening, smudging, fouling
Gun powder	Tattooing, stippling, peppering

Distance travelled by different components of explosion			
	Shot guns	Revolvers and Pistols	Rifles
Smoke	30 cm	30 cm	30 cm
Flame	45 cm	8 cm	15 cm
Gun powder	60 - 90 cm	60 cm	75 - 100 cm

WOUNDS FROM REVOLVERS, PISTOLS, RIFLES

Contact shot (point black shot)	Close shot (within the range of flame)
• Large wound, shows cavitation • Over skull - Stellate, cruciate or cruciform wound • Over abdomen - circular wound • Muzzle imprint may be present • Margins contused and everted • Singeing of hair present • Burning, Blackening, Tattooing - minimal/absent • Tissues are cherry red in colour (carbon monoxide)	• Circular wound • Singeing of hair + • Burning, blackening and tattooing + • Abrasion collar/ grease collar/ dirt collar +

Near shot (within the range of gun powder)	Distant shot (beyond the range of gun powder)
• **No burning, no blackening, no singeing** • **Tattooing +** • **Abrasion collar +** • Round entrance wound	• Circular wound < diameter of the bullet • **Margins inverted** • **Burning, blackening, tattooing absent** • **Abrasion collar present**

ABRASION COLLAR

- When the bullet (projectile of a rifled firearm) penetrates the skin while entering, due to spin, the edge of the entrance wound may be abraded in the form of a collar
- Absolute proof of entrance wound of a rifled firearm (always seen)
- Main factors contributing to abrasion collar
  - **Gyroscopic movement of the bullet**
  - **Elasticity of the skin**
- When the bullet comes in contact with the skin, its spinning action develops great friction against the elasticity of the skin
- Thus it produces a collar of abrasion all around the wound of entry
- It is seen in entry wound of rifled firearms at all ranges
- Helps to determine direction of firing
  - When the bullet enters the skin at right angles - round abrasion collar
  - When the bullet enters the skin obliquely - oval or oblique abrasion collar

WOUNDS PRODUCED BY SHOTGUN

Contact shot	Close shot
• Large, irregular hole resulting from the explosive blast effect • **Burning + Blackening + Tattooing +** • The shot (pellets) enter the body en masse • Cherry red discoloration of tissues	• Circular defect with irregular borders • Burning + Blackening+ Tattooing + • Pellets enter the body en masse • **Rat hole entry** wound (30 cm - 1 m) • **Satellite holes** around entry wound (2 - 3 m)

Near shot	Distant shot
• Circular or oval wound • Smudging upto 30 cm • Wad causes mild abrasions upto 30 cm • Tattooing + • The pellets travel as a compact mass upto 45 cm • After that disperse and enter as individually	• Beyond 2 metres • No burning, blackening or tattooing • Wad may be present inside the wound (upto 5m) • Pellets disperse significantly - the size of the central role decreases • Beyond 6 metres - no central hole

❖ **Rule of thumb: the diameter of spread in inches = range in yards x 1.5**

Entrance wound	Exit wound
Size smaller than the diameter of bullet	Larger
Inverted edges	Everted edges
Bruising, abrasion collar and grease collar	Absent
Burning, blackening and tattooing seen	Absent
Fat protrusion not seen except in contact shot	Present
Tissues may be cherry red due to CO	No colour change
Fibres of clothing may be turned in	Turned out
Lead ring seen on radiological examination	Absent

Shored (supported) exit wound

- If the skin at the exit wound is supported (belt, waist band of trousers or if the body leans against the wall, chair, door)
- Near-Circular exit wound surrounded by abrasion

- Resembles wound of entrance

Bullet wounds in skull

- Wound is **funnel shaped**; funnel opening up in the direction in which the bullet is travelling
- **Entrance wound**
  - Outer table - **punched hole**
  - Inner table - **beveling (sloping surface)**
- **Exit wound**
  - Inner table - **punched hole**
  - Outer table - **beveling (sloping surface)**

Wounding power of bullet

- It is directly related to the kinetic energy at the moment of impact (E=mv2/2)
- Thus the wounding power depends mainly on the velocity of the bullet

Peculiar effects of firearms

- **Ricochet bullet -** before striking the target, bullet strikes an intervening object and then rebounds to the target
- **Yawing bullet -** travel in irregular fashion, produce a key hole entry wound
- **Dum Dum bullet -** a jacketed bullet with nose cut off
- **Tumbling bullet -** rotates in end to end
- **Souvenir bullet** - left in the body for body for some time and covered with dense fibrous tissue
- **Tandem bullet or piggy back bullet-**2 bullets ejected one after other, first one failed to leave and ejected by the next one
- **Frangible bullet** - fragments at the site of impact
- **Mushroom bullet -** expand upon impact and thus produces more serious wounds
- **Kennedy phenomenon** - Surgical alteration or suturing of gunshot wounds, evaluation of wounds become difficult
- **Crime bullet or exhibit bullet: bullet found in the body**
- Test bullet: **test fired bullet**
- **Tracer bullet**
  - Projectiles that are built with a small pyrotechnic charge in their base
  - Ignited by the burning powder, the pyrotechnic composition burns very brightly, making the projectile visible to the naked eye
  - This enables the shooter to follow the projectile trajectory to make aiming corrections

Autopsy in a case of death due to firearms

- Whole body X-ray to localize the bullet/pellets
- All wounds should be photographed
- All skin wounds should be dissected out carefully with surrounding tissue and preserved in glass containers containing rectified spirit
- **The bullet should be removed with fingers** or rubber tipped forceps and not with toothed metal forceps
- It should not be washed as it would remove any residues
- The doctor should mark his initials at the base with a sharp pointed instrument to facilitate its identification in court

Tests for firearms
Harrison and Gilroy test
Neutron activation analysis
Atomic absorption spectroscopy **(AAS)**
Flameless AAS
Dermal nitrate **(paraffin test)**

- Bullet rotates at 3000 revolutions per second as it leaves the barrel of a rifle
- **Incendiary bombs -** primarily cause burns
- **Motolov cocktail -** an incendiary bomb, bottle filled with gasoline and a rag to serve as a wick which is lighted and thrown at the target

THERMAL INJURIES, LIGHTNING, ELECTROCUTION, TRACE EVIDENCE, FORENSIC PSYCHIATRY

BURNS

Estimation of % of body surface area burns

Area of body	Infant	Child	Adult
Head and neck	20	19	9
Front of trunk	20	16	18
Back of trunk	20	16	18
Upper limbs	20	19	18
Lower limbs	20	30	36
Genitals	0	0	1

- ❖ Minimum temperature for producing a burn is 44°C for about 6 hours

Cause of death in burns

- First 24 hours - neurogenic shock
- 24 - 48 hours - hypovolemic shock
- After 48 hours - septic shock

Findings indicative of ante mortem burns

- **Soot in the upper respiratory tract**
- **Carboxy hemoglobin in blood**
- **Albumin and chloride in blisters**
- Healing and granulation
- Increased enzymes in blisters
- **Presence of carbon particles in terminal bronchioles** - absolute proof of life during burns

- ❖ **Pugilistic (boxing or fencing)** attitude occurs both in ante mortem and postmortem burns
- ❖ **Curling's ulcer** - sharply punched out mucosal defects in duodenum in 10% burns deaths

Heat ruptures can be differentiated from incised/lacerated wounds by

- Presence of intact nerves, blood vessels and connective tissue in the floor
- Absence of clotted blood as heat coagulates blood in the vessels
- Absence of bruising or other vital reactions in the margins
- Irregular margins

Antemortem burns	Postmortem burns
Line of redness	Absent
Blister contains serous fluid with proteins and chloride. Base - red	Air and thin clear fluid. Base - pale, dry, hard
Vital reaction present	Absent
Enzymatic activity present	Absent
Carboxyhemoglobin > 10%	Absent
Carbon particles in airway	Absent

SCALDS

- Application of moist heat
- **Liquid above 60°C or steam**

Burns	Scalds
Site: **At and above** the site of contact	At and below the site of contact
Splashing absent	**Splashing present**
Skin: Dry, wrinkled	**Soddened and bleached**
Blisters at the circumference of burnt area	**Blisters over scald area**
Charring, singeing present	Absent
Clothes burnt	Clothes wet, not burnt

HEAT CRAMPS/ MINER'S CRAMPS/STOKER'S CRAMPS

- Persons working in **high temperature** and sweating is profuse
- **Vigorous exercise** also results in loss of electrolytes through profuse sweating in hot weather
- Rapid dehydration and loss of sodium and chloride from the body through sweat
- Severe and **painful cramps** of muscles of arms, legs, abdomen
- Treatment - i.v. saline causes rapid relief

HEAT PROSTRATION/HEAT SYNCOPE/ HEAT COLLAPSE/HEAT

- Most common hyperthermia syndrome
- Failure of CVS to compensate for hypovolemia
- Person standing in the sun becomes pale, his BP falls and collapses suddenly due to pooling of blood in the tower limbs
- Skin cold, pupils dilated, pulse thready
- Treatment - rest with head down position

HEAT HYPERPYREXIA/ HEAT STROKE

- Failure of heat regulating center in hypothalamus
- Very high body temperature (upto 110°F or 43.3°C)
- No sweating, Delirium, coma, convulsions, multiple organ failures
- Predisposing factors - high temperature, increased humidity, minor infections, old age, alcoholism
- Necrosis of the muscles (rhabdomyolysis) and myocardium due to nitrosylation of the ryanodine receptor type 1 (RYR) in skeletal muscle
- Treatment: rapidly cooling the body with ice water till the rectal temperature falls below 102°F

Disorder	Body temperature	Skin	Mental status
Heat cramps	37°C	Moist and cool	Normal
Heat exhaustion	≤40°	Sweating	Normal
Heat stroke	>40°	Dry (anhydrosis)	Impaired consciousness

FROST BITE

- When the tissue temperature drops below 0 °C (32°F)
- Ice crystal formation distorts and destroys the cellular architecture
- Vascular endothelium is damaged, stasis progresses rapidly to microvascular thrombosis.
- Finally, thrombosis, dermal ischemia, and superficial necrosis appear
- Usually occurs in extremities
- Blisters can also be seen

TRENCH FOOT/IMMERSION FOOT

- Immersion foot results from repetitive exposure to wet cold above the freezing point.
- The subsequent development of bullae is often indistinguishable from frostbite.
- This vesiculation rapidly progresses to ulceration and liquefaction gangrene.

ELECTROCUTION

- Voltage is the fundamental force or pressure that causes electricity to flow through a conductor
- Electrocution is rare at less than 100 volts and most deaths occur at more than 200 volts
- Alternating current (AC) is more dangerous than equal voltage of direct current (DC). This is because when AC comes in contact with muscles, it produces tetanic muscle contractions and does not allow the person to release the contact with the source of current
- Currents of 10mA cause pain and muscle contractions and 100mA is fatal
- The electric burn at the point of entry is called Joule burn or endogenous burn
- Spark burn or exogenous burn is produced by intermittent contact and arcing of current from the conductor to the skin. There is an air gap between metal and skin
- Multiple burnt or punched out lesions are produced due to an arc dancing over the body surface which produce crocodile flash burns

- If the point of entry is one upper limb and the point of exit is the opposite foot, the current will pass across the chest and most likely to produce myocardial fibrillation
- Current passing through the head may cause brain stem damage with central respiratory paralysis
- Skeletal muscle in the path of the current may show Zenker's degeneration
- Small balls of molten metal (current pearls), derived from the contacting electrode, may be carried deep into the tissues
- Heat generated by the current may melt the calcium phosphate, which is seen radiographically as round density foci (bone pearls or wax drippings)
- There may be bone necrosis or Zig-zag microfractures

❖ **Zenker's degeneration -** a type of coagulative necrosis, also seen in acute infections like typhoid

Current voltages

- **Domestic current - 220 to 240 volts.**
- **Industrial current - upto 400 kilovolts**
- **Lightning - > 1000 million volts**

LIGHTNING

- **1000 million volts; 20000 amperes**
- **Attracted by the highest points**
- **Chooses the easiest path**

Postmortem appearances

- **Blast effects** due to air expansion around the flash
  - Rupture of ear drums
  - Contusions, lacerations, fractures, rupture of organs
  - Clothes may be torn or stripped off and thrown apart
  - Shoes may be burst open
- **Burn effects**
  - Linear burns over skin creases and folds

Medicolegal importance

- Most deaths occur in the open (persons sheltering under trees, open fields, carrying something which attracts lightening)
- Persons seated in motor vehicles are not affected because of insulation provided by the tyres
- The crime scene may suggest sexual offence or criminal violence - clothes stripped off, abrasions, contusions and lacerations in a body found in an open field
- Diagnosis should be based on the history of thunderstorm in the locality, evidence of effects of lightning in the vicinity of the body and fusion or magnetization of metallic substances

ARBORESCENT BURNS/FILIGREE BURNS/LICHTENBERG'S FLOWERS

- Superficial thin irregular tortuous markings on skin resembling branches of a tree
- Fern-like pattern of erythema over the shoulders or flanks
- Does not correspond to vascular channels
- Not associated with burning
- Staining of tissues by Hb or rupture of capillaries along the pathway of current

TRACE EVIDENCE

- Locard's principle of exchange: When any two objects come into contact, there is always a transfer of material from each object on the other

Tests for blood stains	
Presumptive tests	**Confirmatory tests**
• Benzidine test (Alder's test) • Phenolphthalein **(Kastle Mayer test)** • O-toluidine test • Leucomalachite green test • Luminol test	• Haemin crystal test **(Teichmann test)** • Haemochromogen test **(Takayama test)** • Immunological test - precipitin test • **Spectroscopy** - most reliable for detecting both recent and old stains

Blood grouping from blood stains

- **Latte's crust method**
- **Absorption-elution technique**
- **Absorption inhibition**
- **Latex method**
- **Mixed agglutination**

❖ Agglutinogens in the stain are retained for longer time, even though red cells are destroyed. The absorption inhibition and **absorption elution** method are employed for grouping of such old stains.

DNA TYPING/DNA FINGERPRINTING

- DNA finger printing was developed by Dr. Alec Jeffreys in 1985
- Short tandem repeats(STR) are used as markers for human identification in forensic casework Mitochondrial DNA analysis is the method of choice when dealing with environmentally challenged samples and also used in cases of disputed maternity

Samples collected for DNA analysis

- Muscle is the most ideal source for extracting DNA. 100mg muscle with NS or dimethyl sulphoxide (DMSO) solution saturated with sodium chloride as a preservative
- 5ml of i.v blood with heparin or EDTA
- Blood clot or dried blood stains from the scene of crime can be sent
- Semen, vaginal swabs, saliva sent in the dried condition
- Urine 10ml (frozen)
- Hair (10-20) picked using forceps without damaging the root (cut hair without root is not useful)
- Femur or humerus with bone marrow and molar teeth without preservative
- Finger nail scrapings

Tests for seminal stains

- Creatine phosphokinase test
- Acid phosphatase test
- Florence test
- Barberio's test (crystals of spermin picrate)

FORENSIC PSYCHIATRY

- Mens rea - criminal mind
- Actus rea - actual physical act causing death
- A person is Criminally responsible only when both actus rea and mens rea are present Holograph will is one written by a testator in his own hand writing
- Testamentary capacity is the mental ability of a person to make a valid will
- Observation time for a person for diagnosis of insanity - usually 10 days, but with the permission of Magistrate may be extended to 30 days
- Reception order - issued by the magistrate for admission and detention of a psychiatric patient, valid for 30 days
- Section 84 IPC: (based on McNaughten rule) Nothing is an offence which is done by a person, who at the time of doing it, by reason of unsoundness of mind, is incapable of knowing the nature of the act or that he is doing what is either wrong or contrary to the law
- During lucid interval a person
  - ➢ Can make valid will
  - ➢ Can give valid evidence in a court of law
  - ➢ Is legally responsible for his deeds

REAL INSANITY	FEIGNED INSANITY
Gradual onset	Sudden
No motive	Motive present(commission of crime)
Predisposing factors present(h/o insanity in parents, sudden monetory loss)	Absent
Facial expression – peculiar (vacant look) or fixed look of excitement	No peculiarity, frequently change, exaggerated and voluntary
Insomnia present	Cannot persist, sleeps soundly after a day or two
Patient can stand exertion of fatigue, hunger and sleep for several days without breaking down	Cannot stand exertion for more than a few days and breaks down
Frequent examination - does not mind	Resents for fear of detection

THE MENTAL HEALTH ACT, 1987

Terminologies changed

- **Psychiatric hospital** (instead of mental hospital or asylum)
- **Mentally ill person** (instead of lunatic)
- **Mentally ill prisoner** (instead of criminal lunatic)

Provisions of the act

- Mentally ill person - a person who is in need of treatment by reason of any mental disorder other than mental retardation
- Establishment and maintenance of psychiatric hospitals can be done only with license which has to be **renewed every five years**
- Govt. appoints 5 visitors (atleast 1 Medical officer) for each nursing home - **inspection every month - examine - examine every minor patient**

IMPULSE

- Impulse is a **sudden and irresistible force compelling** a person to the **conscious performance of some action** without motive or forethought and preparation

Types of impulses

- **Kleptomania:** An irresistible desire to steal articles of little value and of no use to the person
- **Pyromania:** Irresistible desire to set fire to things
- **Dipsomania:** An irresistible desire for alcoholic drinks at periodic intervals
- **Oniomania:** Irresistible desire for shopping
- **Mutilomania:** Irresistible desire to injure and mutilate animals.
- **Suicidal and homicidal impulses:** e.g: run amok in cannabis poisoning

STARVATION

- Feeling of hunger lasts for 30 - 48 hours
- Loss of 40% of body weight is usually fatal
- If both water and food are withdrawn, death occurs in 10 - 12 days
- If food alone is withdrawn, death occurs in 6 - 8 weeks
- Rigor mortis sets in and disappears quickly
- Gall bladder is distended with bile
- Baby-farmer: child starved by their parents or guardians

HANGING

- Typical hanging - knot at the occiput
- Atypical hanging - knot elsewhere
- Complete hanging - no part of the body touches the ground
- Partial hanging - body touching the ground

Causes of death in hanging

- Venous congestion
- Asphyxia
- Asphyxia + venous congestion (mcc)
- Cerebral anoxia
- Reflex vagal inhibition
- Fracture dislocation of cervical vertebrae

Tension required to occlude various structures in the neck

- Jugular veins - 2 Kg
- Carotid arteries - 5 Kg
- Trachea - 15 Kg
- Vertebral arteries - 20 Kg

Judicial hanging

- Atypical hanging (knot under the angle of jaw)
- Tear of spinal cord due to Fracture dislocation at C2-C3 or C3-C4

Postmortem findings in hanging

External	Internal
• Cyanosis • Petechiae (Tardieu spots) noted over forehead, face, temples, eyes • Le Facies sympathique • Salivary dribbling • Glove and stocking hypostasis • Ligature mark	• Congestion of viscera • Petechiae • Fluidity of the blood • Tissues under the ligature mark are dry, pale and glistening • Transverse intimal tears of carotid arteries – in cases associated with long drop (e.g. judicial hanging) • Thyroid cartilage fracture • Hyoid bone fracture

Postmortem findings that indicates antemortem hanging

- Dribbling of saliva
- Le Facies Sympathique - if the ligature press the cervical sympathetic chain, the eye on the same side is open and pupils dilated
- Intimal tears in the carotid artery

❖ Ligature mark is seen in both AM and PM hanging
❖ Hyoid bone # seen in 0 - 60 % (common above 40 yrs)

STRANGULATION

- **Ligature strangulation:** neck constricted with a ligature
- **Manual strangulation or Throttling:** Neck constricted with hand
- **Garroting -** victim attacked from behind, throat may be grasped or ligature thrown and neck constricted
- **Mugging -** strangulation caused by holding the neck of the victim in the bend of the elbow
- **Bandsola -** neck constricted between two bamboo sticks

- Constriction of the neck by hands
- Always homicidal

PM findings

- Linear or crescentic abrasions (nail marks) on the neck
- Bruising - one prominent bruising on one side of neck (thumb) and three to four abraded contusions on the other side (other fingers)
- Hemorrhage and bruising into the deeper structures of the neck
- Fracture of superior thyroid horn
- Fracture of hyoid bone

HANGING	LIGATURE STRANGULATION
Ligature mark • Oblique • Does not encircle the neck completely • Below chin and above thyroid cartilage • Base -pale, hard and parchment like	Ligature mark • Transverse • Encircles the neck completely • At or below thyroid cartilage • Base - soft and reddish
Bruising of neck muscles not common	**Bruising of neck muscles common**
Neck stretched and elongated	Not so
Hyoid bone fracture may occur	Uncommon (more common in manual strangulation)
Thyroid cartilage fracture less common	Thyroid cartilage fracture more common
Carotid intimal tears seen	Rare
Salivary dribbling present	Absent
Bleeding from nose, mouth and ears uncommon	Common
Subconjunctival hemorrhage absent	Subconjunctival hemorrhage present

Hyoid bone fractures

- **Inward compression # or adduction #** (periosteum torn outside) - throttling
- **Antero posterior compression # or abduction #** (periosteum torn inside) - hanging
- **Avulsion# or tug # or traction#** - due to muscular over activity

Neck dissection

- **In any case of suspected injury to the neck and suspicious deaths (hanging, strangulation), neck should be opened last**
- After opening abdominal, thoracic and cranial cavity and removing all the viscera and draining all the blood, neck should be opened - bloodless dissection of neck
- In hanging - no extravasation of blood in tissue planes
- In ligature strangulation & throttling - extravasation of blood, injury to neck structures and muscles

DROWNING

- **Wet drowning/Primary drowning:** water is inhaled into the lungs
- **Dry drowning:** water does not enter the lungs; death results from immediate **sustained laryngeal spasm**
- **Secondary drowning/Post immersion syndrome/Near drowning:** submersion victim who is resuscitated and survives for 24 hours
- **Immersion syndrome/Hydrocution/Submersion inhibition:**
  - **Death due to cardiac arrest due to vagal inhibition**
  - **Stimulation of the vagal nerve endings**
    - **Sudden entry of water into nasopharynx or larynx**
    - **Water striking the epigastrium while diving**
    - **Sudden inrush of cold water into the ears**
- **Predisposing factors**
  - **Young swimmers**
  - **Under the influence of alcohol**
  - **Excitement and emotions**

- **Overeating prior to swimming**

Fresh water drowning	Sea water drowning
▪ **0.6%NaCl** ▪ **Denatures the surfactant** ▪ **Hemodilution, hemoglobinuria** ▪ **Hyponatremia, Hypocalcemia, Hyperkalemia** ▪ Cause of death - **ventricular fibrillation, cardiac failure** due to volume overload and hypoxia of myocardium ▪ Lungs – ballooned and light, emphysematous, shape retained, do not collapse after removal, c/s – **crepitus heard, little froth, no fluid**	▪ **>3%NaCl** ▪ **Dilutes surfactant** ▪ **Hemoconcentration** ▪ **Hypernatremia** ▪ Cause of death - pulmonary edema ▪ Lungs - ballooned and heavy, soft, shape not retained, **collapse on removal, c/s – no crepitus, copious fluid and froth**

Post Mortem findings in a case of Drowning

External

- Dilated pupils, Light pink PM staining, RM develops early
- Fine , white , leathery, copious froth in mouth and nostrils (most characteristic finding)
- Weeds, gravel, twigs or leaves present in water may be firmly grasped in hands due to cadaveric spasm which strongly suggests antemortem drowning
- Cutis anserina or goose skin and retraction of scrotum and penis due to submersion in cold water(reaction phenomenon)

Internal

- Lungs - voluminous, completely occupy thoracic cavity, bulge out from chest when sternum is removed, impressions of ribs seen on the anterior surface
- Emphysema aquosum - edematous lungs with froth and Paultauf's hemorrhage
- Edema aquosum - edematous lungs without froth and Paultauf's hemorrhage
- Hydrostatic lung: if a dead body is thrown into water, due to the hydrostatic pressure water passes into the lungs
- Paltauf's hemorrhages - subpleural petechial hemorrhages

Gettler's test

- Chloride content of the right and left chambers of heart is normally equal on both sides
- In fresh water drowning, 50% reduction in chloride concentration on the left side of heart
- In salt water drowning, 30-40% increase in chloride concentration on the left side of heart
- A 25% difference in chloride content considered significant. But this test has doubtful value Other lab features
- Diatoms - unicellular algae, walls made of silica
- Serum strontium levels are raised in drowning
- Plasma specific gravity on the left side of heart < right side(left> right in non-drowning cases)
- Magnesium content of the left side of heart is 1.25mg/1000ml > right side

Findings suggestive of ante-mortem drowning

- Froth from mouth and nostrils
- Cadaveric spasm
- Emphysema aquosum
- Paltauf's hemorrhages

SEXUAL/AUTO-EROTIC ASPHYXIA/ASPHYXIOPHILIA

- **Young males** with abnormal sexual behavior
- Sexual pleasure by partial reduction of blood supply to the brain
- Compressing the blood vessels in the neck
- Accidental death due to tightening of ligature
- Circumstantial evidence - Padding under the ligature, undressed or dressed like a women, pornographic literature, drugs like cocaine, alcohol

- The term, 'Cafe Coronary' , was coined by **Dr Roger Haugen**
- A healthy but grossly intoxicated person suddenly collapses and dies during or after a meal
- Death appears to be due to heart attack. Hence the name café coronary (misnomer)
- At autopsy a large piece of food bolus is found **obstructing the larynx**
- Death is due to **choking**
- The suppression of gag-reflex due to alcohol or drugs makes the individual susceptible to Cafe Coronary

- **Lynching: homicidal hanging**
- **Spanish windlass technique -** a type of suicidal strangulation
- **Burking** - a combination of homicidal smothering and traumatic asphyxia
- **Choking** - obstruction of internal air passages by food particles or foreign body, usually accidental
- **Smothering** - asphyxia caused by closing mouth and nostrils
- **Gagging** - asphyxia caused by forcing a cloth in the mouth

IMPOTENCE & STERILITY

- **Impotence -** inability of a person to perform sexual intercourse
- **Sterility -** inability of a male to beget children and inability of a female to conceive children
- **Frigidity -** inability to initiate or maintain sexual arousal in female
- **Satyriasis -** excessive sexual desire
- **Quoad hanc (Impotentia quoad persona)** - a male impotent with a particular woman but not with other women
- **Fecundation ab extra -** when sperm is deposited in the vulva (no penetration of penis), insemination can occur due to the passage of sperm from external genitalia to the uterus

Artificial insemination

- **Artificial Insemination Homologous (AN)** - If the semen used is derived from the women's husband
- **Artificial Insemination Donor (AID) or Heterologous artificial insemination** - If the semen is obtained from a person other than the husband
- **Artificial Insemination Homologous Donor (AIHD)** - A mixture of husband's semen with the donor semen (Pooled semen) is used

VIRGINITY

- Hymen
- Membranous diaphragm at the vaginal introitus
- Thin (but firm) fold of connective tissue
- 1 mm in thickness
- Usually has a central aperture
- Diameter of hymenal orifice in prepubertal children in mm = age in years
- Usually gets ruptured (posteriorly) during first sexual intercourse
- Semi lunar/crescentic type - most common
- Annular type - may appear intact even after sexual intercourse has taken place
- Fimbriated type - may appear torn even in the intact state
- The ruptured segments of hymen gradually become thicker and smaller and appear as small fleshy pyramidal projections - carunculae hymenales (hymenal tags)
- After vaginal delivery, the hymenal tags may disappear or attain irregular thick margins carunculae myritiformis

Virginity	Defloration
Hymen Intact, Rigid and inelastic Narrow opening hardly allowing tip of a finger to pass	Torn or intact; loose and elastic Wide opening easily allowing two fingers to pass
Labia majora adjacent to each other; completely closing the vaginal orifice	Labia majora are separated, flabby, vaginal orifice seen at lower end
Clitoris small	Clitoris enlarged
Fourchette - intacy	Fourchette - torn
Vagina is narrow, more prominent rugae	After repeated intercourse, becomes patulous and rugae are less obvious

Presumptive signs of pregnancy	Probable signs of pregnancy
• Amenorrhea • Breast changes • Morning sickness • Quickening • Pigmentation of skin • Jackquemier's or Chadwick's sign (discoloration of vagina) • Urinary disturbances • Sympathetic disturbances	• Enlargement of abdomen • Hegar's sign • Goodell's sign (softening of cervix) • Braxton-Hick's sign (intermittent uterine • contractions) • Batlotment • Uterine soufflé • Immunological tests • Biological tests

Positive signs of pregnancy

- Fetal parts and movements felt by placing the hands on the abdomen
- Fetal heart sounds
- Placental soufflé
- Funic or Umbilical soufflé
- X-ray diagnosis (not done now)
- Ultrasound

Spurious or Phantom pregnancy (Pseudocyesis)

- The woman believes that she is pregnant, though she is not.
- May present with enlargement of abdomen due to fat deposition or some pathological condition
- May have false feeling of movement of fetus inside
- May even have false labour pains
- All the symptoms vanish once she is informed that she is not pregnant
- Seen in women who strongly desire for a child or who are afraid of being pregnant
- Occurs in young women and women nearing or just achieved menopause

❖ **Super fecundation -** fertilization of two ova formed from the same menstrual cycle by two separate acts of coitus at short interval
❖ **Super fetation -** fertilization of second ovum in a woman who is already pregnant (ova from different menstrual cycle)
❖ **Atavism -** child does not resemble parents, but grand parents
❖ **Suppositious child -** a child presented by a woman to have been delivered by her, though she has not delivered the child.
❖ **Posthumous child -** child who is born after the death of its father
❖ **Surrogate mother (Womb leasing)**
  ○ Accepts pregnancy and bears child either by artificial insemination or IVF for another woman who is incapable to carry child
  ○ Consent should be obtained prior to the procedure

DELIVERY

Lochia (discharge from the uterus which lasts for 2 -3 weeks after delivery)

- **Lochia rubra:** first 4-5 days after delivery, bright red color
- **Lochia serosa:** next 4 days, thin, pale and serous discharge
- **Lochia alba:** after 9th day, dirty white color

FEATURES	NULLIPARA	MULTIPARA
Size	Smaller (7 x 5 x 2 cm)	Larger (10 x 6 x 2.5 cm)
Weight	40 - 50 g	80 - 100 g
Length	Body is of same length as cervix	Body is twice the length of cervix
Upper surface of Fundus	Less convex Et is in the same line of broad ligament	More convex & is at a higher level than the line of broad ligament
Uterine cavity	Convex inner walls, small triangular cavity with less space	Concave inner walls, wider and larger, rounded cavity

Scar for placental attachment	Not seen	Present. Very faint.
External Os	Small, roundish dimple like depressed opening.	Transverse slit like opening.
Internal Os	Circular, well defined.	Not well defined, margin wrinkled.

- ❖ Uterus returns to normal size **6 weeks** after delivery

ABORTION

Natural abortion

- Spontaneous
- Accidental

Artificial abortion

- Justifiable or Therapeutic or Legal
- Criminal

- ❖ The World Medical Association, adopted a resolution on therapeutic abortion - Declaration of Oslo (1970)

The MTP ACT - 1971 (Amended 1975 & 2002)

Indications

- **Therapeutic** - when the continuation of pregnancy endangers the life of woman or cause serious injury to her physical or mental health
- **Eugenic** - Risk of the child being born with serious physical or mental abnormalities
  - ➢ The women in the first 3 months of pregnancy suffers from German measles, small pox, chicken pox, toxoplasmosis, viral hepatitis, any severe viral infection
  - ➢ If the pregnant woman is treated with drugs like thalidomide, cortisone, aminopterine, antimitotic drug or she consumes hallucinogens or antidepressants
  - ➢ If she is treated by X rays or other irradiation
  - ➢ Insanity of the parents
- **Humanitarian** - if the pregnancy is caused by rape
- **Social** - when the pregnancy is a result of failure of contraception in case if a married woman which is likely to cause serious mental injury
- **Environmental** - when social or economic environment, actual or reasonably expected can injure mother's health

Rules

- Chief Medical Officer of the district is empowered to certify that a doctor has the sufficient training
- A doctor is qualified if he/she has assisted 25 cases of MTP in a recognized hospital
- Consent of the husband not necessary
- No need for the woman to produce age proof, oral statement is enough
- It is enough for the woman to state whether she was raped , it is not necessary that a complaint is lodged
- Duration of pregnancy < 12 weeks - one doctor can perform
- 12-20 weeks - two doctors must agree that there is an indication for MTP
- In case of emergency, can be performed by a single doctor, even without training, even after 20 weeks, even without consulting another doctor, even in a private hospital which is not recognized

SEXUAL OFFENCES

Natural offences	Unnatural offences	Sexual perversions	Sex linked offences
Rape	**Sodomy**	**Sadism**	**Voyeurism**
Incest	**Bestiality**	**Masochism**	**Stalking**
Adultery	**Tribadism**	**Necrophilia**	**Sexual harassment**
	Buccal coitus	**Fetichism**	**Trafficking**
		Transvestism etc	**Indecent assault**

NATURAL SEXUAL OFFENCES

RAPE

- **Consent** - a woman of 18 years and above can give valid consent for sexual intercourse
- **Age of the accused** - in India there is no age limit under which a boy is considered physically incapable of committing rape
- Sexual intercourse or sexual acts by a man with his own wife, **wife not being under sixteen years of age, is not sexual assault**
- **Statutory Rape** - sexual intercourse with a girl below 18 years of age even with her consent. It is neither violent nor physically coerced
- **Marital Rape** - forceful sexual intercourse with wife who is living separately from him, without her consent. It is punishable with imprisonment up to two years provided the age of the wife is not < 12 years

Examination of rape victim

- Completely undressed and examined using **ultra-violet light to detect seminal stains**
- In a virgin, tearing of hymen usually occurs **posteriorly in the 4 or 8 'O clock position or 5 or 7'O clock position**

Genital examination of rape accused

- **Smegma under the prepuce**
  - Smegma is a thick cheesy secretion with a disagreeable odour, containing desquamated epithelial cells and smegma bacilli (Mycobacterium smegmatis)
  - Smegma usually gets wiped off during sexual intercourse
  - Absence of smegma is not a conclusive evidence of sexual intercourse as it can be cleaned during bath
  - Presence of smegma is an evidence that the person did not have sexual intercourse or complete penetration
- **Lugol's iodine test**
  - Shaft of the penis is examined for the presence of vaginal epithelial cells
  - Vaginal epithelial cells have high glycogen content
  - Shaft of the penis is wiped off with a clean filter paper and the filter paper is exposed to vapours of Lugol's iodine
  - Brown colour indicates the test is positive (surest sign of recent sexual intercourse)
- **Pap test**
  - Wash the penis in sterile saline
  - Stain with pap stain to demonstrate vaginal cells, cervical cells, Barr body

Injuries in a rape accused **suggestive of forcible sexual intercourse**

- **Nail scratches over face, chest**
- **Bite marks over arms** and other parts
- **Bruises**
- **Tearing of frenulum**

INCEST

- Sexual intercourse by a man with a woman who is closely related to him by blood (prohibited degrees of relationship) e.g. daughter, sister, granddaughter, step sister.
- In India, incest as such, is not **an offence**

ADULTERY (S. 497 IPC)

- Voluntary sexual intercourse between a married man and some-one other than his wife or between a married woman and someone other than her husband

UNNATURAL SEXUAL OFFENCES S 377 IPC

- **Sodomy/Buggery** - anal intercourse
- **Gerontophilia** - when the passive agent is an adult in sodomy
- **Paederasty** - when the passive agent is a child (catamite) in sodomy

- **Pedophile -** adult who repeatedly engages in sexual activities with children
- **Eunuchs** - male prostitutes in India, act as passive agents in sodomy
- **Buccal coitus or Sin of Gomorrah or Coitus per os**- penis introduced into the mouth
- **Tribadism/Lesbianism/Sapphism** - female homosexuality
- **Bestiality** - sexual intercourse by a human being with a lower animal

❖ **Lateral buttock traction test** - to examine the victim of sodomy

SEXUAL PERVERSIONS

- **Uranism** - general term for sexual perversion which includes sexual gratification by fingering, fondling, licking and sucking the genitalia of opposite sex
- **Paraphilias** - unorthodox sex play by using objects or parts of the body
- **Sadism** - sexual gratification obtained from acts of cruelty or infliction of pain on the partner
- **Lust murder** - murder serves as a stimulus for sexual act
- **Necrophilia (S 297 IPC)-** sexual intercourse with dead bodies
- **Necrophagia(S 297 IPC) -** eating the flesh, drinking the blood of the victim to drive sexual pleasure
- **Masochism** - opposite to sadism, asking the partner to inflict pain on himself for sexual pleasure
- **Bondage/ Algolagnia** - sadism+masochism
- **Fetichism** - sexual excitement by seeing undergarments of a women
- **Transvestism/Eonism** - desire to be identified as opposite sex
- **Scatalogia** - obscene telephone calls
- **Fellatio (irrumination)** - oral stimulation of mate genitalia
- **Annilingus (rimming)** - kissing the anus
- **Cunnilingus** - oral stimulation of female genitalia
- **Masturbation (Onanism, ipsation, autoeroticism)** - deliberate self-stimulation for sexual arousal
- **Exhibitionism (S 294 IPC)** - exposure of genitalia in a public place to obtain sexual pleasure
- **Frotteurism (S 290 IPC)** - sexual satisfaction by rubbing his genitals against a female in crowd
- **Urolagnia** - sexual pleasure by seeing the act of urination
- **Caprolagnia** - sexual pleasure by the smell or sight of faeces or defaecation
- **Undinism** - by urinating over the partner
- **Narcism** - self love
- **Pygmalionism** - falling in love with an object made by him
- **Bobbit syndrome** - female amputates penis of her mate partner
- **Trolism** - sexual practice by involving 3 persons; 2 of one sex and one of the opposite sex
- **Mixoscopia** - sexual satisfaction by the sight of others engaged in sexual intercourse
- **Oedipus complex** - sexual desire of son towards his mother
- **Electra complex** - sexual desire of daughter towards her father
- **Pharoan complex** - sexual desire of brother towards his sister
- **Onanism/ipsation/masturbation** - self stimulation which effects sexual arousal

SEX LINKED OFFENCES

- **Voyeurism/Scotophilia** - see people undress to be sexually satisfied
- **Indecent assault** - any offence committed on a female with the intention to outrage her modesty
- **Stalking** - following a person, monitoring by internet, email, or any electronic communication, spying a person despite clear indication of disinterest by that person, resulting in loss of mental peace of that person
- **Trafficking** - for the purpose of exploitation, whoever recruits, transports, harbours, transfers, receives a person in illegal way

INFANTICIDE

❖ **Infanticide** - unlawful destruction of a child less than one year
❖ **Foeticide** - killing of fetus at any time before birth
❖ **Filicide** - killing of child by parents
❖ **Still birth -** born after 28th week of pregnancy, which did not show any signs of life after birth. The child was alive in utero, but dies during the process of birth

- ❖ **Spalding's sign** - in fetal death, loss of normal overlapping of skull bones (due to separation of cerebrum)
- ❖ Dead birth - died in utero and shows one of the signs following delivery
  - ➢ **Rigor mortis at birth**
  - ➢ **Maceration**
    - o **Aseptic autolysis**
    - o Occurs when the dead child remains in the uterus for 3-4 days **surrounded with liquor but exclusion of air**
    - o **If air enters** the liquor after death, **putrefaction** occurs instead of maceration
    - o **First sign of maceration - reddening of skin with peeling and slippage** (after 12 hours)
  - ➢ **Mummification**

Tests for live birth

- **Static or Fodere's test -** average weight of both lungs before respiration is 30-40gms; after respiration is 60-66 Gms. Not reliable
- **Plocquet's test -** the ratio of weight of lungs to weight of the body before respiration - 1/70; after respiration - 1/35. Not reliable
- **Hydrostatic test or Raygat's test** - the specific gravity of lungs before respiration: 1040-1050; after respiration: 940. Not of much value
- **Breslau's second life test or stomach bowel test** - air swallowed into the stomach which floats
- **Wredin's test -** middle ear changes after birth
- **Vagitus uterinus** - respiration(cry) of the fetus while in the womb after the rupture of membranes Vagitus vaginalis - respiration while the head is in the vagina

The expanded (respired) lungs may sink due to	Unexpanded lungs may float from	Hydrostatic test is not necessary when
• Pneumonia • Congenital syphilis • Atelectasis • Hyaline membrane • disease	• Putrefaction • Artificial • inflation	• Fetus is a monster • Fetus is macerated or mummified - • Fetus born before 180 days of gestation • Stomach contains milk • Umbilical cord has separated and a scar has formed

Changes in the umbilical cord	**Time**
Blood clots at the cut end	2 hrs
Vessels closure and drying	12-24hrs
Inflammatory ring	36-48hrs
Mummification	2-3days
Falls off	5-6days
Healing of ulcer and scar formation	10-12days

BATTERED BABY SYNDROME or CAFFEY'S SYNDROME

- Slightly more in male children
- Youngest or the eldest child
- Repetitive physical injuries as a result of non-accidental violence
- There may also be deprivation of nutrition, care and affection
- The classical feature of this lesion are discrepancy between the nature of injuries and the explanation offered by the guardian, and delay between the injury and medical attention which cannot be explained
- Fractures and injuries will be at different stages of healing
- Most characteristic lesion - laceration of mucosa inside the upper lip and often tear of frenulum
- Nobbing fractures - multiple rib # in the posterior angle
- X-ray shows string of beads appearance in the para vertebral gutter after callus formation
- Infantile whiplash syndrome - shaking a child causes subdural hematoma and intra ocular bleeding

SUDDEN INFANT DEATH SYNDROME/CRIB DEATH/COT DEATH

- Age group 2 weeks to 2 years (Most with a age of 4 months)
- Incidence 0.2 to 0.4% of all live births
- Rainy and winter season
- Premature birth
- Male: female=3:2
- Lower and middle class
- Most deaths in the early morning

Proposed causes

- **Prolonged sleep apnea** (most important)
- Local hypersensitivity of the respiratory tract to bovine mild
- Viral infection of the respiratory tract
- Beds and pillow falling accidentally over the mouth and nose
- Accidental prone position of the baby

Viscera preserved routinely in cases of suspected poisoning

- Stomach and contents
- Small intestine (upper part 30 cm) and contents
- Liver (200 - 300 g)
- One half of each kidney
- Blood (30 ml)
- Urine (30 ml)

Collection of blood

- Before autopsy 20m1 of blood can be drawn from **femoral vein** (or jugular or subclavian vein)
- After removal of viscera - **from iliac veins**
- Blood should **never be collected from pleural or abdominal cavities**

Additional viscera to be preserved in special circumstances

Viscera preserved	Poison
Heart	Strychnine, Digitalis, Oleander
Brain	OPC, opiates, CO, cyanide, strychnine, barbiturates, anesthetics
Spinal cord	Strychnine, gelsemium
CSF	Alcohol
Bile	Narcotics, cocaine, methadone, glutathione, barbiturates
Vitreous	Alcohol, Chloroform
Skin	Hypodermic injection marks
Bone, nails	Arsenic, antimony, thallium, radium
Fat	Insecticides and pesticides

Poison	Preservative
All poisons except corrosives, aconite	Saturated saline
All acids except carbolic acid	Rectified spirit
Blood (Alcohol, cocaine, cyanide, CO)	Sodium fluoride + potassium oxalate
Blood (oxalic acid, ethylene glycol, fluoride)	Sodium citrate
Carbon monoxide	Liquid paraffin
Urine	Thymol or Toluene
Histopathological examination	10% formalin
Suspected rabies	50% glycerine

- Viscera for chemical analysis **should not be preserved in formalin,** as extraction becomes difficult

Poison	Odour
White Phosphorus (diwali poison), arsenic, thallium, selenium, parathion, malathion, aluminium phosphide	Garlic
Ethanol, chloroform, nitrites	Sweet or fruity (acetone/apple like)
Paraldehyde, chloral hydrate	Acrid
Hydrogen sulphide, mercaptans, disulfiram	Rotten egg
Zinc phosphide	Rotten fish
HCN	Bitter almonds
OPC	Kerosene
Cannabis	Burnt rope
Carbon monoxide	Coal gas
Nitrobenzene	Shoe polish
Methyl salicylate	Wintergreen

Poison	Stomach mucosa appearance
Mercury	Slate colored
Arsenic	Red velvety
Sulphuric acid	Black, spongy, perforated, charring and eschar formation
Nitric acid	Yellow
Oxalic acid	White, bleached, scalded appearance
Carbolic acid	Grey or brown, leathery
Copper	Blue or green

Poison/Drug/Condition	Color of urine
Hematuria, Hemoglobinuria, Berries, Beet root Drugs: Dilantin, Phenothiazines, Adriamycin	Red
Rifampicin, Pyridium, Urate crystals	**Orange**
Aniline, Brufen	Pink
Deferoxamine therapy (Et elevated serum iron)	**Vin rose urine**
Pseudomonas aeruginosa infection, Oxalate poisoning	**Green**
Riboflavin	Yellow
Vitamin A, warfarin	Yellowish orange
Phenol or Carbolic acid	**Green** or Black
Nitric acid	Brown
Barbiturates	Liquid gold
Picric acid	Ruby red
Porphyrins	Purple

Tests	Poisons
Marsh & Reinsch test	Arsenic
Trinder's test	Salicylates
Ferric chloride test	Phenol, Phenothiazines, Pheynlbutazone, Salicylates
Lee Jones test	Cyanide (blue color), Salicylates (Purple color)
Qualitative Desferrioxamine colour test (QDCT)	Iron
Meixner test, Melzer test	Amatoxin (Mushroom)
Isonitrile test	Carbon tetrachloride, Chloroform, Chloral hydrate
Tensilon test	Botulism
Litmus test	Corrosives (acids and alkalis)
Marqui's test	Opium

Gastric lavage

- Only absolute contraindication is corrosive poisons except carbolic acid
- **Relative contraindications**
  - Convulsant poisons
  - Comatose patients
  - Volatile poisons
  - Upper GIT diseases like esophageal varices
  - Marked hypothermia
  - Hemorrhagic diseases

Gastric lavage in hydrocarbon poisoning

- Useful in - camphor, halogenated, aromatic, (heavy) metal-containing, and pesticide-containing hydrocarbons
- Contraindicated in - gasoline, kerosene, furniture polish, mineral spirits

Activated charcoal

- Most preferred method
- Large surface area - adsorbs poisons and thus reduces their absorption
- Most effective within 1 hour of ingestion
- Dose: 1-2g/kg body weight

Emesis

- Only recommended method - **syrup of ipecacuanha** (ipecac) - oral, acts both by activating peripheral sensory receptors in the GIT and stimulating vomiting center in the medulla
- Household emetics like **mustard powder and common salt** are not very effective and may lead to complications
- **Apomorphine** (s.c, i.m), copper sulphate, tartar emetic and zinc sulphate **as emetics are obsolete**

ANTIDOTES

Physical or mechanical	Chemical	Universal antidote
Activated charcoal Demulcents – egg albumin, starch, barely water or milk Diluents - water, milk Boiled rice or vegetables	Weak non-carbonate alkalis for acids Weak vegetable acids for alkalis Freshly prepared ferric oxide for arsenic Common salt for silver nitrate Copper sulphate for phosphorus	2 parts of charcoal 1 part magnesium oxide 1 part tannic acid

Pharmacological antidotes

Drug overdose	Antidote	Poison	Antidote
Paracetamol, Acetaminophen	N-Acetyl cysteine, methionine	Cyanide	Amyl nitrite , sodium nitrite, Dicobalt edetate, hydroxycobalamine, 4, dimethyl aminophenol
Beta adrenergics	Propranolol		
Alpha adrenergics	Phentolamine	Amanitins	Benzyl penicillin
Beta blockers	Isoprenaline, Glucagon	Organic peroxides	Ascorbic acid
Cholinergic agents	Atropine	Botulism	Guanidine
Opium	Naloxone	OPC	Oximes, Atropine
Benzodiazepines	Flumazenil	Ethylene glycol, Ethanol	**Fomepizole**
Theophylline	Beta blockers	Methanol	Ethanol
Isoniazid	Pyridoxine	Nitrates	Methylene blue
Heparin	Protamine sulfate	Ergotism	Sodium nitroprusside
Digitalis	Fab antibodies	Radioactive metals	Pentetic acid (DTPA)
Malignant hyperthermia	Dantrolene	Carbon monoxide	Tocopherol
Central anticholinergics	Physostigmine	Beryllium	Sodium salicylate
Peripheral anticholinergics	Neostigmine	Thallium	Prussian blue

❖ When the nature of the poison is not known, universal antidote or coma cocktail (not used now) may be given

Universal antidote	Coma cocktail
• Activated charcoal (50%)	• Dextrose - 100ml of 50% solution
• Magnesium oxide (25%)	• Thiamine-100mg
• Tannic acid (25%)	• Naloxone-2mg

Hemodialysis is useful in the following poisons			Hemodialysis not useful in
Ethanol	Arsenic	Salicylates	Copper sulphate
Methanol	Acetaminophen	Sodium chlorate	Kerosene
Ethylene glycol	Bromides	Boric acid	OPC
Chloral hydrate	Fluorides	Thiocyanates	Benzodiazepines
Lithium	Barbiturates	Aspirin	Digitalis

Miosis		Mydriasis	
Carbolic acid	Formalin	Alcohol (constricted in coma)	Carbon monoxide
Chloral hydrate	Caffeine	Aconite	Cyanide
Opium	Clonidine	Amphetamine	Calotropis
OPC, carbamates	Methyl dopa	Belladonna	Cocaine
Barbiturates	Nicotine	Datura (Atropine)	Viper bite
Benzodiazepines		Nux vomica	

Drugs and Cosmetics act, 1940

- Regulates the import, manufacture, distribution and sale of all kinds of drugs
- Controls the purity, quality and strength of drugs
- Any patent or proprietary medicine should display on the label or container, either the true formula or a list of ingredients

Drugs and Cosmetics Rules, 1945

- **Schedule C: Biological and special products**
- **Schedule E: List of poisons**
- **Schedule F: Vaccines and sera**
- **Schedule G: Hormone preparations**
- **Schedule H: Drugs (Poisons to be sold only on the prescription of a RMP)**
- **Schedule J: List of diseases for the cure of which no drug should be advertised**
- **Schedule L: Antibiotics, antihistaminics, recent chemotherapeutic agents**

AGRICULTURAL POISONS

ORGANOPHOSPHORUS POISONS		ORGANOCHLORINES
Alkyl phosphates	**Aryl phosphates**	DDT, BHC(lindane)
HETP, TEPP, OMPA	Parathion (Follidol, Killphos)	Aldrin, Chlordane
Dimefox, Isopestox	Methyl parathion	Dieldrin, Endosulfan
Malathion(Kill bug, Bugsoline)	Chlorthion	Endrin (plant penicillin),
Sulfotepp, Demeton	Paraoxon	Mirex
Trichlorfon	Diazinon (Tik 20)	Toxaphene , Paraquat

- **MOA:** inhibits true cholinesterase and pseudo cholinesterase
- **Muscarinic signs and symptoms** - broncho constriction, increased bronchial secretions and pulmonary edema, bradycardia, miosis, water loss due to sweating, salivation, lacrimation, micturition, diarrhea
- **Nicotinic** - fasciculation, dyspnoea and cyanosis due to respiratory paralysis
- **Intermediate syndrome**
  - **Seen in 20% patients**
  - **After 1-4 days**
  - Weakness spreads rapidly from the ocular muscles to those of the head and neck, **proximal limbs (spares distal muscles)** and the muscles of respiration, resulting in ventilatory failure ➢ Due to prolonged cholinesterase inhibition and muscle necrosis
  - Due to inadequate treatment, sub-therapeutic administration of oximes and inadequate ventilation
  - **It does not respond to oximes and atropine**
  - Supportive treatment and mechanical ventilation if required
- **Delayed syndrome**
  - 1-5 weeks after exposure
  - **Peripheral neuropathy due to demyelination**
  - Distal muscle weakness, toe drop, sparing of neck and proximal muscles
  - **It does not respond to oximes and atropine**
- **Diagnosis**
  - Cholinesterase determination in blood
  - Normal values 77 - 142 in red cells and 41 - 140 in the plasma
  - Plasma cholinesterase is more sensitive and fall more rapidly before that of red cells

- **Treatment**
  - **Atropine 2-**4mg given i.v. every 10-15 mins
  - Atropine should be **continued until the tracheobronchial tree is cleared of the secretions** and most secretions are dried, but not pupillary status
  - **Cholinesterase reactivators like diacetyl monoxime(DAM), pralidoxime(2-PAM)**
- Cause of death - **respiratory paralysis**
- **Chromolachryorrhoea(red tears) due** to accumulation of porphyrin in lacrimal glands
- Oximes are not effective in: Edrophonium, Dime fox, Methyl diazinon, Organo-carbamates (Carbaryl, Propoxur)

CORROSIVE POISONS

STRONG ACIDS	STRONG ALKALIES
• Desiccation or denaturation of superficial proteins • Coagulation necrosis • Eschar formation • Eschar limits penetration • Gastric strictures and perforation	• Saponification of fats and dissolves proteins • Liquefaction necrosis • Favors penetration • Extensive damage • Esophageal strictures

SULPHURIC ACID

- Chalky white teeth, Swollen, sodden and blackish tongue, Swollen lips
- Burning pain from mouth to stomach, Hematemesis (coffee ground colour), Intense thirst
- Stomach - converted into a soft, spongy, black mass which ready disintegrates on touch
- Vitriolage: throwing concentrated sulphuric acid on the face of the person with an intention to damage, disfiguration or death

NITRIC ACID

- Fuming liquid with a peculiar, penetrating odour
- Xanthoproteic reaction - yellow discoloration of tissues due to production of picric acid
- More abdominal distension due to gas formation

OXALIC ACID

- In the form of oxalate, it is present in spinach, rhubarb, cabbage
- Hypocalcemia - tetany, Chvostek's sign, Trosseau sign
- Oxaluria - envelope shaped calcium oxalate crystals in urine
- Mucous membrane of tongue, mouth, pharynx, esophagus & stomach - bleached and scalded appearance

CARBOLIC ACID/CARBOLISM

- Oxidized to pyrocatechol and hydroxyquinone whose excretion urine which turns green on exposure to air (carboluria)
- Scanty urine containing albumin and hemoglobin
- Chronic poisoning (Phenol marasmus) causes pigmentation of skin and sclera - oochronosis(also seen in alkaptanuria)
- Gastric lavage is indicated as it hardens the tissues and hence risk of perforation is less
- PM appearances: gastric mucosa is swollen, grayish white, hardened (leather bottle stomach)

Treatment of acid poisoning

- Give a demulcent, olive oil, milk, egg white or starch water
- Prednisolone may be given to prevent esophageal stricture and shock
- Eye burns are irrigated with water or sodium bicarbonate solution
- Tracheostomy - if there is edema of glottis

Should not be done in acid poisoning

- Gastric lavage
- Emetics
- Alkaline carbonates or bicarbonates which liberate CO2, as they cause distension and rupture

METALLIC POISONS

ARSENIC

- Copper arsenite - sheele's green
- Copper acetoarsenite - paris green
- Permissible limits of arsenic in ground water - 0.05mg/L
- The gastroenteric type of poisoning resembles cholera
- Greatest quantity is seen in - liver
- Red velvety appearance of mucosa of stomach
- Most affected part of the stomach – pylorus
- Subendocardial petechial hemorrhages of the ventricle is typical of arsenic poisoning (also found in phosphorus, barium, mercury and in cases of heat stroke and acute infectious disease e.g. influenza)
- Rigor mortis lasts longer than usual, Delays putrefaction

Acute poisoning

- Necrosis of intestinal mucosa with hemorrhagic gastroenteritis
- Hypotension, delayed cardiomyopathy

Chronic poisoning

- Aldrich Mee's line on finger nails
- Rain drop pigmentation on skin(meastes like rash)
- Chronic consumption of water containing high arsenic concentrations lead to vasospasm and peripheral vascular insufficiency - black foot disease
- Diabetes, peripheral neuropathy, gangrene
- Cancer of skin, lung, liver (angiosarcoma), bladder, kidney.
- Arsenophagists - some people take arsenic daily as tonic or aphrodisiac and acquire tolerance
- Chelating agent - Dimercaprol

Arsenic poisoning	Cholera
Pain in the throat - before vomiting	After vomiting
Purging - after vomiting	Before vomiting
Dark colored bloody stools initially, later rice water stools	Rice water stools, never blood stained
Tenesmus and anal irritation present	Absent
Vomitus contains mucus, bile and blood	Watery without mucus, bile and blood
Conjunctiva inflamed	Not inflamed

- ❖ Arsenic was used as murder weapons in royal families, and called as "the poison of kings and king of poisons"

MERCURY

- Mercuric ion binds with sulphydryl groups of cytochrome enzymes and interferes with their function resulting in inhibition of oxidative phosphorylation & cellular respiration

ACUTE POISONING

- Inhalation: manifestations similar to Kawasaki disease
- IV injection: Mercurialism (thrombophlebitis, granuloma formation and pulmonary embolism)
- Necrosis of renal tubules, albuminuria, uremia and acidosis
- Membranous colitis develop after many days

- Classic triad of gingivitis, tremors (Danbury tremors) and neuro psychiatric changes
- Advanced condition of Danbury tremors is called Hatter's shakes or glass blower's shakes
- Most severe form is called concussio mercurialis
- Mercurial Erethism - refers to psychological effects of mercury toxicity and is seen in persons working with mercury in mirror manufacturing films.
- Pink disease or Acrodynia is an idiosyncratic reaction seen in children due to chronic mercury exposure
- Mercurialentis - brownish deposit of mercury on anterior lens capsule
- Kidney - membranous glomerulonephritis, PCT necrosis
- Minimata disease - due to eating of fish poisoned by organic mercury (methyl mercury)
- Diphtheritic colitis
- If mother consumes during pregnancy - cerebral palsy in child
- BAL is the chelating agent of choice

❖ **Dimethylmercury**, a compound only found in research labs, is **supertoxic**—a few drops of exposure via skin absorption or inhaled vapor can cause severe cerebellar degeneration and death
❖ **Intracellular glutathione** - acting as **thiol donor**, is the main protective mechanism against mercury induced CNS and kidney damage

LEAD

Chronic poisoning (saturnism, plumbism)

- Occupational hazard in those involved in the manufacture of batteries, pigments, car radiators, tin cans
- **Facial pallor** is the earliest sign
- **Punctuate basophilia or basophilic stippling**
- Blue line on gums called lead **line or Burtonian line** (seen with poor oral hygiene, at the junction of gums and teeth due to deposition of lead sulphide)
- Colic and constipation
- **Lead palsy - common in adults**, wrist drop, foot drop may occur
- **Encephalopathy - most common manifestation in children**
- Diagnosis
  - Coproporphyrin in urine
  - Aminolaevulinic acid in urine > 5 micro grams
  - **Blood lead** > 25 micro gram per 100ml **(Gold standard)**
  - Urine lead > 0.25 microgram per liter
  - X ray - radio opaque bands **(lead lines)** at the metaphyses of long bones in children. The width of the lead lines are related to the duration of exposure. These lines reflect bone growth arrest
  - Lead poisoning in children

Blood level (pg/ml)	Effects
10	**Decreased IQ level,** Decreased hearing, Growth retardation **Fetal effects** by transplacental transfer Impaired peripheral nerve function
20	**Increased nerve conduction velocity** **Increased erythrocyte protoporphyrin** **Decreased vitamin D metabolism**
40	**Decreased Hb synthesis**
100	**Encephalopathy** **Neuropathy** **Frank anemia** **Colic**
150	**Death**

Treatment

- A confirmed **venous blood lead level (BLL) of 45 µg/dL** or more requires prompt **chelation therapy**
- BLLs between 44 and 70 pg/dL - **DMSA**
- BLLs of > 70 pg/dL without encephalopathy **- $CaNa_2EDTA$ + DMSA or BAL**
- BLLs of > 70 pg/dL with encephalopathy - **$CaNa_2EDTA$ + BAL**
- **High blood calcium** levels favors storage of lead, white calcium deficiency causes lead to be released into blood stream

❖ **Half-life of lead in bone: 20-30 years**
❖ **50% of ingested lead is absorbed in children (< 15% absorbed in adults)**

COPPER

- **Copper sulphate (blue vitriol) and copper subacetate(verdegris) are poisonous**
- **Death** is due to hepatic or renal failure or both
- Treatment : stomach wash **with 1% potassium ferrocyanide** which is an effective antidote
- **Emetics are contraindicated**
- Hemodialysis is useful in early stages
- Chelation with penicillamine or BAL or EDTA
- Post mortem appearances - **greenish blue froth** at mouth and nostrils
- Chronic inhalation of copper sulfate - **Vineyard sprayer's lung disease**
- Copper deposits in tissues - **chalcosis**
- **Ptyrlism** - chronic poisoning
- Chronic contact with swimming pool water containing algicidal copper chemical compounds may cause **green hair discolouration**
- **Copper sulphate** is used in the treatment of **phosphorus poisoning** - stomach wash with 0.2% **copper sulphate** forms copper phosphide, which is relatively harmless

Thallium

- Classic triad of **alopecia, skin rash, painful neuritis with confusion**
- Maculopapular skin eruption with butterfly distribution on face
- Mee's line on nails

Metal fume fever (brass chills, Monday fever, smelter shakes)

- Caused by inhalation of fumes produced when metals are heated above their melting point
- Metals involved (decreasing order of frequency): **Zinc, copper, magnesium, iron, chromium, cadmium**

INORGANIC IRRITANTS

White phosphorus	**Red phosphorus**
Garlic odour	Odourless
Luminous in dark	Non luminous
Ignites at 34 degrees, so **kept under water**	Non inflammable
Highly toxic	Non toxic
Used as rodenticide , in fire works	Used on the sides of match box

- Acute poisoning - **vomitus and stools are luminous in dark - Smoky stool syndrome**
- Chronic poisoning due to frequent inhalation of fumes over many years cause osteomyelitis and necrosis of jaw with multiple sinuses discharging pus - **phossy jaw or glossy jaw**

ORGANIC IRRITANTS

ABRUS PRECATORIUS

- Seeds contain active principle abrin, a toxalbumen, which is **similar to viperine snake venom**
- Abrine, hemaglutinin, abralin are other toxins
- When an extract of seeds is injected under the skin of the animal, inflammation, edema, oozing of hemorrhagic fluid from the site of puncture which **resembles viper snake bite**

- Sharp pointed needle like objects called suis are prepared from the paste of seeds, which are forced into the skin of animal or human for homicide (2 suis used to resemble fangs of viper) -used in cattle by leather workers to obtain hides cheaply or for revenge

Artificial bruise is produced by

- **Calotropis**
- **Semecarpus**
- **Plumbago rosea**

SNAKES

Poisonous snakes	**Non poisonous snakes**
Head scales • Small - viper • Large + pit between eye and nostril - pit viper • Large + third labial touches eye and nasal shields - cobra or coral snake • Large, no pit, third labial does not touch nose and eye - krait	Large
Belly scales - large and cover entire breadth	Small and do not cover entire breadth
Head usually triangular	Usually round or oval
Fangs - hollow like hypodermic needles	Short and solid
Teeth two long fangs	Several small teeth
Tail - rounded or flattened	Always rounded
Habits - usually nocturnal	Not so

Snake venom

- **Cholinesterase** is rich in venom of cobra and krait
- **Hemolysins, cytolysins** are rich in viper venom
- Cardiotoxin - cobra venom

Ophitoxaemia is poisoning by snake venom

Cobra. Krait	Viper	Sea snakes
• **Neurotoxic** • **Ptosis** - earliest neurologic symptom • **Ophthalmoplegia** – extraocular muscle weakness, strabismus, diplopia • Complete paralysis after 2 hours • Death due to **respiratory failure** • **Lethal dose: cobra - 12mg; krait - 6mg of dried venom**	• **Hemotoxic (Vasculotoxic)** • **Markedlocal symptoms-** reddish and painful swelling, **persistent bleeding**, blisters • **Hematuria**, hemorrhages in the • GIT, conjunctiva, brain etc • **Death due to shock & hemorrhage** • **Lethal dose - 15 mg**	• **Myotoxic** • Little or no local signs • Polymyositis, • Trismus • **Myoglobinuria**

- Cobra - **burning pain and mild swelling** at the site of bite, slight intoxication
- Krait - no local symptoms, intense **drowsiness and intoxication**

SCORPION STING

- Mixture of **neurotoxic and cardiotoxic venom**
- **More toxic than that of snakes**, but only a small quantity is injected
- Venom is a potent **autonomic stimulator** resulting in the release of massive amounts of catecholamines from the adrenals
- Local burning pain, swelling and paresthesias
- Sweating, **salivation, vomiting**
- **Mydriasis**
- **Hypotension followed by hypertension, bradycardia followed by tachycardia**

- **Arrhythmias**
- **Pulmonary edema**
- **Oliguria**

Cantharides/Spanish Fly/Blister Beetle

- Local application - **vesicle** formation
- Ingestion - nephrotoxicity, **priapism**, convulsions

TOXALBUMEN

- A Toxalbumen is a super-toxic protein that resembles bacterial toxin in action, causes agglutination of red cells with some hemolysis and is antigenic
- Plant toxalbumen or phytotoxin
  - **Ricin** in Ricinus communis
  - **Crotin** in Croton tiglium
  - **Abrin** in Abrus precatorius
- Animal toxalbumen: snake and scorpion venoms

CNS DEPRESSANTS

ALCOHOL

- Absolute alcohol - 99.95% alcohol
- Rectified spirit - 90-95% ethanol + 5-10% methanol + traces of castor oil
- Methylated spirit - 99% alcohol + 5% wood naptha
- Surgical spirit - 90-95% ethanol + 5-10% methanol
- Safety limit of alcohol : Male - 210g /week; Female - 140g/ week
- Action : Low concentration - CNS stimulant; High concentration - CNS depressant
- Diaphoresis, diuresis(inhibits ADH), stimulates appetite

Beverage	% of alcohol
Vodka	60 - 65
Rum, liquor	50 - 60
Whisky, gin, brandy	40 - 45
Port, sherry	20
Wine, champagne	10 - 15
Beer	4 - 8

Blood level of alcohol (mg %)	Behavior
< 10	Sober
20 - 70	Drinking
80 - 100	Under the influence
150 - 300	Intoxicated, drunk
>400	Coma

Conc. of alcohol in blood (mg %)	Symptoms
0 - 50	Mild euphoria
50 - 100	Increased confidence, impaired judgment, nystagmus
100 - 150	Confusion, impaired memory, slow reaction time
150 - 300	Staggering gait, increasing confusion, loss of muscle coordination
300 - 400	Decreased response to stimuli, stupor
>400	Deep coma, death

- Urine alcohol: blood alcohol **= 1.35 : 1**
- **Widmark's formula** : a = prc (blood); a = 3/4prq (urine)
- **Henry's law: alveolar**: blood alcohol = 2100: 1

Methods to find blood and urine alcohol levels

- Alcohol dehydrogenase method
- Kozelka & Hine test
- Gas chromatography(most specific)
- Breath analyzer
- Cavett test

Alcohol induced thiamine deficiency	
Wernicke's encephalopathy (acute) • Global confusion • Ophthalmoplegia • Ataxia	**Korasakoff's syndrome (chronic)** • Amnesia • Confabulation (filling the memory gaps by imaginary events)

LCOHOL WITHDRAWL SYNDROMES

Alcoholic hallucinosis	**Alcoholic ketoacidosis**	**Delirium tremens**
• Onset: 24-36 hours • Objects appear **distorted, shadows seem to move** • Treatment: Chlorpromazine **Rum fits** • Onset: 7-48 hours • Clonic-tonic movements	• Onset: 24-72 hours • During **withdrawl or after heavy drinking** • Drowsiness, confusion, • THR,TRR, Kussmaul's breathing • Blood alcohol typically not high • High anion gap metabolic acidosis • Markedly elevated serum ketones	• Onset: 3-5 days • **Sudden withdrawl, temporary excess, trauma, acute infection may precipitate** • Dramatic onset of Clouding of consciousness, disorientation, loss of recent memory • Vivid visual hallucinations • Agitation, restlessness, tremors, ataxia • Insomnia, **Autonomic disturbances** • Treatment: diazepam

- **Marchiafava syndrome** - corpus callosum degeneration
- **McEwan's sign -** in alcoholic coma, pupil is constricted if the patient is stimulated by pinching or slapping the cheek, the pupils dilate and the slowly constrict. Differentiates alcoholic coma from coma due to other causes
- **Fatal dose:** 150 - 250 ml of absolute alcohol taken in one hour; **60 - 200 ml** of methyl alcohol
- **Cause of death:** depressant action on brainstem respiratory center; aspiration of vomitus
- **Statutory limit for driving in India**: 30 mg% (S 185 of Motor Vehicles Act)

Methanol

- Early symptoms - vertigo, head ache, stiff neck
- Later - ocular toxicity (fixed dilated pupils, diminished [snow-storm] vision, optic atrophy)
- CNS depression is more intense and prolonged
- Formic acid is responsible for retinal toxicity and high anion gap metabolic acidosis
- Antidotes: ethanol, fomepizole
- Fatal dose: 70 - 100 ml

BARBITURATES

- Fatal period: 1-4 days
- Pupils are initially constricted, later dilated
- Hypothermia
- Cutaneous blisters barbiturate blisters over dependent parts (buttocks, back of thighs, calves and forearms)

LSD (LYSERGIC ACID DIETHYLAMIDE)

- Feeling of depersonalization
- The feeling of being able to fly under its influence may can lead users to jump from windows
- Flash back phenomenon - experiences recurrence of the effects of previous LSD trip
- Hyperacusis, synesthetic experiences (stimulation of one sensory modality is perceived as sensation in a different modality, e.g., sound produces a sensation of colour), changes in body image, time space perceptions

DELIRIANT POISONS

DATURAI

- Clinical features: blind as a bat, dry as a bone, red as a beet and mad as a wet hen
- Patient tries to pull imaginary threads from tips of his fingers (carphologia) and threads imaginary needles.

COCAINE

- Initially used as a local anesthetic
- Stage of excitement: dilated pupils, hypertension which may lead to cerebral bleeding, feeling of tingling and numbness of the hand and feet, a numb feeling at the place where the drug has touched
- Stage of depression: death due to respiratory or cardiac failure; sudden death may occur due to arrhythmias
- Usual route of intake is the application to the nasal mucous membrane (snorting)
- Cocainism: Chronic abuse cause blackening of tongue and teeth
- Ulceration and perforation of nasal septum
- Magnan symptom/cocaine bugs/formication is characteristic of chronic cocaine abuse where there is a feeling of grains or small insects are creeping under the skin (tactile hallucination)

CANNABIS (INDIAN HEMP)

- Cocaine + heroine = speed ball
- Active component tetra hydro cannabinols (THC)
- Chronic poisoning
  - **Gynacomastia**
  - **Hashish insanity (run amok)**
  - **Amotivation syndrome**
- Does not produce physiological dependence or addiction but psychological dependence and tolerance develop
- Various forms of cannabis
  - **Bhang** - mildest, decoction from dried leaves and fruit shoots; 15% of active principle
  - **Majoon** - sweet prepared from plant extract
  - **Ganja (marihuana, reefer, joint)** - leaves and flower tops of female plant; 15-25% of active principle
  - **Charas or Hashish** - resin exuding from leaves and stems; 25-40% of active principle
  - **Marijuana** - dried flowering tops crushed and smoked in a pipe
  - **Sinsemilla** - seedless marijuana

SPINAL POISONS

STRYCHNOS NUX VOMICA

- Active principles - Strychnine, Brucine, Loganine
- MOA: Competitive antagonism of inhibitory neurotransmitter glycine at the post-synaptic junction of motor neurons of the anterior horn cells resulting in release excitation
- GABA is not involved

Clinical features

- **Convulsions at intervals**
- **Opisthotonus** (spasmodic hyperextension of spine - body is bent backwards)
- **Emprosthotonus** (body is bent forwards)
- **Pleurosthotonus** (body is bent laterally)
- **Trismus** (lock jaw)

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- **Risus sardonicus** (spasm of facial muscles producing characteristic grimace)
- **Consciousness** is not lost till the end
- Dilated pupils

Tetanus	Strychnine poisoning
History of injury	History of poison consumption
Gradual onset	Sudden onset
Trismus occurs early	Trismus occurs late
Groups of muscles affected at a time	All muscles affected simultaneously
Muscle rigidity is sustained between convulsions	Muscles relaxed in between convulsions
Chemical analysis negative	Positive for strychnine

HCN - (Prussic or Sheele's acid or cyanogens)

- **Smell of bitter almonds**
- Cyanide inhibits **cytochrome oxidase, carbonic anhydrase** and blocks final step of oxidative phosphorylation and prevents the formation of ATP
- **Reduces the oxygen carrying capacity of blood** by preventing oxygen uptake by Hb
- Blood contains **normal oxygen content**
- Potassium ferrocyanide and ferricyanide are non-poisonous
- Sodium nitroprusside - an antihypertensive, overdosage results in **cyanide toxicity**
- **Fatal dose: HCN: 50-60mg; KCN: 200-300mg**
- **Treatment:**
  - **Amyl nitrite, Sodium nitrite**
  - **Sodium thio sulphate**
  - **Hydroxyl cobalmine**
  - **Dicobalt EDTA**
  - **4-dimethyl phenol**

KEROSENE POISONING

- Lethal dose: 30 to 100 mL
- Kerosene is toxic both through inhalational and oral routes
- Severe poisoning - **pulmonary oedema**, haemoptysis, mental confusion, cyanosis, convulsion and coma.
- Death is mainly due to **ventricular fibrillation and respiratory failure** in inhalational poisoning
- The pupils are initially constricted and later dilated.
- Aspiration of as little as **0.2 mL of kerosene** oil can produce **chemical pneumonia** & pulmonary oedema.
- The chest radiograph may reveal perihilar densities, basal pneumonia, and atelectasis.
- **Induction of vomiting or gastric lavage is contraindicated** due to increased risk of aspiration
- Activated charcoal is not useful
- **Antibiotic and steroids are not indicated**

WAR GASES

- War gases are chemicals used to produce damage and destruction during warfare

Types	Examples
Lachrymators or Tear gases • Not harmful to life • Severe lacrimation due to intense irritation • Spasm of eyelids • Temporary blindness	Chloro-aceto-phenone (CAP) Bromo-benzyl cyanide (BBC) Ethyl iodo-acetate
Lung irritants or Asphyxiants • Can be fatal • Inhalation causes dyspnea, chest tightness, cough, labored and noisy breathing, cyanosis, collapse and death due to pulmonary edema	Chlorine Phosgene

Nasal irritants or Strenutators • Vapours cause intense pain and irritation in the nose and sinuses • Head ache, nausea and vomiting	Diphenyl chlorarsine (DA) Diphenylamine chlorarsine (DM) Diphenyl cyanarsine (DC)
Nerve gases • Inhibit the transmission of nerve impulses • Consciousness is lost within seconds • Convulsions may follow	GA (Tabun) GD(Sarin) GB (Soman) GF (Cyclosarin)
Paralysants • They act by different mechanisms interfering with oxygen transport	Carbon monoxide Hydrogen sulphide Hydrogen cyanide
Vesicants or Blistering gases • On contact with skin, it causes intense itching, redness, vesication and ulceration	Sulphur, Mustard, Oximes

SUBSTANCE ABUSE

Substance abuse in India

- 20-30% of adult males and around 5% of adult females use alcohol
- 48% of adult males and 25% of adult females use tobacco in some form
- 24 % adult males and 3% of adult females are smokers
- 33 % males and 18% females use smokeless tobacco product

Drug	**Slang name**
Chloral hydrate	**Knock out drops**
Alcohol + Chloral hydrate	**Mickey Finn**
Methylene-dioxy-methamphetamine (MDMA)	**Ecstasy, club drug or rave drug**
Methylene-dioxy-amphetamine	**Love drug**
Street heroin (brown sugar)	Smack, Junk, Dope
Opium	Black stuff, brick
Cocaine	**Star dust**, happy dust, heaven dust, coke, snow
Cannabis	Grass, pot, reefer, rope, viper's weed, marijuana
Barbiturates	Candy, goof ball
Narcotics	Cotton brothers, Dr. White
Morphine	God's machine, Miss Emma
Amphetamine	Speed, crystal, **Superman drugs**
Phencyclidine	**Angel dust**, peace pill
Ketamine	Purple, jet, super k

Addicts jargon	**Meaning**
All lit up	Euphoria following IV injection of narcotic
Bull horrors	Paranoid delusions induced by cocaine
Chicago leprosy	Multiple skin abscesses in injection drug abuser
Chinaman on the back/monkey on the back	To suffer withdrawl symptoms
Cold turkey	To suffer withdrawl symptoms following abrupt stoppage of narcotic abuse
Croaker	Doctor
Dream stick, Gong, Joy stick	Opium pipe
Eye opener	First shot of the day
Giving birth	Difficult expulsion of constipated stools by an opium addict
Goof er	Barbiturate addict
Gow head, Hop head	Opium addict
Grass hopper, Viper	Marijuana addict

Joy popper, Pleasure shooter	Occasional intravenous drug user
Kiester plant	A condom or finger stall filled with drugs kept concealed in rectum
Square apple or square	Non addict
Torpedo	Alcoholic drink with chloral hydrate
Huffing	Inhaling vapors of a volatile substance in a cloth
Bagging	Inhaling and exhaling into the bag
Chasing the dragon	Inhalation of vapours of heroin
Freak out or bad trip	Unpleasant LSD experience
Trip	Effects of LSD
Soft drugs	amphetamine, barbiturates, cannabis, LSD
Hard drugs	opium, heroin, cocaine, methedrin

Food poisoning

- **Death cap -** Amantia phalloides
- World's most venomous animal - **box jelly fish**
- Most common fish poisoning - ciguatera poisoning
- **Ptomaines** - alkaloids formed as a result of bacterial decomposition of protein
- **Leucomaines** - when ptomaines are formed in living cells
- Cadaveric alkaloids - when ptomaines are formed in dead tissue

Ordeal of poison

- Poisonous calabar bean **(physostigmine)** is given in an attempt to detect guilt
- Person who vomits up the bean is innocent
- Person who becomes ill or dies is considered guilty

Fetal lobster syndrome (Boric acid poisoning)

- Split hand/split foot malformation (Median clefts of hand and feet)
- Presenting with syndactyly
- Aplasia and hypoplasia of phalanges, metacarpals and metatarsals

- **Hippus - aconite poisoning**
- **Oxalic acid (acid of sugar) causes hypocalcemia.** Used as a bleach to remove stains, removing writing and signature illegally
- **Poppers -** street term for various alkyl nitrites take for recreational purposes through direct inhalation
- **Itai-Itai disease (ouch-ouch) -** a combination of osteoporosis and osteomalacia associated with renal disease, in post-menopausal women in Japan, due to irrigation of rice fields with cadmium **containing water**
- **Conium Maculatum (hemlock)** administered to Socrates for execution
- **Brompton's cocktail** (previously used for pain relief in terminal cancer) **cocaine + morphine + chlorpromazine + alcohol**
- Quinine - cardiac poison and an abortifacient that causes partial deafness
- **Cinchonism** - caused by repeated doses of quinine either therapeutic or overdose
- **Gila monster** - a species of venomous lizard

*****END*****