

## FORENSIC MEDICINE & TOXICOLOGY

**The general public** is fast becoming law conscious and the doctors are being sued from time to time in a Court of law for their acts of omission or commission. Therefore, it is incumbent upon **doctors must have a good knowledge** of the law governing their profession, in order not to transgress the law.

**History:** The Code of Hammurabi, King of Babylon (about 4000 to 3000 B.C) is the oldest known medico-legal code. The first medico-legal autopsy was done in Bologna (Italy) in 1302, by **Bartolomeo De Varignana**. The first book on Forensic Medicine was published in 1602 by an Italian physician, Fortunato Fedele. Orfila (professor of chemistry and legal medicine at Paris) is considered the founder of modern toxicology. Paulus Zacchias — written "medico-legal questions", questions Medico legalis."

- a. In the 18th century, study in legal Medicine as a subject was established by appointing professorship in Germany.
- b. In England Mc Naughten's (who was aschizophrenic) rule has been established to deal with legal matters in cases of insanity or like situations whatsoever

**Forensic medicine:** is the application of medical and paramedical knowledge in the administration of law and justice. Legal medicine and state medicine are other names for it.

**Medical jurisprudence:** deals with the legal rights, privileges, duties and obligations of medical practitioner.

### LEGAL PROCEDURE

**Inquest:** is the legal or judicial inquiry to ascertain matter or fact. (Cr.P.C. 174)  
It is the investigation into the cause of death. It is conducted in cases of murder, suicide, accidents and suspicious deaths.

- 1) Police inquest: done by the Officer-in-charge of the police station (S.174, Cr.P.C). Medico-legal autopsy is ordinarily done on requisition of the sub-inspector of police. The inquest report is signed by the police officer and two witnesses.
- 2) Coroner's inquest: in Bombay till 1999. Coroner's court is a court of enquiry and not of trial.
- 3) Magistrate's inquest: done by an Executive Magistrate (Collector, Deputy collector, Tahsildar, etc) in cases of death in police custody, death due to police firing, death in prison, dowry death & exhumation (S.176, Cr.P.C).

**Courts of law:** Criminal and Civil.

- 1) Supreme Court: is the highest court and has power of supervision over all courts of law. It is purely an appellate court. A supreme court Judge can pass any sentence authorized by law.
- 2) High Court: highest court for state. It may try any case and pass any sentence authorized by law.
- 3) Sessions Court: can pass any sentence authorized by law, but a death sentence passed by it must be confirmed by the High court (S.366, Cr.P.C). An Assistant Sessions court can pass a sentence of imprisonment up to 10 years.

4) Magistrate Courts are of 3 types:

- a) Chief Judicial Magistrate: can pass a sentence of imprisonment up to 7 years and any amount of fine.
- b) I Class Judicial Magistrate: can pass a sentence of imprisonment up to 3 years and fine up to 5000 rupees.
- c) II Class Judicial Magistrate: can pass a sentence of imprisonment up to 1 year and fine up to 1000 rupees.

**Offence may be Cognisable or non-cognisable.**

Cognisable offence: It is an offence in which a police officer can arrest a person without warrant from the Magistrate, e.g., rape, murder, robbery, etc.

**The common punishments allowed by law awarded are:**

- (i) Death (hanged by neck till death)
- (ii) Imprisonment for life. (Max. up to 20 years)
- (iii) Imprisonment of sometime but less severe than life imprisonment. This may be the form of simple or rigorous imprisonment.
- (iv) Monetary fine (Sec.53, I.P.C)
- (v) Detentions in reformatories. DRC

**The death sentence** can be commuted by the President of India (on mercy appeal), by Supreme Court of India (on appeal or by the High Court by merits).

**Subpoena or Summons:** is a written document issued by the court and served on the witness under a penalty in all cases by the Police officer to attend the court for giving evidence on a particular day and time (S.174, I.P.C; S. 87, Cr.P.C). It may be served from a criminal or civil court. The witness will be excused from attending the court, if he has a valid and urgent reason. If the witness fails to attend the Court: (1) in a civil case, he will be liable to pay damages, and (2) in a criminal case, to fine or imprisonment (S. 172, I.P.C).

**Conduct money** is fee paid to a witness at the time of serving the summons to cover the expenses for attending the court. Given only in civil cases. In no case the medical practitioner should insist on conduct money when he receives a subpoena from Criminal court because he is liable to be charged with contempt of court.

**Perjury** means giving willful false evidence while under oath, or failure to tell what he knows or believes to be true (S.191, I.P.C). The witness is liable to be prosecuted for perjury, and the imprisonment may extend to 7 years (S. 193, I.P.C).

**Record of evidence:** (S. 137, I.E.A)

(1) Oath

(2) Examination-in-chief (direct examination)

This is the first examination of a witness and consists of questions put to him by the lawyer (counsel or advocate) for the side which has summoned him. In government prosecution cases, the public prosecutor first examines the witness. Leading questions are not allowed except when the witness is hostile.

(3) Cross-examination

In this, the witness is questioned by the lawyer for the opposite party, i.e., lawyer for the accused (defense lawyer). Leading questions are allowed. The court has the power to disallow questions which are intended to insult or annoy or offensive in form (S. 152, I.E.A)

(4) Re-examination (Re-direct examination) (S. 137, I.E.A)

This is conducted by the lawyer for the side which has called the witness. The opposite lawyer has the right of re-cross examination on the new point raised. Leading questions are

not allowed.

(5) Questions by judge

The court is also empowered (S. 311, Cr.P.C), to recall and reexamine any witness already examined, if his evidence appears to the Court to be essential to the just decision of the Court. The judge may ask any questions at any stage of the examinations to clear up doubts.

**Medical evidence:** Evidence means all legal means, which help to prove or disprove any matter in question.

**Types:** Oral, Documentary, Direct, Indirect or circumstantial, Hearsay

**A. Documentary evidence.** 3 types: MC, DC, Dying declaration.

1. **Medical certificate:** it refers to ill-health, insanity, death, etc. they are accepted in a Court of law, only when they are issued by a qualified RMP. A medical practitioner is legally bound to give a death certificate, stating the cause of death without charging fee, if a person whom he has been attending during his last illness dies (Registration of Birth and Deaths Act, 1970). The certificate should not be given if the doctor is not sure of the cause of death, or if there is the least suspicion of foul play. In such cases, the matter should be reported to the police. Issuing or signing a false certificate is punishable under S. 197, I.P.C.

Death certificate: In India, the International Statistical Classification of Death, Injuries and Causes of Death is used.

2. **Medico-legal reports:** are reports prepared by a doctor on the request of the investigating officer for his guidance, usually in criminal cases, e.g., assault, rape, murder, poisoning, etc. These are admitted as evidence in court only when the doctor gives oral evidence on oath.

3. **Dying declaration:** It is a written or oral statement of a person, who is dying as a result of some unlawful act, relating to the material facts of cause of his death or bearing on the circumstances. A magistrate should be called to record the declaration. If the patient's condition is serious, and there is no time to call a Magistrate, the doctor should take the declaration in the presence of two witnesses. The person need not take oath, because of the belief that a dying person tells the truth. Leading questions should not be asked. It should be read over to the declarant, and his signature or thumb impression is taken. The doctor and the witness should also sign the declaration. If the declarant survives, the declaration is not admitted, and the person is called to give oral evidence.

4. **Dying deposition** is a statement of a person on oath, recorded by a Magistrate in the presence of the accused or his lawyer, who is allowed to cross-examine the witness. It has greater value than dying declaration bcoz the accused has an opportunity of cross-examining the dying person. Not followed in India.

**B. Oral evidence:** it includes all statements which the Court permits, or which are required to be made before it by the witness, in relation to matters of facts under enquiry (S. 60, I.E.A). it must be evidence of a person who saw, heard or perceived it by that sense or in that manner. Oral evidence is more important than documentary evidence, as it permits cross-examination.

Exceptions to oral evidence:

(1) Dying declaration (S. 32 & 157, I.E.A)

(2) Expert opinion expressed in treatise (S. 60, I.E.A)

(3) Evidence of a doctor recorded in a lower Court (S. 291, I.E.A)

(4) Evidence of a witness in a previous judicial proceeding (S. 33, I.E.A)

- (5) Reports of certain govt. scientific experts: Chemical examiner, Chief Inspector of Explosives, Director of Finger Print Bureau, Director of CFSL or SFSL, Director of Haffkine institute, Bombay and Serologist to the Govt. (S. 293, Cr. P.C)
- (6) Public records, E.g., Birth and death, certificates of marriage.
- (7) Hospital records: Routine entries are admissible without oral evidence.

### **Types of Witness**

Common and Expert.

**Common witness:** (witness of fact; occurrence witness) is a person who gives evidence about the facts observed or perceived by him. "First hand knowledge rule"

**Expert witness:** is a person who has been skilled in technical or scientific subject, and capable of drawing opinions and conclusions from the facts observed by himself, or noticed by others, e.g., doctor, firearms expert, finger prints expert, hand-writing expert, etc (S.45, I.E.A)

**Hostile witness:** is one who is supposed to have some interest or motive for concealing part of the truth, or for giving completely false evidence (S.191, I.P.C)

### **MEDICAL LAW AND ETHICS**

The medical profession is governed by legislation and by a Code of ethics and Etiquette. Medical ethics deals with the moral principles which should guide members of the medical profession in their dealings with each other, their patients and state. Enforcement of the code is done by the medical councils. (CCH).

**Central Council of Homoeopathy Act, 1973.** (19th December, 1973)

Amendment vide Homoeopathy Central Council of Amendment Act, 2002. Gazette of 9th December, 2002.

Schedule I: No: of elected members from each state.

- (a) No: of RMP exceeds 100 – not exceeding 10000 = 1 seat
- (b) No: of RMP exceeds 10000 – not exceeding 20000 = 2 seats
- (c) No: of RMP exceeds 20000 – not exceeding 30000 = 3 seats
- (d) No: of RMP exceeds 30000 – not exceeding 40000 = 4 seats
- (e) More than 40000 RMP = 5 seats.

Schedule II: Recognized medical qualifications granted by Universities, Board or Medical Institutions in India.

Schedule III: Qualifications granted by medical institutions outside India.

### **Functions:**

1. Medical Register: the council maintains a register of medical practitioners who are enrolled on any State Medical Register.
2. Medical Education:
3. Recognition of foreign medical qualifications
4. Appeal against disciplinary action
5. Warning notice for serious misconduct.

**Serious professional misconduct:** (Infamous conduct in professional respect)

It is any conduct of the doctor which might reasonably be regarded as disgraceful or dishonourable. The conduct of the doctor is judged by professional men of good repute and competence. The main cause for penal erasure is serious professional misconduct. It deprives the doctor of all the privileges of a registered practitioner.

### **Warning notice**

The following are some of the offences contained in the warning notice:-

1. Adultery (voluntary sexual intercourse between a married person, and a person married or not, other than his or her spouse)
2. Conviction by a court of law
3. Issuing false certificates
4. Performing criminal abortions or illegal operations
5. Dichotomy or fee splitting, i.e., receiving or giving commission to a professional colleague or a manufacturer or trader in drugs or appliances, or a dentist, chemist etc.
6. Covering, i.e., assisting some person who has no medical qualification to attend, treat or perform an operation on some person.
7. Advertisement – Repeated advertisement in a newspaper by a medical practitioner is an example of ethical negligence.
8. Using touts or agents for procuring patients.

### **Duties of Medical Practitioners**

A. Doctor should:

1. Exercise reasonable degree of skill and knowledge
2. Attend a patient as long as he requires treatment
3. Prescribe or furnish suitable medicines
4. Warn patients of the dangers involved in the use of a prescribed drug or device
5. Inform patient of risk
6. Notify communicable diseases to the health authorities.
7. Maintain professional secrecy.

**Privileged communication:** It is a statement made bonafide upon any subject matter by a doctor to the concerned authority, due to his duty to protect the interests of the community or of the State.

Examples of privileged communication

1. A syphilitic taking bath in public pool
2. Engine or bus driver found to be colour blind
3. A person with infectious diseases working as a cook.
4. A doctor's duty is to notify birth, death, infectious disease to public health authority.

### **Professional negligence (Malpraxis)**

It is defined as 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. Negligence is defined as doing something that is not supposed to do, or failing to do something that one is supposed to do.

**Medical negligence** falls under following section – sec. 304 A, IPC 312, Indian contract act. (except – IPC 351.)

**I. Civil negligence:** Liability for negligence arises if the following conditions are satisfied:

- a) Duty – Existence of a duty of care by the doctor
- b) Dereliction – Failure of the doctor to maintain care and skill
- c) Direct causation – The failure to exercise a duty of care must lead to damage
- d) Damage – the damage which results must be reasonable anticipated.

A civil wrong is known as – **‘Tort’**

**The doctrine of res ipsa loquitur:** It means the thing or fact speaks for itself.

**Novus actus interveniens:** It means an unrelated action intervening. A person is responsible for his actions and also for its consequences. This principle applies to cases of assault and accidental injury. If the doctor is negligent, which results from the logical consequence of events, then the responsibility for the subsequent disability or death may pass from the original incident to the later negligent action of the doctor by the principle of "novus actus interveniens".

**II. Criminal negligence:** (Sec. 304A IPC). It occurs when the doctor shows lack of competency, gross inattention, criminal indifference to the patient's safety, or gross negligence in the selection and application of remedies. It is practically limited to cases in which the patient has died. The doctor may be prosecuted by the police and charged in criminal court with having caused the death of the patient by a rash or negligent act not amounting to culpable homicide. The doctor can be punished with imprisonment up to 2 years, or with fine, or with both.

**Contributory negligence:** It is any reasonable conduct or absence of ordinary care on the part of the patient, or his personal attendant, which combined with the doctor's negligence.

**Therapeutic misadventure:** It is a case in which an individual has been injured or had died due to some unintentional act by a doctor or agent of the doctor or hospital.

It may be subdivided into:

- 1) Therapeutic (when treatment is being given)
- 2) Diagnostic (where diagnosis only is the objective at the time)
- 3) Experimental (where the patient has agreed to serve as a subject in an experimental study).

**Vicarious liability:** (liability for act of another) An employer is responsible not only for his own negligence but also for the negligence of his employees, if such acts occur in the course of the employment and within its scope, by the principle of respondent superior (let the master answer).

**Euthanasia** (Mercy killing): It means producing painless death of a person suffering from hopelessly incurable and painful disease. It has no legal sanction in India.

**Consent:** means voluntary agreement, compliance or permission.

It may be: (i) Express (verbal or written) or (ii) Implied.

Reasons for obtaining consent:

- (i) To examine, treat or operate upon a patient without consent is assault in law.
- (ii) If there is no informed consent the doctor may be charged for negligence.

**Rules for consent:**

1. Oral consent should be obtained in the presence of a third party, e.g., nurse.
2. Written consent should be taken for court presentation.
3. The consent should be free, voluntary, clear, intelligent, informed, direct, and personal.
4. In medico-legal cases such as rape, pregnancy, delivery, abortion the woman should not be examined without her consent.
5. In case of a female, the examination should be made only by a or under the supervision of a female medical practitioner (S. 53, IPC)
6. An arrested person at his request may be examined by a doctor to detect evidence in his favour (S.54, IPC)
7. A person above 18 years can give consent to suffer any harm, which may result from an act not intended or not known to cause death or grievous hurt (Sec. 87, IPC).

8. A person can give valid consent to suffer any harm which may result from an act, not intended or not known to cause death, done in good faith and for its benefit (S.88 IPC)
9. Consent is not a defense in cases of professional negligence.
10. A child under 12 years cannot give valid consent to suffer any harm which may result from an act done in good faith and for its benefit. The consent of parent or guardian is taken (S. 89, IPC)

**Malingering or shamming** means conscious, planned feigning or pretending a disease for the sake of gain. Malingering can be diagnosed by keeping the patient under observation and watching him without his knowledge.

**Consumer Protection Act** (COPRA) passed on 1986, came into force in 1987.

## IDENTIFICATION

Identification is the determination of the individuality of a person based on certain physical characteristics, i.e., exact fixation of personality.

**Corpus delicti:** (body of offence, essence of crime) means, the elements of any criminal offence. E.g., murder. The main part of corpus delicti is the establishment of identity of the dead body, and infliction of violence in a particular way, at a particular time and place, by the person or persons charged with the crime and none other.

**Race:** It can be determined by complexion, colour of eyes, hair, clothes and skeleton. Cephalic index =  $\frac{\text{Maximum breadth of skull}}{\text{Maximum length of skull}} \times 100$ .

It divides skull into (DOMBA)

1. Dolico-cephalic (long-headed) C.I. 70 to 85 – seen in pure Aryans, Aborigines and Negroes.
2. Mesati-cephalic (medium-headed) C.I. 75 to 80 – seen in Europeans and Chinese.
3. Brachy-cephalic (short-headed) C.I. 80 to 85 – seen in Mongolisms (Max C.I)

**Sex:** It has to be determined in cases of (1) Heirship, (2) Marriage, (3) Divorce, (4) Legitimacy, (5) Impotence, (6) Rape, etc.

**Sex chromatin:** is a small plano-convex mass, lying near nuclear membrane (Barr body). Accuracy of sex determination from pelvis and skull is 98%. Barr body was first demonstrated by Dixon and Tarr. In buccal smear, barr body is present in 20 to 80 % of cells in the female (more than 25% cells are determined) and 0 to 4% in males. Buccal smear is used in determination of sex. Examination of blood is used in determination of sex. Neutrophil leucocytes contain a small nuclear appendage of drumstick form (Davidson body – help in sexing) in upto 6% of cells in the female but is absent in males. Sex of a developing foetus can be determined at the end of 4th month of I.U life.

**Intersex:** It is an intermingling in one individual of characters of both sexes, in varying degrees, including physical form, reproductive organs and sexual behaviour. It results from some defect in the embryonic development.

It can be divided into four groups:

- 1) Gonadal agenesis – In this the testes or ovaries have never developed. The nuclear sex is negative.
- 2) Gonadal dysgenesis – External sexual structures are present, but at puberty the testes or ovaries fail to develop.
  - a) Klinefelter syndrome – The anatomical structure is male but the nuclear sexing is female. Sex chromosome is XXY (47 chromosomes). There is delay in onset of puberty, behavioral disorders and mental retardation. Small testis, infertility, gynaecomastia, azoospermia.

Increased urinary gonadotropins.

b) Turner's syndrome – The anatomical structure is female but the nuclear sexing is male. The sex chromosome pattern is XO (45 chromosomes). Earliest feature in newborn girl is oedema of hands and feet and loose nuchal folds. Other features – short stature, webbed neck – shield chest, renal defects – horse shoe kidney and duplication of renal pelvis, cardio-vascular defect – co-arcuation of aorta, skeletal disorder – cubitus valgus, gonadal streaks – seen in Turner's syndrome, mental status – normal.

3) True hermaphroditism – In this an ovary and testis or two ovotestis are present within the external genitalia of both sexes.

4) Pseudo-hermaphroditism – Internally gonadal tissue of only one sex is seen, but external appearance is of the opposite sex.

a) Male pseudohermaphroditism: Nuclear sex is XY, but sex organs and sexual characteristics deviate to female form, because of testicular feminisation.

b) Female pseudohermaphroditism: Nuclear sex is XX, but deviation of sex organs and sexual characteristics towards male are seen, due to adrenal hyperplasia.

Skeleton: Recognizable sex differences do not appear until puberty except in pelvis, and the accuracy from this bone is about 75 to 80%. The determination of sex is based mainly upon the appearance of the pelvis, skull, sternum and the long bones.

## AGE

Age can be determined from teeth, ossification of bones, secondary sexual characteristics, and general development in case of children.

**1. Teeth:** Teeth are useful for age determination (a) by the stage of development, and (b) by secondary changes.

Temporary teeth: these are 20 in number – 4 incisors, 2 canines, 4 molars in each jaw.

In ill-nourished children and in rickets, dentition may be delayed. In syphilis, dentition appears premature or even present at birth. Eruption of temporary teeth is for 2 - 2½ years. The temporary teeth begin to fall at about the sixth or seventh year after the eruption of first permanent molar. In children mixed dentition remains at 6 – 12 years of age.

Age 9: 12 permanent teeth, 8 I, and 4 1st molars + deciduous molars and canines.

Age 11: 20 permanent teeth, 8 I, 8 Pm and 4 M.

Age 14: 28 permanent teeth, and no deciduous teeth.

Permanent teeth are 32 in number: 4 incisors, 2 canines, 4 premolars, and 6 molars in each jaw.

Developmentally, teeth are divided into two sets:

(1) Superadded permanent teeth: Are those which do not have deciduous predecessors. (all permanent molars, 6 in each row)

(2) Successional permanent teeth: are those which erupt in place of deciduous teeth.

(Permanent premolars in place of deciduous molars, 10 in each row).

Temporary teeth eruption (in months) – Total 20.

Eruption of permanent teeth (in years) – Total 32.

**Gustafson's method** – The age estimation of adult over 21 years (between 25 – 60 years) depends on the physiological age changes in each of the dental tissues such as attrition, paraodontosis, secondary dentin, cementum apposition, root resorption, transparency of the root (The most reliable criteria).

## 2. Growth of individual bones:

The bones of skeleton are formed in hyaline cartilage. The earliest centres of ossification appear at the end of second months of pregnancy. At the eleventh intrauterine week, there are 806 centres of bone growth, at birth about 450, while the adult skeleton has 206 bones.

Tarsus and carpus bones ossify from a single centre. Typically, a long bone such as tibia, has become ossified throughout its shaft (diaphysis) at birth; whereas its two ends (epiphysis) are later ossified by secondary centres. The process of union of epiphysis and diaphysis is called fusion. In an individual bone once union has begun, it will be completed by 12 to 18 months.

For determining the age, skiagrams of the shoulder, elbow, wrist, hip, knees, ankle, pelvis and skull, should be taken in antero-posterior position. Union of epiphysis in cartilaginous bones occurs slightly earlier by about 1 year in the female than in the male, but reverse is seen in the closure of the sutures of the skull.

The symphysis pubis is probably the single best criterion for determining age from third to fifth decades. If male criterion is used for females, the age would be underestimated by about 10 years.

Sternum: Four pieces of body of the sternum fuses with one another from below upwards between 14 and 25 years. At about 40 years the xiphoid unites with the body. The manubrium fuses with the body in old age.

The greater cornu of the hyoid bone unites with the body between 40 and 60 years.

Skull: Bones of calvaria are 8 in number: parietal 2, frontal 1, temporal 2, occipital 1. Bones of the face and jaw are 14 in number: maxilla 2, zygomatic 2, nasal 2, lacrimal 2, palatine 2, inferior nasal concha 2, mandible 1, and vomer 1. Lateral and occipital fontanelles usually close within the first two months. The anterior fontanelles and the two halves of the mandible unite at the second year. The basioccipital fuses with the basisphenoid at about 18 to 21 years. In the vault of the skull, closure of the sutures begins on the inner side 5 to 10 years earlier than on the outer side. Closure of all sutures indicates age more than 60 years. Suture closure in skull occurs later in females than in males. Sacrum: the sacrum becomes a single bone between 21 and 25 years.

### **3. Secondary sexual characters:**

In males:

(i) At about 14 years – fine hair begins to appear at pubis.

Testes – large, firmer.

Penis – begins to enlarge.

(ii) At about 15 years – pubic hair thick, extends upto umbilicus, dark - axillary hair appears.

(iii) At about 16 years – appearance of hair at face.

(iv) Between 16 – 18 years – voice becomes deep.

In females:

(i) At 13 – 14 years – Sequence of puberty is (i) breast begins to develop (ii) hair on mons veneris (iii) menstruation starts.

(ii) At 14 – 15 years – Female public hair thin; straight tops above mons veneris; hair appears in axilla.

**Doctor's estimation** of age is not proof but merely an opinion.

### **Medico-legal importance of age:**

1) **Criminal responsibility:** Any act done by a child under 7 years is not an offence (S. 82, IPC). It is an offence if done before 7 years according to Railways act. A child between 7 and 12 years is presumed to be capable of committing an offence, if he attains sufficient maturity (S. 83, IPC).

2) **Judicial punishment:** According to the Juvenile Justice Act, 1986, "juvenile" means a boy who is below the age of 16 years, or a girl who is below 18 years. No delinquent juvenile shall be sentenced to death or imprisonment.

3) **Rape:** Sexual intercourse by a man with a girl under 15 years even if she is his own wife, or with any other girl under 16 years even with her consent is rape (S. 375, IPC)

4) **Kidnapping:** It is an offence

(a) to kidnap a child with the intention of taking dishonestly any movable property, if the age of child is under 10 years (S. 369, IPC)

(b) to kidnap a minor from lawful guardianship if the age of a boy is under 16 and that of a girl under 18 years (S. 361, IPC)

(c) to procure a girl for prostitution, if her age is under 18 years (S. 366-A, IPC), and

(d) to import into India from a foreign country a female for the purpose of illicit intercourse, if her age is less than 21 years (S. 366-B, IPC).

5) **Employment:** A child below 14 years cannot be employed to work in any factory or mine or in any other risky employment. A person completing 15 years (adolescent) is allowed to work in a factory as an adult.

6) **Attainment of majority:** A person attains majority on the completion of 18 years. (S. 3, Ind. Majority Act, 1875)

7) **Evidence:** A child of any age can give evidence if the court is satisfied that the child is truthful (S. 118, IEA)

8) **Marriage contract:** A female under 18 years and a male under 21 years, cannot contract marriage (Child marriage restraint act, 1978)

9) **Infanticide:** The charge of infanticide cannot be supported, if the infant can be proved under the age of 6 months of intra-uterine life.

10) **Criminal abortion:** A woman who has passed the child-bearing age cannot be charged of procuring criminal abortion.

**Rule of Haase:** A rough method of calculating the age of the foetus.

(1) Upto 5 months, age of foetus =  $\sqrt{\text{length (in months)}}$

(2) > 5 months =  $\text{length (in cm)} / 5 = (\text{months})$ .

Length of an infant: At birth = 50 cm, end of 6 months = 60 cm, end of 1st year = 68 cm, end of 4 years = 100 cm (double).

Birth weight doubles by 5 months, triples by 1 year.

For the confirmation of age between 6 and 12, best means is dental examination.

### **Fusion of bones / joints:**

(ii) 15 to 16 years – Elbow joint.

(iii) 16 to 17 years – Ankle joint

(iv) 17 to 18 years – Hip joint

(v) 18 to 19 years – Knee, shoulder, knee joint. Centre appears for inner end of clavicle.

(vi) 18 to 20 years – Iliac crest fuses.

(vii) 21 years – Fusion of ischial tuberosity and inner end of clavicle. Patella completely ossifies at 14 years.

(viii) 2nd and 5th decades – Age of 20 years is determined by pubis.

(ix) 14 to 25 years – Sternum fusion takes place below upwards.

(x) Bertellion system – for greater than 21 years.

(xi) Epiphseal union of sternal end of clavicle occurs at the age of 22 years.

1st ossification centre to appear is clavicle, and lower jaw at 2nd week of intra uterine life.

In post – maturity, ossification centres appear in capitate, hamate.

**Stature:** By applying Karl – pearson formula, we will be able to calculate stature of the individual from long bones. Multiplying factor of estimating stature: from femur (males) is 3.6 to 3.8, from humerus (males) is 5 to 6.

**Dactylography,** (finger-print system, dermatoglyphics, Galton system)

Most reliable method of identification of a person. Finger prints are impressions of pattern formed by the papillary ridges of the fingertips.

Finger prints are classified primarily as: (i) Loops 67%, (ii) whorls 25%, (iii) arches 6 to 7% (iv) composite forms – 1 to 2% (least common).

In practice, **16 to 20 points** of fine comparison are accepted as proof of identity. The patterns are not inherited. The pattern is different in identical twins.

Ridge alterations occurs in eczema, acanthosis nigricans and scleroderma.

Permanent impairment of the finger print pattern occurs in leprosy, electric injuries, and after exposure to radiation.

**Poroscopy** – This is the further study of fingerprints described by Locard.

M.L.I:

(i) Recognition of impression at the scene of crime.

(ii) Identification in case of accidental exchange of new-born infants.

(iii) Prevention of impersonation

(iv) Cheques, bank notes and other legal documents.

**Cheiloscopy:** is the study of lip-prints.

**Superimposition:** It is the technique applied to determine whether the skull is that of the person in the photograph. A life sized negative of the skull is prepared. The negatives of the photograph and the skull are superimposed by aligning the characteristic point in negative. A negative result is having more credibility because, it can definitely be stated that the skull and the photograph are not those of the same person.

**Hair:** Study of hair is known as Trichology.

Medullary index of hair is used to determine the **species**.

Human hair is fine, thin, cuticular scales are short, broad, not continuous; cortex – thick, 4 to 10 times as broad as medulla; medulla – thin, pigment evenly distributed; precipitin test specific for human.

Animal hair is coarse, thick, cuticular scales very large, step-like projection; cortex thin.

Scalp hair grows at 3 mm a week.

Hair becomes loose after 72 hours of death.

ABO groups can be determined in a single hair from any part of the body by a modified absorption – elution technique with 100 % accuracy.

## **DEATH AND ITS CAUSE**

**Thanatology** deals with death in all its aspects. Death is of two types: (1) somatic, systemic or clinical, and (2) molecular or cellular.

**Somatic death** is the complete and irreversible stoppage of the circulation, respiration and brain functions, but there is no legal definition of death.

**Autopsy** means, post-mortem examination of a body (whole body).

**Objectives:**

(1) To find out the time since death.

- (2) To find out the cause of death.
- (3) To find out the manner of death, whether accidental, suicidal or homicidal.
- (4) To establish the identity.
- (5) In new-born infants to determine live birth and viability.

**Rokitansky's** method is autopsy technique for infants.

Before doing the post-mortem, body should be identified by policeman.

**Exhumation:** is the digging out of an already buried body from the grave. There is no time limit for exhumation in India. The body is exhumed only when there is a written order from the First Class Magistrate (Chief Judicial Magistrate). It should be conducted in natural light in early morning. Average number of sample of earth taken is 6 to 7. Disinfectants should not be sprinkled on the body. In suspected mineral poisoning, hair, nails and long bones, e.g., femur should be preserved for chemical analysis. It is not done for Hindus. Performed for Christians, Muslims and Parsies.

**Molecular** death means the death of cells and tissues individually, which takes place usually one to two hours after the stoppage of vital functions.

**Brain death** consists of: (1) Deep unconsciousness with no response to external stimuli or internal need; (2) No movements, no spontaneous breathing; (3) Cessation of spontaneous cardiac rhythm without assistance; (4) No reflexes (except occasionally spinal reflexes), (5) Bilateral dilatation and fixation of pupils; (6) Flat iso-electric EEG; provided that (a) all of the confirmatory mentioned are present for a 24 hour period; (b) patient's body temperature should not be below 32°C. (c) metabolic and endocrine disturbances, which can be responsible for coma should be excluded.

**Modes of death:** (1) Coma, (2) Syncope, (3) Asphyxia.

**Coma** is the insensibility, which involves the central portion of the brain stem, and may result in death.

**Syncope** is sudden stoppage of action of the heart, which may prove fatal. It is due to vaso-vagal attacks resulting from reflex parasympathetic stimulation.

**Asphyxia** is a condition caused by interference with respiration or due to lack of oxygen in respired air due to which the organs and tissues are deprived of oxygen. (together with the failure to eliminate CO<sub>2</sub>), causing unconsciousness or death.

**The cause of death** is the disease or injury responsible for starting a sequence of events, which are brief or prolonged and which produce death. It may be divided into: (1) Immediate cause, (2) Basic cause, (3) Contributory cause.

#### **Negative autopsy:**

When gross and microscopic examination, toxicological analysis and laboratory investigations fail to reveal a cause of death, the autopsy is considered as negative. It may be due to (1) Inadequate history, (2) Inadequate external examination, (3) Inadequate or improper internal examination, (4) Insufficient laboratory examinations, (5) Lack of toxicological analysis, (6) Lack of training of the doctor.

**Obscure autopsies:** are those which do not show a definite cause for death, in which there are minimal, indefinite or obscure findings, or even no positive findings at all.

**Sudden death:** Death is said to be sudden or unexpected, when a person not known to have been suffering from any dangerous disease, injury or poisoning is found dead or dies within 24 hours after the onset of terminal illness.

**Natural death** means that the death was caused entirely by the disease, and the trauma or poison did not play any part in bringing it about.

### **POST-MORTEM CHANGES**

The signs of death appear in the following order:

- (I) Immediate (somatic death).
  - (1) Insensibility and loss of voluntary power
  - (2) Cessation of respiration
  - (3) Cessation of circulation.
- (II) Early (cellular death).
  - (4) Pallor and loss of elasticity of voluntary power
  - (5) Changes in the eye
  - (6) Primary flaccidity of muscles
  - (7) Cooling of the body
  - (8) Post-mortem lividity
  - (9) Rigor mortis
- (III) Late (decomposition and decay)
  - (10) Putrefaction
  - (11) Adipocere formation
  - (12) Mummification.

Complete stoppage of respiration for more than 4 minutes usually causes death.

**Suspended animation:** In this condition, signs of life are not found, as the functions are interrupted for sometime, or are reduced to minimum. However, life continues and resuscitation is successful in such cases. Voluntarily, practitioners of yoga can pass into a trance, death like in character. Involuntary suspension of animation lasting from a few seconds to half-an-hour may be found in new-born infants, drowning, electrocution, cholera, after anesthesia, shock, sunstroke, cerebral concussion, insanity, etc.

**Changes in skin:** Skin becomes pale and ashy-white and loses elasticity within a few minutes of death. Lips appear brownish, dry and hard due to drying.  
**Changes in eye:** Loss of corneal reflex is not a reliable sign of death. Opacity of cornea may occur in diseases like cholera, wasting diseases before death. If the lids are open, cornea remains clear for about 2 hours. The retina is pale for the first 2 hours. At about 6 hours, the disk outline is hazy and becomes blurred in 7 to 10 hours.

**Cooling of the body (Algor mortis):** The body heat is lost by conduction, convection and radiation. The curve of cooling is sigmoid in pattern. Internal organs take 24 hours to cool. The temperature of the body rises up for the first two hours after death by sunstroke, septicemia, tetanus, strychnine poisoning called post-mortem caloridity.

A rough idea of time in hours after death can be obtained by the formula, (Normal body temperature – Rectal temperature) / Rate of temperature fall per hour.

**The rate of cooling** of the body in first six hours is 2.50F per hour, the rate in next hours is 1.5 – 20F.

**Factors affecting rate of cooling:** In India, during summer, cooling is very slow. In tropical climates, the heat loss is roughly 0.5 to 0.70C per hour. Children and old people cool more rapidly than adults. Fat bodies cool slowly than lean bodies. Cooling is more rapid in humid atmosphere than in dry atmosphere. A body immersed in cold water cools rapidly; the rate of fall being almost twice as fast as by air cooling. Bodies buried in earth cool rapidly than

that in air, but more slowly than those in water.

**Post-mortem hypostasis:** This is the bluish-purple or purplish-red discoloration which appears under the skin of the dependent parts of the body after death, due to capillo-venous distension. Also called post-mortem staining, sub-cutaneous hypostasis, livor mortis, cadaveric lividity, suggillations, vibices and darkening of death. The intensity of the colour depends on the amount of reduced haemoglobin in the blood.

**Post-mortem lividity** begins shortly after death, but it may not be visible for about half to one hour after death in normal individuals, and for about one to 4 hours in anaemic persons. It is usually well developed within 4 hours and reaches a maximum between 6 and 12 hours. It is more marked in asphyxia and is less marked in death from wasting diseases, hemorrhage and from anaemia and lobar pneumonia.

In a body lying on its back, it first appears in the neck, and then spread over the entire back except parts directly pressed on, i.e., shoulder-blades, buttocks, calves and heel.

**Post-mortem stains** can occur in some cases before death in cholera. The location of the lividity indicates the position of the body during post-mortem interval. Hypostasis lasts for hours. Blood clots after ½ hour of death.

Post-mortem staining gets fixed after 5 – 6 hours. A contusion can be differentiated from post-mortem staining by doing incision test.

In carbon-monoxide poisoning, the colour is cherry-red.

In hydrocyanic acid poisoning, the colour of stain is bright-red.

In poisoning by nitrates, potassium chlorate, potassium bicarbonate, nitrobenzene and aniline (causing methaemoglobinaemia) the colour is red-brown, or brown

In poisoning by phosphorus, the colour is dark – brown. (Blue in P.V.Chadha)

In case of aniline or CO<sub>2</sub> poisoning, it is deep blue, due to excess of reduced Hb.

In asphyxia, the colour of stains is deeply bluish-violet or purple.

In septic abortion caused by Cl. Welchii, the colour is often greyish-brown.

In hanging, hypostasis, will be most marked in the legs, and hands. In drowning, PM staining is usually found on the face, the upper part of chest, hands, lower arms, feet and calves, as they are the dependent parts. If the body is constantly moving its position, as after drowning in moving water, the staining may not develop.

As decomposition progresses, the lividity becomes dusky in colour and turns brown and green before finally disappearing with destruction of the blood.

**Muscular changes:** After death, muscles of body pass through three stages:

- (1) Primary relaxation or flaccidity,
- (2) Rigor mortis or cadaveric rigidity,
- (3) Secondary flaccidity.

Primary flaccidity: During this stage, death is somatic only, and it lasts for one or two hours.

**Rigor mortis (cadaveric rigidity):** This is a stage of stiffening of muscles, sometimes with slight shortening of the fibres. Individual cell death takes place at this stage.

**Mechanism:**

ATP is responsible for elasticity and plasticity of muscle. The lost ATP (during muscle contraction) during life is resynthesized. After death there is no resynthesis of ATP. The PM alteration of ATP is due to dephosphorylation and deamination. When ATP is reduced to a critical level (85% of the normal) the overlapping portions of myosin and actin filaments

combine as a rigid link of actomyosin, which is viscous and inextensible, and causes hardness and rigidity of muscle rigor. The rigidity is maximum, when the level of ATP is reduced to 15%. Rigor persists until decomposition of the proteins of the muscle fibres makes them incapable of any further contraction.

### **The order of appearance of rigor mortis:**

All the muscles of the body, both voluntary and involuntary are affected. It first appears in involuntary muscles; the myocardium becomes rigid in an hour. It begins in the eyelids, neck, and lower jaw, and passes upwards to the muscle of the face, and downwards to the muscles of the chest, upper limbs, abdomen and lower limbs. It passes off in same order.

When rigor is fully developed, the entire body is stiff, the muscles shortened, hard and opaque. Rigor of erector pilae muscles may cause roughness of skin – known as cutis anserina or goose skin. Rigor is tested by trying to lift the eyelids, depressing the jaw, and gently bending the neck and various joints of the body. RM may occur in amputated limbs and diseased parts.

### **Time of onset of RM:**

In India, it begins 1 to 2 hours after death and takes further 1 to 2 hours to develop.

Duration of RM:

In India, usually it lasts for 24 to 48 hours in winter and 18 to 36 hours in summer. When rigor sets in early, it passes off quickly and vice versa.

### **Conditions altering duration and onset:**

In death from diseases causing great exhaustion and wasting, e.g., cholera, typhoid, tuberculosis, cancer, etc and in violent deaths as by cut-throat, firearms or by electrocution, the onset of RM is early and duration is short.

In Strychnine and other spinal poisons, the onset is rapid and the duration is longer. In deaths from asphyxia, severe haemorrhage, apoplexy, pneumonia, nervous disease causing paralysis of muscle, and perfusion with normal saline, the onset is delayed.

The onset is slow and duration is long in cold weather. The onset is rapid due to heat, because of the increased breakdown of ATP but the duration is short. RM may persist for 3 to 4 days in refrigerated conditions.

### **Conditions simulating RM:**

(1) **Heat stiffening:** When a body is exposed to temperatures above 65°C rigidity is produced, which is much more marked than that found in RM. It is seen in deaths from burning, high voltage electric shocks and from falling into hot liquid. The stiffening remains until the muscles soften from decomposition.

(2) **Cold stiffening:** When the body is exposed to freezing temperatures, the tissues become frozen and stiff, simulating rigor.

(3) **Cadaveric spasm or Instantaneous rigor or cataleptic rigidity:** In this condition, the muscles that are contracted during life, become stiff and rigid immediately after death without passing into the stage of primary relaxation. It occurs especially in cases of sudden death, excitement, fear, severe pain, exhaustion, sudden asphyxial death, cerebral haemorrhage, injury to the nervous system, firearm wound of the head, etc. this is usually limited to a single group of muscles and frequently involves the hands. No other condition simulates cadaveric spasm and it cannot be produced by any method after death. It may be explained on the basis of diminished or exhausted ATP in the affected muscles.

**MLI:** in case of suicide the weapon, e.g., pistol or knife is seen firmly grasped in victim's hand which is a strong presumptive evidence of suicide. In case of drowning, materials such as grass, weeds or leaves may be found firmly grasped in the hand which shows ante

mortem drowning.

**Secondary relaxation:** Muscle becomes soft and flaccid due to breaking down of actinomyosin due to putrefaction.

**Putrefaction:** It is the final stage following death, mainly by the action of bacterial enzymes, mostly anaerobic organisms derived from the bowel. Putrefaction is delayed after death due to poisoning by: Carbolic acid, Zinc chloride, Strychnine, Heavy metal poisoning e.g. Arsenic, Antimony.

**The chief destructive bacterial agent** is *Cl. Welchii* which causes marked hemolysis, liquefaction of post-mortem clots and of fresh thrombi and emboli, disintegration of tissue and gas formation in blood vessels and tissue spaces. Enzyme Lecithinase produced by *Cl. welchii* is most important.

**The characteristic features of putrefaction** are : (i) changes in the colour of the tissue, (ii) collection of gases in the tissues, (iii) liquefaction of tissues.

(i) changes in the colour of the tissue: The first external sign of putrefaction in a body lying in air is a greenish discolouration of skin over caecum i.e. right iliac fossa, where the contents of the bowel are more fluid and full of bacteria.

The colour appears in 12 to 18 hours in summer and one to two days in winter. The greenish discoloration then spreads over the entire abdomen, external genitals and then patches appear successively on the chest, neck, face, arms and legs. The patches become dark-green and later purple and dark blue. The marbled appearance is prominent in 36 to 48 hours. The earliest internal change is reddish brown discolouration of the inner surface of the vessels, especially the aorta.

(ii) Collection of gases in the tissue: Gases collect in the intestines in 6 to 12 hours in summer. From 18 to 36 hours after death, the gas collects in the tissues, cavities and hollow viscera under pressure and the features become bloated and distorted. After 3 days, the face is so discoloured and bloated that identification becomes difficult. The hair becomes loose and is easily pulled out.

(iii) liquefaction of the tissues: Colliquative putrefaction begins from 5 to 10 days or more after death.

**Skeletonisation:** In India, an unconfined buried body is reduced to a skeleton within a year.

**Internal phenomenon:**

The organs show putrefactive changes in the following order :

1. Larynx and trachea,
2. Stomach, intestines, spleen,
3. Liver and lungs,
4. Brain,
5. Heart,
6. Uterus, prostate, kidney,
7. Skin, muscle, tendon,
8. Bone.

In putrefaction, when bubbles appear the organ has a honey combed, foamy appearance.

Prostate and virgin uterus resists putrefaction for a very long time. Putrefaction begins above 10°C and optimum between 21 °C and 38°C. A body decomposes in air twice as rapidly as in water and eight times as rapidly as in earth; formula is given by Taylor.

Putrefaction is the surest sign of death. After death, the onset of putrefaction is in the stage of secondary relaxation. Gas rigidity appears after 72 hours.

**Entomology of cadaver:** Is the study of insects and maggots that infest the dead body. Bones begin to decompose after death in 3-10 years. Less than 7 amino acids in bone

suggest the age of bone to be (after death) more than 100 years. Total ultraviolet fluorescence of cut surface of bones is seen in 35-100 years. Foamy liver is due to bubbling up of gas. Putrefaction is affected by age, clothing and moisture. Maggots in a dead body do not appear before 48 hours.

### **Adipocere (Saponification)**

In this, the fatty tissues of the body changes into a substance known as adipocere. The change is due to gradual hydrolysis and hydrogenation of pre-existing fat such as olein, into higher fatty acids, which combine with calcium and ammonium ions to form insoluble soaps, which being acidic, inhibit putrefactive bacteria. Adipocere is delayed by cold and formed rapidly by warm humid climate and moist damp soil.

**Fresh adipocere** is soft, moist, whitish and translucent but old samples are dry, hard, cracked, yellowish and brittle. It is inflammable and burns with a faint yellow flame. It floats in water and dissolves in alcohol and ether. It is formed first in subcutaneous tissue. The face, buttocks, breast, abdomen are the usual sites. In temperate country, the shortest time for its formation is about 3 weeks in summer. Foetuses under 7 months do not show this change. In India, it has been observed within 3 days.

**Mummification:** It is a modification of putrefaction.

**Dessication or, Dehydration** or drying and shrivelling of the cadaver occur due to evaporation of water but the natural appearance and features of the body are preserved. It begins in the exposed parts of the body such as face, hands and feet and then extends to the entire body including the internal organs. A mummified body is practically odourless. The time required for complete mummification of a body varies from three months to a year or two. Two factors are necessary for the production of mummification: (1) The absence of moisture in the air, and (2) The continuous action of dry or warmed air.

### **Embalming:**

In this, the contents of the body cavities are removed and the vascular system is injected with an embalming fluid containing 40% formaldehyde and 10% methyl alcohol.

## **MECHANICAL INJURIES**

Mechanical injuries (wound) are injuries produced by physical violence.

**An injury** is any harm, whatever illegally caused to any person in body, mind, reputation or property (S. 44, IPC)

A wound or injury is a break of the natural continuity of any of the tissues of the living body.

### **Classification:**

(I). Mechanical:

1. Abrasions 2. Contusions 3. Lacerations 4. Incised wounds 5. Stab wounds 6. Firearm wounds 7. Fractures and dislocations

(II) Thermal:

1. Due to cold-

(a) Frost bite (b) Trench foot (c) Immersion foot.

2. Due to heat—

(a) Burns (b) Scalds.

III. Chemical: (a) Corrosive acid (b) Corrosive alkalies.

IV. Injuries due to lightning, electricity, X-ray and radio-active substances..

### **Abrasions**

An abrasion is a destruction of the skin, which involves superficial layers of epidermis only. They are caused by a blow, a fall on a rough surface, by being dragged in a vehicular accident, finger nails, thorns or teeth-bite. The exposed raw surface is covered by exudation of lymph and blood, which produces a protective covering known as scab or crust. They are simple injuries, bleed slightly, heal rapidly and leave no permanent scar.

Types: Abrasions are of four types.

1. **Scratches**: These are caused by a sharp object passing across the skin, such as finger nails, pin or thorn.

2. **Grazes** (sliding, scraping or grinding abrasion): They are most common type of abrasions. They show uneven, longitudinal parallel lines (grooves or furrows) with the epithelium heaped up at the ends of these lines, which indicate the direction in which the force is applied.

An abrasion caused by violent friction against a broad rough surface as in dragging over the ground is called brush burn.

3. **Pressure abrasion** (Crushing or friction abrasion): Ligature mark. They are caused by crushing of the superficial layers of the epidermis and are associated with a bruise of the surrounding area.

4. **Impact abrasions** or Imprint abrasions— they are caused by impact of a rough object, such as a person knocked down by a motor car. They are also called pattern abrasions.

### **Age of Abrasions:**

1. Fresh — Bright red.

2. 12 to 24 hours — Lymph and blood dries up leaving a bright scab.

3. 2 to 3 days — Reddish-brown scab.

4. 4 to 7 days — Epithelium grows and covers defect under the scab.

5. After 7 days — Scab dries, shrinks & falls off.

In ante-mortem abrasions, intravital reaction and conges-tion is seen.

Erosion of the skin produced by ants, excoriations of the skin by excreta and pressure sores resemble abrasions.

### **Contusions (BRUISES)**

A contusion is an effusion of blood into the tissues, due to rupture of the subcutaneous vessels, caused by blunt trauma. This is accompanied by a painful swelling and crushing or, tearing of the subcutaneous tissues usually without destruction of the skin. A contusion is a superficial injury. When a large blood vessel is injured, a tumour-like mass called haematoma is formed. The size of the bruise is slightly larger than the surface of the agent which caused it, as blood continues to escape into the area.

If the part is vascular and loose, such as face, vulva, scrotum, a slight degree of violence may cause a large bruise. If the tissues are strongly supported and covered by thick dermis, such as abdomen, back, scalp, palm and soles, moderate violence may produce a small bruise.

**Bruising** is more marked on tissue overlying bone. Children and old people bruise more easily. Hemorrhages in the soft tissues around the eyes and in the eyelids (black-eye) may

be caused by blunt impact to the forehead.

### **The Age of Bruise:**

A bruise heals by destruction and removal of the extra-vascular blood.

At first (1-2 hours)—Red.

Few hours to 3 days—Blue

4th day — Bluish-black to brown (haemosiderin).

5 to 6 days — Greenish (haematoidin).

7 to 12 days—Yellow (bilirubin).

2 weeks—Normal.

In ante-mortem bruising there is swelling, damage to epithelium, extravasation, coagulation and infiltration of the tissue with blood and colour changes.

Bruises are of less value than abrasions. In self inflicted bruises, typical colour changes are not seen.

Artificial bruises: Some irritant substances when applied to skin produce injuries, which simulate bruises. Artificial bruises are dark brown and true bruises show typical colour change.

### **Incised wounds**

An incised wound (cut, slash or slice) is a clean cut through the tissues, which is longer than it is deep. It is produced by pressure and friction against the tissue by object having a sharp cutting edge such as knife, razor, scalpel, sword, etc.

Incised wound appears lacerated on testes. Incised wounds are deeper at their beginning, because more pressure is exerted on the knife at this point, known as the head of the wound.

Towards the end of the cut, the wound becomes shallow, called tailing of the wound.

Age of incised wound:

Fresh—Hematoma formation.

12 hours—Edges are red, swollen, adherent with blood and-lymph.

24 hours—A continuous layer of endothelial cells cover the surface.

36 hours—The capillary network is complete.

48 to 72 hours—The wound is filled with fibroblasts.

3 to 5 days—Definite fibrils running parallel to the vessels are seen; vessels show thickening and obliteration.

1 to 2 weeks—Scar tissue is formed.

**Hesitation** marks or tentative cuts or trial wounds—They are cuts which are multiple, small and superficial, often involving the skin and seen at the beginning of the incised wound.

They are seen in suicidal wounds.

Chop wounds: They are wounds caused by a blow with the sharp cutting edge of a fairly heavy weapon like a hatchet, axe, a sword etc.

Wound produced by a curved weapon such as sickle is both stab & incised wound.

### **Stab or Puncture Wounds**

Stab wound is a penetrating injury caused by sharp-pointed objects, such as knife, dagger, nail, needle, arrow, screw driver, etc. penetrating the skin and underlying tissues that is deeper than its length and width of the skin.

Most important dimension in stab wound is depth. Punctured wound is deeper than its width and length on skin. The length of wound is less than width. If a single edged weapon is used, the surface, triangular or wedge shaped, one angle of the wound will be sharp, the

other blunt or torn.

**Harakiri:** It is an unusual type of suicide, in which the victim inflicts a single large wound on the abdomen with a short sword while in a sitting position or falls forward upon a ceremonial sword and pulls out intestines. The sudden evisceration of the internal organs causes a sudden decrease of intra-abdominal pressure and cardiac return, producing sudden cardiac collapse.

### **Lacerations**

They are open wound.

Lacerations are tears or splits of skin, mucous membrane, muscle or internal organs produced by application of blunt force to the broad area of the body. Displacement of tissues occurs most commonly when soft tissues are crushed against bone, e.g., scalp, shins, shoulders, and face. They are caused by blows from blunt objects, by falls on hard surfaces, by machinery, traffic accidents, etc.

If the force produces bleeding into adjacent tissues, the injury is a 'contused-laceration' or 'bruised tear'. If the blunt force produces extensive bruising and laceration of deeper tissues, it is called 'crushing' injury.

Incised like or incised looking wounds: Lacerations produced without excessive skin crushing may have relatively sharp margins. The sites are the scalp, eyebrows, cheek bones, lower jaw, iliac crest, perineum, and shin.

**Stretch lacerations:** is seen in the running over by a motor vehicle, and the flap may indicate direction of the vehicle.

**Avulsion** is a laceration produced by sufficient force (shearing force) delivered at an acute angle to detach (tear off) a portion of a traumatised surface or viscus from its attachments.

### **Defense wounds**

It results due to immediate and instinctive reaction of the victim to save himself, either by raising the arm to prevent the attack or by grasping the weapon.

**Self-inflicted** wounds are those inflicted by a person on his own body.

**Fabricated** wounds (fictitious, forged or inverted wound) are those which may be produced by a person on his own body or by another with his consent.

### **REGIONAL INJURIES**

Most fragile bone in the skull to get fractured is — temporal bone.

Depressed fractures -> The outer table is driven into the diploe and inner table is fractured irregularly. Depressed fracture is also called signature fracture. Localised depressed fracture are caused by blows from heavy weapon with a small striking surface e.g. stone, stick, axe, hammer etc.

Pond or Indented fractures —> They occur only in skulls which are elastic i.e. the skulls of infants.

Gutter fractures - They are formed when part of the thickness of the bone is removed so as to form a gutter e.g. oblique bullet wound.

Countre-coup lesions fracture means that the lesion is present in an area opposite the side of impact in head injury.

Concussion is a state of temporary unconsciousness, which results from violence applied to the skull. Concussion of the spinal cord is called railway spine.

In fracture, X-ray examination, callus is not readily visible for 3 weeks.

Whip lash injury is due to violent acceleration or deceleration force.

In Boxing injuries fracture of the skull is rare but sub-dural hemorrhage occurs. It is most

common type of hemorrhage. Deterioration of speed and co-ordination are the chief symptoms of the onset of punch-drunk (traumatic encephalopathy) condition. Repeated blows to the head produce small hemorrhages and degenerative changes in brain.

- The specific pulmonary injury of air blast is called 'blast lung'.
- Most common mechanism of fracture of spine is hyperflexion.
- Most common site of spinal cord injury is thoracolumbar junction (T10- L1).
- Best method of assessing spinal cord injury is MRI.

### **Intracranial Hemorrhage**

1. Extradural hemorrhage: — It is caused always due to trauma.

Most common artery causing extradural hemorrhage is anterior branch of middle meningeal artery. Most common site of extradural hemorrhage is Temporo-parietal area where main source of bleeding is middle meningeal artery. There is a history of head injury which causes the bleeding and temporary unconsciousness usually. This is followed by a period of normal consciousness, the lucid interval of few hours to a week.

2. Subdural hemorrhage:

May occur from relatively mild trauma. It is essentially venous or capillary, not arterial.

3. Subarachnoid hemorrhage

This is the most common form of traumatic intracranial hemorrhage.

4. Intracerebral hemorrhage

Most common cause of intracerebral hemorrhage is hypertension.

Most common site of intracerebral hemorrhage is putamen (corpus striatum).

Most common blood vessel leading to intracerebral hemorrhage is lenticulo striate branch of middle cerebral artery.

## **MEDICO-LEGAL ASPECTS OF WOUNDS**

**Homicide:** is killing of a human being by another human being.

Types of homicide:

(1) Lawful (a) Excusable (b) Justifiable

(2) Unlawful (a) Murder (b) Culpable homicide (not amounting to murder/ amounting to murder) (c) Rash or negligent homicide.

**Justifiable homicide:** This is the homicide which is justified in the circumstance which led to the killing of a person. This may occur; (a) In the administration of justice, like execution of sentence of death (b) The maintenance of justice, e.g., in suppressing riots, or executing arrest, or killing in course of violent crime, e.g., a woman who kills a person who attempts to rape her.

**Excusable homicide:** This is the homicide caused unintentionally by an act done in good faith. This includes: (a) Killing in self-defense when attacked, provided there is no other means of defense (b) Causing death by accident or misadventure (c) Death following a lawful operation (d) Homicide committed by an insane person.

**Murder:** S. 300, IPC

Culpable homicide: S. 299, IPC

Punishment for murder: S. 302, IPC – Imprisonment for life, and also fine.

Punishment for culpable homicide: S. 304, IPC – Imprisonment for life, or for a term which may extend to 10 years and also fine.

Causing death by negligence: S. 304 – A, IPC – Imprisonment for a term, extend to 2 years

or/with fine, or with both.

### **Grievous Injury**

According to 320 I.P.C., anyone of the following injuries is grievous:

1. Emasculation (Loss of potency).
2. Permanent privation (loss) of sight of either eye.
3. Permanent privation of hearing of either ear.
4. Privation of any member or joint.
5. Destruction or permanent impairing of the power of a member or joints
6. Permanent disfiguration of the head and face.
7. Fracture or dislocation of a bone or tooth.
8. Any hurt which endangers life or, which causes the victim to be in the severe bodily pain or, unable, to follow his ordinary pursuits for a period of 20 days.

**Hurt means** bodily pain, disease or infirmity caused to any person (S. 319, IPC)

Punishment for voluntarily causing hurt: Imprisonment up to one year, or with fine up to one thousand rupees or both (S. 323, IPC)

Injury is any harm whatever illegally caused to any person in body, mind, reputation or property (S. 44, IPC)

Punishment for voluntarily causing grievous hurt: Imprisonment for a term extending to seven years and also fine (S. 325, IPC)

Punishment for voluntarily causing grievous hurt by dangerous weapons or means: Imprisonment for a term up to 10 years and also fine (S. 326, IPC)

**Dangerous weapons or means:** According to Sec. 324 and 326, IPC, dangerous weapons or means include any instrument for shooting, stabbing or cutting or any instrument, which used as a weapon of offence, is likely to cause death; fire or any heated substance; poison or any corrosive substance; explosive substance or any substance which are harmful to human body to inhale, to swallow, or to receive in to the blood or by means of any animal.

**Voluntarily causing hurt by dangerous means:** Imprisonment for a term up to 3 years or with fine, or both (S. 324, IPC)

**Assault** is an offer or threat or attempt to apply force to body or another in a hostile manner (S. 351, IPC)

### **Dowry death**

Sec. 304 B, I.P.C., where death of the women occurs under abnormal circumstances within seven years of her marriage. Punishment: imprisonment not less than 7 years, but may extend to life imprisonment. Sec. 498-A, IPC "Whoever, being the husband or relatives of the husband of a woman, subjects such women to cruelty shall be punished with imprisonment up to 3 years".

**Causes of death from wounds:** (1) Immediate or direct (2) Remote or indirect

(1) Immediate causes: (a) hemorrhage (b) reflex vagal inhibition (c) shock (d) mechanical injury to a vital organ

(2) Remote causes: (a) infection (b) gangrene or necrosis (c) crush syndrome (d) neglect of injured person (e) surgical operation (f) natural disease (g) supervention of disease from a traumatic lesion (h) thrombosis (i) fat embolism (j) air embolism.

Causes of fat embolism: (1) Fracture of a long bone (2) an injury to adipose tissue which forces liquid fat into the damaged blood vessels, (3) injecting oil into circulation, e.g., in criminal abortion (4) occasionally due to natural disease without trauma as in sickle cell anaemia (5) in case of burns.

## **FIRE-ARM INJURIES**

**A firearm** is any instrument which discharges a projectile by the expansive force of the gases produced by burning of an explosive substance. Forensic ballistics is the science dealing with the investigation of firearms, ammunition and the problem arising from their use.

### **Classification:**

(I) Rifled weapons: (1) Rifles: (a) Air and gas-operated rifles (b) 0.22 rifles (c) Military and sporting rifles (2) Single-shot target practice pistols (3) Revolvers (4) Automatic pistols (5) True automatic weapons (machine guns)

(II) Smooth-bored weapons (shotgun) (1) Single barrel (2) Double barrel (3) Slide action (4) Bolt – action (5) Semi-automatic (6) Automatic.

**Choking** is a constricting device at the muzzle end of shot gun.

Muzzle-loading guns are loaded entirely from muzzle end with the help of a rod using gunpowder, pieces of cloth, stones, metal fragments, seeds, bolts, wood, screws, etc. When the entire barrel from breech to the muzzle end is of same diameter, it is called cylinder-bore. In choke-bore, the distal 7.5 to 10 cm. of the barrel is narrow. There are some shotguns which have small portion of their bore near the muzzle end rifled, which are called "paradox guns". A musket is a military shoulder arm. It has a long fore-stock and usually takes a bayonet at the muzzle. Shot guns are effective up to 30 metres (30-40 yards). 12 bore gun means that a sphere of 1/12 pound of lead will exactly fit the bore of the gun. Markings in projectile occur in Rifle.

### **Rifle:**

A Rifle is a gun with a long barrel, the bore of which is rifled. A Carbine is a short barrelled rifle or a musket. It is effective upto 300 metres. The military rifle has a magazine and bolt action and can kill at a range of 3,000 metres. The pressure in the firing chamber is about 20 tonnes per square inch. The bullet as it leaves the barrel rotates at about 3,000 revolutions per second. Rifles may be single-shot, repeating, semi-automatic and automatic.

### **Revolver:**

Revolvers are so called because the cartridges are put in chambers in a metal cylinder, which revolves or rotates before each shot, to bring the next cartridge opposite the barrel, ready to be fired. It has a cylindrical magazine situated at the back of the barrel, which is capable of revolving motion. The bores vary from 5.6 to 11.4 mm (0.22 to 0.45 inch). The muzzle velocity is 150 to 180 metres per second. The effective range is 100 metres.

### **Air rifle and Air pistol**

In these compressed air is used to fire lead slugs. Their range is about 40 metres. Cartridge: is used in shot gun. Detonator cap is situated at the base of the rim. Soiling in a gun shot wound is due to lead content, more marked in distant shot gun wound. Ring of grease occurs at a distance beyond 2 feet.

### **Powders**

1. Black gun powder—It consists of potassium nitrate 75%, sulphur 10% and charcoal 15%. Except— Lead peroxide.

2. Smokeless: it consists of nitrocellulose (single base) or, nitroglycerine and nitrocellulose (double base) powder which produces much less flame and smoke and are more completely burnt than black powder.

**Bullets:**

The traditional bullet is made of soft metal and has a round nose. This is known as the round-nose soft bullet, and is usually used in rifles and revolvers. In revolver and pistol, the bullet is short and the point usually round or ogival. In rifle, the bullet is elongated with pointed end. Rifle bullet weight ranges from 2 to 33 grams. The extent of muscle damage by a bullet depends primarily on the velocity.

**A dum dum bullet**, so called because tip is chiselled out, is one which fragments extensively upon striking and produces extensive wounds with ragged margins.

**Incendiary bullets** contain phosphorus. Gun shot wound is a perforated wound. Glance bullet causes gutter fracture. In case of shot by bullet, the presence of singeing (of hair) and charring (of skin) indicates a distance up to 6 inches.

**Near wound** caused by fire-arms is characterised by— (i) **Tattooing** by unburnt powder, (ii) Presence of grease collar and abrasion collar, (iii) Presence of carbon monoxide in the blood of the injured tissues in the track of the bullet.

Bevelling of the skull in bullet injury:

(i) At broad end of the entry point, inner table shows bevelling, (ii) At exit point of bullet, outer table shows bevelling.

**In close shot**, the victim is within the range of the frame i.e. few feet.

The term point blank is used when the range is very close to or in contact with the surface of the skin. Blasting effect is usually seen.

The entrance wound is circular, with inverted edges and is surrounded by blackened and singed area. Abraded collar and grease or, dirt collar are present in gun shot entrance injury. Some contusion is present in abraded collar, called contusion collar. The abrasion collar and contusion collar are proof of an entrance wound.

**Skull**—In the skull, the wound of entrance shows a punched hole in the outer table. Opening in the inner table is large and shows beveling (sloping). At the point of exit, a punched-out opening is produced in the inner table and beveled opening on the outer table. Greater damage is produced by Dumdum bullet, larger bullet and round bullet.

**A bullet traveling** in an irregular fashion instead of traveling nose-on is called a yawning bullet. A bullet that rotates end-on-end during its motion is called a tumbling bullet.

**Ricochet bullet** is one which before striking the object aimed at, strikes some intervening object first, and then after ricocheting and rebounding from these, hits the object.

**Tandem bullet** or piggyback bullet (one behind the other).

**Souvenir bullets:** if a bullet is present for a long time in the body, there will be no fresh bleeding in the surrounding area.

## THERMAL DEATH

**Cold:**

Trench foot and Immersion foot are the result of prolonged exposure to severe cold (5 to 8°C) and dampness. The term Immersion foot is used for cases with frost bite. In frost bite, skin becomes hard & black in about 2 weeks. Frost bite occurs due to exposure to extremes of cold (- 2.5°C).

**Heat:**

1. **Heat cramps** (miner's cramps or, fireman's cramps): They are caused by rapid dehydration of body through the loss of water and salt in the sweat.
2. **Heat hyperpyrexia** or Heat stroke: The term thermic fever or sunstroke is used when there has been direct exposure to the sun. High temperature, increased humidity, minor infections, muscular activity, and lack of acclimatisation are the principal factors of the initiation. Failure of cutaneous blood flow and sweating leads to breakdown of heat regulating centre of hypothalamus.

**C/F:** In some cases, symptoms are headache, giddiness, nausea, vomiting, weakness, staggering gait, mental confusion, muscle cramps, restlessness and excessive thirst occur. The skin is dry, hot and flushed with complete absence of sweating.

3. **Heat prostration** (heat exhaustion and heat syncope): Heat prostration is a condition of collapse without increase in body temperature, which follows exposure to excessive heat. Main cause of death is vascular collapse and syncope. Muscle cramp is due to loss of Na<sup>+</sup> ion.

**BURNS**

A burn is an injury which is caused by application of heat or chemical substances to the external or internal surfaces of the body.

**Burns due to X-rays and radium** vary from redness of the skin to dermatitis, with shedding of hair (epilation) and pigmentation of surrounding skin. Curling ulcer is seen in burn patient.

**Degrees of Burns**

Dupuytren recognised six degrees of burns but they were merged into three groups by Wilson.

1. **Epidermal** (First and Second degree Dupuytren): Usually a blister (vesicle or bulla) is formed which is covered by white, avascular epidermis, bordered by red, hyperaemic skin. These burns are very painful. Repair is complete without scar formation.
2. **Dermo-epidermal** (Third and Fourth degree Dupuytren): Whole thickness of skin is destroyed. Skin and subcutaneous tissue is affected. In Dermo-epidermal, pain and shock are greater than in first degree burns (most painful).
3. **Deep** (Fifth and Sixth degree Dupuytren): In this, there is gross destruction not only of the skin and subcutaneous tissue but also of muscles and even bone. Nerve endings are also destroyed and as such, the burns are relatively painless.

**The extent of the surface**

The estimation of the surface area of the body involved is worked out by the 'rule of nine' by Wallace.

- 9% for head and each upper limb,
- 9% for front of each lower limb,
- 9% for back of each lower limb,
- 9% for front of chest,
- 9% for back of chest,
- 9% for front of abdomen,
- 9% for back of abdomen i.e. 99% of the body.

Remaining 1% for external genitalia.

Involvement of 50% of burn proves fatal, even of first degree.

### Causes of death in burns

- (i) Primary (neurogenic) shock due to pain,
- (ii) More, than half of deaths from burns occur from secondary shock due to fluid loss from burnt surface.
- (iii) Toxaemia.
- (iv) Sepsis —> It is late cause of death due to burn.
- (v) Acute renal failure,
- (vi) Pyemia.
- (vii) Suffocation.

**Flash burns** refer to thermal burns due to sudden exposure to flame.

Presence of **carbon particles** in trachea and an elevated CO saturation together are absolute proof that the victim was alive when fire occurred. The exudate begins to dry in 12-24 hrs. from dry brown crust within 2-3 days; pus may form under slough in 36 to 72 hours; slough falls off in 4 to 6 days.

**Pugilistic attitude** (boxing, fencing, or defence attitude)

Pugilistic attitude is due to heat stiffening, seen both in AM and PM burns. This stiffening is due to coagulation of protein albumin of the muscles which causes contraction. Heat stiffening is due to exposure of the body to temperature above 75°C. Pugilistic attitude is seen in those dying due to burns, and sudden immersion in boiling liquid. In heat stiffening, body assumes a posture of generalised flexion.

### Scalds:

A scald is an injury which is caused by application of liquid above 60°C or from steam.

**Electrical injuries:** The electric mark (Joule burn) is specific and diagnostic of electrical burn. Joule burn is both exogenous and endogenous burn. High tension electric currents may produce multiple burns or punched out lesions due to arcing from conductor to the body without contact, which present crocodile flash burns. Crocodile flash burn is due to high voltage flash burn. Most common cause of death in electrocution is ventricular fibrillation.

Death may occur from paralysis of medullary (respiratory centre) or from ventricular fibrillation and cardiac arrest.

### Lightning stroke

A flash of lightning is due to an electrical discharge from a cloud to the earth. The burns may be Arborescent or Filigree burns (Lichtenberg's flowers). **Arborescent** burns are superficial, irregular, thin, resembling the branches of a tree.

### STARVATION

In acute starvation, there is a feeling of hunger for the first 30 to 48 hours, followed by pain in the epigastrium which is relieved by pressure. After 4 to 5 days of starvation, general emaciation and absorption of the subcutaneous fat begins to occur. The tongue is coated and dirty and thirst is intolerable. Usually the loss of 40% of body weight is fatal. The intellect remains clear till death. Death occurs from exhaustion, circulatory failure due to brown atrophy of the heart, or intercurrent infection. Ammonia in brain is detoxified into Glutamine. During starvation the substance which heart uses as energy source is acetoacetate. If starvation exceeds 7 days then the major nutritional supply of brain comes from ketone-bodies. Absorption of Vit. B12 occurs in ileum.

The **changes in starvation** seen are Hypoglycemia, Hyper-triglyceremia and Ketoacidosis. (except—Hyper cholesterolemia). Iron absorption is decreased by phosphates, phytates, oxalates (except—ascorbic acid).

**Fatal period:** If both water and food are completely stopped, death occurs in 10 to 12 days.

If food alone is stopped, death occurs in 6-8 weeks or even.

On P-M examination, the heart is small (from brown atrophy), and chambers are empty. The gall bladder is distended with bile.

## **MECHANICAL ASPHYXIA**

Asphyxial deaths:

1. Suffocation—Mechanical obstruction to airways other than by hanging, strangulation and throttling. MC cause is inhalation of irritant gas.
2. Smothering—Closing the external respiratory orifice by hand or by other means.
3. Gagging—Closing mouth and nose with cloth etc. and tying around head or stuffing it into mouth.

### **Hanging:**

Hanging is that form of asphyxia which is caused suspension of the body by a ligature, which encircles the neck, the constricting force being the weight of the body.

**In partial hanging**, the bodies are partially suspended; the weight of the head (5-6 kg) acts as the constricting force.

**Typical hanging:** In typical hanging, the ligature runs from the midline above the thyroid cartilage symmetrically upward on both sides of neck to the occipital region.

### **Causes of Death:**

1. Asphyxia: A tension of 15 kg on ligature blocks the trachea.
2. Venous congestion: The jugular vein is closed by a tension in the rope of 2 kg.
3. Combined asphyxia and venous congestion: this is the commonest cause.
4. Cerebral anemia: A tension of 4 to 5 kg on ligature blocks carotid arteries, and 20 kg blocks the vertebral arteries.
5. Reflex vagal inhibition from pressure on the vagal sheath or carotid bodies.
6. Fracture or dislocation of the cervical vertebrae.

Fatal period: The usual period is 3 to 5 minutes.

### **Post-mortem appearance:**

The ligature mark in the neck is the most important and specific sign of death from hanging. The ligature mark is situated above the level of thyroid cartilage between the larynx and the chin in 80 percent cases. In partial hanging, the feet touch the ground. Le facie sympathique (if the ligature knot presses on cervical sympathetic, the eye on the same side may remain open and its pupils dilated) is seen in ante-mortem hanging. The eyes are frequently protruded and firmer and the conjunctiva congested, the pupils are usually dilated. Saliva may be found dribbling from the angle of the mouth (due to stimulation of the salivary glands by the ligature). Seminal emission is common. In rare cases (5 to 10%), the intima of the carotid arteries show transverse split. Hyoid bone is fractured in 15 to 20% cases. Are seen in persons above 40 years; involves the great horn at junction of the inner two-thirds and outer one-third.

**Judicial hanging:** Justifiable homicide is judicial hanging and death of a suspected criminal while executing arrest. Legal death sentence is carried out by hanging the criminal. The cause of death in judicial hanging is fracture dislocation at the level of second and third or third and fourth cervical vertebra.

Lynching is a type of homicidal death by hanging by large group of people.

### **Strangulation:**

Strangulation is that form of asphyxia, which is caused from constriction of the neck by a ligature without suspending the body.

It is of two types: (1) Strangulation by ligature, and (2) manual strangulation or throttling. Cause of death: Death may be due to (1) asphyxia, (2) cerebral anoxia or venous congestion (3) combined asphyxia and venous congestion, and (5) rarely fracture – dislocation of cervical vertebrae.

The mark in strangulation completely encircles the neck transversely. Classical signs of asphyxia are seen in about 50% of victims.

Doing a post-mortem on a suspected case of strangulation in situ examination of neck structures is done after opening the skull and the chest, to allow blood to drain from the neck blood vessels. Most important sign of strangulation is ligature mark. Hyoid bone may be fractured in older persons in 10 to 15% cases.

**The common methods of homicidal strangulation** are: (1) Strangulation by ligature, (2) Throttling, (3) Bandedola, (4) Garroting, and (5) Mugging

**Mugging** is homicidal strangulation caused by holding the neck of the victim in the bend of the elbow.

**Bandedola** is a type of homicidal strangulation caused with sticks.

**Garroting** is type of homicidal strangulation caused by twisting a lever like tourniquet.

#### **(Signs of Strangulation) Signs of Asphyxia:**

Intense maximum congestion and deep cyanosis of the head and neck is seen in strangulation. The eyes are wide open and pupils dilated. The tongue is swollen and protruded. Petechial hemorrhages are common in to the skin of the eyelids, face, forehead, behind the ears and scalp. Blood stained froth may escape from the mouth and nostrils and there may be bleeding from nose and ears. There is severe congestion and hemorrhage into the subcutaneous tissue in and above the area compressed. The intima of the carotid artery are not usually damaged. Injury of hyoid bone is not common in strangulation because the level of constriction is below the bone. Fracture of the thyroid cartilage is more common. Pulmonary oedema may be present.

#### **Throttling**

Throttling is manual strangulation. Fracture of the hyoid bone in 30-50% cases. Fracture of the thyroid cartilage and hyoid bone are usually found in above 40 years. Hyoid bone fracture does not occur in choking. It is always homicidal.

**Hyoid bone** fractures can be classified in to three groups: (1) Inward compression fractures, (2) Antero-posterior compression fractures, (3) Avulsion fractures.

**Inward compression fracture** is seen in throttling, where the main force is an inward compression acting on the hyoid bone. Antero-posterior compression fractures is seen in case of hanging, the hyoid bone is forced directly backwards, due to which the divergence of greater horns is increased which may fracture with outward displacement of the posterior small fragment. Avulsion fractures occur due to muscular over-activity, without there being direct injury to the hyoid bone. They are also called "tug" or "traction" fractures.

#### **Suffocation:**

Suffocation is a general term to indicate that form of asphyxia, which is caused by deprivation of oxygen, either due to lack of oxygen in the environment or from obstruction of the air-passages.

#### **Smothering:**

Smothering is a form of asphyxia which is caused by closing the external respiratory orifices either by the hand or by any other means, or blocking up the cavities of the nose and mouth by the introduction of a foreign substance, such as mud, paper, cloth, etc.

**Gagging:** is a form of asphyxia which results from forcing a cloth into the mouth, or the closure of mouth and nose by a cloth or similar material, which is tied around the neck.

**Overlaying:** It is a type of smothering. Overlaying or Compression suffocation results due to compression of the chest, so as to prevent breathing. Overlaying by mother is common in European countries. The usual findings are those of asphyxia.

**Burking:** It is a method of homicidal smothering and traumatic asphyxia.

### **Homicidal choking**

In choking, there is obstruction within airways. It is very rare and is practicable only when the victim is an infant or suffering from disability or, disease or, under the influence of alcohol.

### **Cafe Coronary:**

This is a condition in which a healthy but grossly intoxicated person, who begins a meal, suddenly turns blue, coughs violently, then collapse and dies due to asphyxia. Death appears to be due to sudden heart attack. A blow on the back or on the sternum may cause coughing and expel the foreign body.

### **Traumatic Asphyxia**

Traumatic asphyxia results from respiratory arrest due to mechanical fixation of the chest, so that the normal movement of the chest wall is prevented. Common cause is crushing by falls of earth in a coal mine or during tunneling or in a building collapse. An intense cyanosis of deep purple or purple-red colour of the head, neck and upper chest, above the level of compression is the prominent feature.

### **Sexual Asphyxia**

Partial asphyxia causes cerebral disturbance with feeling of sexual gratification. These cases are associated with some form of abnormal sexual behavior, usually masochism and transvestism.

### **Drowning**

Drowning is a form of asphyxia due to aspiration of fluid into air-passages, caused by submersion in water or other fluid. Commonest type of drowning is accidental.

**In immersion syndrome,** death occurs by vagal inhibition and cardiac arrest. Cold water drowning causes immersion syndrome. In secondary drowning, death occurs in half an hour to two days after resuscitation due to secondary changes in lungs. In secondary drowning, sign of asphyxia absent. Victim of drowning in a state of suspended animation can be revived in as long as 10-20 minutes. The extent and direction of the exchange through the alveolar lining depends on the difference between osmotic pressure of the blood and the water.

The drowning in **fresh water**, water passes rapidly from the lungs to the blood, leading to hemolysis and dilution of the blood with an abrupt increase in blood volume. Fresh water alters or denatures the protective surfactant which lines the alveolar wall. When water is inhaled, vagal reflexes cause increased peripheral airway resistance with pulmonary vasoconstriction, development of pulmonary hypertension, decreased lung compliance and fall of

ventilation perfusion ratios. The concentration of serum electrolytes (sodium and calcium) decreases, serum potassium increases. The heart is subjected to hypoxia, overfilling, sodium deficit and potassium excess. Cardiac arrhythmias leading to ventricular tachycardia and fibrillation occur, probably due to hypoxia and hemodilution. Hemodilution leads to hemolysis, haemoglobinemia, and haemoglobinuria, marked hyponatraemia and hyperkalaemia. The potassium and chloride content of the left side of the heart is decreased.

**Drowning in Sea water** — Due to high salinity of sea water (usually over 3% NaCl), water is drawn from the blood into the lung tissue, and produces severe pulmonary oedema and hypernatraemia and increase in magnesium ion. This causes haemoconcentration. In sea water drowning, chloride content of the left side of the heart is higher (as is Mg concentration).

**Causes of Death:** (1) Asphyxia, (2) Ventricular fibrillation (3) Laryngeal spasm (4) Vagal inhibition (5) Exhaustion (6) Injuries.

**Fatal period:** Death usually occurs in 4 to 8 minutes of complete submersion. Hyper-ventilation before drowning can cause death.

**Post-mortem appearance:**

Gettler's test is used in drowning. Gettler's test is based on the biochemical changes in blood in a case of typical drowning. Gettler devised, a test to estimate the chloride content of blood from both sides of the heart. A difference of 25 percent in chloride content is considered significant.

— Limitations of Gettler's test:

1. There is progressive loss of chloride from blood after death. To be maximal value therefore the test has to be made within a reasonably short time after death.
2. Has no value in atypical drowning.
3. Has no value in congenital cardiac defects such as shunts & patent foramen ovale where admixture of blood freely occurs between two sides of the heart.
4. Has no value if drowning medium and blood contain the same amount of chloride.

**In homicidal drowning,** multiple injuries may or may not be present. Chloride estimation is not of any help after 12 hours. Absence of foam in drowning can be found in death due to laryngeal spasm and immersion syndrome.

**Regurgitation of gastric contents** into the larynx and trachea in cases of drowning is due to vomit reflex due to medullary hypoxia. Cutis-anserina is seen in drowning. Cutis-anserina proves that molecular death present at the time of drowning. Wrinkling of limbs indicate that body was in water. Most important evidence for drowning is water in lungs and stomach. In drowning in unconscious state, there is no ballooning of lungs. Water can be absent in stomach in cases of drowning due to sudden death due to vagal inhibition. Presence of water in stomach in case of drowning is found in 70% cases. Deep inspiration above the water level and air pockets in clothing may cause early floatation of the body. Post-mortem staining is usually found on the face, the upper part of chest, hands, lower arms, and feet. The colour of PM stain is light-pink due to oxygenation, but in some cases it is dusky and cyanotic. Petechial hemorrhages are seen in subpleural tissues of lungs.

**A fine white leathery froth** is seen at mouth and nostrils, most characteristic external sign of drowning. The inhalation of water irritates the mucous membrane of air passages; mucous gland produces large quantity of tenacious mucous. Froth without mucous is seen in

death due to strangulation, acute pulmonary oedema, electrical shock, during an epileptic fit, in opium poisoning and putrefaction.

**Cutis anserina** (goose skin or. goose flesh) in which the skin has granular and puckered appearance may be seen. Weeds, grass, sticks, leaves etc. floating in water may be firmly grasped in the hands due to cadaveric spasm. It indicates antemortem drowning. Bleaching of the cuticle becomes quite evident after 12 hours of immersion. The skin becomes sodden, thickened, wrinkled and white in colour, known as "Washer-women's" hands, within 12-18 hours.

**Wet drowning** is due to entry of water into lungs. In wet drowning, lungs are overdistended and alveolar walls are torn. On section, an oedematous condition is seen. This has been described as "emphysema aquosum".

**In dry drowning**, death occurs due to laryngeal spasm. There is no water entry into lungs. The alveolar walls may rupture due to increased pressure during forced expiration and produce sub-pleural haemorrhage known as 'Paltauf's haemorrhages'. They are shining, pale bluish – red, and may be minute or 3 – 5 cm in diameter. Usually present in the lower lobes.

The stomach contains water in 70% of cases. The small intestine may contain water in 20% cases. This sign is regarded as positive evidence of death by drowning as it depends on peristaltic movement which is a vital act. Haemorrhages are found in middle ear and temporal bone. Temporal bone haemorrhages are also seen in deaths due to hanging, head injury and CO poisoning.

**Diatoms:** Presence of diatoms in tissue is a sign of ante-mortem drowning. Diatoms are microscopic, unicellular, silica coated algae. The bone marrow of long bones such as femur, tibia, and humerus or sternum is examined for diatoms. Diatoms are examined by acid digestion technique.

## **Diagnosis**

The reliable signs of drowning at autopsy are:

1. Antemortem drowning is best demonstrated by fine, white froth at the mouth and nose.
2. The presence of weeds, stones etc. grasped in hand, shows ante-mortem drowning.
3. The presence of fine froth at lungs and air passages.
4. The voluminous water-loaded lungs.
5. The presence of water in stomach and intestine.
6. Finding of diatoms in the tissues.

The above signs are not found if death occurs due to vagal-inhibition. In dry – drowning, the PM appearances are those of asphyxia.

The body floats in about 12 to 18 hours in summer and 18 to 36 hours in winter in India.

## **SEXUAL OFFENCES**

### **Abnormal Sexual Perversions**

1. Necrophagia—Necros = corpse; phagia = to eat.
2. Masochism—Opposite to sadism. Derived from the name of Leopold von Sacher-masoch, an Austrian novelist. Being whipped by his wife used to be a stimulant for his literary work.
3. Necrophilia—Sexual intercourse with dead body.
4. Fetichism—Sexual satisfaction by contact with articles of opposite sex.
5. Voyeurism (Soptophilia)—Peeping Tom. It is sexual enjoyment from watching.

6. Frotteurism—Contact with other persons to obtain sexual gratification.
7. Undinism—Sexual pleasure by witnessing the act of Urination.
8. Transvestism—Trans = opposite, Vesta = clothing or Eonism. The term is derived from the name of Chevalier d' Eon Beamont, a Frenchman. It is usually found in the males who derive sexual pleasure by wearing female dress.
9. Satyriasis—Incessant sexual desire.
10. Priapism—Painful penile erection in absence of sexual desire.
11. The combining of Sadism and Masochism is called bondage.
12. Pyromania — Sexual stimulation while seeing flames or, destruction of buildings.

### **Classification of Sexual Offences**

I. Natural offences (1) Rape (2) Incest

II. Unnatural offences (1) Sodomy (2) Tribadism (3) Bestiality (4) Buccal coitus.

III. Sexual perversions: (1) Sadism (2) Masochism (3) Necrophilia (4) Fetichism (5) Transvestism (6) Exhibitionism (7) Masturbation (8) Voyeurism (9) Frotteurism (10) Undinism, etc.

### **Rape (S. 375, IPC)**

A man is said to commit rape, if he has sexual intercourse with a woman:

1. against her will,
2. without her consent,
3. with her consent, when her consent has been obtained by putting her or any person whom she is interested in fear of death, or of hurt,
4. with her consent, when the man knows that he is not her husband and that she has given consent because she believes that he is another man to whom she is lawfully married.
5. with her consent, when at the time of giving such consent, by reason of unsoundness of mind or intoxication or the administration of any stupefying substance, she is unable to understand the nature and consequences of that to which she gives consent,
6. with or without her consent when she is under 16 years of age;

**Exception:**— sexual intercourse by a man with his own wife is not rape, if she is above 15 years of age (Sec 375 IPC).

**Rape offence** is punishable under Sec- 376 IPC.

(1) Whoever commits rape shall be punished with imprisonment for a term of not less than 7 years, but which may be for life or ten years and also fine. If the woman raped is his own wife and is not under 12 years, the imprisonment may extend to 2 years or fine or with both.

(2) Whoever, (a) being a police officer commits rape, within the limits of his jurisdiction, in the premises of any station house, or on a woman in his custody, (b) being a public servant takes advantage of his official position and commits rape on a woman in his custody, (c) being on the management or the staff of a jail, remand home, etc., commits rape on any inmate, (d) being on the management of a staff of a hospital commits rape on a woman of that hospital, (e) commits rape on a woman knowing her to be pregnant, (f) commits rape on a woman below 12 years, or (g) commits gang rape, shall be punished with rigorous imprisonment of not less than 10 years or life imprisonment and also fine.

A woman of 16 years and above can give valid consent for sexual intercourse. The slightest penetration of the penis within the vulva, with or, without emission of semen or rupture of hymen constitutes rape. Rape can be committed even when there is inability to produce erection of penis. Under the law, rape can only be committed by a man and a woman cannot rape a man, although she may be guilty of an indecent assault upon him. In India, there is no age limit under which a boy is considered physically incapable of committing rape. Medical proof of intercourse is not legal proof of rape. Rape is a cognizable offence. False rape is called simulated rape.

**Incest:** Incest is a sexual intercourse by a man with a woman, who is closely related to him by blood e.g. a daughter, grand daughter, sister, stepsister, aunt and mother. In India, incest as such is not an offence.

**Paraphilias:** Abnormal and unorthodox sex play by using unusual objects or parts of the body are known as paraphilia.

### **Unnatural Offences**

Voluntary sexual intercourse against the order of nature with any man or woman or animal is an unnatural sex offence (S. 377, IPC). These offences are punishable with imprisonment for life or up to 10 years and also with fine.

**Homosexuality** means persistent emotional and physical attraction to members of same sex.

**Sodomy** is anal intercourse between two males or, between a male and female. It is also called **buggery**. It is called gerontophilia when the active agent is an adult and paederasty, when the passive agent is a young boy, who is known as catamite.

A **paedophile** is an adult who repeatedly engages in sexual activities with children below the age of puberty. The consent of sodomy is of no value, as both partners are punishable.

**Buccal coitus** (coitus per os or sin of Gommorrah): The male organ is introduced into mouth, usually of a young child.

1. Male prostitutes are called—Eunuchs.
2. Castrated Eunuchs—Hijrahs.
3. Eunuchs with intact genitalia—Zenana.

**Tribadism:** Female homosexuality is known tribadism or lesbianism. Sexual gratification of a woman is obtained by another woman by simple lip kissing, generalised body contact, deep kissing, manual manipulation of breast and genitalia, genital apposition, friction of external genital organs etc. In some cases, enlarged clitoris is used as an organ of passion or some artificial penis or phallus may be used. Many lesbians are masculine in type, possibly because of endocrine disturbances. The practice is usually indulged in by women who are mental degenerates or who suffer from nymphomania (excessive sexual desire). Lesbians who are jealous of one another, when rejected may commit homicide, suicide or

both.

**Bestiality:** Bestiality is sexual intercourse by a human being with a lower animal. Dogs and cats are common animals for female. Usually the animal manipulates the genitalia with its mouth and the actual coitus is very rare.

**Sexual Perversions:** Sexual perversions are persistently indulged sexual acts in which complete satisfaction is sought and obtained without sexual intercourse.

1. Uranism—Perversion of sexual instinct.

2. Sadism—In sadism, sexual gratification is obtained or increased from acts of physical cruelty or causing of pain upon one's partner. The term is derived from the name of a French nobleman, the Marquis de Sade, infamous for his crimes and writings. Many of his stories were about sexuality, cruelty, and torture.

3. Lust murder—In extreme cases of sadism, murder serves as a stimulus for sexual act and becomes equal to coitus.

4. Sexual oralism—It is the obtaining of sexual pleasure from the application of the mouth to the sexual organs.

—Sin of Gomorrhah —> Buccal coitus, coitus per os.

—Felatio —> is the oral stimulation or manipulation of the penis either by the female or male.

— Cunnilingus is the oral stimulation of the female genitalia.

5. **Masturbation** (Onanism, ipsation)—Masturbation is the deliberate self stimulation, which effects sexual arousal. In females, a finger is gently and rhythmically moved over clitoris or labia minora or steady pressure is applied over these parts with several fingers or whole hand. Masturbation is an offence when practiced openly e.g. in telephone booth, lavatories etc.

6. **Exhibitionism:** It is a willful and intentional exposure of the genitalia in a public place while in the presence of others, to obtain sexual pleasure. This is punishable under Sec 294 IPC with imprisonment up to 3 months or fine.

7. **Indecent Assault:** Indecent assault is an offence committed on a female, with the intention or knowledge to outrage her modesty.

— This includes: Kissing of any part of female body, Pressing the breasts or private parts, Touching private parts or- thereabout including thighs, Exposing her genital parts or breasts,

**A medical practitioner can be accused of indecent assault if he examines a female patient by stripping her clothes without her consent and even with her consent in the absence of a female attendant (viz. nurse).** Such assaults are punishable under Sec 354 IPC up to 2 years imprisonment and/or fine.

## **SEMINAL FLUID**

Seminal stains have to be detected in cases of rape or attempted rape, sexual murder of the female, sodomy and bestiality. Fertility of fluid has to be proved in disputed paternity.

Chemical Examination:

(a) Florence test: It is the best test for seminal stains. The stain is extracted by 1%

hydrochloric acid and a drop is placed on a glass slide. A drop of florence solution (potassium iodide, iodine and water) is allowed to run under the cover slip. If semen is present, dark-brown crystals of choline iodide appears immediately. They are rhombic crystals resembling haemin. The test is not proof of seminal fluid, but only of presence of some vegetable or animal substance.

(b) Barberio's test: A saturated aqueous or alcoholic solution of picric acid when added to spermatic fluids produces yellow needle-shaped rhombic crystals of spermine picrate. In Barberio's test, presence of spermine in semen is detected.

(c) The Acid phosphatase test: The prostatic secretion element of seminal fluid contains very much higher percentage of acid phosphatase. This test is conclusive in the absence of demonstrable sperms or in aspermia.

(d) Creatine phosphokinase: Serological typing of the semen is possible by precipitin method.

(e) Ammonium molybdate test: for semen stains.

### **IMPOTENCE AND STERILITY**

**Impotence** is the inability of a person to perform sexual intercourse.

**Sterility** is the inability of the male to beget children, and in the female, the inability to conceive children.

**Frigidity** is the inability to start or maintain the sexual arousal pattern in the female.

Impotence may be pleaded as a ground for all - Divorce, Adultery, Unnatural sexual offence except rape.

#### **The question of impotence and sterility may arise in:**

(A) Civil— (i) nullity of marriage (ii) divorce (S.12, Hindu Marriage Act, 1955; S.24, Special Marriage Act, 1954) (iii) adultery (iv) disputed paternity and legitimacy (v) suits of adoption (vi) claim for damages where loss of the sexual function is claimed as the result of an assault or accident

(B) Criminal— (i) adultery (ii) rape (iii) unnatural offences.

Men with primary impotence associates sex with dirtiness and sinfulness. Systemic disease which is most frequently associated with secondary impotence is Diabetes mellitus.

Psychogenic or fear of impotence or, fear of inability complete the act are most common causes of temporary impotence.

Impotent quoad is an individual who may be impotent any particular woman (quoad = as regards) but not with others. Vaginismus is involuntary spasm of perineal muscle so that sexual intercourse is not possible. Treatment is psychotherapy. After vasectomy, the person should be advised to abstain from sexual intercourse for about 3 months. A battered child is one who has received injuries as a result of non-accidental violence produced by a parent or guardian.

Sudden infant death syndrome (SIDS or Cot death)—The commonly accepted hypothesis suggests that some infants have prolonged sleep apnoea, which makes them susceptible to hypoxia, which leads to bradycardia and cardiac arrest.

### **ARTIFICIAL INSEMINATION:**

It is artificial introduction of semen into the vagina cervix or uterus to produce pregnancy.

One ml. of semen is deposited by means of syringe in or near the cervix.

Indications:

- (i) When the husband is impotent (not an indication for A.I.D).
- (ii) When the husband is unable to deposit the semen in vagina due to hypospadias.
- (iii) When the husband is sterile.
- (iv) When there is Rh-incompatibility between husband and wife,
- (v) When husband is suffering from hereditary disease such as colour blindness, sickle cell disease.

#### **Legal problems of Artificial Insemination Donor:**

1. Adultery—Donor and recipient cannot be held guilty of adultery in India, as Sec. 497 IPC requires sexual intercourse as necessary part of adultery.
2. Legitimacy—such a child is illegitimate and cannot inherit property.
3. Nullity of marriage and divorce—Artificial insemination is not a ground for nullity of marriage or divorce. However, if A.I is due to impotence, it is a ground. If A.I is done without the consent of the husband, he can sue his wife for divorce and the doctor for damages.
4. Natural birth: if a child is born naturally sometime after a child born by A.I, the status of the child born after A.I remains illegitimate unless it is adopted, and the status of the natural born child remains legitimate.

#### **Test tube baby (IVF):**

The ovum is removed from the ovary of the woman and is fertilised outside the body. At the stage of blastocyst, the embryo is returned to the uterus, which gets implanted in the endometrium.

#### **Surrogate birth:**

Artificial insemination with the semen of the barren woman's husband is carried out in a hired woman.

#### **VIRGINITY**

A virgin (virgo intacta) is a female who has not experienced sexual intercourse. Defloration means loss of virginity. The question of virginity arises in case of (1) nullity of marriage, (2) divorce, (3) defamation, and (4) rape.

#### **Signs of virginity:**

A. Genital findings:

- (i) Labia majora — firm, elastic and rounded and lies in close contact with each other even in full abduction of the thighs
- (ii) Labia minora — soft and elastic, small and pinkish colour. They lie in close contact and are not visible being under the labia majora.
- (iii) Clitoris — not enlarged,
- (iv) Vestibule — narrow,
- (v) Hymen — intact.
- (vi) Vagina — narrow and tight with rugosed pinkish walls, ori is slit like due to the apposition of wall, and due to presence of hymen.
- (vii) Perineum — entire.

B. Extra genital findings:

- (i) Breast — hemispherical, firm, plump and elastic.
- (ii) Nipple — small and pointed surrounded by pink areola.

Narrow and tight vagina is not seen in false virgin. Tears on hymen caused by sexual intercourse or by fore body is usually situated postero-laterally.

**Causes of rupture of hymen:**

- 1. An accident—Hymen does not rupture by riding, jump dancing etc.
- 2. Masturbation.
- 3. Sola pith introduced into vagina.
- 4. Sanitary tampon.

Most important sign of defloration is hymen rupture. Important support of uterus preventing prolapse is transverse cervical ligaments. In women who are used to coitus, and in those who have borne children, the hymen is destroyed and different sized small, round,, fleshy projections or tags, known as carunculae hymenales or myrtiformes are formed round the hymenal ring.

**PREGNANCY**

Pregnancy is a condition of having a developing embryo or foetus in the female, when an ovum is fertilized by a spermatozoon.

The question of pregnancy has to be determined in the following conditions:

- (1) When a woman pleads pregnancy to avoid attendance in Court as a witness.
- (2) When a woman convicted of capital crime, pleads that she is pregnant, to avoid execution. The High Court has the power to postpone the execution of death sentence or to commute it as Imprisonment for life (S.416, Cr.P.C).
- (3) When a woman feigns pregnancy soon after death of her husband to claim succession to estate.
- (4) To assess damage in a seduction or breach of promise of marriage case.
- (5) When a woman blackmails a man and accuses that she is pregnant by him, to compel marriage.
- (6) In allegations that an unmarried woman, widow, or a wife living apart from her husband is pregnant
- (7) When a woman alleges that she is pregnant in order to get greater compensation when her husband dies through the negligence of some person
- (8) When pregnancy is alleged to be motive for suicide or murder of unmarried woman or widow
- (9) In cases of divorce, the woman may claim to be pregnant to receive more alimony
- (10) In cases of alleged concealment of birth of pregnancy and infanticide.

**Diagnosis of pregnancy:** the signs and symptoms are usually classified into three groups:

- (1) The Presumptive signs, (2) The Probable signs, (3) The Positive signs.

(1) **The presumptive** signs are amenorrhoea, changes in breast, morning sickness, quickening, pigmentation of the skin, changes in the vulva, urinary disturbances, fatigue and sympathetic disturbances.

Amenorrhoea is the earliest and one of the most important symptom of pregnancy. Breast changes are quite characteristic in primi-gravidas but are of less value in multiparas. Morning sickness usually appears about the end of the first month and disappears 6 to 8 weeks later. Nausea and vomiting are usually present in the morning, and pass off in a few hours. From about 16th to 20th week, the pregnant woman feels slight fluttering movements in her abdomen (Quickening). The vulva, abdomen and axillae become darker due to the deposit of pigment, and a dark line extends from the pubis to beyond the umbilicus, the so called linea nigra. The mucous membrane of the vagina changes from pink to violet, deepening to blue as a result of venous obstruction, after the fourth week (Jackquemier's sign or Chadwick's sign). Enlarging uterus exerts pressure on the bladder and produces frequent micturition. Easy fatigue is very important. Salivation, perverted appetite and irritable temper are common.

(2) The **probable signs** of pregnancy are enlargement of the abdomen, Hegar's sign, Goodell's sign, Braxton-Hick's sign, Ballottement, uterine souffle, biological tests and immunological tests.

During pregnancy, abdomen gradually enlarges in size after the 12th week. Hegar's sign is positive at about the sixth week. This is the most valuable physical sign of early pregnancy. Goodell's sign is the progressive softening of the cervix from below upwards, well marked from the fourth month. Intermittent, painless uterine contractions are easily felt after the fourth month known as Braxton-Hick's sign. They are present even when the fetus is dead. Ballottement is positive during the fourth and fifth month of pregnancy as the fetus is small in relation to the amount of amniotic fluid present. This can be negative if the amniotic fluid is scanty. Uterine souffle is a soft blowing murmur, which is synchronous with the mother's pulse. It is due to passage of blood through the uterine vessels.

The biological tests are (1) The rapid rat test (2) The Aschheim-Zondek test (3) Friedman test (4) Hogben or female toad test (5) male frog test (6) Galli-Mainini test.

The immunological tests are (1) Inhibition (indirect) latex slide test (2) Direct latex slide test.

(3) **Positive signs of pregnancy:** They are fetal movements, fetal heart sounds, X-ray diagnosis and Sonography.

Fetal movements are felt by placing the hands on the abdomen by 24 weeks. Fetal parts can be identified by abdominal palpation by 36 weeks. Fetal heart sounds are important and definite sign of pregnancy. They are heard between 18 to 20 weeks for the first time. Rate is usually about 160 at fifth and 120 at the ninth month, not synchronous with the mother's pulse.

Fetal sounds are not heard: (a) when the fetus is dead, (b) when there is excessive amount of liquor amnii, (c) when abdominal wall is very fatty, (d) when examination is made before 18 weeks of pregnancy. At about 15 to 16 weeks, fetal parts can be detected with certainty. Usually the skull and spine are seen at 15 to 16 weeks.

Radiological signs of fetal death are (1) Spalding's sign, (2) Collapse of the spinal column due to absence of muscle tone, (3) presence of gas in the heart and great vessels.

**Pseudocyesis** (spurious or phantom pregnancy): is usually observed in patients nearing the menopause or in younger women who intensely desire children.

Signs of pregnancy in the dead: The presence of an embryo, foetus, placental tissue, membranes or any other product of conception is a positive proof.

**Period of gestation:** Average is 280 days from the first period of the last menstrual period, so that the actual period is about 270 days or less. Maximum period concluded for medico-legal purpose is 354 days from the coitus to live-birth. The maximum period accepted by English courts on medical evidence is 349 days. Child born at or after 210 days of uterine life are viable, i.e., are born and able to survive.

Posthumous child: It is a child born after the death of its father, the mother being conceived by the said father.

**Superfecundation:** it means the fertilisation of two ova which have been discharged from the ovary at the same period by two separate acts of coitus committed at short intervals.

Superfoetation: This means the fertilisation of a second ovum in a woman who is already pregnant.

### **Legitimacy and paternity:**

Legitimacy is the legal state of a person born in lawful marriage. If a person is born during the continuance of a legal marriage, or within 280 days after the dissolution of a legal marriage by divorce or death of the husband, his birth is presumed to be legitimate (S.112, I.E.A).

Atavism - The child does not resemble its parents, but resembles its grandparents.

**Wife battering:** A battered wife is a woman who has received a deliberate, severe, and repeated demonstrable physical injuries from her husband. Faulk has categorised the involved men into five groups: (1) Dependent passive, (2) Dependent suspicious, (3) Violent and bullying, (4) Dominating, (5) Stable and affectionate.

**Delivery** means the expulsion or extraction of the child at birth. The question of delivery arises in (1) abortion, (2) infanticide, (3) concealment of birth, (4) feigned delivery, (5) legitimacy, (6) nullity of marriage, (7) divorce, (8) chastity, and (9) blackmail.

**Signs of recent delivery** in the living: For the first 2 or 3 days the woman is pale, exhausted and ill-looking with increase in pulse and slight fever. Breasts are full, enlarged and tender with a knotty feeling, and colostrum or milk may be expressed. The areolae are dark, nipples enlarged, and superficial veins prominent, and Montgomery's tubercles are present. The abdominal walls are pendulous, wrinkled and show striae gravidarum especially in flanks which appear as irregular, pink, subcutaneous scars. The uterus feels like hard muscular tumour, the upper border of which lies about 3 cm. below the umbilicus. It then diminishes in size by about 1.5 cm a day. The labia are tender, swollen and bruised or lacerated. The vagina is relaxed and capacious. Perineum may be lacerated. Cervix is soft and dilated and its edges torn and lacerated transversely.

The **lochia** is a discharge from the uterus which lasts for 2 or 3 weeks. During the first 4 to 5 days, the discharge is bright-red and contains large clots (lochia rubra). During the next 4 days, it becomes serous and paler in colour (lochia serosa). After the ninth day, colour

becomes yellowish-green or turbid (lochia alba) until its final disappearance.

If the blood or urine gives a positive pregnancy test, it is strong corroborative evidence that pregnancy has recently terminated.

Oligohydramnios is seen in renal-agenesis. In pregnancy, trace element not supplemented from diet is iron.

Signs of Remote delivery in the dead include:

1. Uterus is larger, thicker, and heavier.
2. Walls are concave from inside.-
3. Top of the fundus is convex, and at a higher level than that of broad ligaments.
4. The body of uterus is twice the length of cervix (same length in virgin).
5. The cervix is irregular in form, shortened, its edges show cicatrices.
6. External os is enlarged, and Internal os is not so well defined.

## **ABORTION**

Legally, abortion (miscarriage) means the premature expulsion of the fetus from the mother's womb at any time of pregnancy, before full term of pregnancy is completed.

**Classification:** (1) Natural: (a) Spontaneous (b) Accidental (2) Artificial (a) Justifiable (b) Criminal.

**Natural abortion** is the abortion occurring at any time due to natural causes.

**Justifiable or therapeutic abortion:** Abortion is justifiable only when it is done in good faith to save the life of a woman, if it is materially endangered by the continuance of pregnancy. The World Medical Association in 1970, adopted a resolution on therapeutic abortion, known as Declaration of Oslo.

Criminal abortion is the induced destruction and expulsion of the foetus from womb of the mother unlawfully, i.e., when there is no therapeutic indication for the operation.

Under S.312, IPC, whoever voluntarily causes criminal abortion is liable for imprisonment up to 3 years, and/or fine; and if the woman is quick with child, the imprisonment may extend up to 7 years.

If the means used to abort do not succeed, it is punishable under S.511, IPC with imprisonment up to half of the punishment under S.312.

Under S.313, IPC, if the miscarriage is caused without the consent of the woman, the imprisonment may be up to 10 years.

Under S.314, IPC, if a pregnant woman dies from an act intended to cause miscarriage, the offender is liable to be punished with imprisonment up to 10 years.

Under S.315, IPC, a person doing an act intended to prevent the child from being born alive or to cause to die after its birth is liable to be punished with imprisonment up to 10 years.

Under S.316, IPC, causing death of quick unborn child by any act amounts to culpable homicide, and the punishment may extend up to 10 years imprisonment.

**The medical termination of pregnancy act** was passed in 1971. Under this act, pregnancy can be terminated under the following conditions: (1) Therapeutic (2) Eugenic (3) Humanitarian (4) social.

Therapeutic abortion is indicated when the continuation of pregnancy endangers the life of a woman or may cause serious injury to her physical or mental health.

**Eugenic:** When there is risk of the child being born with serious physical or mental abnormalities. This may occur: (A) If the pregnant mother in the first three months suffers from German measles, small-pox or chicken-pox, viral hepatitis, toxoplasmosis, any severe viral infection (B) If the pregnant mother is treated with drugs like thalidomide, cortisone, etc (C) Mother is treated by X-rays or radio-isotopes (D) Insanity of the parents

**Humanitarian:** when pregnancy is caused by rape

**Social:** (A) Failure of contraceptive techniques in case of a married woman (B) when social or economic environment, actual or reasonably expected can injure the mother's health.

Only a qualified RMP possessing experience can terminate pregnancy. A RMP can qualify if he has assisted in performance of 25 cases of M.T.P in a recognised hospital. The consent of the woman is required before conducting abortion; written consent of the guardian is required if the woman is a minor or lunatic. Consent of husband is not necessary. The age of women for abortion is over 18 years. MTP act, 1971 allows termination of pregnancy up to 20 weeks. If the period of pregnancy is below 12 weeks, it can be terminated on the opinion of a single doctor. If the period of pregnancy is between 12 and 20 weeks, two doctors must give opinion that there is an indication. The doctor is protected from any legal action for any damage caused or likely to be caused in terminating pregnancy, provided he has acted in good faith and exercised proper care and skill.

### **Methods of procuring criminal abortion:**

(I) Abortifacient drugs: which produce congestion of the uterine mucosa and then uterine bleeding, followed by contraction of the uterine muscle and expulsion of the foetus, or they cause the uterine contraction by stimulating the myometrium directly.

(i) Drugs that act directly on the uterus:

(A) Ecboolics: They increase uterine contraction and are likely to cause abortion. Eg., Ergot, Hydrastis canadensis, Quinine, Lead in the form of pills made from diachylon (lead oleate) or lead palster is commonly used.

(B) Emmenagogues: They produce or increase menstrual flow. The chiel of these are savin, borax, apiol, rue, laburnum, oestrogens, sanguinarin, senacio, caulophyllin, hellebore, etc.

(iii) Irritants of the Genito-urinary tract: They produce reflex uterine contractions, e.g., oil of pennyroyal, oil of tansy, oil of turpentine, cantharides, etc

(iv) Irritants of the Gastro-intestinal tract: Any substance which causes irritation of the colon may produce hyperaemia and contractions of uterus. Saline cathartics, such as magnesium sulphate or drastic purgatives, such as, aloes, calomel, castor oil, croton oil, jalap, colocynth etc are commonly used.

(v) Drugs having poisonous effects on the body: (a) Inorganic irritants: e.g., lead, copper, iron, mercury, and antimony (b) Organic irritants: e.g., cantharides, unripe fruit of pappaya, unripe fruit of pineapple, seeds of moringa, juice of calotropis, bark of plumbago rosea, saffron, etc.

(II) General violence: It acts directly on the uterus, or indirectly producing congestion of pelvic organs, or hemorrhages between uterus and membranes.

(i) Intentional: (1) Severe pressure on abdomen by blows, kicks, jumping, etc and massage of the uterus through the abdominal wall. (2) Violent exercise like horse riding, cycling, jumping from height, running upstairs, etc. (3) Cupping.

(ii) Accidental:

(III) Local violence: (1) Syringing (2) Rupture of the membranes (3) Dilation of the cervix (4) Abortion stick (5) Air insufflations (5) Electricity (6) Curettage (7) Pastes.

**Methods for therapeutic abortion:** The common methods are

- (1) Low rupture of membranes
- (2) Utus paste injection
- (3) Dilatation of cervix and oxytocic infusion, or a direct injection of 10 units of oxytocin into the uterus causing abortion
- (4) Dilatation of the cervix and evacuation of the uterus by curettage, during the first three months.
- (5) Prostaglandins
- (6) Amniotic fluid replacement therapy
- (7) Vacuum aspiration.
- (8) Abdominal hysterectomy

**Doctor's duties in a case of criminal abortion:**

The doctor should keep all the information obtained by him as a professional secret. He must ask the patient to make a statement about the induction of criminal abortion. He must treat her to the best of his ability. He must consult a professional colleague. If the woman's condition is serious, he must arrange to record the dying declaration. If the woman dies, he should not issue a death certificate, but he should inform the police.

## **INFANTICIDE**

According to the Infanticide Act of England (1938), infanticide means the unlawful destruction of a child under the age of one year. In India, there is no such special Act, and as such there is no difference between the murder of newborn infant and that of any other individual. Foeticide is the killing of a fetus at any time prior to birth.

A **Stillborn child** is one, which is born after 28th week of pregnancy, and which did not breathe or show any other signs of life, at any time after being completely born.

Causes of still birth are: prematurity, anoxia of various types, birth trauma especially intracranial hemorrhage due to excessive moulding, placental abnormalities, toxæmias of pregnancy, erythroblastosis foetalis, and many types of congenital defects.

A **dead-born child** is one which has died in utero, and shows one of the following signs after it is completely born.

**Signs of dead-born are:** (1) Rigor mortis at delivery (2) Maceration (3) Mummification.

**Maceration** is a process of aseptic autolysis, and is the usual change. This occurs when the dead child remains in the uterus for about 3 or 4 days surrounded with liquor amnii but the exclusion of air. The earliest sign of maceration is skin slippage, which can be seen in 12

hours after the death of the child in utero. The body of a macerated fetus is soft, flaccid and flattens out when palced on a level surface. It has a sweetish, disagreeable odour.

**Spalding's sign:** Loss of alignment and over-riding of the bones of the cranial vault occurs due to shrinkage of the cerebrum after the death of the foetus. The sign will develop within a few days of death of the foetus, but often takes much longer time, sometimes even 2 to 3 weeks.

Mummification occurs when the fetus dies from deficient supply of blood, when liquor amnii is scanty, and when no air enters uterus.

**Viability of the infant:** Viability means the physical ability of a fetus to lead a separate existence after birth apart from its mother, by virtue of a certain degree of development. Livebirth means that the child showed signs of life when only part of the child was out of the mother, though the child may not have breathed or completely born. The causing of death of such a child is homicide.

**Live-birth is probable when:**

- (1) All the lobes of the lungs are fully expanded with or without obstructive emphysema
- (2) There is oedema of the lungs, especially gross
- (3) An alveolar duct membrane is present and has widespread distribution in the lungs
- (4) Pulmonary atelectasis due to obstruction of an alveolar duct membrane is present
- (5) Contusions of the lung are present.

**Tests for live birth:**

- (A) Static test o Fodere's test: Average weight of both lungs before respiration varies; 30 to 40 gm and after respiration 60 to 66 gm.
- (B) Hydrostatic test: The specific gravity of lungs before respiration varies from 1040 to 1050 and after respiration about 940, so it floats in water.
- (C) Plocquet's test: Weight of lungs to body. 1:70 – unrespired lung, 1:35 – respired lung
- (D) Wredin's test: For air in the middle ear.
- (E) Breslow's sign: For air in stomach and duodenum.

Still-birth is probable in the presence of:

- (1) Maceration of the infant
- (2) Flooding of the lung with liquor amnii, and especially evidence of phagocytosis of meconium by the cells lining the cells
- (3) Desquamation of the bronchial epithelium
- (4) Distension of large bowel with meconium indicating a struggle to breathe.

**Meconium** is the green viscid substance consisting of thickened bile and mucus.

**Caput succedaneum:** is an area of soft swelling that forms in the scalp over the presenting part of the head in vertex presentations.

**Cephalhematoma:** is a localised accumulation of blood deep to the scalp, between the periosteum and bone surface.

Umbilical cord attached to the child shrinks and dries in 12 to 24 hours, and an inflammatory ring forms at the base in 36 to 48 hours. It mummifies on second to third day.

The cord falls off on the fifth or sixth day and leaves an ulcer, which heals and forms a scar in 10 to 12 days.

Contraction of the umbilical arteries starts in about 10 hours and is completely closed by third day. The umbilical vein and ductus venosus are closed on the fourth day. The ductus arteriosus closes by tenth day, and foramen ovale by second or third month.

**Causes of death of the fetus** may be due to (1) Natural causes, and (2) Unnatural causes.

**Natural causes:** (i) Immaturity (ii) Debility due to lack of general development (iii) Congenital diseases (iv) Malformations (v) Haemorrhage from the umbilical-cord, genital organs, stomach, rectum, etc (vi) Post-maturity (vii) Pre-eclamptic toxæmia (viii) Disease of the placenta or its accidental separation from the uterine wall (ix) Placenta prævia or abnormal pregnancy (x) Neonatal infection (xi) Intrapartum or ante-partum anoxia (xii) Cerebral birth trauma (xiii) Erythroblastosis foetalis.

Unnatural causes: These may be (1) Accidental, and (2) Criminal

(1) **Accidental causes:** (a) During birth: Prolonged labour, prolapse of cord or pressure on the cord, twisting of the cord around the neck or knots of the cord, injuries to the mother, death of the mother. (b) After birth: Suffocation.

(2) **Criminal causes:** These may be (1) Acts of commission, and (2) Acts of omission  
(a) Acts of commission: Suffocation, strangulation, drowning, burning, blunt head injury, fracture and dislocation of cervical vertebrae, wounds, poison.  
(b) Acts of omission or neglect.

**The abandoning of infants:** If the father or mother of a child under the age of 12 years, or anyone having the care of such child, leaves such a child in any place with the intention of abandoning the child, shall be punished with imprisonment up to 7 years (S. 317, IPC).

**Concealment of birth:** Whoever, secretly buries or otherwise disposes of the dead body of a child, whether such child dies before or after or during its birth, intentionally conceals the birth of such child, shall be punished with imprisonment up to 2 years (S. 318, IPC).

**Sudden infant death syndrome (SIDS),** or cot death or crib death is defined as the sudden and unexpected death of seemingly healthy infant, whose death remains unexplained even after a complete autopsy. Accepted hypothesis is sleep apnoea.

**Battered baby syndrome:** A battered baby is one who has received injuries as a result of non-accidental violence, produced by a parent or guardian. The classical features are the obvious discrepancy between the nature of injuries, and explanation given by the parents, and delay between the injury and medical attention which cannot be explained.

Diagnosis of BBS: (1) Nature of injuries (2) time taken to seek medical advice (3) recurrent injuries.

DD of BBS: Scurvy, congenital syphilis and osteogenesis imperfecta, (except –

osteomyelitis).

## **BLOOD STAINS**

The source of the blood (human or animal) is determined by the Serologist of the Government of India at Calcutta. All stains should be sent to the SFSL.

The chemical tests depend on the presence in the blood stains of an enzyme peroxidase, which in the presence of hydrogen peroxide, oxidises the active ingredient of the reagent and produces the characteristic coloured compound.

I. Benzidine test: Most reliable chemical test for blood. Add a drop of saturated solution of benzidine in glacial acetic acid and then a drop of 10 volumes hydrogen peroxide. If blood is present, dark blue colour is produced immediately. A positive reaction is given by blood of almost any age, blood that has been exposed to heat or cold. It detects blood when present in a dilution of one part of blood in 3 lakhs. If a negative reaction is obtained it is certain that the stain is not blood. After death, up to 150 years the test which is positive is Benzidine test.

II. Micro chemical examination:

1. Red corpuscles.

2. Haemin crystal test (Teichmann's Test)—A small crystal of sodium chloride and 2 to 3 drops of glacial acetic acid are placed on a glass slide. Brownish-black rhombic crystals of haemin or haematin chloride arranged singly or in clusters are seen if blood is present.

3. Haemochromogen crystal test (Takayama test) – Place a small piece of suspected material on a glass slide and add 2 or 3 drops of Takayama reagent (sodium hydroxide, pyridine, glucose), and cover with a coverslip. Pink, feathery crystals of hemochromogen or reduced alkaline hematin arranged in clusters, sheaves, etc., appear in one to six minutes. It is delicate and more reliable.

III. Spectroscopic examination:

— It is the most delicate, specific and reliable test for detecting the presence of blood in both recent and old stains.

IV. Serological examination: This determines whether the blood is derived from human being or from a lower animal.

(A) Immunological methods: (1) Precipitin test (2) Antiglobulin consumption test (3) Gel diffusion (4) Double diffusion in agar gel (5) Precipitation-electrophoresis

(B) Isoenzyme methods

## **For Blood Stains**

1. Magrath test—If blood is present, luminescence is seen.

2. Takayama's test—Haemochromogen crystal test. Delicate and reliable test. Pink, feathery structure.

3. Tiechmann's test—Haemin crystal test, microscopy test

4. Precipitin test—Confirm blood of human origin.

5. Phenolphthalein test—Kastle-Mayer test -> pink-purple, ex mely delicate.

6. Benzidine test—Best preliminary test, blue colour.

7. Chromatography—Absorption spectroscopy is the best test
8. Guicuin test—Deep blue.
9. Leuco malachite test—Peacock-blue colour.

## FORENSIC PSYCHIATRY

Psychiatry deals with the study, diagnosis and treatment of mental illness. Forensic psychiatry deals with the application of psychiatry in the administration of justice.

**Insanity** or soundness of mind can be defined as a disease of the mind or the personality, in which there is derangement of the mental or emotional processes.

**Aphasia:** The loss of ability to express meaning by the use of speech or writing (motor aphasia), or to understand spoken or written language (sensory aphasia).

**Delirium:** It is a disturbance of consciousness in which orientation is impaired, critical faculty is blunted or lost and thought content is irrelevant or inconsistent. It occurs in physical disease with high fever, overwork, mental stress, metabolic disease, cerebral neoplasm or drug intoxication. Such persons are not responsible for their criminal acts.

**Delusion:** It is a false belief in something which is not a fact, and which persists even after its falsity has been clearly demonstrated. It is a disorder of thought.

Types:

- (i) Grandeur or exaltation—A man imagines himself to be very rich while in reality he is a pauper.
  - (ii) Persecution—Person imagines that attempts are being made to poison him by his near relatives,
  - (iii) Reference—The person believes that people, things, events etc. refer to him in a special way.
  - (iv) Influence—His thought, feelings and actions are being influenced and controlled by some outside agencies.
  - (v) Infidelity—A man imagines his wife to be unfaithful while in fact she is chaste.
  - (vi) Nihilistic—The person declares that he does not exist or that there is no world seen in major depression.
  - (vii) Hypochondriacal—The person believes that there is something wrong with his body, though in fact he is healthy.
- Such person is not responsible for his antisocial act.

**Hallucination** is a false sense of perception, without any external object or stimulus to produce it. They are purely imaginary and may affect any or all the special sense organs.

Types:

- (i) Visual: A person imagines of being attacked by a lion when no lion exists (most commonly seen in delirium).
- (ii) Auditory: A person hears voices, when no one is present (schizophrenia).
- (iii) Olfactory: A person smells pleasant or unpleasant odour when none is present.
- (iv) Gustatory: A person feels different types of taste in the mouth though no food actually

is present.

(v) Tactile: A man imagines rats and mice crawling into his bed (Magnan symptom or, cocaine bug).

Hallucinations occur in fevers, intoxications and insanity. Visual and auditory hallucinations are most common. A person suffering from unpleasant hallucination may commit suicide or homicide. Olfactory hallucination is seen in temporal epilepsy.

**Illusion** is a false interpretation by the senses of an external object or stimulus which has a real existence e.g. a lion for a dog, or hears the notes of birds to human voice, imagines a string to be snake, stem of a tree for a ghost in dark. A sane person may experience illusion, but is capable of correcting the false impressions. An insane person continues to believe in the illusions even though the real facts are clearly pointed out.

**Impulse:** This is a sudden and irresistible force compelling a person to the conscious performance of some action without motive or fore-thought. A sane person is capable of controlling an impulse, but an in-sane person may do things on impulse.

Types:

- (i) Kleptomania—An irresistible desire to steal articles of little value.
- (ii) Pyromania—An irresistible desire to set fire to things.
- (iii) Mutilomania—An irresistible desire to mutilate animals.
- (iv) Dipsomania—An irresistible desire for alcoholic drinks at periodic intervals.
- (v) Sexual impulses—including sexual perversions.
- (vi) Suicidal and Homicidal impulses.

**Obsession:** In this, a single idea, thought or emotion is constantly entertained by a person which he recognises as irrational, but persists inspite of all efforts to drive it from his mind. It is a disorder of content of thought. Any attempt to resist makes them appear more insistent. It is a borderline between sanity and insanity e.g. continuous checking of bolting of door of husband's room, a wife may continuously believe her husband to be unfaithful.

**Phobia:** It is an excessive or irrational fear of a particular object or situation.

**Lucid Interval:** This is a period occurring in insanity during which all the symptoms of insanity disappear completely. The individual is able to judge his acts soundly and he becomes legally liable for his acts. If he commits an offence, he cannot be completely held responsible, because it is difficult to know whether he was suffering from some mental abnormality at the time of committing the offence. In mania and melancholia, lucid intervals are common.

### **Difference between Psychosis and Neurosis**

| Trait                  | Psychosis                                                              | Neurosis                                                                  |
|------------------------|------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 1. Nature              | A disease entity with physical basis which determined genetically----- | A reaction to stressful circumstances due to adverse childhood experience |
| 2. Severity            | Major                                                                  | Minor                                                                     |
| 3. Empathy             | Absent                                                                 | Present                                                                   |
| 4 Contact with reality | Absent                                                                 | Present                                                                   |

|            |        |         |
|------------|--------|---------|
| 5. Insight | Absent | Present |
|------------|--------|---------|

**Psychopath:** A person who is neither insane nor mentally defective, but fails to conform to normal standards of behaviour.

**Psychopathic disorder:** It is a persistent disorder or disability of mind which results in abnormally aggressive or seriously irresponsible conduct or a part of the person.

**Psychopathic personality:** An antisocial person who has been emotionally unstable from childhood or adolescence, but has normal intelligence. He lacks foresight and fails to learn from punishment.

**Psychoses:** They are characterised by a withdrawal from reality; a living in a world of fantasy.

**Neuroses:** The patient suffers from emotional or intellectual disorders, but he does not lose touch with reality.

**Neurasthenia:** It is a condition of nervous exhaustion due to physical or mental conditions. There is abnormal fatigue and irritability of the nervous system.

**Mutism:** It is complete loss of speech. It is seen in hysteria, catatonic schizophrenia, depression, organic brain lesion and malingering.

#### **Causes of Insanity:**

- (i) Hereditary, e.g. Huntington's chorea and amaurotic family idiocy.
- (ii) Environmental factors e.g. faulty parental attitude and lack of mental hygiene.
- (iii) Psychogenic e.g. unsuccessfully repressed mental conflicts.
- (iv) Precipitating e.g. financial and business worries, frustrations and disappointment in sexual affairs, death of close relatives, senile degeneration, myxoedema, pernicious anemia etc.

#### **Classification of Insanity (W.H.O. 1965)**

- I. **PSYCHOSES**
- (A) Organic psychoses: (1) Senile and presenile dementia (2) Alcoholic psychosis (3) Associated with intracranial infections, e.g. epidemic encephalitis, abscess, meningitis, tuberculosis, G.P.I, etc. (4) Associated with cerebral arteriosclerosis, epilepsy, intra-cranial tumours, degenerative diseases, brain anomalies etc (5) Associated with other physical conditions such as endocrine, metabolic and nutritional disorders etc.
- (B) Functional psychoses:
- (a) Schizophrenia: 1. Simple type 2. Hebephrenic type, 3. Catatonic type, 4. Paranoid and other atypical or unspecified form.
- (b) Affective type: 1. Involutional melancholia. 2. Manic-depressive 3. Paranoid states 4. Other atypical forms.

- II. **NEUROSES:** 1. Anxiety neurosis 2. Hysterical-neurosis 3. Phobic 4. Obsessive-compulsive 5. Depressive 6. Depersonalisation syndrome 7. Hypochondriacal 8. Unspecified neurosis.

|      |             |             |
|------|-------------|-------------|
| III. | PERSONALITY | DISORDERS.  |
| IV.  | SEXUAL      | DEVIATION.  |
| V.   | DRUG        | DEPENDENCE. |

**Mental Subnormality:** (Oligophrenia, amentia)

1. Idiocy: Idiots are defined as persons so defective in mind from birth or an early age, that they are unable to guard themselves against ordinary physical dangers. Their mental age does not exceed that of a normal of 3 years. Intelligent quotient (I. Q) 0-20 (profound retardation).
2. Imbecility: Imbeciles are persons who are so defective in mind birth or an early age, that they are incapable of mane themselves or their affairs. An imbecile child is incapable of being taught. Their mental age ranges between that of normal child of 3 to 7 years. I.Q. 20-50 (moderate retardation).
3. Feeble minded (Moron): In these mental defects, not amounting to imbecility exists from birth or an early age, and they require care, super-vision and control for their protection. Mental age 6 to 11 years. I.Q. 50-75 (Mild retardation).
4. Normal I.Q: It is more than 90. Mental retardation is I.Q. less than 70.

**I.Q.** =  $\frac{M.A}{C.A} \times 100$  (M.A.-Mental age; C.A - Chronological age)

**Psychosis associated with Organic diseases:**

- 1) Pre-senile dementia: Dementia is a condition in which there is degeneration of mental faculty after they have been fully developed.
- 2) Senile dementia: It is caused due to arteriosclerosis and old age. It usually starts after 65 years.
- 3) Cerebral tumours.
- 4) Cerebral trauma: It causes concussion and post-traumatic automatism.
- 5) Drug induced Psychosis: Dependence on barbiturates, amphetamines, cannabis, heroin, cocaine etc. lead to Psychosis. Cocaine, LSD, amphetamines and mescaline can produce clinical symptoms similar to schizophrenia.
- 6) Toxic Psychosis: Heavy metals, such as arsenic and mercury produce mental degeneration.
- 7) Deficiency states: (i) Deficiency of cyanocobalamin—pernicious anemia, (ii) Nicotinic acid—pellagra. (iii) Thyroxine—myxoedema. (iv) Pituitary hormones—hypopituitarism. (v) Hypoglycemia produces mental degeneration.

**8) Alcoholism:**

- a. Alcoholic blackouts—Amnesia of several hours for events during a drinking session.
- b. Delirium tremens—It usually occurs in a chronic drunkard, (i) One-two days after sudden withdrawal of alcohol. (ii) Due to heavy drinking. (iii) Injuries, infection and shock act as precipitating factor. This is the commonest type of Psychosis in the chronic alcoholic. The patient becomes sleepless, restless, irritable and then develops disorders of perception and coarse muscular tremors of face, tongue and hands. Disorientation and hallucinations of sight and hearing are common. He may be incited to commit suicide, homicide or violent assault. Symptoms usually last for 3 to 7 days. Such persons are not criminally responsible.
- c. Alcoholic hallucinosis.
- d. **Korsakov's psychosis:** It is characterised by loss of memory for recent events both retrograde and antero-grade. The physical component of this syndrome consists of ophthalmoplegia, ataxia, and peripheral neuritis and is known as **Wernick's encephalopathy.**

- 9) General Paralysis of insane: This is a chronic progressive condition leading to paralysis and dementia. It is usually associated with meningo-vascular syphilis and tabes dorsalis. The memory is impaired and thought retarded.

**Functional Psychosis:** This is a disease of hereditary origin affecting young adults and forms a major group of all psychiatric illnesses.

**I. Schizophrenia:** It is a condition of split personality, in which the patient loses his contact with environment. It is primarily a disorder of thinking (cognition). It is characterised by splitting of different psychic functions: (1) Disorders of behaviour: withdrawal from reality, pre-occupation with the self (narcissism), depersonalization, passivity of thought. (2) Disorders of thought: confused thoughts leading to thought block, neologism. (3) Disorders of affect: depression, elation, inappropriate moods, anxiety and blunting of emotions. (4) Delusions: of grandeur, paranoid, hypochondriac and influence. (5) Hallucinations—commonly auditory, sometimes visual and tactile. (6) Personality deterioration: affecting his work, family and social relationships.

Schizophrenia is the commonest type of insanity in homicidal crimes.

**The types are:**

(1) Simple schizophrenia: It begins in early adolescence. There is a gradual loss of interest in the outside world from which he withdraws. He becomes emotionally flat and apathetic and has difficulty in forming social relationships. (2) Hebephrenia: it begins in adolescents or young adults. Thinking process is disturbed. Wild excitement, illusions, hallucinations and bizarre delusions are present. (3) Catatonia: This is characterised by alternating stages of depression, excitement and stupor, impulsive suicidal or homicidal attacks and auditory hallucinations are common. (4) Paranoid schizophrenia: Paranoid schizophrenia develops insidiously in the fourth decade. It is characterised by suspicion, delusions of persecution and auditory hallucinations. At first delusions are indefinite, but later they become fixed on some person.

**II. Affective types:**

**Manic-depressive psychosis:**— The primary disturbance is of affect. The mood varies between extremes of joy and sadness. It occurs periodically.

In diagnosis of Insanity, person should be kept under observation up to a maximum 30 days.

**Feigned Insanity:**—Insanity may be feigned by criminals to evade sentence of death or long term prison, by soldiers and policemen to leave the service, and by businessmen to avoid contract.

**Neurosis:** This forms a group of personality disturbances resulting from reactions to life situations. They may occur singly or in combination.

**1. Anxiety Neurosis**

**2. Hysterical Neurosis:** It is common in young females but may occur in old ladies whose nervous system starts degenerating. The patient shows deafness, blindness, loss of smell, anaesthesia, paraesthesia, paralysis, aphonia, amnesia, fainting fits, anorexia etc

**3. Phobic Neurosis**

| Type  | of             | Phobia | Fear | of             |
|-------|----------------|--------|------|----------------|
| (i)   | Agaraphobia    | —»     | Fear | of open spaces |
| (ii)  | Claustrophobia | —>     |      | closed spaces  |
| (iii) | Necrophobia    | —»     |      | dead bodies    |
| (iv)  | Nyctophobia    |        | —>   | darkness       |
| (v)   | Phonophobia    |        | —»   | sound          |

|        |                      |                   |                    |
|--------|----------------------|-------------------|--------------------|
| (vi)   | Thanatophobia        | —>                | death              |
| (vii)  | Pathophobia          | —>                | disease            |
| (viii) | Toxiphobia           | —>                | being poisoned     |
| (ix)   | Hydrophobia          | —> fear of water, | seen in rabies     |
| (x)    | Acrophobia           | —> fear of        | height             |
| (xi)   | Sitophobia           | —> fear of        | eating             |
| (xii)  | Social phobia        | —>                | public performance |
| (xiii) | Aerophobia           | --->              | Air                |
| (xiv)  | Algophobia           | —>                | Pain.              |
| It     | interferes           | with              | daily activity.    |
| 4.     | Depressive           |                   | Neurosis.          |
| 5.     | Obsessive compulsive |                   | neurosis.          |

## THE MENTAL HEALTH ACT, 1987

• **Indian Lunacy Act** was passed in 1912. It was repealed by the Mental Health Act, 1987. The Mental Health Act was enacted by parliament to consolidate and amend the law relating to the treatment and care of "mentally-ill person" to make better provision with respect to their property and affairs and for matters concerned with".

**Mental Disorder and Responsibility:** Responsibility, in the legal sense, means the liability of a person for his acts or omissions, and if these are against the law, the liability to be punished for them.

**Civil responsibility:** the question of civil responsibility arises in the following conditions.

- (1) **Management of property and affairs:** If on enquiry, a person is found incapable of managing his property and affairs, but is not dangerous to himself or to others, the Court appoints a manager to look after his property, granting him necessary power.
- (2) **Insanity and contracts:** A contract is invalid if one of the parties at the time of making it was incapable of understanding what he was doing due to insanity. The mental disorder of partner does not itself dissolve the partnership, unless steps are taken for dissolution.
- (3) **Insanity and marriage contract:** A marriage is considered invalid, if at the time of marriage either party (1) is incapable of giving valid consent due to insanity, or (2) though capable of giving valid consent, has been suffering from such a kind or degree of mental disorder as to be unfit for marriage and procreation, or (3) has been suffering from recurrent attacks of insanity or epilepsy.
- (4) **The competence of insane to be a witness:** An insane person is not competent to give evidence if he cannot understand the necessity of telling the truth due to insanity. An insane person is competent to give evidence during the period of lucid interval.
- (5) **Consent and insanity:** Consent to certain acts like sexual intercourse or hurt is not valid if such consent is given by a person who from unsoundness of mind, is unable to understand the nature and consequences of that of which he gives consent.
- (6) **Insanity and testamentary capacity:** Testamentary capacity (testament = will) is the mental ability of a person to make a valid will. The requirements of a valid will are follows. A written and properly signed and witnessed document must exist. The testator must be major, and of sound disposing mind, at the time of making the will. No force, undue influence, or dishonest representation of facts, should have been applied by others. Persons can make valid wills during lucid interval. The most common symptom of absence of legal capacity is impairment of memory. The most important thing to determine is whether at the time of making the will, the testator understood the business in which he was engaged, and knew how he wanted to dispose of his property.

## Criminal responsibility:

The law presumes that every person is sane and responsible for his actions. The defense

has to prove that the accused is insane. The law presumes that for every criminal act, there must be criminal intent or mind = mens rea (mens = mind; rea = criminal) motivating it. The following are the tests for detecting criminal responsibility of an insane person.

1. **Mc Naughten Rule** (the right or wrong test; the legal test): English courts, in dealing with the responsibility of the insane in criminal cases are guided by the rules laid down after the Mc Naughten trial in 1843. The most important of this rule is as follows:—"an accused person is not criminally responsible, if it is clearly proved, that at the time of committing the crime that he was suffering from such a defect of reason from abnormality of mind, that he did not know the nature and quality of act he is doing, or that what he was doing was wrong". This legal test has also been accepted in India as the law of criminal responsibilities under sec. 84, IPC.

2. **Durham rule**: "An accused person is not criminally responsible, if his unlawful act is the product of mental disease or mental defect".

3. **Curren's rule**: "An accused person is not criminally responsible, if at the time of committing the act, he did not have the capacity to regulate his conduct to the requirements of the law, as a result of mental disease or defect.

4. **The irresistible impulse test**: "An accused person is not criminally responsible, even if he knows the nature and quality of his act and knows that it is wrong, if he is incapable of restraining himself from committing the act, because the free agency of his will has been destroyed by mental disease".

5. The **American law institute test**: "A person is not responsible for criminal conduct, if at the time of such conduct, as a result of mental disease or defect, he lacks adequate capacity either to appreciate the criminality of his conduct, or to adjust his conduct to the requirements of the law".

**Automatism**: It is the conduct of a person whose consciousness is impaired to such an extent that he is not fully aware of actions. Main factors producing automatism: (i) Epilepsy (ii) Concussion (iii) Hypoglycemia (iv) Somnambulism (Non-insane automatism).

**Somnambulism**: It means walking during sleep.

**Somnolentia (semisomnolence)**: It is often called sleep-drunkenness and is midway between sleep and walking.

**Impulse**: Some crimes are committed due to an impulse in which the person loses self control, such as sudden violent anger. Such persons are criminally responsible unless insanity is present.

**Hypnotism or Mesmerism**: This is a sleep like condition produced by artificial means or, by suggestions

**Delirium**: A delirious person may commit violent criminal acts due to delusions and hallucinations. He is not legally responsible for the acts committed during delirium.

### **Drunkenness:**

(i) An intoxicated person (voluntary drunkenness) is criminally responsible if he has intention or knowledge of committing a crime.

(ii) Mental disorder brought about by drugs and delirium tremens due to drink frees one of criminal responsibility. Also in post-traumatic automatism, twilight state and paranoid states, the person is free from criminal responsibilities.

| <b>Types</b> | <b>of</b>             | <b>personality</b> | <b>disorders:</b>   |
|--------------|-----------------------|--------------------|---------------------|
| (a)          |                       |                    | Paranoid—suspicious |
| (b)          | Schizoid—withdrawn,   | emotional          | coldness            |
| (c)          | Schizo-typal—oddities | of                 | thinking            |
| (d)          | Histrionic—attention  |                    | seeking             |

- (e) Narcissistic—self-centered  
 (f) Antisocial—flouting norms  
 (g) Avoidant—low self esteem  
 (h) Borderline—unpredictable  
 (i) Dependent—seeking human contact  
 (j) Compulsive—perfectionist  
 (k) Passive aggressive—procrastination. — There is no definite treatment.

**Psychic dependence:** (i) Cocaine (ii) Marijuana (iii) Amphetamine (iv) LSD

Physical dependence and Psychic both: (i) Opiates (ii) Alcohol (iii) Barbiturates.

**Clinical toxicity in alcohol:** (i) Fatty liver (ii) Cirrhosis (iii) Pancreatitis (acute chronic)  
 (iv) Wernicke-Korsakoff syndrome (v) Peripheral neuropathy (vi) Gynecomastia (vii) Amenorrhea.

**Psychiatric emergencies are:** (i) Delirium (ii) Bereavement (iii) Suicide (iv) Mania (iv) Panic attack.

## TOXICOLOGY

General considerations

### DEFINITIONS

**Toxicology:** is the branch of medicine that deals with properties, actions, lethal dose, toxicity, detection or estimation of, and treatment poisons.  
 Forensic toxicology:

—**Forensic toxicology** deals medical and legal aspects of the harmful effects of chemicals on human body.

Poison:

—**Poison** is a substance, which may be liquid, solid or gas, which when administered in small quantity into the living body or brought into contact with any part of it, leads to injury or ill-health by its constitutional or local effects or both.

**Clinical toxicology** deals with human diseases, caused by, or associated with abnormal exposure to chemical substances.

| Characteristics     | of                   | Ideal                        | suicidal  | and         | Homicidal | poisons   |
|---------------------|----------------------|------------------------------|-----------|-------------|-----------|-----------|
| Characteristics     |                      |                              | Suicidal  |             |           | Homicidal |
| 1. Signs            | and                  | symptoms                     | nil/few   | Resemble    | diseases  |           |
| 2. Death            |                      |                              | Painless  |             | Definite  |           |
| 3. Physical quality |                      | Tasteless                    | or        | of pleasant | taste     |           |
| Colourless,         |                      | Odourless,                   | Tasteless | Highly      | toxic     |           |
| 4. Examples         | Opium, Barbiturates, | Organo-phosphorus compounds, | Endrin    | Organic     | fluorine  |           |
| compound,           | Thallium,            | Arsenic,                     | Aconite   |             |           |           |

Section under Cr.P.C / IPC **relevant to poisoning**  
 1. Section under Cr PC — section 39, 40, 175  
 2. Section under IPC — section 176, 193, 202, 284, 299, 300, 304A, 324, 326, 328.

**The law on poisons:**

1. **Poison's act, 1919:** It was passed to regulate the importation, possession and sale of poisons.

2. **The drug and cosmetics act, 1940:** It regulates the import, manufacture, distribution,

and sale of all kinds of drugs. One of its main features is the control of the quality, purity and strength of drugs.

3. **The drugs and cosmetic rules, 1945:** They are framed under the Drugs Act, 1940, to regulate the importation of drugs, the functions and procedures of the Central Drugs Laboratory, the appointment of licensing authorities, and the manufacture, distribution and sale of drugs.

4. **The pharmacy act, 1948:** It was passed in order to regulate the profession of pharmacy and to constitute Central Council of Pharmacy and State Councils of Pharmacy. The object of this act is to allow only registered pharmacists to compound, prepare, mix or dispense any medicine on the prescription of a medical practitioner.

5. **The drugs control act, 1950:** It provides for the control of sale, supply and distribution of drugs, the issue of cash memo for sale, marking of prices, and exhibiting list of prices and stocks.

6. **The drugs and magic remedies (objectionable advertisement) act, 1954:** The object of this act is to ban advertisements which offend decency or morality, and to prevent self-medication and treatment which cause harmful effects.

7. **Narcotic drugs and Psychotropic substances act, 1985:** It repeals 3 acts; (1) The opium act, 1957 (2) The opium act, 1978 (3) The dangerous drugs act, 1930.

8. **Prevention of illicit traffic in narcotic drugs and psychotropic substances act, 1988.**

**A love philter** is a drug, which is supposed to increase the love between the giver and taker. Examples are all aphrodisiacs, such as Arsenic, Cantharides, Alcohol, Opium, Cocaine and Cannabis.

**Classifications:** Poisons may be classified according to the chief symptoms they produce:

**I. Corrosives:**

1. Strong acids
  - (a) Inorganic acids—Sulphuric, nitric, hydrochloric.
  - (b) Organic acids—Carbolic, oxalic, acetic, salicylic.
2. Strong alkalies—Hydrates & carbonates of sodium, potassium & ammonia.
3. Metallic salts—Zinc chloride, ferric chloride, potassium cyanide, chromates.

**II. Irritants:**

1. Inorganic
  - (a) Non-metallic—Phosphorus, chlorine, bromine, iodine.
  - (b) Metallic—Arsenic, antimony, mercury, copper, lead, zinc, silver etc.
2. Organic
  - (a) Vegetables—Abrus precatorius, castor, croton, calotropis, aloes.
  - (b) Animal—Snake & insect bites, cantharides, ptomaines.
3. Mechanical—Powdered glass, diamond dust, hair etc.

**III. Systemic**

1. Cerebral—
  - (a) Somniferous—Opium, barbiturates.
  - (b) Inebriant—Alcohol, ether, chloroform.
  - (c) Deliriant—Datura, belladonna, hyocyamus, cannabis etc.
2. Spinal—Nuxvomica, gelsemium.
3. Peripheral—Conium, curare.
4. Cardiovascular—Aconite, digitalis, quinine, oleander, tobacco, hydrocyanic acid.
5. Asphyxiants—CO, CO<sub>2</sub>, hydrogen sulphide.

**IV. Miscellaneous**

- Food poisoning, Botulism.

## Fate of Poisons in the body

Some inorganic poisons like arsenic and antimony are retained in nails, hair, bones etc. for a considerable time. Certain poisons like chloroform, phosphorus, nitrates, aconite and acetic acid are destroyed in the body and no trace of them can be detected in the viscera or tissues if post-mortem is delayed.

## Action of poisons:

1. — By direct contact. Local
- Chemical destruction - > by corrosives.
- Congestion & inflammation by irritants.
- Tingling of skin and tongue by aconite.
- Dilatation of pupils by belladonna or datura.
2. — By shock caused by Remote
- Cantharides acting on kidneys produce nephritis.
- Nux vomica on spinal cord produces convulsions.
3. — Both local & remote, e.g. oxalic acid, phosphorus etc. Combined

## Toxicity of poisons:

- |     |             |           |   |     |       |     |       |
|-----|-------------|-----------|---|-----|-------|-----|-------|
| (1) | Extremely   | toxic     | = | 1   | mg/kg | or  | less  |
| (2) | Highly      | toxic     | = | 1   | to    | 50  | mg/kg |
| (3) | Moderately  | toxic     | = | 50  | to    | 500 | mg/kg |
| (4) | Slightly    | toxic     | = | 0.5 | to    | 5   | gm/kg |
| (5) | Practically | non-toxic | = | 5   | to    | 11  | gm/kg |
| (6) | Relatively  | harmless  | = | >   |       | 15  | gm/kg |

**Acute poisoning:** Is caused by an excessively single dose, or several smaller doses of a poison taken over a short interval of time.

**Chronic poisoning :** It is caused by smaller doses over a period of time resulting in gradual worsening e.g. arsenic, phosphorus, antimony and opium.

**Self poisoning** (attempted suicide, parasuicide, or pseudocide)  
It is a conscious, often impulsive, manipulative act, undertaken to rectify an intolerable situation.

### Collection:

1. Stomach wash (entire quantity).
  2. 10 ml. blood.
  3. Urine, as much as possible.
- 10 mg of sodium fluoride for 10 ml of blood acts as a preservative and as an anticoagulant.

## Diagnosis of Poison in the Dead

### I. Post-mortem appearances

#### (a) External

1. The colour changes in the corroded skin and mucous membrane: Sulphuric and Hydrochloric acid: grey, becoming black; nitric acid: brown; hydrofluoric acid: reddish-brown; carbolic acid: greyish-white; oxalic acid: grey, blackened by blood; cresols: brown, leathery; caustic alkalis: greyish-white; mercuric chloride: bluish-white; zinc chloride:

whitish; chromic acid and potassium chromate: orange, leathery.  
 2. Colour of post-mortem staining—the skin may be dark-brown or yellow in phosphorus and acute copper poisoning. Cherry red in carbon-monoxide. Chocolate coloured in cases of death from poisoning by nitrites, aniline, nitrobenzene, acetanilide and chlorate of potash owing to the formation of methaemoglobin.  
 3. Smell about the mouth and nose — Substances which may be recognised by their odour are cyanides, phenol, cresol, opium, alcohol, ether, chloroform, camphor, paraldehyde etc.

(b) **Internal**

1. Smell—The skull should be opened first to detect unusual odours in the brain tissues. This is useful in cyanide, alcohol, phenol, cresol, ether, chloroform and camphor poisoning.
2. Oesophagus—Corrosive alkalis produce marked softening and desquamation of the mucous membrane. In acute cantharidin poisoning —> mucous membrane is swollen, congested and may show patches of ulceration.
3. Upper respiratory tract—Corrosive alkali or acid poisoning —> oedema of glottis, congestion & desquamation of the mucous membrane of the trachea & bronchi.
4. Stomach:
  - (i) Hyperemia—Irritant poison.
  - (ii) Softening—Corrosive & irritant poisons,
  - (iii) Ulcers—Corrosive & irritant poisons,
  - (iv) Perforation—Seen in strong mineral acid, especially sulphuric acid.
5. Duodenum and Intestines—In intestine, characteristic change seen is mercury poisoning. It is a colitis, which may resemble enteritis of acute bacillary dysentery.
6. Liver:
 

Liver necrosis—Substances such as arsphenamine, chloroform, trinitrotoluene, carbon tetrachloride and senecio.

Fatty liver— Arsenic, carbon tetrachloride, amanita phylloides, yellow phosphorus, iodine, rarely ferrous sulphate.
7. Kidney—Parenchymatous degenerative changes found in irritant metal poisoning and in cantharidine poisoning. Extensive necrosis of proximal convoluted tubules may be found in deaths from poisoning by mercuric chlorides, phenol, lysol and carbon tetrachloride.
8. Heart—Subendocardial hemorrhage in left ventricle-acute arsenical poisoning.

|             |                                 |                   |
|-------------|---------------------------------|-------------------|
| <b>II.</b>  | <b>CHEMICAL</b>                 | <b>ANALYSIS.</b>  |
| <b>III.</b> | <b>EXPERIMENTS</b>              | <b>ON</b>         |
| <b>IV.</b>  | <b>MORAL AND CIRCUMSTANTIAL</b> | <b>ANIMALS.</b>   |
|             |                                 | <b>EVIDENCES.</b> |

**Duties of Medical practitioner in a case of suspected poisoning**

- I. Medical
 

Care and treatment of the patient.
- II. Legal
 

Assist the police to determine manner of death.

  1. In case of suspected homicidal poisoning—Doctor has to confirm his suspicion before opinion. For this he must:-
    - (a) Collect vomit and urine and submit for analysis.
    - (b) Observe and record the symptoms in relation to food; other persons affected at the same time.
    - (c) Consult senior practitioner.
    - (d) Remove the patient to hospital or appoint nurses of his confidence.
    - (e) If suspicion of homicide is confirmed, shift the patient to hospital.
  2. Suspected articles preserved.
  3. If a private practitioner is convinced of homicidal poisoning, he is bound to inform the

- police officer or magistrate.  
 4. In suicidal poisoning—not bound to inform police.  
 5. If practitioner is summoned by investigating police officer, he is bound to give all information (Sec. 175 I.P.C.)  
 6. Govt. Medical officer has to report the police all cases of suspected poisoning.  
 7. If the condition of patient is serious, arrange to record dying declaration.  
 8. If the patient dies he should not issue death certificate, but inform police.

### **Differential diagnosis of Poisoning based on Vital signs and CNS activity**

- A. STIMULANT POISONING**  
 1. Sympathomimetic syndromes:  
 (a) Amphetamines (b) Caffeine (c) Cocaine (d) Ergot alkaloid (e) MAO inhibitors (f) Theophylline.  
 2. Anticholinergic syndromes:  
 (a) Antidepressants (tricyclic) (b) Antihistamines (c) Belladonna alkaloids (d) Mydriatics (topical) (e) Plant / mushrooms.  
 3. Hallucinogenic syndromes:  
 (a) LSD & synthetic analogue (b) Marijuana (c) Mescaline (d) Phencyclidine.  
 4. Withdrawal syndromes:  
 (a) Alcohol (b) Antidepressants (c) Beta-blockers (d) Clonidine (e) Narcotics (f) Sedative hypnotics.

- B. DEPRESSANT POISONING:**  
 1. Sympatholytic syndromes:  
 (a) Adrenergic blockers (b) Calcium channel blockers (c) Digoxin.  
 2. Cholinergic syndromes:  
 (a) Bethanecol (b) Carbamate insecticides (c) Organophosphate insecticides (d) Myasthenia gravis drugs (e.g. Pyridostigmine) (e) Physostigmine.  
 3. Narcotic syndromes:  
 (a) Analgesics (b) Antispasmodics (GI).  
 4. Sedative-hypnotic syndromes:  
 (a) Alcohol (b) Anti epileptics (c) Barbiturates (d) Benzodiazepines (e) Hydrocarbons.

An anion metabolic acidosis is characteristic of methanol, ethylene glycol and salicylate intoxication. An increased anion gap metabolic acidosis with respiratory alkalosis, ketosis and tinnitus suggests salicylate poisoning. An increased osmolal gap accompanied by visual symptoms suggests methanol poisoning. Pulmonary edema (ARDS) can occur with carbon monoxide, cyanide, narcotic, paraquat, phencyclidine, sedative-hypnotics, salicylate poisoning, irritant gas. Aspiration pneumonia is common in patients with coma, seizures and petroleum distillate poisoning. Radio-opaque densities may be visible in abdominal X-rays, followed by ingestion of calcium salts, chloral hydrate, enteric coated tablets, heavy metals, lithium, phenothiazine, salicylates etc. Bradycardia and AV block may occur in patients poisoned by anti-arrhythmic agents, beta blockers, cholinergic agents (carbamate and organophosphorus insecticides), digitalis, lithium.

- Treatment of Poisoning**  
 The treatment of patient consists of  
 I. Removal of unabsorbed poison from the body.  
 II. Administration of antidotes.  
 III. Elimination of poison by elimination.  
 IV. Symptomatic treatment.
- I. REMOVAL OF UNABSORBED POISON FROM THE BODY**

1. Inhaled poison— Patient must be removed into fresh air; artificial respiration and oxygen (6 to 8 litres per minute) should be given. Air-passages should be kept free from mucus by postural drainage or by aspiration.
2. Injected poisons—If the poison has been injected subcutaneously by a bite or injection, a tight ligature is applied immediately above wound; wound should be excised & poison sucked out.
3. Contact poisons—Removed by washing with water or should be neutralised by specific chemical.
4. Ingested poisons—

**Gastric lavage** is useful within three hours after ingestion of a poison.  
Contraindications:

- (i) The only absolute contraindication is corrosive poisoning (except carbolic acid) due to danger of perforation,
- (ii) Stomach wash is done with proper precautions in
- (a) Convulsant poisons, as it may lead to convulsions.
- (b) Comatose patients, because of the risk of aspiration of fluid into the air-passages.
- (c) Volatile poison, which may be inhaled.
- (d) Upper alimentary disease e.g. oesophageal varices
- (e) In patient with marked hypothermia.

**Emetics:** When difficulty in obtaining or using stomach tube.  
Household emetics:

- (i) Large amount of warm water.
- (ii) Mustard powder in warm water.
- (iii) Common salt in warm water.
- (iv) Vomiting can also be produced by tickling the back of the throat with a finger, leaf twig or, wooden tongue depressor. It is the best method.

Contraindications:

- (i) Same as stomach wash
- (ii) Severe heart & lung diseases
- (iii) Advanced pregnancy.

## II. ADMINISTRATION OF ANTIDOTES

Antidotes are substances which counteract or neutralise the effect of poison.

### 1. Mechanical or Physical antidotes:

They neutralise poisons by mechanical action or prevent their absorption.

- (a) Animal charcoal.
- (b) Demulcents are substances which form a protective coating on the gastric mucous membrane and thus do not permit the poisons to cause any damage e.g. milk, starch, egg white, mineral oil, milk of magnesia, aluminium-hydroxide gel etc. Fats and oils should not be used for oil soluble poisons as kerosene, phosphorus, organo-phosphorus compound, DDT, phenol, carbon tetra-chloride etc.
- (c) Bulky food acts as a mechanical antidote to glass powder.

### 2. Chemical antidotes

They counteract the action of poison by forming harmless or insoluble compound or by oxidising poison.

- (i) Common salt decomposes silver nitrate.
- (ii) Albumen precipitates mercuric chloride.
- (iii) Dialysed iron is used to neutralise arsenic.
- (iv) Copper sulphate is used to precipitate phosphorus.

- (v) Alkalies neutralise acids by direct chemical action. It is safer to give a little weak solution of an alkaline hydroxide, magnesia or ammonia. Bicarbonates should not be given because of the possible risk of rupturing the stomach due to liberated CO<sub>2</sub>
- (vi) Acids neutralise alkalies by direct chemical action: Only harmless substances should be given e.g. vinegar, lemon juice, canned fruit juice.
- (vii) Potassium permanganate has oxidising property. 1: 5000 solution is used in poisoning for opium, strychnine, phosphorus, cyanide, barbiturate, atropine and other alkalies.
- (viii) A solution of tincture iodine or Lugol's iodine precipitates most alkaloids, lead, mercury, silver, quinine, strychnine etc.
- (ix) Tannic acid tends to precipitate apomorphine, cinchona, strychnine, nicotine, cocaine, aconite, pilocarpine, lead, silver, aluminium, cobalt, copper, mercury, nickel and zinc.

### **Universal**

### **antidote:**

When the exact poison is not known, or when a combination of two or more poisons had been taken, universal antidote is given. It consists of powdered animal charcoal 2 parts; magnesium oxide 1 part; tannic acid (strong tea) 1 part. Charcoal absorbs alkaloids; tannic acid precipitates alkaloids, glucosides and many of the metals. Magnesia neutralises acids without gas formations. It is combination of physical and chemical antidotes.

### **3.**

### **Physiological**

### **antidotes**

They act on the tissues of the body and proc exactly opposite to those caused by the poison. Atropine and physostigmine are two real physiological antidotes. Other examples are barbiturate & picrotoxin or amphetamine; strychnine and barbiturates; cyanides and amyl nitrite.

### **Chelating**

### **agents:**

- (a) B.A.L (British anti-lewisite; dimercaprol) — It is used as physiological antidote in arsenic, bismuth, mercury, copper, gold and other heavy metals. Dimercaprol has two unsaturated sulphhydryl group and thus prevents union of Arsenic with the - SH group of the respiratory enzyme system.
- (b) E.D.T.A. (Ethylenediaminetetra-acetic acid; calcium disodium versenate): It is a chelating agent and is effective in lead, mercury, copper, cobalt, cadmium, iron and nickel poisoning.
- (c) Penicillamine (cuprimine)—It is a hydrolysis product of penicillin, having stable - SH group. It is the chelating agent of maximum efficiency for the heavy metals. Penicillamine is commonly used for the management of heavy metal poisoning of copper, lead, mercury.
- (d) Desferroxamine: Useful in acute iron poisoning.

## **III. ELIMINATION OF POISON BY EXCRETION**

1. Renal excretion:  
Salicylates and phenobarbitone can be easily excreted in alkaline urine. Alkalinisation is usually carried out with sodium bicarbonate. Amphetamine, quinine and quinidine can be excreted in acid urine. Acidification can be achieved with ammonium chloride, arginine or lysine.
2. Purging:  
30 gm of sodium sulphate with large amount of water hastens the elimination of poison in the stool. Magnesium sulphate should be avoided as it may produce CNS depression in cases of renal failure.
3. Diaphoretics:  
Agent increases perspiration. Agents are pilocarpine nitrate, alcohol, salicylates, and antipyretics.
4. Peritoneal dialysis  
Alcohols, long acting barbiturates, chloral hydrate, lithium, salicylate & sodium chlorate are

effectively removed by peritoneal dialysis.  
 5. Hemodialysis or Hemoperfusion  
 Hemoperfusion -> Many substances that cannot be removed effectively by aqueous dialysis can be removed by hemoperfusion through specially designed coated charcoal columns. It has same indications as for dialysis.  
 Hemodialysis may be used for following poisons: BLAST  
 B—Barbiturates, L—Lithium, A—Alcohol-Methanol, S—Salicylates, T—Theophylline.

**IV. SYMPTOMATIC TREATMENT.**  
 Few Specific Antidotes

|     | Indication                                                       | Antidote / drug                                                                                             |
|-----|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| 1.  | (i) Amanita muscaria<br>(ii) Organophosphates<br>(iii) Carbamate | Atropine injection                                                                                          |
| 2.  | Cyanides                                                         | (i) <b>Dicobalt edetate</b><br>(ii) Sodium nitrite<br>(iii) Sodium thiosulphate<br>(iv) <b>Amyl nitrite</b> |
| 3.  | Digoxin                                                          | Antidigoxin Fab (antibody fragments)                                                                        |
| 4.  | Paracetamol                                                      | (i) <b>N-acetyl cysteine</b><br>(ii) methionine                                                             |
| 5.  | Lead                                                             | Calcium disodium edetate                                                                                    |
| 6.  | Copper                                                           | <b>Penicillamine</b>                                                                                        |
| 7.  | Mercury, arsenic, gold                                           | <b>BAL</b> or Dimercaprol                                                                                   |
| 8.  | Acute Iron poisoning<br>Aluminium                                | Desferrioxamine                                                                                             |
| 9.  | Phosphorus white (yellow)                                        | Copper solution                                                                                             |
| 10. | <b>Benzodiazepines</b>                                           | Flumazenil                                                                                                  |
| 11. | Beta blockers                                                    | Glucagon                                                                                                    |
| 12. | CO, Cyanides, H <sub>2</sub> S                                   | Oxygen                                                                                                      |
| 13. | Organophosphates                                                 | Pralidoxime                                                                                                 |
| 14. | Phenol                                                           | Polyethylene glycol 400                                                                                     |
| 15. | Methanol                                                         | Ethanol (Hemodialysis)                                                                                      |
| 16. | <b>Cocaine</b>                                                   | <b>Amyl nitrite</b>                                                                                         |

|     |                           |                                                       |
|-----|---------------------------|-------------------------------------------------------|
| 17. | Aconite                   | Atropine                                              |
| 18. | <b>Dhatura</b>            | <b>Physostigmine</b>                                  |
| 19. | Mineral acids             | Milk mixed with magnesium oxide                       |
| 20. | Salicylate poisoning      | Forced diuresis (Hemodialysis)                        |
| 21. | Snake poison              | Polyvalent anti snake venom                           |
| 22. | Cannabis                  | No specific antidote, stomach wash, symptomatic drugs |
| 23. | <b>Thallium poisoning</b> | <b>Prussian blue</b>                                  |

### Contra-indications

1. Phosphorus —» Demulcents because, they increase absorption.
2. Sulphuric acid —» Sodium bicarbonate reacts with acid and liberates CO<sub>2</sub> gas, which may cause perforation.
3. Carbaryl poisoning —» Pralidoxime.
4. Oxalic acid —» Large amounts of water.
5. In Liver damage —» BAL is contraindicated. -

### Preservation of Organs

1. Rectified spirit is used as preservative for many poisons except alcohol, kerosene, phosphorus, paraldehyde, carbolic acid, acetic acid because the organic acids and paraldehyde are soluble in alcohol and the phosphorescence of phosphorus is diminished by alcohol.
2. Saturated Sodium chloride is used for preservation of organs in poisoning with—(a) Alcohol, (b) Acetic acid, (c) Carbolic acid, (d) Paraldehyde, (e) Phosphorus poisoning, (f) Corrosive poisoning, (g) Organophosphorus poisoning, (h) Lead poisoning.
3. In alcoholic poisoning—Store blood in sodium fluoride + oxalate. Store urine in phenyl mercuric nitrite.
4. Never use formalin as a preservative for chemical analysis because extraction of poison, especially non-volatile organic compounds becomes difficult.
5. Minimum quantity of blood required to be preserved for chemical analysis is 10 ml.
6. Brain is preserved in Normal saline, Rectified spirit.
7. Uterus, Brain, Heart are preserved in Rectified spirit.

### Organs to be preserved

- 1) Nails & Hairs—In chronic arsenic poisoning.
- 2) Skin—In gun shot injuries and when injectable poison is used
- 3) Heart—In strychnine poisoning, cardiac poisons, arsenic.
- 4) Brain—In Barbiturate, anaesthetic gas, strychnine, organophosphorus & volatile organic acid poisoning.
- 5) Lung—In gas poisoning (CO-poisoning), HCN, alcohol. chloroform poisoning.
- 6) Bone—In Arsenic, Thallium, Antimony, Lead and Radium poisoning.
- 7) Hair about 20 gms—In Aconite and Arsenic poisoning.
- 8) CSF—Alcohol poisoning & Sodium fluoride.
- 9) No preservatives are required—In Lungs, Long bones, Hairs & Nails.

10) Urine should be preserved in—Opium, Barbiturate, Alcohol poisoning.

**Peculiar odour (smell) emitted on opening the abdomen at autopsy:**

1. Fruity Ethyl alcohol
2. Kerosene like odour Kerosene, organophosphorus compounds
3. Phenolic odour Carbollic acid, lysol
4. Rotten eggs Hydrogen sulphide
5. Garlic odour Arsenic, phosphorus, thallium
6. Fishy (mushy) Zinc phosphide
7. Bitter almonds odour Cyanide
8. Burnt rope Cannabis (marijuana)

**Colour changes observed with post mortem lividity (post mortem stains)**

1. Purple → In Hypoxia (due to reduced hemoglobin).
2. Chocolate colour → In Sodium nitrite, Quinine, Potassium chlorate.
3. Cherry red → In CO, Hydrocyanic acid poisoning.
4. Bluish green → Hydrogen sulphide.
5. Blue → Copper sulphate.
6. Yellow / brownish → Phosphorus.

**CORROSIVE**

**POISONS**

A corrosive poison fixes, destroys and erodes the surface with which it comes in contact. They act by extracting water from the tissues, and coagulate cellular proteins and convert haemoglobin into haemin.

**MINERAL**

**ACIDS**

They produce coagulation necrosis. They have no remote action. Nitric acid produces a yellowish stain. Sulphuric acid and caustic alkalis reddish-brown stains; hydrochloric acid and carbollic acid whitish or greyish-yellow stains on the skin and mucous membranes.

**SULPHURIC**

**ACID**

Sulphuric acid is the strongest corrosive poison. Pure sulphuric acid ( $H_2SO_4$ ) is a heavy, odourless, colourless, non-fuming, hygroscopic, oily liquid and has tendency to carbonise organic substances.

**Signs**

**and**

**symptoms:**

Burns of the mouth result in excess salivation, pain, dysphonia and dysphagia. Oesophageal symptoms and signs include drooling, painful swallowing, retrosternal pain and neck-tenderness. Vomiting of blood & mucous may occur. In sulphuric acid poisoning, stomach mucosa is stained black. It is like blotting paper. The vomit is brown or black, mucoid, strongly acid, and may contain shreds of charred wall of the stomach. Teeth are chalky-white. Constipation is severe and there is tenesmus. Edema, erythema and ulceration of the oesophagus may be followed by fibrosis with stricture formation and obstruction of the gastric outlet.

Fatal dose—5

to

10

ml.

Fatal

period—24

hours.

**Causes**

**of**

**death:**

(i) Circulatory collapse, (ii) Spasm or oedema of glottis, (iii) Collapse due to perforation of stomach, (iv) Toxaemia (v) Delayed death may occur due to hypostatic, pneumonia, secondary infection, renal failure or starvation due to stricture of oesophagus.

**Treatment:**

Gastric lavage or emetics are contraindicated. The acid should be immediately diluted and neutralised by giving 250 ml of water or milk mixed with 4 tsf. of calcium or magnesium oxide (antidote), aluminium hydroxide gel or calcined magnesia or soap water may be used. Alkaline carbonates and bicarbonates which liberate carbon dioxide should not be used as they cause gastric dilatation and sometimes rupture. Prednisolone may be given to prevent oesophageal stricture and for shock.

#### **Post-mortem**

#### **appearances:**

Corrosion of the mucous membranes of lips, mouth and throat and of the skin over the chin, angles of mouth and hands is seen. The necrotic areas are at first greyish-white but soon become brown or black and leathery.

#### **Internal**

The greater part of stomach may be converted into a soft spongy black mass which disintegrates when touched. The stomach wall has a brown or black colour. Perforation may occur in sulphuric acid poisoning with the escape of the gastric contents into the peritoneal cavity. Chemical peritonitis & corrosion of organs is seen.

#### **VITRIOLAGE**

#### **(Vitriol**

#### **throwing)**

Throwing of sulphuric acid on another individual is known as **vitriolage**. Most common agent used as vitriolage is sulphuric acid. Jealous or disgruntled persons may throw a corrosive to disfigure and harm their enemies. Blindness may occur. Death may result from shock or toxæmia. The burns are painless, penetrating and the acid devitalises the tissues and predispose to infection. Sometimes, corrosive alkali or juice of marking nut or calotropis is used to disfigure the face.

#### **Treatment:**

The affected part is washed with plenty of water and soap or sodium or potassium carbonate. Later, a thick paste of magnesium oxide or carbonate is applied.

#### **NITRIC**

#### **ACID**

#### **(HNO<sub>3</sub>)**

Nitric acid (aqua fortis) is a clear, colourless, fuming, heavy liquid and has a peculiar and choking odour. In concentrated form, it combines with organic matter and produces an yellow discolouration of tissue due to the production of picric acid (xanthoproteic reaction).

#### **Signs**

#### **&**

#### **Symptoms:**

They are those of poisoning by sulphuric acid. It causes yellow discolouration of the tissues including the crowns of the teeth and yellow stains on the clothing. Inhalation of fumes causes lacrimation, photophobia, irritation of air passages and lungs producing sneezing, coughing, dyspnoea & asphyxia. Brown colour of urine is seen in Nitric acid poisoning.

Fatal dose — 10 to 15 ml.

Fatal period — 12 to 24 hours.

#### **Post-mortem**

#### **appearance:**

They are those of sulphuric acid but the tissues are stained yellow, except stomach. The stomach is soft, friable and ulcerated & greenish in colour.

Treatment : Same as for Sulphuric acid.

#### **HYDROCHLORIC**

#### **ACID**

#### **(HCl)**

It is a pungent, colourless, fuming liquid. It is a natural constituent of the fluid of the stomach and bowels.

#### **Signs**

#### **and**

#### **Symptoms:**

The mucous membrane is at first grey or grey white, and later becomes brown or black, due to production of acid haematin.

Fatal dose—15 to 20 ml. Fatal period—18 to 24 hours.

#### **OXALIC**

#### **ACID**

It occurs in the form of colourless, transparent, prismatic crystals, and resembles in appearance the crystals of magnesium sulfate & zinc sulphate. It is used as ink-remover solution in forgeries.

Action:

- (i) Local— Corrosive poison. Corrodes mucous membrane of the digestive tract.
- (ii) Systemic—(a) Shock, (b) Hypocalcemia, (c) Renal damage: oxalates produce tubular nephrosis or necrosis and cause death from uremia in 2 to 14 days. Fatal dose—15 to 20 gms. Fatal period—One to two hours.

Signs and Symptoms

(a) Fulminant poisoning: There is a burning, sour, bitter taste in the mouth with a sense of constriction around the throat and burning pain from the mouth to stomach. Vomit usually contains altered blood and mucus and has a 'coffee ground' appearance. Thirst may be present. In oxalic acid poisoning, pulse is feeble and rapid. If life is prolonged, diarrhoea will occur.

(b) Acute poisoning: If the patient survives for a few hours, hypocalcaemia and digestive upset occurs. There is muscle irritability and tenderness, tetany usually convulsions, numbness & tingling of the fin tips & legs. Cardiovascular collapse, stupor or coma.

(c) Delayed poisoning: Symptoms of uraemia are seen. The urine may be scanty or suppressed and may contain traces of blood, albumin and calcium oxalate crystals

Treatment:

The stomach is washed out carefully using calcium lactate or gluconate. The antidote for oxalate poisoning is calcium gluconate 10%, 10 ml i.v. at frequent intervals.

Post-mortem

appearances:

Mucous membrane of the tongue, mouth, pharynx & oesophagus will be whitened, as if bleached. Stomach is reddened or, eroded or, almost black. The stomach contents are gelatinous and brownish due to acid haematin formation. The kidneys are swollen by oedema, congested and the tubules are filled with oxalate crystals.

## CARBOLIC

## ACID

## (Phenol)

When pure, the acid consists of short, colourless, prismatic needle-like crystals, which have a burning sweetish taste, which turn pink and liquefy when exposed to air. It has a characteristic carbolic or phenolic smell. Commercial carbolic acid is dark brown liquid. It is readily absorbed from the alimentary tract, respiratory tract, rectum, vagina, serous cavities, wounds and through the skin. Phenol is converted into hydroquinone and pyrocatechol in the body before being excreted in the urine.

Fatal dose—One to two gm.  
Fatal period—3 to 4 hours.

**Signs & Symptoms:** —Poisoning by carbolic acid is known as carbolism.

1. Local

(a) Skin: It causes burning and numbness. It precipitates protein and coagulates cell contents. Produces white opaque eschar.

(b) Digestive tract: Hot burning pain extends from the mouth to the stomach followed by tingling and later anaesthesia.

(c) Respiratory tract: Pulmonary & laryngeal oedema develop due to irritation.

2. Systemic effects

Depressant of nervous system, especially the respiratory centre. Headache, giddiness, tinnitus, muscular spasm and later collapse, unconsciousness and coma occur. The temperature is subnormal. In phenol poisoning, pupils are contracted. Breathing is stertorous. Pulse is rapid, feeble and irregular in carbolic acid poisoning. Face is covered with cold sweat, dusky cyanosis. There is strong odour of phenol in breath. Urine is scanty and contains albumin & free hemoglobin; suppression may follow. In carboluria, the urine may be colourless or slightly green at first, but turns green or even

black on exposure to air. In the body, phenol is partly oxidised to hydroquinone and pyrocatechol, which with unchanged phenol are excreted in the urine. The further oxidation of hydroquinone and pyrocatechol in the urine is the cause of green colouration. This is known as Carboluria. The hydroquinone and pyrocatechol may cause pigmentation in the cornea and various cartilages—a condition called ochronosis.

### Treatment

The stomach should be washed with plenty of lukewarm water containing animal charcoal, olive oil, castor oil, magnesium or sodium sulphate or, saccharated lime with which phenol combines and forms harmless products. Magnesium sulphate or medicinal liquid paraffins should be left in the stomach.

### Post-mortem

### appearances

Corrosion of the skin, especially in tracks from the angles of the mouth on to chin, has a greyish or brown colour. The tongue is usually white and swollen and there is smell of phenol about the mouth. The stomach mucosal folds are swollen and covered by opaque, coagulated, grey or brown thickening and looks leathery. Kidneys show hemorrhagic nephritis.

## NON-METALLIC

## POISONS

### PHOSPHORUS

There are two varieties: (1) White or crystalline, (2) Red or amorphous. It is a protoplasmic poison, which affects cellular oxidation.

Difference between White and Red phosphorus

|    | Trait           | White Phosphorus                                                              | Red Phosphorus                             |
|----|-----------------|-------------------------------------------------------------------------------|--------------------------------------------|
| 1. | Colour          | White or yellow                                                               | Reddish-brown.                             |
| 2. | Appearance      | Translucent, waxy cylinders                                                   | Amorphous, solid mass                      |
| 3. | Smell           | Garlic like                                                                   | Odourless.                                 |
| 4. | Taste           | Garlic like                                                                   | Tasteless.                                 |
| 5. | Luminosity      | Luminous in dark                                                              | Non-luminous.                              |
| 6. | Exposure to air | Oxidises & emits white fumes; ignites at 34°C and as such is kept under water | Non-oxidised, Non-fuming, Non-inflammable. |
| 7. | Toxicity        | Highly toxic                                                                  | Non-toxic                                  |

### Signs

### and Fulminating

### Symptoms: poisoning

1.

This is seen when more than 1 gm. is taken. Death usually occurs within 12 hours due to shock.

2.

### Acute

### poisoning

(A): First stage: Symptoms occur within a few minutes to a few hours & lasts 8 hours to 3 days. Ingestion produces burning pain in the throat and abdomen with intense thirst, nausea, vomiting, diarrhoea & severe abdominal pain. Breath & excreta have garlic like odour. Luminescent vomit and faeces are diagnostic. Skin contact produces painful penetrating second & third degree burns.

(B) Second stage: This is a symptom-free period lasting for 2 to 3 days.

(C) Third stage: Symptoms of systemic toxicity. There is nausea, vomiting, diarrhoea, haema-temesis. Liver tenderness and enlargement. Jaundice and pruritis. Hemorrhages occur into skin, mucous membrane & viscera, due to injury of blood vessels and inhibition of blood clotting. Renal damage results in oliguria, haematuria, casts, albuminuria. Convulsions, delirium and coma occurs. Death may result from shock, hepatic failure, central nervous system damage, hematemesis or, renal insufficiency.

|       |        |   |    |    |     |       |
|-------|--------|---|----|----|-----|-------|
| Fatal | dose   | — | 60 | to | 120 | mg.   |
| Fatal | period | — | 2  | to | 8   | days. |

#### Treatment:

1. Gastric lavage using 1: 5000 solution of potassium permanganate oxidises phosphorus into phosphoric acid and phosphates, which are harmless.
2. Antidote—copper sulphate: It coats the particles of phosphorus with a film of copper phosphide which is relatively harmless.
3. Vitamin K.
4. Peritoneal or hemodialysis.

#### Post-mortem

#### appearances:

In acute poisoning jaundice is produced. The gastric and intestinal contents may smell of garlic and may be luminous. The mucous membranes of the stomach and intestine are yellowish or greyish white in colour. The liver becomes swollen, yellow, soft, fatty and is ruptured. After a week, acute yellow atrophy appears.

#### Chronic

#### Poisoning:

The frequent inhalation of fumes over a period of years causes necrosis of the lower jaw in the region of a decayed tooth. This condition is known as 'Phossy Jaw', in osteomyelitis and necrosis of the jaw occurs, with multiple sinuses discharging foul smelling pus.

Poisoning:

Phosphorus is known as Diwali poison. Accidental poisoning in children may occur due to chewing of fireworks or by eating rat poison.

#### IODINE

It occurs as bluish-black, soft, scaly crystals and has a metallic lustre and an unpleasant taste.

Action: It is a protoplasmic poison fixing protein and causes necrosis. Signs & Symptoms:

It acts as acid corrosive poison. There is intense thirst, vomiting and lips are stained brown. Vomiting matter -> dark yellow or blue in colour with peculiar odour of Iodine. Urine -> scanty, red-brown in colour.

Fatal dose: 2 to 4 gm (30 to 60 ml of tincture). Fatal period: Several days.

Chronic poisoning (Iodism):

The symptoms are pain over the frontal sinus, running of nose, conjunctivitis, bronchial catarrh, salivating nausea vomiting, purging, emaciation, wasting of breasts, testes etc. and acne & erythematous patch on the skin.

#### INSECTICIDES

#### AND

#### WEED

#### KILLERS

Insecticide poisoning is most common form of suicide.

#### ZINC

#### PHOSPHIDE

It reacts with acid in the stomach and liberates phosphine. The symptoms are vomiting, diarrhoea, cyanosis, respiratory distress, fever and death.

Fatal dose: 5 gm. Fatal period: 24 hours.

It has a garlic odour in stomach contents. Blood is cherry red.

## ORGANOPHOSPHORUS

## POISONS

They are derived from phosphoric acid and form two series of compounds

(1) Alkyl phosphates—  
(i) HETP (hexaethyltetraphosphate) (ii) TEPP (tetraethyl-pyrophosphate) (iii) OMPA (octamethylpyrophosphoramidate) (iv) Malathion (kill bug).

(2) Aryl phosphates—  
(i) Parathion (follidol) (ii) Diazinon (tik-20).

**Action:** Organophosphorus insecticides irreversibly inhibit acetyl cholinesterase and cause accumulation of acetyl choline at muscarinic and nicotinic synapses.

They have three distinct toxic effects :

1. **A muscarinic-like effect**—Nausea, vomiting, abdominal cramps, urinary and fecal incontinence, increased bronchial secretions, sweating, salivation, urinary frequency and incontinence. Porphyriaemia, resulting in chromatolachyorrhoea (shedding of red tears) due to accumulation of porphyrin in the lacrimal gland. Contracted pin point pupils (miosis), blurring of vision may occur. In severe poisoning, bradycardia, hypotension, pulmonary edema.

2. **Nicotinic sign** include—twitching, fasciculations, weakness, hypertension, respiratory rate decreased with respiratory failure.

3. **CNS effects**—anxiety, restlessness, tremor, convulsive confusion, weakness and coma.

Fatal dose:

TEPP, HETP, OMPA, Parathion—80 mg i.m. or, 175 orally.

Malathion and diazinon one gram orally.

Fatal period — Usually within 24 hours.

**Cause of Death:**

Death is caused by paralysis of respiratory muscles, respiratory arrest due to failure of respiratory centre or intense broncho constriction.

Diagnosis is by giving atropine. Symptoms are relieved without atropinizing.

### Treatment:

1. Atropine, a muscarinic receptor antagonist, should be administered for muscarinic effect upto drying of bronchial and mucous membrane secretions.

2. Pralidoxime (2-PAM), an oxime that reactivates cholinesterase, is indicated for nicotinic symptoms in organophosphorus poisoning.

3. Gastric lavage and contaminated skin is washed with 2g and water. Post-mortem appearances:

Blood stained froth is seen at the mouth and nose. The stomach content may smell of kerosene. Suicide is very common.

## CARBAMATES

Carbamate insecticides include carbaryl, aldicarb, baygon, ficam and propoxur. Carbamates reversibly inhibits acetyl cholinesterase enzyme. Atropine is the antidote.

## ENDRIN

It is a polycyclic, polychlorinated hydrocarbon. It is also called plant penicillin.

## METALLIC

## POISONS

## ARSENIC

Arsenic poisoning causes premalignant condition. Metallic arsenic is not poisonous, as it is not absorbed from the alimentary canal. When volatilised by heat, arsenic unites and forms poisonous vapour of arsenic trioxide.

### Poisonous

### compounds:

1. Arsenious oxide or, Arsenic trioxide (sankhya or, somal-khar)—It is known as white arsenic or arsenic. A pinch of Arsenic trioxide can kill as many as 5 persons.
  2. Copper acetoarsenate (paris green)—It combines with sulphhydryl enzymes and interferes with cell metabolism.
- Signs and Symptoms:

1. The Fulminant type—Large doses of arsenic can cause death in one to 3 hours from shock.
  2. The Gastroenteric type —This is acute poisoning, resem—bling bacterial food poisoning or, cholera. The stools are expelled frequently and involuntarily, are dark coloured, stinking and bloody, but later becomes colourless, odourless and water resembling rice-water stools of cholera. Dehydration with muscular cramps, cyanosis, feeble pulses, syncope, coma, exhaustion, convulsion, general paralysis and death, skin eruptions.
  3. Narcotic form—Tenderness of the muscle, delirium, coma and death.
- Fatal dose: 0.1 to 0.2 gm or, 100 to 200 mg. Fatal period: One to two days.

### Difference between Arsenic poisoning and Cholera:

|    | Trait          | Arsenic poisoning                            | Cholera                                            |
|----|----------------|----------------------------------------------|----------------------------------------------------|
| 1. | Pain in throat | Before vomiting                              | After vomiting                                     |
| 2. | Purging        | Follows vomiting                             | Precedes vomiting                                  |
| 3. | Stools         | Like rice-water in early stage, later bloody | Rice-watery and pass in continuous involuntary jet |
| 4. | Tenesmus       | Present                                      | Absent                                             |
| 5. | Vomited matter | Contains mucous, bile and blood              | Watery without mucous, bile and blood              |

### Treatment:

Freshly prepared precipitated hydrated ferric oxide (arsenic antidote) is given. In arsenic poisoning BAL is an antidote. Calcium disodium versenate. Penicillamine.

### Post-mortem

### appearance:

Red-Velvety appearance of the stomach mucosa.

### Chronic

### poisoning:

1. CNS—Polyneuritic, optic neuritis.
2. Skin—finely mottled brown change mostly on the temples eyelids and neck (rain drop type).

Chronic arsenic poisoning causes (i) Basal cell carcinoma. (ii) Cirrhosis of liver. here may be a rash resembling fading measles rashes. Hyperkeratosis & Hyperpigmentation of the part and soles with irregular thickening of the nails is seen. Development of bands of opacity in the finger nails are called Aldrich-Mess lines. Arsenophagists are people who take arsenic daily as tonic or as an aphrodisiac and they acquire a tolerance of ia 0.3 gm or more in one dose.

Poisoning : Homicidal

Arsenic is the most popular homicidal poison. It delays putrefaction. It can be detected in completely decomposed body. It can be found in bones, hair and nails for a long time. It can be detected in charred bone and ashes. It is sometimes used in abortion sticks.

Tests for detection: Marsh's test and Reinsch's test.

## MERCURY

Most poisonous salt of Hg is mercuric chloride (corrosive sublimate), occurs as colourless masses of prismatic crystals.

Symptoms — Acrid metallic taste, hoarse voice, greyish white coating of tongue, blood-stained stool, circulatory collapse, necrosis of jaw, membranous colitis, proximal renal tubular necrosis.

Fatal dose: 1 to 4 gm. Fatal period: 3 to 5 days.

Treatment:

Gastric lavage with sodium formaldehyde sulfoxylate. BAL (BALMIER) is chelator of choice.

Penicillamine. 10 gm of sulfoxylate in 100 – 200 cc of distilled water by slow i.v. injection is repeated after 4 – 6 hours acts as an antidote.

Chronic Poisoning:

The symptoms are salivation, a blue line on gum, sore mouth & throat, fine tremors of the tongue, hands, arms, anaemia. Shaking palsy is associated c Hg poisoning. Mercurial tremors are also called hatter's shakes or glass blower's shake. Mercurial erethism is seen in persons working with mercury in mirror manufacturing firms. Erethism is characterised by shyness, timidity, irritability, loss of confidence, mental depression, loss of memory & insomnia. Mercurialentis is a peculiar eye change due to brownish deposit of mercury through the cornea on the anterior lens capsule. It is bilateral and has no effect on visual acuity.

## LEAD

Acute poisoning —The symptoms are metallic taste, dry throat, peripheral circulatory collapse, paraesthesias, depression, coma and death.

Fatal dose—Lead acetate 20 gm; lead carbonate 4 gm. Fatal period—One to two days.

Treatment:

The combination of BAL and calcium disodium versenate is effective.

Chronic poisoning (plumbism)—causes:

Inhalation of lead dust and fumes by makers of white lead, smelters, plumbers, glass-polishers. Chronic poisoning results from a daily intake of one to two mg. of lead.

## Signs

## and

## Symptoms:

**LAPEC** : L -> Lead line; A -> Anemia; P -> Palsy, Pallor, Punctate basophilia, E -> Encephalopathy; C -> Colic, constipation.

Facial pallor—The facial pallor about the mouth is one of the earliest and most consistent sign. Anemia—In early stage polycythemia but later there is anaemia which is associated with punctuate basophilia, polychromasia, nucleated RBC, and an increase in mononuclear cells of microcytic hypochromic anaemia. Punctate basophilia or basophilic stippling means the presence of many dark-blue coloured pinhead sized spots in the cytoplasm of red blood cells due to toxic action of lead on porphyrin metabolism. Lead line—A stippled blue line, called Burtonian line, is seen on the gums in 50 to 70% of cases. A similar blue line is seen in cases of poisoning by mercury, copper, bismuth, iron and silver. Abdominal colic and constipation—later symptoms. Lead palsy—wrist drop, peripheral neuropathy, foot drop. Encephalopathy—Lead encephalopathy is most common in children. The symptoms are vomiting, headache, insomnia, visual disturbances, delirium, hallucinations, convulsions, coma and death. In adult, encephalopathy is rare. Menstrual irregularity—amenorrhoea, dysmenorrhoea. Renal dysfunction. Sterility.

Diagnosis:

In poisoning, the concentration of lead in blood is usually between 0.1 to 0.6 mg. per 100 ml. X-ray evidence of increased radio-opaque bands of lines at the metaphyses of long

bones is seen in children.

Treatment:

Most effective treatment of plumbism is calcium-disodium versenate. BAL Penicillamine.

## COPPER

Copper as a metal is not poisonous. Copper compounds are powerful inhibitors of enzymes.

Ptyalism is seen in copper poisoning.

Fatal dose—15 gm. Fatal period—1 to 3 days.

Treatment: (i) Stomach wash c solution of potassium ferrocyanide. (ii) N-penicillamine. (iii) EDTA. (iv) BAL.

## ORGANIC

## IRRITANT

## POISONS

### RICINUS

### COMMUNIS

The castor plant (arandi) grows all over India. Seeds are smooth, flattened-oval, mottled, light and dark brown. Entire plant is poisonous, containing toxalbumen RICIN, a water-soluble glycoprotein and a powerful allergen (CBA). A toxalbumen or phytotoxin is a toxic protein, which resembles a bacterial toxin in action and causes agglutination of red cells with some hemolysis and is antigenic.

Signs and Symptoms—Symptoms include salivation, bloody diarrhoea, impaired sight, delirium, convulsions, uremia and jaundice. The powder of seeds when applied to the eye causes conjunctivitis.

Fatal dose—Ten seeds; ricin 6 mg.

Fatal period—Two to several days.

P.M. appearances—Ricin produces haemorrhagic inflammation of the G.I. tract.

### CROTON

### TIGLIUM

Croton tiglium (Jamalgota or naepala) seeds contain toxalbumen CROTIN and CROTONOSIDE, a glycoside, which is not expressed with the oil. Seeds are oval, dark-brown with longitudinal lines.

Signs and Symptoms —There is hot burning pain from mouth to stomach, salivation, vomiting, purging, vertigo, prostration, collapse and death.

Fatal dose — 4 seeds; 1.5 cc. of oil.

Fatal period — 6 hours to 3 days.

Treatment: Stomach wash, demulcent drink and symptomatic treatment.

### ABRUS

### PRECATORIUS

It is also known as Jequirity or Indian liquorice (gunchi or, rati). The seeds are egg-shaped, bright scarlet colour with a large black spot at one end. The seeds contain an active principle abrin, a toxalbumen, which is similar to viperine snake venom. In seeds also present is abrine, an amino acid, haemoglutinin in the cotyledons, a lipolytic enzyme, and abralin, a glycoside.

Signs and Symptoms:

After ingestion, symptoms include abdominal pain, diarrhoea, weakness, cold perspiration, trembling of the hands, weak rapid pulse and rectal bleeding. When an extract of seeds is injected under the skin of the animal, inflammation, oedema, oozing of hemorrhagic fluid from the site of puncture, necrosis. The animal drops down after 3 to 4 days. Tetanic convulsions occur.

Fatal dose — 90 to 120 mg. by injection, 10 gm. orally. Fatal period — 3 to 5 days.

Poisoning — The seeds are used for killing cattle, small sharp-pointed spikes on needles or 'suis' are prepared which are then dried in the sun.

Treatment: Injection with antiabrin.

## ERGOT

Ergot is the dried sclerotinum of the fungus *Claviceps purpurea*, which grows on cereals like rye, barley, wheat, oats etc. It contains alkaloids, ergotoxin, ergotamine. and ergometrine.

Signs and Symptoms:

In acute cases, there is nausea, vomiting, diarrhoea, giddiness, tightness in the chest, difficulty, in breathing, marked muscular weakness and exhaustion. There may be tingling and numbness in the hands and feet, paraesthesias, followed by twitchings or cramps in the muscles. Bleeding from nose and other mucous surface is common.

Chronic poisoning:

There is tingling and numbness of the skin, vasomotor disturbances leading to dry gangrene of the fingers. There is a sensation of insects creeping under the skin (tactile hallucination).

Fatal dose—One to two gm. Fatal period—One to several days.

Poisoning: The consumption of bread made with contaminated rye is the chief cause of ergotism. Ergot is commonly used as an abortifacient.

## SEMECARPUS

## ANACARDIUM

Marking nuts (bhilawa) are black, heart-shaped with rough projections at the base. Their pericarp contains an irritant juice which is brownish, oily and acrid but turns black on exposure to air.

The active principles are semecarpol and bhilawanol.

Signs and Symptoms:

The lesion resembles a bruise. The juice, when applied externally causes irritation and a painful blister, which contains acrid serum.

Fatal dose — 5 to 10 gm.

Fatal period — 12 to 24 hours.

## CALOTROPIS

The juice is taken by mouth or introduced into uterus on an abortion stick for criminal abortion and as a cattle poison. Also used as arrow poison. To produce artificial bruise. The juice produces an acrid bitter taste, salivation, dilated pupils, tetanic convulsions, collapse and death.

Treatment: Stomach wash, demulcents and symptomatic.

## SNAKES

The Poisonous snakes may be divided into five families—

1. Crotalidae — Pit viper, Rattle snake, Bush master.

2. Viperidae (true viper) — Russel's viper, Saw-scaled viper.

3. Elapidae — Cobra and Krait

4. Hydrophidae — Sea snakes

5. Colubridae — Boom slangs, Bird snakes.

In India, out of 200 species of poisonous snakes, five are dangerously poisonous to man. —

King cobra, cobra, common krait, Russell's viper and saw-scaled viper.

The most common poisonous snake is Common krait. Rat-snake is a non-poisonous snake.

## Difference between Poisonous and Non-poisonous snakes

|   |              | Poisonous                                                         | Non-poisonous                          |
|---|--------------|-------------------------------------------------------------------|----------------------------------------|
| 1 | Belly scales | Large and <b>cover entire breadth.</b><br>Middle scale hexagonal. | Small and do not cover entire breadth. |

|    |             |                                                                                                                                                                                                                                                                                                                         |                                                                                |
|----|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| 2. | Head scales | 1. Small (vipers)<br>2. Large and<br>(a) If there is a opening between eye and nostril (pit-viper)<br>(b) <b>Third labial touches the eye</b> and nasal shields (cobra)<br>(c) Central row of scales on back enlarged; under surface of the mouth has only 4 infralabials, the <b>fourth being the largest (kraits)</b> | Head scales large with the exceptions as mentioned under the poisonous snakes. |
| 3. | Fangs       | Hollow like hypodermic needles                                                                                                                                                                                                                                                                                          | Short and solid.                                                               |
| 4. | Tail        | Compressed                                                                                                                                                                                                                                                                                                              | Not much compressed.                                                           |
| 5. | Habits      | Usually nocturnal ,                                                                                                                                                                                                                                                                                                     | Not so.                                                                        |
| 6. | Teeth       | Two long fangs                                                                                                                                                                                                                                                                                                          | Several small teeth.                                                           |

### Snake venom:

- 1) The venom of the Indian cobra (Naja-Naja) contains a neurotoxin, a hemolysin, a cardiotoxin, a cholinesterase, phosphatidase.
- 2) Venom of pit viper contains hyaluronidase and proteolytic enzyme.
- 3) Venom of elapids {cobra, krait} are neurotoxic. Death occurs from respiratory paralysis.
- 4) The viperine venom is mainly hemolytic, causes intra-vascular hemolysis and depression of coagulation mechanism.
- 5) The sea snake venom is myotoxic.

**Clinical manifestations**—The most common manifestation following snake bite (poisonous or non-poisonous) is fright.

### Cobra:

Local symptoms start within 6 to 8 minutes. The bitten area is tender with slight burning pain. The patient feels sleepy, slightly intoxicated, weakness of legs and is unable to stand or move. There may be extra-ocular muscle weakness, ptosis and strabismus. Coma sets in and finally the respiration stops with or without convulsions and the heart stops.

### Krait:

There is no swelling and burning pain at the site of the bite.

True viper (Russel viper):

When venom is injected, the spot develops severe pain, the swelling starts within 15 minutes. Tingling and numbness over the tongue and mouth or scalp and paraesthesia

around the wound occur. The main feature is persisting shock. A hemorrhagic syndrome with blood stained sputum, hemorrhages from gums, rectum, the site of bite etc. occur due to increased coagulation time. Intravascular hemolysis may lead to hemoglobinuria and renal failure.

### **Sea-snakes:**

After half to one hour, the patient develops pain, stiffness, and weakness of the skeletal muscles.

Fatal dose:

— Cobra 12 mg; Russell's viper 15 mg; Echis 8 mg; Krait 6 mg, of dried venom.

Fatal period:

— Cobra half to six hours; viper one to two days.

Treatment:

Polyvalent antsnake venom serum should be given to neutralise the poison.

### **CANTHARIDES**

The powder of dried body of Spanish fly (blister beetle) is used externally as an irritant.

## **SOMNIFEROUS POISONS**

### **OPIUM**

Opium (afim) is also known as Kasoomba or, Madak or, Chandu. Opium is the dried juice of the poppy (papaver somniferum).

Opium contains two chemically different groups of alkaloids—

(a) The phenanthrenes—morphine 10%, codeine 0.5% and thebaine 0.3%, which are narcotic.

(b) The isoquinolines—papaverine 10% and narcotine 6%, no narcotic property.

The artificial derivatives are heroin, dihydromorphine.

Opiates exert their effects because of their chemical similarity to natural substances called endorphins. Opioid drugs are capable of producing physical addiction, and also psychological and euphoria.

Fatal dose — opium 2 gm.; morphine 0.2 gm. Fatal period — 6 to 12 hours.

### **Signs and Symptoms:**

The contact of morphine with the skin of sensitive persons may cause erythema, urticaria and itching dermatitis. It first stimulates, then depresses and finally paralyses the nerve centres.

I. Stage of excitement—There is a sense of well being, increased mental activity, freedom from anxiety, talkativeness, restlessness, hallucinations, flushing of face, maniacal condition.

II. Stage of stupor—The symptoms are headache, incapacity for exertion, a sense of weight in the limbs, giddiness, drowsiness and stupor.

III. Stage of coma—The patient passes into deep coma from which he cannot be aroused. The pupils are contracted to pinpoint size and do not-react to light, but in late stage they may be found to be dilated. — An overdose of narcotics cause hypotension, depressed

reflexes and coma (except — dilated pupils).

Differential diagnosis of Opiate poisoning:

- 1) Opium poisoning—The odour of breath, bradycardia, pinpoint immobile pupils, stertorous respiration, slow pulse, moist perspiring skin are prominent features.
- 2) Acute alcoholic poisoning—Pupils are dilated and reacting.
- 3) Barbiturate poisoning—Shallow respiration, deep coma, no response to painful stimuli, deep reflexes are depressed, low blood pressure, dilated pupils.
- 4) CO poisoning—Intermittent convulsions, cherry red colour of skin and carboxy-hemoglobin in blood.
- 5) Uraemic coma—Cheyne-Stokes respirations, ammoniacal odour.
- 6) Diabetic coma—Deep respirations with air, hunger, odour of acetone in heart, sugar and acetone in the urine.

### **Treatment:**

Naloxone hydrochloride is a specific opioid antagonist. Atropine is not recommended. N-allyl normorphine (lethidrone or nalorphine) is a specific antidote for morphine codeine, pethidine and methadone. Naltrexone is 17 times more potent than naloxone. When coma is deep -> artificial respiration and oxygen. Substitution with oral methadone, followed by gradual withdrawal of methadone.

Post-mortem appearances:

Signs of asphyxia are prominent. Froth is seen at the mouth and nostrils. The brain, meninges and abdominal organs are congested.

Chronic poisoning (morphinism; morphinomania):

The patient becomes restless, irritable, disturbed by dreams or insomnia. Loss of memory, mental fatigue, gradual intellectual, and moral deterioration occur. Constipation, contracted pupils, impotence are frequent.

Withdrawal symptoms of opioids tend to be opposite to the acute effects of the drug and include nausea and diarrhoea, coughing, lacrimation, rhinorrhoea, profuse sweating, twitching muscles, and piloerection or, goose bumps (except—miosis).

In addition, sensations of diffuse body pain, insomnia and yawning occur with intense drug craving.

Test for detection: Marquis test.

## **INEBRIANT POISONS**

### **ETHYL ALCOHOL**

Absolute alcohol contains 99.95% alcohol; rectified spirit contains 90% alcohol.

The approximate percentage of alcohol in beverages is— Rum and liquors—50 to 60%;

Whisky, gin, brandy 40 to 45%; Port, Sherry 20%; Wine 10 to 15%; Beers 4 to 8%.

Arrack—It is a liquor distilled from palm, rice, sugar or jaggery etc. and has a strength of 40 to 50%. It may be mixed with chloral hydrates and potassium bromide for getting a greater kick.

Absorption—About 20% of alcohol is absorbed from the stomach and 80% through small intestines.

### **Action:**

Alcohol is a well known stimulant, but is a selective depressant, especially of the higher

nervous centres which it inhibits. It is a hypnotic and diaphoretic.

**Symptoms:**

1. **Stage of excitement**—There is increased confidence and a lack of self control. When jerking movement is in the direction of the gaze and independent of the position of the head, it is known as alcohol gaze nystagmus and appears at blood levels of 40 to 100 mg/100 ml. Mental concentration is poor and judgement impaired. These effects are usual between 50 to 150 mg/100 ml of blood alcohol.
2. **Stage of incoordination**—When alcohol content of the blood attains a level of 150-250 mg/100 ml.
3. **Stage of coma**—The person passes into a state of coma with stertorous breathing. The pupils are contracted, but stimulation of the person e.g., by pinching or slapping, causes them to dilate with slow return (**Mc Evan sign**).

Death occurs from asphyxia due to respiratory paralysis, but it may occur from shock.

'Legal intoxication' requires a blood alcohol concentration of at least 80-100 mg/dl.

Fatal dose — 150 to 200 ml of absolute alcohol consumed in 1 hour.

Fatal period — 12 to 24 hours.

**Treatment** — Hemodialysis and peritoneal dialysis is performed.

**Chronic poisoning:**

Alcohol addicts are people, who cannot stop drinking for long, or who experience withdrawal symptoms. Chronic alcoholics are those who have reached a state of irreversible somatic or brain changes caused by alcohol.

Treatment:

**Antabuse (disulfiram)** is given in a single daily dose. Antabuse inhibits the enzyme aldehyde dehydrogenase. Antabuse leads to accumulation of acetaldehyde (aldehyde syndrome) in the blood and tissues and causes unpleasant symptoms, such as flushing, palpitation, anxiety, sweating, headache, abdominal cramps, nausea and vomiting due to which the patient dislikes alcohol.

**DRUNKENNESS**

A person is held responsible for crime committed in the voluntary drunkenness condition.

'**Widmark's formula**' is used to calculate the quantity of ethyl alcohol in the body. The widmark formula is  $a = prc$ , where (a) is the weight of alcohol in gm in the body (p) is the body weight in kg (c) is the concentration of alcohol in blood in mg/kg and (r) is a constant (0.6) for men and (0.5) for women.

Widmark's formula for urine analysis, is  $a = \frac{3}{4} prq$ , where (q) is the alcohol concentration in mg/kg.

Delirium tremens occur in chronic alcoholics due to (1) temporary excess (2) sudden withdrawal of alcohol (3) shock after receiving an injury, such as fracture of a bone, or (4) from acute infection, such as pneumonia, influenza, erysipelas etc.

All individuals with a blood alcohol level of 140 mg % are intoxicated to the point where they cannot deal with unusual, emergency or non-customary problems. Law in some countries have made it an offence to drive a motor vehicle above a specified blood alcohol level; e.g. England — 80 mg %, and USA — 150. mg %

Below 10 mg% = Sober, 20 – 70mg% = Drinking, 80 – 100 mg% = Under the influence, 150 – 300 mg% = Drunk, 400 mg% and above = Coma and death.

Saturday night paralysis occurs in the stage of coma and due to pressure on the radial nerve.

Breath analysis machines operate on the principle that alcohol absorbs radiation in the infra-red region of the spectrum and that the amount of infra-red light absorbed by a vapour is proportional to the concentration of alcohol in that vapour. 60 to 100 ml of breath received into a dry balloon and analysed by drunkotester, intoximeter, alcometer, alcotest or breathalyser.

The person is asked to blow into a plastic balloon through a glass tube, containing a crystalline bichromate-sulphuric acid mixture. If blood alcohol is 80 mg% or more, the crystals will become green to a predetermined distance. The test may be false positive because alcohol may remain in the mouth even after a small drink. The residual alcohol in the mouth disappears in 20 minutes. As such, the test should be repeated after 20 minutes.

### **METHYLALCOHOL**

Mineralised methylated spirit consists of 90% of ethyl alcohol, 9.5% of wood naphtha and 0.5% of crude pyridine.

#### **Signs and Symptoms:**

There may be delirium and coma. Urine is strongly acid and may contain acetone and a trace of albumin. Acidosis is caused. The pupils are dilated and fixed. Visual disturbances like photophobia and blurred vision, concentric diminution of visual fields for colour and form, followed by sudden loss of vision or complete blindness occur due to optic neuritis and atrophy..

Fatal dose — 60 to 240 ml. Fatal period — 24 to 36 hours.

#### **Treatment:**

(i) Gastric lavage with 5% bicarbonate solution. (ii) Ethyl alcohol. (iii) Hemodialysis is the treatment of choice in severe poisoning.

The most effective treatment of withdrawal of ethyl alcohol including delirium tremens is Benzodiazepines.

### **BARBITURATES**

Barbiturate administration is contraindicated in Porphyria, Anaphylaxis and Asthma. They have a depressant action on the central nervous system. Large doses directly depress the medullary respiratory centre. Involuntary suicide is accidental barbiturate poisoning.

#### **Signs and Symptoms:**

The first symptom is usually drowsiness. A short period of confusion, excitement, delirium and hallucination is common. Hypothermia, cyanosis, hypotension, weak rapid pulse and cold clammy skin occurs. The pupils are usually slightly contracted but react to light; they may dilate during terminal asphyxia. Respiration becomes irregular, sometimes Cheyne-Stokes in character and finally stop (respiratory depression). The finding of blisters on the skin, often at the area of erythema, strongly suggests barbiturate poisoning. Death may occur from respiratory failure or ventricular fibrillation in early stage and bronchopneumonia

and irreversible anoxia in later stage (flaccid coma).

**The combination of alcohol and barbiturate causes rapid death.**

Fatal dose: Short acting—1 to 2 gm. Medium acting— 2 to 3 gm. Long acting—3 to 5 gm.

Fatal period: 1 to 2 days.

Treatment:

— No specific antidote.

1. Gastric lavage, with warm water mixed with potassium permanganate and a suspension of animal charcoal or tannic acid.
2. Supportive measures (i.e. ABC) (i.e. Airway, Breathing, Circulation).
3. Forced alkaline diuresis - it is helpful only in long acting barbiturates which are eliminated primarily by renal excretion.
4. Hemodialysis & Hemoperfusion (through a column of activated charcoal) - is highly effective in removing long acting as well as short acting agents. Therefore it is better than forced alkaline diuresis.

Scandinavian method uses anti-shock measures, maintenance of airway and adequate respiratory support.

Chronic poisoning:

Dependence is both psychic and physical.

**CHLORAL HYDRATE**

It is colourless, crystalline substance having peculiar pungent odour and a pungent bitter taste. It depresses CNS.

Fatal dose — 5 to 10 gm.

Fatal period — 8 to 12 hours.

Poisoning:

Accidental poisoning results by taking large doses as hypnotic. It is given in food or drink to render a person suddenly helpless for the purpose of robbery or rape. Its action is so rapid that it has been given the name 'knockout drops'.

A combination of alcohol and chloral hydrate is commonly known as 'Mickey Finn'

**PETROLEUM DISTILLATES KEROSENE**

Signs and Symptoms:

If the fumes are inhaled, there is feeling of dizziness, headache, nausea and vomiting.

There may be pneumonitis, intense excitement, hallucinations and convulsions, the person becomes unconscious & passes into coma. After ingestion, there is usually burning pain in throat nausea, vomiting, colicky pain and diarrhoea. There is giddiness, heaviness in the head, dyspnoea, cyanosis, drowsiness and coma.

Fatal dose — 15 to 30 c.c. of kerosene. Fatal period — Within 24 hours.

**DELIRIANT POISONS**

**DATURA FASTUOSA**

There are two varieties:

- (i) Datura alba—white flowered plant.
- (ii) Datura niger—a deep purple flowered plant.

The fruits are spherical and have sharp spines (thorn-apple). *Datura stramonium* is known as thorn apple. They contain 0.2 to 1.4% of hyoscine (scopolamine), hyoscyamine, and atropine.

Signs and Symptoms:

A bitter taste, dryness of mouth and throat, dysphagia, voice hoarse, Fever. The face becomes flushed, conjunctivae congested, widely non-reacting dilated pupils, temporary blindness, photophobia and diplopia. Restlessness, agitation. Delirium is restless and purposeless; in earlier stage indicated by excitement, talkativeness and unintelligent speech. Hallucinations of sight and hearing and delusion occurs.

Fatal dose — 1 gm (100 to 125 seeds).

Fatal period —. 24 hours.

Treatment:

Physostigmine is specific in *Datura* poisoning. Pilocarpine nitrate.

Poisoning: —Crushed or powdered seeds or an extract is used by criminals for stupefying a victim prior to robbery, rape or kidnapping.

Mydriatic test—The pupil dilates within half an hour, if *datura* is present.

### **CANNABIS SATIVA OR INDICA**

It is also known as Indian hemp, hashish or marihuana. The principal constituent of resin of marijuana is tetrahydro cannabinol. It is a CNS stimulant.

It is used in the following forms:

1. Bhang—It is prepared from the dried leaves and fruit shoots.
2. Majoon—It is a sweet prepared with bhang. It increases appetite and sexual desire.
3. Ganja—It is prepared from the flower tops of female plant.
4. Charas or hashish—It is the resin exuding from the leaves and stems of the plant.

Signs and Symptoms

Large doses cause -

1. Inebriation—The person becomes dreamy or semi-conscious and he has realistic vision, usually of sexual nature e.g. he sees nude beautiful women dancing before him, playing music, singing sexual love song. It causes psychological high, raises heart rate, delays psychomotor skills.
2. Narcosis—There is giddiness and ataxia, tingling and numbness of the skin, general anaesthesia.

Fatal dose—Charas 2 gm; ganja 8 gm; bhang 10 gm/kilo body weight.

Fatal period—Several days.

Chronic poisoning:

Used in excess, it causes degeneration of CNS. There is loss of appetite, weakness, wasting, tremors, vacant look, red eyes, impotence, mental deterioration. Rarely, they become insane, and may suffer from hallucinations and delusions of persecution. There may be an impulse to kill. The person may run amok i.e. he develops a psychiatric disturbance marked by a-period of depression followed by violent attempt to kill people. He first kills a person against whom he may have real or imaginary enemity. and then kills anyone that comes in his way until homicidal tendency lasts. Then he may commit suicide or surrender himself.

Poisoning—Majoon and charas are sometimes used by road poisoners to stupefy person to facilitate robbery.

## **COCAINE**

It is obtained from leaves of *Erythroxylum coca*. It is colourless, odourless, crystalline substance with bitter taste. It is used as a local anaesthetic, acts as a vaso constrictor. The usual route of intake is snorting and skin popping.

Signs and Symptoms:

(i) Stage of excitement—There is bitter taste, dryness of mouth, fatigue, black teeth and tongue & visual hallucination (ii) Stage of depression—Within an hour, respirations become feeble, collapse, convulsions and death occurs. Death is due to respiratory failure or vascular collapse.

Fatal dose — 1 to 1.5 gm orally.

Fatal period — Few hours.

Treatment — Amyl nitrite is antidote and given by inhalation.

Cocaine habit—The patient may suffer from hallucinations, convulsions, delirium and insanity.

Magnan's symptoms or cocaine bug is characteristic, in which there is feeling as if grains of sand are lying under the skin or some small insects are creeping on the skin (tactile hallucinations).

## **DRUG DEPENDENCE**

**Drug addiction**—The most important drugs of addiction are alcohol, opium, pethidine, heroin, barbiturates, cannabis and amphetamine.

**Drug habituation (habits)** -There is psychological or emotional dependence on the drug.

**Drug dependence**—It includes both the term addiction and habituation.

Addiction consists of physical and psychological dependence.

### **Withdrawal symptoms:**

May begin within 6 to 8 hours following stoppage of drug. It includes chilliness, yawning and rhinorrhoea, goose skin, lacrimation. gross tremors, and dilatation of pupils are seen.

Narcotic addicts may be killed by a hot shot i.e. a dose of narcotic with a poison as strychnine in it.

Psychoactive Drug classification:

1. Sedatives—Barbiturates, minor tranquilisers, alcohol.
  2. Stimulants—Amphetamines, cocaine.
  3. Opiates—Heroin, methadone, morphine.
  4. Marijuana.
  5. Major tranquilisers—Chlorpromazine.
  6. Anti depressants—Tricyclics, MAO Inhibitors. (Mono Amino Oxidases)
- MAO - A inhibitors — Clorgiline Moclobemide  
MAO - B inhibitor — Selegeline (Depremyl).

Cocaine and LSD do not produce physical dependence. Street heroin is known as smack, junk or dope. Amphetamines cause paranoid, psychosis and psychic dependence.

Hallucinogenic drugs—LSD, phencyclidine (angel dust).

## **FOOD**

### **BACTERIAL**

In the infection type, organisms belong mainly to salmonella, proteus, coli, streptococcus,

## **FOOD**

## **POISONING**

### **POISONING**

shigella. In the toxic type, is due to ingestion of preformed toxin in prepared food. —Exotoxins e.g. enterotoxin of staphylococci and the botulinum toxin, produce intoxication. Incubation period of staphylococcal food poisoning is 1-6 hours.

## **BOTULISM**

There are no symptoms of gastroenteritis (i.e. no diarrhoea) It is caused by neurotoxin, an exotoxin of clostridium botulinum multiplied in the food e.g. tinned meat| fish, fruits etc. The fatal dose, for an adult is 0.01 mg, The toxin paralyses the nerve ending. Signs and Symptoms: The incubation period is 12 to 30 hours. There is nausea, vomiting, constipation, ocular pharyngeal paralysis, salivation, sometimes aphonia. Excessive fatigue, diplopia. marked muscular weakness. The patient is conscious till death, which is preceded by coma or delirium. Bulbar palsy and descending paralysis is seen. Differential diagnosis of botulism includes Tetanus, Epilepsy and Acute gastroenteritis.

## **LATHYRUS**

## **SATIVUS**

(Khesari dal)

Consumption exceeding 30% of the total diet for more than 6 months; produces lathyrism. The active neurotoxic principle is B(N)-oxalyl aminoalanine -> BOAA. The continuous use of L. sativus produces neurolathyrism, characterised by progressive spastic paraplegia, sphincters, sensation and mental faculties are preserved.

## **ARGEMONE**

## **MEXICANA**

The Argemone oil contains two alkaloids -> sanguinarine and dihydro sanguinarine. Causes epidemic dropsy. Hypersecretory glaucoma, Diarrhoea, CCF are seen in -> Epidemic dropsy (But no convulsions). Sanguinarine interferes with the oxidation of pyruvic acid, which accumulates in blood. The symptoms of epidemic dropsy consists of sudden non-inflammatory, bilateral swelling of legs. Tests for detection of Argemone oil are (i) Nitric acid test: The colour becomes brown to orange-red shows presence of Argemone oil, positive when concentration is 0.25 percent. (ii) Paper chromatography test: This is the most sensitive test. It can detect argemone oil up to 0.0001 percent in all edible oils and fats.-

## **SPINAL**

## **POISONS**

## **STRYCHNOS**

## **NUX**

## **VOMICA**

Mechanism of action of strychnine poisoning is post synaptic block. Strychnine (kuchila) is a powerful alkaloid obtained from the seeds of the strychnos nux vomica. The seeds contain two principal alkaloids -> strychnine 1.5% and brucine 1 55%. Strychnine poisoning resembles tetanus poisoning. The action is particularly noted in anterior horn cells. In strychnine poisoning convulsions affect all muscles at a time. The mouth is covered with froth, frequently blood stained. The convulsions are most marked in antigravity muscles, so that the body typically arches in hyperextension opisthotonus. Sometimes spasm of abdominal muscle may bend the body forward (emprosthotonus), or to the side (pleurosthotonus). Consciousness is not lost. Fatal dose — 30 to 100 mg; one crushed seed. Fatal period — One to two hours. Treatment:

(i) Short acting barbiturates, (ii) Diazepam, (iii) Stomach wash with potassium permanganate.

Post-mortem appearance — In strychnine poisoning, brain is required to be preserved. Post-mortem calorificity is seen in strychnine poisoning.

## CARDIAC

## POISONS

Cardiac poisons are  
(i) *Nicotiana tabacum* (ii) *Digitalis purpurea* (iii) *Nerium odorum* (iv) Yellow oleander (v) *Cerbera odallam* (vi) Quinine  
(vii) Aconite — Fatal period : 1 - 8 hours, antidote : atropine. (viii) Hydrocyanic acid.

**DIGITALIS** (*D. purpurea*, *D. lanata*, *Strophanthus gratus*)  
Entire plant is toxic, containing over 30 cardiac and steroidal toxins. The roots, leaves and seeds of digitalis contain digitoxin, digitonin and digitalin.  
Action: By inhibiting the Na<sup>+</sup>K<sup>+</sup>ATPase. Digitalis prolongs the diastolic period of the heart. In therapeutic doses, it depresses both excitability and conductivity. But in toxic dose, excitability is increased with extrasystole.  
Signs and symptoms:  
Nausea, vomiting, abdominal pain, nervous irritability, tingling and coldness in extremities, increased heart rate, varying degrees of AV block, ectopic beats, coupled rhythm, Atrial Fibrillation and Ventricular Fibrillation. Patient becomes drowsy, coma sets in and death occurs.

Fatal dose: 15 to 30 mg of digitalin, 4 mg of digitoxin,  
Fatal period: 1 to 24 hours.

Treatment:

- (1) Stomach wash with tannic acid
- (2) Bowels should be evacuated
- (3) Specific antidotes (i) 100 mg lignocaine i.v / dilantin / propranolol
- (4) Trisodium EDTA to lower serum Ca level.
- (5) Potassium salts to reduce extrasystoles and arrhythmias.
- (6) Bradycardia is treated with atropine sulphate 0.6 mg i.v repeated for 4 days.
- (7) Symptomatic.

**NERIUM** **ODORUM** (White oleander)  
Grow wild in India.

All parts of plant are poisonous, containing several cardiac glycosides, primarily oleandroside (oleandrin), and nerioside (nerin), which resembles digitalis in action.  
Signs and symptoms:

It produces contact dermatitis. Ingestion causes difficulty in swallowing and articulation, abdominal pain, vomiting, profuse frothy salivation, and diarrhoea. Pulse is at first slow, then later rapid and weak, BP falls, respiratory rate increased, pupils dilated, muscular twitchings, tetanic spasm, lock-jaw, drowsiness, coma, respiratory paralysis and death occurs.

Fatal dose: 15 gm of root.  
Fatal period: 24 to 36 hours.

**CERBERA** **THEVETIA** (Yellow oleander)

All parts are poisonous. Seeds contain 3.5 to 4% of the cardiac glycoside thevetin. which is similar to digitalis in action, others are thevetoxin, nerifolium, peruvoside and ruvoside and cerebrin.

Signs and symptoms:  
Pulse is rapid, weak and irregular, BP low. Heart block, collapse and death from peripheral circulatory failure.

Treatment:

- (1) Stomach wash
- (2) Sodium molar lactate transfusion with glucose and 1 mg. atropine, 2 cc adrenaline and 2

mg  
(3)

noradrenaline.  
Symptomatic.

### CERBERA

### ODALLUM

(Pilikirbir)

Active principles: Cerberin, cerebroside, odollin, odolotoxin, thevetin and cerapain.  
Signs and symptoms:

Initial symptoms are gastro-intestinal. Cardiac toxicity within 3 hours of ingestion. There is bitter taste, nausea, severe retching, vomiting, abdominal pain and in few cases diarrhoea, general weakness, blurring of vision, sinus bradycardia, irregular respiration, collapse and death from heart failure.

Chief bio-chemical changes are Hyperkalemia, and depression of transaminase activity.

Fatal dose: Kernel of one fruit.

Fatal period: 1 or 2 days or more.

Treatment:

(1) Stomach wash

(2) Atropine 0.5 mg i.v and repeated every 15 to 30 min to keep heart rate above 50 per minute

(3) Correct hyperkalemia.

### QUININE

It is a strong protoplasmic poison with anaesthetic and sclerosing action. It stimulates and then depresses central nervous system.

Signs and symptoms:

Headache, giddiness, ringing in the ears, partial deafness, disorders of vision, pupils are fixed and dilated. Mental confusion, pain in the abdomen, nausea and vomiting, confusion of thought, muscular weakness, itching, erythematous or urticarial rash on the skin, methaemoglobinemia, tachycardia, hypotension, cyanosis, delirium and coma.

Fatal dose: 8 to 10 gm.

Fatal period: Few minutes to 2 days.

Treatment:

(1) Gastric lavage

(2) i.v. fluids to promote diuresis

(3) Bilateral stellate ganglion blocks causes return of vision.

(4) Symptomatic.

### HYDROCYANIC

### ACID

It is also called prussic acid or cyanogen. The pure acid is a colourless, transparent volatile liquid with an odour like bitter almonds. Cyanides are white powders. More than 5% carboxyhemoglobin is seen in cyanide poisoning. Cyanide inhibits the action of cytochrome oxidase and carbonic anhydrase. It kills by creating histotoxic or cytotoxic anoxia. Cyanide acts by reducing the oxygen carrying capacity of the blood, and by combining with the ferric iron atom of intra-cellular cytochrome oxidase, prevents the uptake of oxygen for cellular respiration.

Signs and Symptoms:

Massive doses may produce sudden loss of consciousness and prompt death from respiratory arrest. People suffering from achlorhydria may not suffer from toxic effect of oral ingestion of potassium cyanide. The mouth is covered with foam which is sometimes blood-stained. Death occurs from respiratory failure.

Fatal Dose -50 to 60 mg of pure acid; 200 to 300 mg of potassium cyanide.

Fatal period—2 to 10 minutes.

Treatment:

(i) Amyl nitrite is used by inhalation. (ii) Sodium nitrite is given i.v. (iii) Sodium thiosulphate in 50% solution i.v. converts cyanide to non-toxic thiocyanates.

(iv) Methylene blue i.v. (v) Cobalt EDTA. (vi) Para amino prophenone (PAPP) acts by forming meth.Hb. (vii) Qxygen. P. M. appearance: The blood is bright cherry red due to formation of cyan-met-haemoglobin. The post mortem staining may be cherry-red or brick red.

## ASPHYXIANTS

### CARBON

### MONOXIDE

It is a colourless, tasteless, non-irritant gas which is produced due to incomplete combustion of carbon. It is insoluble in water. It burns with a blue flame. Upper limit of safety of carbon monoxide in air is 0.01%. 50% COHb produces symptoms like alcoholic intoxication. 50%-60% produces syncope or coma with intermittent convulsions. Exposure of atmosphere containing 0.2% of gas will cause death in about 4 hours, 0.4% in one hour, and 10% in 20 to 30 minutes. Symptoms of CO poisoning:

| Carboxyhaemoglobin (COHb)% | Symptoms                                                                                                                                      |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 0 to 10%                   | = No appreciable symptoms                                                                                                                     |
| 10 to 20%                  | = Breathlessness on moderate exertion, mild headache                                                                                          |
| 20 to 30%                  | = Throbbing headache, irritability, emotional instability, disturbed judgment, defective memory and rapid fatigue                             |
| 30 to 40%                  | = Severe headache, nausea, vomiting, dizziness, dimness of vision, confusion.                                                                 |
| 40 to 50%                  | = Increased confusion, sometimes hallucinations, severe ataxia, rapid respirations and collapse with attempts at exertion                     |
| 50 to 60%                  | = Syncope or coma with intermittent convulsions, rapid respirations, tachycardia with a weak pulse and pink or red discoloration of the skin. |
| 60 to 70%                  | = Increasing depth of coma with incontinence of urine and faeces.                                                                             |
| 70 to 80%                  | = Profound coma with depressed or absent reflexes, a weak thready pulse, shallow and irregular perspiration.                                  |
| Above 80%                  | = Rapid death from respiratory arrest                                                                                                         |

P. M appearance: Death by CO poisoning is called Conflagration.

A cherry - red colouration of the skin, mucous membranes, areas of hypostasis. Fine froth may be seen at mouth and nose. Bilateral symmetrical necrosis of the lenticular nuclei and punctiform hemorrhages in the white matter of brain.

## **HYDROGEN SULPHIDE**

It is found in large quantity in sewer --> sewer gas. It has a smell of rotten eggs.

## **WAR GASES**

- (i) Vesicant—Mustard gas, lewisites.--
- (ii) Asphyxiant—Chlorine, phosgene.
- (iii) Tear gases—Chlor acetophenone (CAP), ethylchloroacetate (K.S.K), bromobenzyl cyanide (B.B.C.).
- (iv) Nerve gases—They are compounds related to phosphate esters in action and toxicity.

## **Points to remember in FMT ( last moemnt revisions)**

- 1. Pin – point pupils = Opium
- 2. Dilatation of pupils = Datura, Cyanide
- 3. Constriction of pupils = Opium, phenol, organo-phosphorus, physostigmine, chloral hydrate.
- 4. Cumulative poisons are: Barbiturates, and methyl alcohol
- 5. Habit forming poisons are: Caffeine and Nicotine.
- 6. Addiction drugs are: Alcohol, Barbiturates, Cocaine, Cannabis, Chloral hydrate, Opium, Pethidine.
- 7. Hemodialysis is good value in: Salicylate, methanol, barbiturate, and aspirin (except kerosene oil and diazepam)
- 8. 1st sign of intra-uterine death: Gas shadow in aorta (as early as 12 hours).
- 9. Increased anion gap is seen in Salicylate poisoning, lactic acidosis, starvation.
- 10. Ideal suicide poison = Cyanide
- 11. Ideal homicide poison = Thallium, fluoride compounds.
- 12. Commonly used homicidal poisons: Arsenic, aconite
- 13. Commonly used suicidal poisons: Endrine, Opium, Barbiturates, Organo-phosphorus compounds.
- 14. Poison resembling cholera = Arsenic
- 15. Poison resembling tetanus = Strychnine
- 16. Poison resembling natural death = Thallium
- 17. Poison resembling fading measles = Arsenic
- 18. Poison resembling thyrotoxicosis = Bi-nitro compounds.

## **Tests for detecting poisons:**

Arsenic = Marsh's test, Reinsch's test  
Opium = Marquis test  
Alcohol = Mc'evan's test  
Datura = Mydriatic test  
Phenol = Green urine.

## **IMPORTANT POINTS TO REMEMBER**

The Percentage of blood alcohol in the stage of "**dead drunk**" is 0.5%.

Pisiform gets ossified by 12 yrs of age.

By 14 yrs. patella gets ossified.

Anterior fontanelle closes by 18 months of age.

The height of a child is double of birth height by 4 years of age,

Under IPC, a person below 7 years is not criminally responsible.

Fatal period of Datura poisoning is 24 hours.

In India, rigor mortis sets within 1-2 hours.

While dispatching blood and urine for chemical analysis, sodium fluoride is added as preservative in concentration of 50 mg/10ml.

**Critical level** of alcohol in blood is 0.15%.

The minimum age for giving consent for surgery is 18 years.

In fractured ends of bone, soft provisional callus is formed by 15 hours.

The minimum time required for adipocere formation in a dead body is 21 days.

Indian Medical Council Act was enacted in 1956.

Mental retardation is I.Q. Below 70.

Ratio between ethyl alcohol in blood to urine is 1:1.33

**Gas rigidity** appears after 72 hours.

Marbling is noticed by 36 hours.

Full development of rigor mortis takes about 12 hours.

In exhumation, 6-7 samples of earth are collected.

Intercourse with wife below 15 years of age is considerable rape.

Fatal period of aconite is usually 1-5 hours.

Cooling of body is gradual upto 1-3 hours.

Hypostasis is mottled within first 3 hours of death.

**Killing** range of a military rifle is 3000 yards.

Juvenile offender is a person under 16 years

The dispersion of pellets is seen usually at distance beyond 10 feet.

In a gunshot wound, the presence of singeing of hair or charring of skin denotes a fire up to 18 inches.

Dispersion of pellets in shotgun injury is calculated as dispersion in inches = 1.5 times the dispersion in yards.

An infant born before 210 days is not legally considered capable of maintaining a separate existence.

A bruise showing bluish black discoloration is 4 days old.

The upper limit of safety for carbon monoxide in air is 0.01%.

Rh positivity in India is 93%.

In an abrasion, the scab usually dries and falls between 4-6 days.

Fatal dose of opium is 2 gm.

The range of an air rifle is about 90 yards.

**Mixed dentition** is seen in children between 6-12 years of age.

Basisphenoid unites the basi-occiput at the age to 22 years.

First permanent molar appears at age of 6-7 years.

Judicial first class Magistrate can pass a sentence of imprisonment upto 3 years.

Age of maturity for those under court of wards is 21 years. In India, sexual maturity is gained at 14 years of age.

The degree of accuracy in determining sex from long bones is 80%.

Fatal period of sulphuric acid poisoning is 18-24 hours.

Multiplying factors for estimating stature from humerus and femur in males are 5-5.3 and 3.6-3.8 respectively.

☐ **Colliquative** liquefaction is seen within 1 week after death.

A contusion assumes green colour by 6 days.

Marriage age for boys and girls are 21 years and 18 years respectively.

Internal organs take 24 hours to cool. A person becomes major at the age of 18 years.

Eruption of temporary teeth is completed by 2 to 2.5 years.

Foetal parts can be detected on plain X-ray usually by 16 weeks.

Child below 12 years is not required to take an oath.

Xiphoid process unites with sternum at age of 40 years.

Cranial capacity is 10% less in females.

Nuclear features persist in decomposition for a period of 2-3 years.

Precipitin test is positive to be opium in dead body upto 10 years.

After death, benzidine test is positive upto 150 years. Bones begin to decompose after death in 3-10 years.

Less than 7 aminoacids in bone suggest age of bone after death as more than 100 years.

The rate of cooling of body in first 6 hours is 2.5°F and in next 6 hours as 1.5"-2.0cF. Victim of drowning in a state of suspended animation can be revived as long as 10-20 minutes.

Centre of ossification for **pisiform** bone appears at an age of 10-12 years.

The floatation time in summer for a dead body after drowning is one day.

The age of 15 years old female is best determined by the radiography of upper end of radius and ulna.

☐ **Maggots** in a dead body do not appear before 48 hours.

☐ Hairs become loose after 72 hours of death.

Epiphyseal union of sternal end of clavicle occurs at age of 22 years.

Washer woman's hands and feet usually occur within 12-18 hours.

Saponification in drowning occurs in about 5 weeks.

Death ensues in about 5 mts. of complete submersion.

☐ By ABO, RH, MN systems the exclusion of Paternity is about 50%.

Estimation of Age from eruption of teeth is possible upto 17 to 21 years of age.

Gustafson's method for estimation age of adult over 21 years.

In poisoning by salicylates, the Gastric lavage is useful upto 24 hours.

The age of consent for medical examination in cases of rape is minimum 12 years.

If a person is absent from his usual haunts, and has not been heard for 7 years, he is presumed to be dead.

Infanticide means unlawful destruction of child below 1 year of age.

By ABO, Rh, MN systems the exclusion of Paternity is about 50%

Estimation of Age from eruption of teeth is possible upto 17 to 21 years of age

In poisoning by salicylates, the Gastric lavage is useful upto 24 hours

The age of consent for medical examination in cases of rape is minimum 12 years

In sin of Gomorrah, buccal swabs are useful upto 9 hours

In most countries, breath alcohol concentration 35 mg/100 ml is considered an offence  
After absorption, the ratio of alcohol in blood and urine is constant and is 1:1.31

Histologically, reticulum fibres in an abrasion are seen on 8 days

Widmark's formula for urine analysis of alcohol is  $\frac{3}{4}$  prq

Pancreas constitute 0.1% of body weight

Punishment for false evidence is given under section 193 of IPC

Length of a female larynx is about 3.8 cm

Calcification of third molar begins at 8-10 years.

Lip prints on cheiloscopy are divided into 8 patterns

1 gm tablet of aluminium phosphide is able to liberate 1.0 gm

The diameter of "human hair at 15 years of age is 0.053 mm \*

Alcohol gaze nystagmus is produced at an average blood levels of 80 mg%

The residual alcohol in mouth takes about 20 min to disappear and within this period breath analyser test may be false positive

Skeletal muscles constitute about 29% of body weight

Term '**under the influence**' of alcohol is used when blood concentration is 80-100mg%

Statutory rape is rape under 15 years of age

Weight for occluding internal jugular vein hanging is 2 kg

- Majority of deaths due to Aluminium phosphide occurs in within 24 hours
- During sleep, rectal temperature is 0.5-1.0°C lower
- Drowned body floats in about 12-18 hours in summer S
- Bones constitute about 12% of body weight
- Absence of III molar tooth indicates that the person is definitely under the age of 17 years

In a dead body, maggots in rainy day are seen in 6 hours.

Arsenic, Aconite and Dhatura are generally used as homicidal poisons.

Ricin is the active principle of croton oil seed.

- Abrin** is the active principle of abrus precatorius.
- Soneryl is a coloured babriturate.

Breath alcohol can be measured by Alcometer or Drunkometer.

The fatal dose of Dhatura is about one grain.

Physostigmine can be regarded as the specific antidote of Dhatura.

Amygdaline is the glucosides of vegetable origin found in cyanides.

The process of putrefaction can be retarded by carbon monoxide gas.

Euthanasia means "Mercy killing".

Joule burn is seen in electrocution.

Amyl nitrate is an antidote for poisoning due to hydrocyanic acid.

Olive green discoloration of urine on exposure to air is seen in poisoning due to carbolic acid.

Overlying is a type of smothering.

- Optic atrophy is the characteristic feature of poisoning by methyl alcohol.
- Dryness of mouth, dilated pupils and delirium are symptoms of Dhatura poisoning. (All 'D's')

The first permanent tooth to erupt is first molar.

Dying declaration can be recorded by a medical officer.

Presence of fine white leathery froth in mouth and nostrils is seen in drowning.

Privation of any member of joint is a grievous hurt.

- Pugilistic** attitude is seen in burn death due to coagulation of proteins.

Dying declaration should be recorded by Magistrate.

Nalorphine is an antidote for morphine.

- Locard's principle states that every contact leaves a trace.

The strongest corrosive poison is sulphuric acid.

☞ **Arborescent** markings are seen in lightning.

Before performing Postmortem examination, body should be identified by Policemen.

Warrant case means a case relating to an offence punishable with death, imprisonment for life or for a term exceeding two years.

In civil cases, a reasonable sum for travelling expenses is generally tendered when the summons is served. This is known as conduct money. It is paid by the party that has called his as a witness.

Hair cells are of special interest in cell sexing since both Barr body and Y chromosome can be demonstrated.

Nails, hairs and long bones are preserved in cases of chronic arsenic poisoning.

Postmortem fibrinous clots in heart are known as "Cardiac polyp".

The surest sign of death is putrefaction.

The rigor mortis starts first at upper eye-lids.

Dribbling of saliva from the angle of the mouth is generally considered as the surest sign of hanging.

☞ Presence of soot in respiratory tract is the surest sign of burn.

Strong sulphuric acid when thrown on the face of a person is known as "Vitreol throwing".

Black gun powder consists of potassium nitrate, sulphur, and charcoal.

Nitrocellulose or Nitroglycerine is used as a smokeless gun powder.

☞ **Richochette** bullet is one which strikes any other surface before striking the object.

The pulmonary lesion in the injury of air blast is called "Blast lung".

Loss of virginity is called defloration.

The Buccal coitus is called "Sin of Gomorrah".

The commission of sexual assault upon a dead body is called "Necrophily".

☞ **"Testamentary capacity"** is the capacity of a person to make a valid will.

Malpraxis is defined as want of reasonable skill and or willful negligence on the part of doctor resulting in deterioration of patients' health or his death.

Copper sulphate is used as an antidote to phosphorus.

☞ **'Gyrojet'** are cartridges or miniature rockets driven by solid fuel, which produces considerable heat and smokeless gas on burning.

☞ Forensic means courts of law.

Deposition means a statement on oath made by a witness in a judicial proceeding. It is taken down in writing and signed by the witness and magistrate.

Document means any matter expressed or described upon any substance by means of letters, figures or marks, or by more than one of these means.

Evidence includes all legal means which help to prove or disprove any matter of fact, the truth of which is submitted to judicial investigation. It can be oral (direct, indirect or hearsay), documentary & circumstantial.

Hurt is defined as bodily pain, disease or infirmity caused to any person.

Injury includes every inquiry other than a trial, conducted by a Magistrate or court.

Investigation includes all the proceedings for the collection of evidence conducted by a Police officer or by any person other than a magistrate who is authorised by a magistrate on his behalf.

Jury means a body of persons sworn to render verdict in a court of justice. It is composed of uneven number and not less than 7 and more than 9 persons.

☞ Metropolitan area means any area in the state comprising a city or a town whose population exceeds one million.  
 Offence means any act of omission made ☞ punishable by law for the time being in force.  
 Perjury means wilful ☞ utterance of falsehood under oath.  
 ☞ **Plaintiff** is one who brings an action in a court of law.  
 Summons case means a case relating to ☞ an offence punishable with imprisonment for a term not exceeding two years  
 ☞ Testimony means the evidence, oral or written, of a witness under oath.  
 Warrant means a written authority under "hand and seal". It is used ☞ for the arrest of persons or for their forcible production in a court of law  
 Traumatic rupture of hymen is seen on posterolateral aspect. ☞  
 ☞ Taylor gave a formula on rate of decomposition of dead body in air, water and earth.  
 Most reliable method of determining personal identity is ☞ **Dactylography**.  
 Contre-Coupe injury is seen in head ☞ injury.  
 Strychnine acts on anterior horn cells. ☞  
 Last organ to putrefy ☞ in male is prostate whereas in female it is ungravid uterus.  
 In Carboloria, ☞ urine turns green on exposure to air.  
 Cyanide poisoning produces cherry ☞ red colour.  
 McEwen's sign is seen in alcoholism. ☞  
 Cutis anserina is ☞ seen in drowning.  
 Shaking palsy or 'mad Hatters' is seen with mercury ☞ poisoning.  
 Poison which can be detected in burnt bodies is arsenic. ☞  
 ☞ Cephalic index helps in identification of race.  
 Tentative cuts are seen in ☞ suicides.  
 ☞ **Pugilistic attitude** is seen in antemortem or postmortem burns.

Death in police custody is investigated by ☞ **Magistrate**.  
 Precipitin test is used to identify human blood in stains. ☞  
 ☞ **Gelsimium** is a spinal cord poison.  
 Desferrioxamine is ☞ antidote used in iron poisoning.  
 Spalding's sign is seen in ☞ maceration.  
 Impotence is inability to perform the sexual act. ☞  
 Smack is ☞ crude form of **heroin**.  
 Ganja is obtained from flowering ☞ tops.  
 Stomach may be greenish in poisoning due to nitric acid. ☞  
 Lines ☞ of Zahn are present in antemortem clots.  
 Conium is a peripheral ☞ poison.  
 Emphysema aqueosum is seen in wet drowning. ☞  
 Fornication ☞ (**Magnan's** symptom) is seen in cocaine dependence.  
 Rigor ☞ mortis is simulated by cadaveric spasm.  
 Thorn apple is Datura ☞ stramonium.  
 Dirt collar is seen in fire arm entry wound. ☞  
 Apoplexy is ☞ cerebral congestion.  
 Feminine of impotence is frigidity. ☞  
 In ☞ **oath taking**, a medical man does not require to keep his hands on a holy book.

Thanatology is science that deals with death.

Number of hours since death is calculated by multiplying the fall in rectal temperature with **0.67**.

Dichotomy is related to splitting of fees.

Fracture of hyoid bone in a case of strangulation is commonly seen in the greater horn.

In a fresh case of death due to ventricular fibrillation, heart at postmortem will be flabby.

Punctate basophilia is seen in lead poisoning.

**Felony** is a category of rape, murder or burglary.

Testamentary capacity is related to will.

McNaughten was an accused.

Accepted procedure of first aid for acute coronary is Heimlich manoeuvre.

Mode of death from obstruction of air passages from within is anoxic anoxia.

Brain may be preserved in normal saline or rectified spirit.

CSF is preserved in poisoning due to alcohol.

Long bones are preserved in poisoning due to arsenic, lead or antimony.

Exhumation is usually done in the early morning.

In India, **Exhumation** is done for Mohammadans and Christians.

Macroscopically and microscopically, there will not be any change to the heart in case of myocardial infarction death up to 8 hours.

Foamy liver is due to bubbling up of gas.

Leukocyte alkaline phosphatase level is low in CML.

The essential lesion of coronary atherosclerosis is found in intima.

The classical site of ischaemic colitis is splenic flexure.

The rigor mortis disappears in the order of eyelids, neck, thorax, lower limbs (in the order of appearance).

Primary relaxation is stage of somatic death.

After death, the onset of putrefaction is in the stage of secondary relaxation.

Species of origin of blood is determined by precipitin test.

It is a criminal offence in India, for a person to drive a motor vehicle after consuming **alcohol**.

Dum dum bullet is so called because tip is chiselled off.

Cyanides mainly affect Cytochrome oxidase.

In **electrocution**, death is most often due to ventricular fibrillation.

Le facies sympathique is seen in hanging.

The characteristic sign of Korsakoff psychosis is amnesia.

Aconite is most commonly used as a homicidal poison.

Alcohol is maximally absorbed from small intestine.

Absolute alcohol has 99.95% alcohol.

Viscera obtained from a body due to death from alcoholic intoxication are preserved in supersaturated saline.

In strychnine poisoning, rigor mortis sets in early and lasts shortly.

A short barreled rifle is called carbine.

The most fragile bone in skull to get fractured is temporal

The most common type of skull fracture is fissure.

Rigor mortis sets early in cases with deaths due to apoplexy.

In cadaveric spasm, stage of primary relaxation is missing.

Heat stiffening is due to exposure of body to temperature above 75°C.

The presence of blackening, **tattooing** and scorching in a shotgun injury indicates distance of fire upto 3 feet.

Lucid interval is seen in extradural haemorrhage and insanity.

In forgeries, oxalic acid is used as ink remover solution.

Pond fracture (of skull) is found in children.

**Blasting** effect is usually seen in a firearm injury from point blank range.

Olive oil is used in stomach wash in carbolic acid poisoning.

Fracture of middle cranial fossa causes injury to VII and VIII cranial nerves.

Histologically amyloid deposits always begin intercellularly.

Ischiopubic index is significantly more in females.

Unconsciousness occurs immediately after head injury due to concussion.

A female has more sternal index, ischiopubic index and sciatic notch index.

**Ewings** postulates refer to accidents as a cause of death.

Loss of muscular coordination and staggering gait are seen in patient with blood alcohol concentration of 150-300

Dinitro compounds poisoning resembles thyrotoxicosis.

Aconite is known as **Sweet** poison.

CuSO<sub>4</sub> is antidote of Phosphorus.

Foder's test compares weight of lungs to the body.

Diaphanus test denotes that after death, finger webs lose their lustre.

Gaping of deep incised wound is dependent on cleavage lines of Langer.

When a patient is injured or dies due to some unintentional act during treatment by a doctor or agent of the doctor or known as therapeutic misadventure.

Glass blowers shakes are seen with poisoning due to **mercury**.

'Run amok' is sometimes seen with cannabis.

**Abrus** is viper-like poison.

Bluish green hypostasis is seen in H<sub>2</sub>S poisoning

Marquis test is used in opium poisoning.

Datura is also known as '**Road** poison'.

Marsh's test and Reinsch test are used in arsenic poisoning.

Exposure to nickel causes carcinoma nasopharynx.

Best test for seminal stain is Florence test.

Fall of a tooth is grievous injury.

To conduct a postmortem, an authorisation letter is necessary from police officer, magistrate and coroner.

A consent is invalid if obtained from a person who is intoxicated, insane or under threat.

In India, exhumation has no time limit.

Colour changes of putrefaction are first observed in iliac fossa.

**Dipsomania** is seen with alcohol.

Subpoena is a seen kind of document.

In exhumated bodies, the poison likely to be detected most significantly is arsenic.

Postmortem in a newborn is done by opening first the abdominal cavity.

Tests for circulation are Magnus, Diaphanous and Icard's.

Compressed air is used to fire lead slugs in air rifle.

Most important sign of defloration is ruptured hymen.

Cafe coronary occurs when a person is intoxicated.

Overlying is a type of smothering.

Death in fresh water in comparison to salt water is earlier.

Bevelling of inner table of skull is seen in fire arm entry wound.

In burking, cause of death is traumatic asphyxia.

• **Bansdola** is a form of homicidal strangulation.

Convincing proof of burial alive is sand in trachea and bronchi.

In India. Coroner's courts are held in Bombay.

Corpus delict deals with body of crime.

• **Burking** is a name derived from person.

Bullet is picked up with hands.

The process which causes the drying up of tissues and internal viscera to a sufficient degree to halt putrefaction is called mummification.

The most important cause of temporary impotence is fear.

Minimum quantity of blood required to be preserved to mineral poisoning.

Superimposition is technique most useful for identification from skull.

Brown atrophy of heart is seen in starvation deaths.

Most common type of finger impression is **loop**.

Lead poisoning is common in children.

Presence of alveolar duct membrane in foetal autopsies is indicative of live birth.

• The science of finger print was first demonstrated by Francis.

Karl Pearson formula is used to calculate stature of the individual from long bones.

• Filigree burns are due to lightening.

The **commonest homicidal poison** used in India is Arsenic.

BAL is contraindicated in liver damage.

KCN is ineffective as a poison if kept for long time, patient takes excess of carbohydrate or suffers from achlorhydria.

Inquiry into circumstances of death is called inquest report.

Non-poisonous pure metals are mercury, copper and lead.

• **Phossy Jaw** is produced by chronic white phosphorus poisoning.

Pyralism is seen in copper poisoning.

Chloral hydrate is also called knockout drops or **Micky Finn**.

Chromodacryorrhoea is sometimes preapilated by organophosphorus

Rape is a cognizable offence.

To make a positive identification with the help of a partial finger print, the points of similarity should be at least 16.

The most striking symptoms of pregnancy is **cessation** of menstruation.

The most reliable chemical test for blood is benzidine test.

The position colour of tests for blood are —Benzidine test (Blue), Guiacum test (deep blue), Kastle Meyer test, Leucomalachite test (Peacock blue), Haemin Crystal (dark brown).

Takayama reagent is used in haemochromogen test.

Heat stiffening is due to coagulation of albumin.

Term **immerssion** foot is used for cases with frost bite.

Boxer's attitude is seen in persons dying of burns.

III and IV degree of burns are most painful. •

Smokeless gun powder is composed of nitrocellulose.

Gunshot wound is a type of perforated wound.

Supreme Court is purely an **appellate** Court.

Police inquest can be done by a person not below the rank of sub-inspector.

Haemodilution occurs in fresh water drowning.

In chronic mercury poisoning, face is first affected.

Wrist drop and foot drop may be seen in poisoning with lead.

After taking cyanide, patient first feels numbness in extremities.

**Nux vomica** seeds contain 2 alkaloids, strychnine and brucine.

Lynching is a form of homicidal hanging.

'Arrow poison' is nux vomical (also called Kuchila).

Commonest industrial metal poisoning is by lead.

Haemorrhagic spots are found in poisoning by thallium.

Amyl nitrate is antidote of cocaine poisoning.

In sea water drowning, there is steep rise in  $\text{Na}^+$  and  $\text{Mg}^{++}$ .

Cadaveric spasm occurs immediately after death.

Least common type of finger prints is composite.

Preauricular sulcus is useful for identification of sex.

Seminal emission is common in **hanging**.

In methyl alcohol poisoning treatment recommended is ethyl alcohol and sodium bicarbonate.

The presence of fine white leathery froth in mouth indicates drowning.

Lower end of femur can help to determine the age.

Res ipsa loquitur means evidence speaks for itself.

Resorption elution technique is used for detection of blood stains.

In females, obturator foramen is triangular shaped.

Absorption of lead is mainly through lung.

Incised like lacerated wound appears at forehead.

Medical jurisprudence is the subject concerned with knowledge of law in relation to the practice of medicine. In a nutshell, it deals with legal aspects of medical practice.

Crime means a social harm which has been defined and made punishable by law.

**No conduct money** is paid in criminal cases, however, provision is made by the Govt under sec. 312 Cr PC for payment of reasonable expenses of an expert witness attending before any criminal court.

The body is exhumed only when there is a written order issued by 1st class Chief Judicial or Executive magistrate or the Coroner. There is not time limit for exhumation in India.

Putrefaction is the surest sign of death. The earliest sign is manifested as greenish discoloration in the right iliac fossa.

Heat stiffening is due to coagulation of albumin and muscle proteins.

Cold stiffening is due to solidification of fats when body is exposed to very low temperatures

Presence of blood stained froth in the air passage and diatoms in internal viscera and bone marrow is considered surest sign of drowning.

The chief post mortem finding in case of starvation is distended gall bladder.

Heat exhaustion is caused by dehydration and salt deficiency.

Presence of soot in the respiratory passage is the surest sign of ante-mortem burn.

Diatoms resist putrefaction.

About 1900 cal is the minimum daily dietetic requirement below which manifestations of starvation appear.

For estimating surface area in burnt patient "**Wallace's Rule** of Nine" has been employed.

The Taser Gun is a device for immobilizing victims by using electric current without causing death or serious injury.

In drowning, Paltauf's haemorrhages are seen subpleurally in the lungs

Molecular death is more significant medico-legally than somatic death.

Semen contains more than double quantity of CPK than any other body fluid. Levels over 400 units are almost diagnostic. The enzyme is stable and can be demonstrated as late as 6 months after soiling.

Hanging is one of the common forms of suicide among men.

Judicial hanging is the official method of execution of death sentence. The dislocation often takes place between the **2nd & 3rd** cervical vertebra.

Dribbling of saliva is the vital sign of ante-mortem hanging and is due to stimulation of salivary glands by ligature.

**Lynching** is homicidal hanging where several persons acting jointly overpower an individual and hang him by means of a rope to a tree or like object.

Strangulation is almost always homicidal.

In strangulation, ligature completely encircles the neck horizontally below thyroid cartilage. Injury to carotid arteries common. Bleeding from nose, mouth and ears. Emphysematous patches on lungs are commonly seen during postmortem examination, fracture of hyoid bone commonly occurs in throttling (near the greater cornua).

**Smothering** is a form of asphyxia caused by mechanical occlusion of the external air passages viz. the nose and the mouth by hands, cloth or any other material.

Overlying or compression suffocation results due to compression of the chest so as to prevent breathing. It is common method of infanticide.

Burking is a method of homicidal smothering and traumatic asphyxia.

Drowning is a form of asphyxia due to aspiration of fluid into air passage, caused by submersion in water or other fluid.

Death ensues rapidly in fresh water than in salt water or sea water.

The fine froth at the mouth and nose is pathognomonic of drowning.

**Cutis anserina** or goose skin has no value as a diagnostic sign of death from drowning.

Diatoms test is negative in dead bodies thrown in water or in dry drowning.

In a typical case of drowning, diatoms are found in brains and bone marrow.

Drowning is one of the commonest forms of suicide amongst females.

**Buccal coitus** is Sin of Gomorrah.

Strychnine poisoning resembles tetanus / epilepsy / hysteria.

Thallium resembles natural death.

Exhumation is done: In presence of police officer. In the supervision of Medical Officer. Written order from 1st class Magistrate or coroner.

Most common mode of death in strangulation is Asphyxia.

The common mode of choking is Accidental.

**Caffey syndrome** is Battered baby syndrome.

In judicial hanging, fracture/dislocation of the vertebrae at the level of C3 and C4 vertebra.

☞ In Asphyxia, the place where the Tardieu spots occur in lung is interlobar fissures.  
Forensic thanatology deals with Medicolegal study of death.

In ☞ dental fluorosis, the teeth are characterised by mottled enamel.

☞ **Wreden's test**—for detecting the presence of air in middle ear for determining live birth or dead foetus.

The rules for criminal ☞ responsibility of Insane:

Mc Naughten's rule

Durham's rule

Current's rule

Blood group of Parents, Child group ☞ possible:

O x O i.e. OO x OO = O ♣

A x B i.e. OA x OB = O, A, B, AB. All are ♣ possible

O x A i.e. OO x OA = O, A. ♣

Macerated body of a foetus ☞ indicates—dead-born.

Cadaveric spasm (Instantaneous rigor) affects ☞ voluntary muscles only.

The most dependent means of identification of ☞ persons is finger prints.

If a person survives after giving dying ☞ declaration, it can be used as corroborative evidence.

Paraffin test or ☞ dermal nitrate test detects Gunpowder residue on hands.

☞ **Knockout agents**: Chloral hydrate, Potassium bromide

☞ **Saturday night paralysis** due to pressure on the Radial nerve.

Leading questions ☞ are permissible in cross-examination.

Preservative used to preserve the ☞ urine for chemical analysis is Thymol crystals.

In Arsenic poisoning, ☞ putrefaction is delayed.

Arsenic is employed for embalming of Cadaver. ☞

☞ Subendocardial haemorrhages in Arsenic poisoning.

The poison which is found ☞ in maximum quantities in various organs in Postmortem is — Arsenic.

☞ Poisoning resembling fading measles — Arsenic.

Optic atrophy occurs in ☞ Methyl Alcohol poisoning.

Minimum Alcohol consumed by person, estimated by ☞ — **Widmarks formula**.

Widmark's formula, to determine — ☞ Quantity of Alcohol consumed.

The preservative used for viscera in Alcohol ☞ poisoning—Saturated sodium chloride solution.

Barbiturates increase the ☞ toxicity of Alcohol by Synergism.

Methylated spirit contains—95% Rectified ☞ spirit and 5% Methyl alcohol.

The common preservative for viscera—Rectified ☞ spirit

The organs that resist putrefaction—uterus (Non pregnant); ☞ Prostate.

The poisons which Resist putrefaction—Arsenic, Edrin, Datura, ☞ Strychnine.

Thick and leathery stomach wall in —Phenol poisoning. ☞

☞ **Ochronosis** (Pigmentation of skin and cartilages) in — Phenol poisoning.

In Phenol poisoning —Urine is green coloured. ☞

Delicate and ☞ reliable test for Blood stains—Takayama's test (Hemochromogen crystal test).

Teichman test for blood stains is — ☞ **Haemin Crystal test**.

Extremely delicate test for Blood stains—Phenolphthalein test ☞ (Kastle-Mayer test).

The best test for Blood stains—Chromatography & absorption spectroscopy.  
 Leukomalachite green test is a chemical test for & —Blood.  
 In severe burns, remnant indicative of Male sex—Inguinal & canal.  
 Carbonaceous soot particles in Respiratory tract suggestive of—Antemortem burns.  
 Lichtenberg's flowers or filigree burns or & Arborescent markings is seen in Lightninging.  
 In chemical burns by & Corrosives—Vesication does not occur.  
 & **Paltauf's haemorrhages** (usually in lower lobes of lungs) in —Drowning.  
 & Immersion syndrome is due to—Vagal inhibition  
 Froth may be absent in case & of death due to — Dry drowning.  
 The specimen used for Diatom's test—Sternal & bone marrow.  
 Salt water drowning —Increased.&  
 Postmortem & staining:  
     Usually mistaken for —Contusion.  
     Can occur before death in —Cholera.  
 Hypostasis or cadaveric lividity — Postmortem ♣ staining.  
 Purple colour in —Asphyxia. ♣  
 Blue green colour in —Hydrogen ♣ sulphide poisoning.  
 Blue vitreol—Copper sulfate.&  
 Verdigris—Copper & subacetate.  
 Green line on the gums in —Copper poisoning.&  
 Most potent & of all preparations of cannabis is —Charas.  
 Stomach wash in & **opium** poisoning, done with —Potassium permanganate.  
 In & opium poisoning, there is loss of all secretions except sweat.  
 In opium & poisoning, atropine is contraindicated.  
 Methaemoglobinaemia is caused by & poisoning due to Nitrates.  
 Antidote used in common types of poisonous & shakes, in India includes polyvalent antsnake venom.  
 Viperbite like & poison—Abrus.  
 Sea snake venom—Myotoxic.&  
 Diwali poisons are —Mercury, & phosphorous.  
 Nephrotoxic poisons—Phenol, Oxalic acid, Mercury.&  
 Blotting & paper like stomach in sulphuric acid poisoning.  
 Sodium nitrate looks and & tastes like common salt.  
 Tingling of skin and tongue by & **Aconite** poisoning.  
 Tannic acid precipitates & alkaloids.  
 Physiological antidote produce symptoms opposite to those of & poison is:  
     Atropine—Physostigmine  
     Cyanide—Amyl nitrite  
     Strychnine—Barbiturate  
 In phosphorous poisoning, avoid oil and fats as they & increase absorption.  
 In Endrin poisoning, the pupils are dilated.&  
 & Albumin helps to precipitate in Mercury poisoning.  
 Lead poisoning, causes & constipation.  
 In Potassium permanganate poisoning, lesions resemble & Tertiary syphilis.  
 Symptoms of Abrus precatorius poisoning resemble & viperine snake bite.  
 Cocaine acts as an Aphrodisiac.&

Charas is known as Hashish.

In **treatment** of Nuxvomica poisoning, most important is I.V. injection of Barbiturates.

Pupils show alternate contraction and dilatation in Aconite poisoning.

Charcoal acts as a mechanical Antidote.

Potassium ferrocyanide solution is used as gastric lavage solution of poisoning due to copper sulphate.

Skin and mucous membranes are colored yellow in poisoning due to nitric acid.

Delayed poisoning by oxalic acid is characterised by —Uraemia.

Large amount of water is contraindicated in —Oxalic acid poisoning.

Hypocalcemia can occur in —Oxalic acid poisoning.

Hypocalcemia can occur in —Oxalic acid poisoning.

Oxalic acid resembles—Magnesium sulfate.

Coffee ground vomitus is seen in Oxalic acid poisoning.

Datura seeds look like—Brinjal seeds capsicum seeds or Tomato seeds.

Physiological antidote for Datura poisoning—Pilocarpine

Stupefying poison—**Datura**.

Road poison—Datura.

If a person survives after giving dying declaration, it can be used as corroborative evidence

Arsenic is employed for embalming of Cadaver

Subendocardial haemorrhages are seen in Arsenic poisoning

The poison which is found in maximum quantities in various organs in Postmortem is -

### **Arsenic**

Poisoning resembling fading measles - Arsenic

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Barbiturates increase the toxicity of Alcohol by Synergism

Methylated spirit contains 95% Rectified spirit and 5% Methyl alcohol

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**Ochronosis** (Pigmentation of skin and cartilages) is seen in Phenol poisoning

Extremely delicate test for Blood stains - Phenophthalein test ('Kastle-Mayer test).

The best test for Blood stains is Chromatography absorption spectroscopy

In severe burns, remnant indicative of Male sex is inguinal canal

**Lichtenberg's** flowers or filigree burns or Arborescent markings are seen in Lightning

In chemical burns by Corrosives Vesication does not occur

Immersion syndrome is due to Dry drowning

Rule of House is used for calculating age of the fetus-

PM staining usually mistaken for -Contusion

PM staining can occur before death in -Cholera

Most potent of ail preparations of cannabis is Charas

Amenorrhoea and infertility can occur in Chronic lead poisoning

If a person is absent from his usual haunts, and has not been heard for at least 7 years, he is presumed to be dead

In opium poisoning there is loss of all secretions except sweat

In opium poisoning, atropine is contraindicated

Strongest corrosive poison is sulphuric acid  
 Antidote used in common types of poisonous snakes in India includes polyvalent antiserum  
 Viper bite like poison is **Abrus**  
 Sea snake venom is Myotoxic  
 Diwali poisons are - Mercury, phosphorus  
 Blotting paper like stomach is seen in sulphuric acid poisoning  
 Spinal poisoning may be mistaken commonly for Tetanus  
 Sodium nitrate looks and tastes like common salt  
 Tingling of skin and tongue is seen in Aconite poisoning  
 In phosphorous poisoning, avoid oil and fats as they increase absorption  
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 Pupils show alternate contraction and dilatation in Aconite poisoning  
 Charcoal acts as a mechanical antidote.  
 Delayed poisoning by oxalic acid is characterised by Uraemia Large amount of water is contraindicated in Oxalic acid poisoning Hypocalcemia can occur in Oxalic acid poisoning  
 Coffee ground vomitus is seen in Oxalic acid poisoning  
**Datura** seeds look like- Brinjal seeds, capsicum seeds or Tomato seed  
 Antidote for chlorpyrifos poisoning is. PAM.  
 Prussian blue is used in poisoning by thallium.  
 In gastric lavage, tube is passed upto 50 cm mark  
 Oleander causes heart block  
 Puppe's rule is used for bullet injuries  
**Wredin's** test detects changes in middle ear  
 Rain drop pigmentation of skin is seen in arsenic poisoning  
 Algor mortis refers to cooling of body  
 American Law Institute Test is related to criminal responsibility  
 Poroscopy was described by Locard  
 Burrowed servant doctrine is related to vicarious liability  
 Wax-drippings or bone pearls are due to thermal injuries  
 Lichtenberg's flowers refers to Filigree burns  
**Cutis anserina** is due to exector pilae  
 Cupping' is a method of criminal abortion  
 Crocodile flash burns are due to antemortem electric burns  
 Hospital providing defective equipment or drugs is causing Corporate, negligence  
 Contusion collar is a proof of Gun shot entrance  
 In **'Commando punch'**, injury usually occur in neck  
**Blast lung** is seen due to air explosion Therapeutic orphans result due to experimentation  
 The name hatters shake is given because it is common in hat making industry  
 Trotter and Glessner's formulae are used for estimating stature

Rachiotomy saw is used to remove spinal cord

In cases of increased intracranial pressure, Kernhan's notch is seen on midbrain

In artificial insemination of Donor without husband's consent, if the legal presumption of legitimacy be rebutted, parental rights will be vested in mother only

Agonal period is period between lethal occurrence and death

K master is responsible for the faults of his servants is known as Vicarious liability, Biliard ball ricochet effect is seen in firearm injuries

Cavett test is used for determing blood alcohol

☐ **Dactylography** was first used in India by Sir W. Herschel

☐ Huffling is common solvent abuse

Sewer gas contains CO<sub>2</sub>, methane and H<sub>2</sub>S

Stomach-bowel test' is used for knowing if infant respiration occurred

'Swallow tails' are seen in lacerated wound

Most common type of abrasions of grazes

☐ **Osteometric** board is used to estimate stature

Skull is square in Mongolians

In human head hair, bar bodies are found in hair follicles in a proportion of 29± 5% in females and 6+2% males

Curator bonis is person appointed to manage the affairs of mentally incompetent

"☐ **Crib deaths**' are due to asphyxia

☐ Commoriant's literally means dying together

For identification, palatoprints are taken from anterior part

Pink teeth are seen in death due to asphyxia

The order of appearance of rigor mortis follows Nysten's law

Postmortem lividity in a case of hanging is most prominent over lower extremities

Postmortem staining of a dead body lying undisturbed persists till it merges with discolouration of putrefaction

Bleeding from nostrils, mouth and ears is relatively common in strangulation

☐ **Contre coup** injury is seen in brain

In deep incised wounds, Langer's lines determine gaping

Mugging by definition is homicidal

☐ **Ligature mark** in hanging is an example of imprint abrasion

Immediate cause of death in burns is neurogenic shock

Common cause of death in crush syndrome is acute renal failure

Abrasion is seen in injury with rifled arm

Spermin in semen is detected by Barberio test

The impotent **quoad** is impotent to a particular woman

Seminal fluid choline originates from Leydig cell

To establish diagnosis of feigned insanity, the person can be observed for a maximum period of 30 days

☐ Incessant sexual desire is known as satyriasis

Dhatura poisoning is due to intake of seeds

Mercury damages glomeruli and renal tubules

Cyanide poisoning kit contains amyl nitrite, Sodium nitrite and sodium thiosulfate

☐ Chromolachryorrhoea in organophosphorus poisoning is due to porphyrin

A green line in gums in copper poisoning is Clepten line

In **Eonism**, there is cross dressing

Garrotting is used as a method of execution in some countries

Tardieu spots are numerous in thymus, AV junction and conjunctiva

In body packer syndrome, person dies of abused drug overdose

In drowning, emphysema aquosum is seen in 80% cases

In embalming fluid, the concentration of formaldehyde and methyl alcohol are 40% and 10% respectively

Emmenagogues are used for criminal abortion

**McNaughten** rule has been included in India in section 84 of IPC

**Hydrocution** is another term for immersion syndrome

Diminished responsibility is a term used for borderline mental state

**Minisatellite** or stutters are terms used for DNA finger printing

Section 312 IPC is related to abortion

Sankya or somalkhar is a compound of lead

The compounds used for taking finger prints are French chalk, lead carbonate and mercury

'**Central pocket loop**' is a variety of Composite finger print

Reaction phenomenon is seen drowning

Alcoholic palimpsests are a type of blackout

Arsenic poisoning may lead to thrombocytopenia, leukemia and BM suppression

In arsenic poisoning, bands of opacity in finger nails are called **Aldrich-Mees lines**

Affiliation cases are related to paternity dispute

Kennedy phenomenon results due to surgical alteration

Incineration, dismemberment and advanced putrefaction are methods of effacement of identity

Moletova cocktail is a bomb

Medullary index is used to determine sex

Harrison and Gilroy test is used for firearm injury

After respiration, the weight of lungs increases by about 30 gm

The most characteristic defence injuries are those sustained during an attack by knife

**Ploucquet's test** is used to estimate live birth

Weight of pineal gland is 0.1 to 0.2 gm

In smothering, there is abrasion on the inner side of upper lip

Death during anaesthesia, D.C. to be written by anaesthetist

Privileged communication may be used by a doctor to **blackmail his patients**

Repeated intentional advertisement by a doctor in newspaper is professional misconduct

Oath taking in the court is court formality

The inquiry into the circumstances of death is inquest report

16 years age of female is an age to give valid consent for lawful sexual intercourse

Age of consent for medical examination is after eruption of III molar

Fragmentary medulla is seen in Negroid

For saliva, test used is alpha amylase test

Rule of Haase is used for estimation of foetal age

Wilson's classification is used to classify burns

Drugs interfering in blood grouping are barbiturate, aspirin and heparin

Phenol also retards putrefaction

In strangulation, neck muscle rupture is common

In fresh water poisoning, there may be hyperkalemia, hemolysis and ventricular fibrillation

Brain stem death occurs in encephalomyelitis

Postmortem examination is done for all organs of the body

### Historical milestones

Code of **Hammurabi**—oldest known medico-legal code.

Hippocrates (father of Medicine)

—discussed lethality of wounds

—formulated medical ethics.

**Manu law's** — medical ethics— many sexual matters — most scientifically discussed.

Justinian code

—regulated the practice of medicine & surgery.

— established the function of the medical expert for legal procedure.

Bartolomeo De Varignana — first medicolegal autopsy done by him in Italy.

Paulus Zacchias — written "medico-legal questions", questions Medico legalis." Fortunato

Fedele—written first book on Forensic medicine.

Orfil—considered as father of Modern Toxicology.

a. In the 18th century, study in legal Medicine as a subject was established by appointing professorship in Germany.

b. In England Me Naughten's (who was schizophrenic) rule has been established to deal with legal matters in cases of insanity or like situations whatsoever

Sec 118 IPC—Concealing design to commit offence punishable with death or imprisonment for life.

Sec 176, IPC—Omission to give notice or information to public servant by person legally bound to give it.

Sec 177 IPC—Furnishing false information.

Sec 182 IPC—False information with intent to cause public servant to use lawful power to the injury of another person. .--Sec 191 IPC—Giving false evidence

Sec 192 IPC—Fabricating false evidence.

Sec 193 IPC—Punishment for false evidence.

Sec 194 IPC—Giving or fabricating false evidence with intent to procure conviction of capital offence.

Sec 195 IPC — Giving or fabricating false evidence with intent to procure conviction of offence punishable with imprisonment for life or imprisonment.

Sec 197 IPC—Issuing or signing false certificates.

Sec 201 IPC—Causing disappearance of evidence of offence, or giving false information to screen offenders.

Sec 203 IPC—Giving false information respecting an offence committed.

Sec 204 IPC—Destruction of document to prevent its production as evidence.

Sec 284 IPC —Negligent conduct with respect to poisonous substances.

Sec 304 IPC—Causing death by negligence.

Sec 309 IPC—Attempt to commit suicide

Sec 313 IPC—Causing miscarriage without woman's consent.

Sec 318 IPC—Concealment of birth by secret disposal of dead body.

Sec 319 IPC—Hurt.

Sec 320 IPC—Grievous hurt.

Sec 351 IPC—Assault.

Sec 362 IPC—Abduction.

Sec 375 IPC —Rape.

Sec 376 IPC—Punishment for rape.

Sec 377 IPC—Unnatural offences.

Sec 497 IPC—Adultery.

Sec 39 Cr. P.C—Every person, aware of the commission of or of the intention of any other person to commit any offence is punishable under I.P.C. shall forthwith give information to the nearest magistrate or police officer of such commission or intention.

Sec 84 IPC—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 what he is doing is either wrong or contrary to law.

Confabulation—Pathological loss of memory, e.g. — Korsakoff s psychosis. — Early stages of dementia.

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