

# CHAPTER 1

## INTRODUCTION

There are two distinct aspects of law-medicine relationship: (1) Forensic medicine, and (2) Medical jurisprudence. They are essentially different subjects, but are closely related.

**Forensic or legal medicine** (forensic = of or used in Courts of law) deals with the application of medical knowledge to aid in the administration of justice. It is used by the legal authorities for the solution of legal problems. Some examples are: applying the medical knowledge in deciding cases of injuries, murder, suicide, accidents, sexual offences, poisoning, etc. In short, it deals with medical aspects of law.

**Medical jurisprudence** (juris = law; prudentia = knowledge) deals with legal responsibilities of the physician with particular reference to those arising from physician-patient relationship, such as medical negligence cases, consent, rights and duties of doctors, serious professional misconduct, medical ethics, etc. In short, it deals with legal aspects of practice of medicine.

**Forensic pathology** deals with the study and application of the effects of violence or unnatural disease in its various forms in or on the human body, in determining the cause and manner of death in case of violence, suspicious, unexplained, unexpected, sudden and medically unattended deaths.

**Medical ethics** deals with the moral principles which should guide members of the medical profession in their dealings with each other, their patients and the State.

**Medical etiquette** deals with the conventional laws of courtesy observed between members of the medical profession. A doctor should behave with his colleagues as he would have them behave with himself.

Ethical behaviour is a self-imposed duty upon each doctor. A doctor should not criticise or denigrate the professional ability of another doctor, while dealing with a patient.

Forensic medicine deals almost entirely with crimes against human beings in which medical examination and evidence are required. Forensic medicine is mostly an exercise of commonsense, combined with the application of knowledge and

experience, already acquired in the study of other branches of medicine, surgery, obstetrics, etc. Its aim is to find out the truth. Its particular field of activity is judicial investigation, both civil and criminal. All medical work is of a responsible character, especially the medico-legal work, such as issuing certificates of lunacy, ill-health, etc. In all cases of crime involving the person, e.g. homicide, suicide, assault, sexual offences, traffic accidents, poisoning, etc., the help of the medical practitioner is sought by the police. In all such cases, the doctor will be required to appear as an expert witness in a Court of law. In some cases, the doctor is the chief source of evidence upon which legal decisions are made. In cases of sudden death, the authorities will depend mostly or completely on medical evidence in establishing the cause of death, and in case of accident to determine blame.

A doctor may be called to testify (1) as an ordinary witness who saw an incident, (2) as the medical practitioner who treated the patient, (3) as an expert to give his opinion on matter of science. In the first two conditions it is his duty and obligation to testify. In the last condition he may refuse the request: (1) if he feels reluctant to undergo what he fears will be a painful experience, (2) if he feels that he is not sufficiently qualified to testify with any conviction in that particular case, and (3) if he feels that he cannot spare the time to prepare properly or to make long appearances in Court. A properly prepared physician often finds his Court room experience educative and not as traumatic as he would have anticipated. His introduction to the legal process may be unpleasant if he is irritated by an aggressive prosecuting or defence lawyer. The reluctance of medical practitioners to become witnesses is mainly due to the pressures of their private practice. Other factors include a fear of merciless cross-examination, harassment, and even the recall.

All forensic science expert witnesses must strive to achieve respect, understanding and credibility in Court. They must give the appearance, the aura of being independent, non-partisan witnesses. The appearance and projected image of neutrality,



impartiality and objectivity are as important as the authentic characteristics. A doctor should not become partisan. Once a theory is embraced, it is only human nature to eagerly search for facts which support that theory, and reject those which indicate some other theory. Brouardel, the French medico-legal authority wrote, "if the law has made you (the physician) witness, remain a man of science; you have no victim to avenge, no guilty person to convict, and no innocent person to save. You must bear testimony within the limits of science". The attitude of a scientific witness should be the same whether he is called by the prosecution or by the defence. The doctor really testifies neither for nor against the prosecution or the defence. The doctor's expertise is in the application of science to a legal controversy and the proper interpretation of scientific findings. His sole obligation is to present the truth as he sees it, adding nothing, withholding nothing and distorting nothing. He should not concern himself with the previous character of the accused or with other evidence in the case. He should not be influenced in any way by emotional consideration, such as sympathy or antipathy. The doctor must be honest, for confidence is inspired by honesty and success depends upon confidence.

It is advisable that the doctor should learn to look from the medico-legal standpoint upon such of his cases as are likely to become the subject matter of judicial investigation. He should acquire the habit of making a careful note of all the facts observed by him. The medico-legal aspects of any case must always be secondary to life saving treatment of the patient. Vagueness and theory have no place in forensic medicine. He should examine the facts which come to his knowledge in his special capacity, draw his conclusions logically and correctly after a detailed consideration of the pros and cons of the case, and indicate to the Court that interpretation, along with the grounds on which it is based. Presumption is not proof, and conjecture is not evidence. The Court has no special medical knowledge. It relies on his witness for an opinion and expects him to assist it with his special knowledge and experience. The burden of presenting medical facts and medical opinions in the best possible way rests on the doctor. Forensic pathologist testifies on so-called "fact issues", such as cause and manner of death, rather than "ultimate issue" of guilt or innocence, so that opinion based upon reasonable

medical certainty is adequate to support the testimony of the forensic pathologist. The medical evidence does not itself prove the case of prosecution. Other things being equal, the better the presentation of medical evidence, the better is the administration of justice. Demeanour, appearance, professional manner and general behaviour of the expert witness are almost equal in importance to forensic ability during testimony. The doctor should avoid talking too much, talking too soon, and talking to the wrong persons. Prejudicial and sensational statements should not be made prior to trial. The pathologist should never overlook an opportunity to remain silent. The doctor must be guarded in what he says and how he says it.

The medico-legal expert is not a detective. He may use his knowledge and intelligence to help the police to solve a crime. His role should be to furnish the police with specific information on matters of which he has specialised knowledge. Because of his special knowledge, a non-medical clue may have a significance to him, which even an experienced police officer has not grasped. The medical expert should be very careful when he is examining living people. He should not encourage an accused person to talk about the crime with which he is charged, or about the events that led to his arrest. If, during a medical examination, a person says anything that might incriminate himself, it should be neither recorded nor reported. However, occasions may arise when a doctor may use an admission to direct the police to certain lines of inquiry and action without actually disclosing what has been said.

Three things are needed for success : (1) the power of observation, (2) a wide range of exact knowledge, (3) the power of deduction. The power of constructive imagination is also essential when there are no more facts to be observed, and no further inferences to be drawn. There is no substitute for basic intelligence and clinical competence. Experience, commonsense, and willingness to consider other possibilities are as essential in the practice of forensic medicine as a wide range of theoretical knowledge. The attributes of the physician are : (1) caution, (2) foresight, and (3) wisdom.

The doctor should develop a fair understanding, satisfactory appraisal and high index of awareness of the medical, philosophical and legal problems related to the determination of the manner of death. He should be thoroughly familiar with the problems



of causality and manner of death. He should realise that total complications of extraneous injuries do not change the manner of death from unnatural to natural, e.g., the victim of a homicidal attack dying with peritonitis following abdominal injuries and surgery should be certified as homicide victim and not as surgical complications. A good command of language, clear presentation, and ability in expressing a relatively firm opinion are necessary for the success of the medical witness. The doctor must be alert to where evidence should be looked for, and how it should be interpreted. His failure may make the difference between life and death or between freedom and imprisonment of a suspected person. It may deprive a widow of compensation to which she is entitled, may cause an innocent person to be prosecuted or punished, may permit a murderer to escape punishment, or may cause some person or institution to be held financially liable to damages for which they were not responsible.

William Osler wrote : "Medicine is a science of uncertainty and an art of probability. Absolute diagnoses are unsafe and are made at expense of the conscience". Medicine is a biological science with the variability inherent in biological matters. One thing that makes medicine so difficult is that there is no such thing as the average man. We can only say the reading is 'within the range of normal'. Forensic medicine is not an exact science. Unexpected results are produced due to biological variations. In every case, there is an element of uncertainty, and absolute proof is a rarity in any medical problem. The most extraordinary events occur in medico-legal practice, and a careful evaluation must always be made to ensure that dogmatic statements by medical witnesses do not mislead the investigating officers. No possibility is wholly excluded in medical experience. Doctors should bear in mind the essential difference between probability and proof. The medical witness should not be dogmatic about his opinion, and also lawyers should not expect him to be so. They should be reasonable in their opinions and should not overstate the likelihood of a relationship between cause and effect. The doctor should be ready to defend every finding and conclusion on the report on clinical and scientific grounds. He should be aware of professional and scientific viewpoints which might differ from his, and should be familiar with the latest scientific literature in relation to the subject involved. For

the purpose of illustrating and clarifying his testimony, the medical expert may employ photographs, maps, diagrams, charts, X-rays, skeletons, models, etc., when they are properly verified.

Forensic medicine can be mastered only by an extensive practical experience acquired by an application and study of medico-legal problems. Courts of law are open to the public. Medical students and newly qualified doctors should attend the Courts, where they can follow the proceedings, hear the evidence given by medical witness, and note the questions put and the replies given. This will familiarize the doctor with legal procedures and help to lessen the painful experience of giving evidence. Forensic pathologists have an ethical obligation to contribute to further knowledge, research and education in their field. He should avoid special efforts to "cover up" medical negligence or intentional wrong doing.

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 to have good knowledge of the law governing their profession, in order not to transgress the law.

**HISTORY :** Medicine and law have been related from the earliest times and the bonds which united them were religion, superstition and magic. Law-medicine problems are found in the written records in Egypt, Sumer, Babylon, India and China dating back 4000 to 3000 B.C. A Chinese materia medica of about 3000 B.C. gives information on poisons. Imhotep (27th century B.C.), Grand Vizir, Chief Justice and chief physician of King Zoser of Egypt, enacted rules for medical practice, which was brought under law. The Code of Hammurabi, King of Babylon (about 2200 B.C.), is the oldest known medico-legal Code. In fourth century, B.C., Manu (King and law-giver) in his treatise, Manusmriti, laid down various laws including punishment for various sexual offences, and recognised mental incapacity due to intoxication, illness and age. Between fourth and third century B.C. Arthashastra of Kautilya defined penal laws and regulated medical practice. Hippocrates (460 to 377 B.C.), the "Father of Western Medicine" was born and practiced in the island of Kos in Greece, discussed the lethality of wounds. His contribution to medical ethics is by far his greatest in our field. About 300 B.C., the



Rabbis of the Rabbinical Court, responsible for implementing the Jewish laws, sought the aid of medical expert in the administration of justice. Later, Greek and Roman jurists and medical men collaborated in the development of the principles of forensic medicine. Shushruta (father of Indian surgery), between 200 to 300 A.D. in his treatise *Susruta Samhita* dealt with various medicolegal problems. In the sixth century A.D. the Justinian Code (Roman emperor) and Institutes regulated the practice of medicine and surgery, and established the function of the medical expert for legal procedure. The first medico-legal autopsy was done in Bologna (Italy) in 1302, by Bartolomeo De Varignana. In the thirteenth century, a manual was prepared to aid in the investigation of death in China. The 'Constitutio Criminalis Carolina', published in Germany in 1532, recognised that there were several types of homicide which were not punishable under certain conditions, one of which was an offender who was 'deprived of his understanding'. In sixteenth century, the Penal Code of the Bishop of Bamberg, and the Caroline Code, both increased importance of legal medicine by their insistence that medical testimony was an essential part of the proof in trials. The first book on Forensic Medicine was published in 1602 by an Italian physician, Fortunato Fedele. The greatest of

all works was the "Questiones Medico-legalis" (medico-legal questions), written by Paulus Zacchias, who was principal physician to Pope Innocent X, and Alexander VII, and an expert before the Rota Romana, the Court of Appeal. This was published in seven volumes from 1621 to 1635 and two additional volumes in 1666, at Amsterdam. This work remained an authority in medico-legal matters until the beginning of the nineteenth century. Paulus Zacchias is considered the Father of Legal Medicine as well as Father of Forensic Psychiatry. In *Questiones Medico-legalis*, he declared that physicians should have exclusive competence in the field of pathological mental states, *amentias*. He provided a classification of mental disorders keeping in mind the legal issues at that time. Around the end of the sixteenth century, autopsies in medico-legal cases began to be generally practised. In the eighteenth century, professorships in legal medicine were founded by the State in Germany. Orfila (1787 to 1853), professor of chemistry and legal medicine at Paris introduced precise chemical methods into toxicology. He is considered the founder of modern toxicology. In 1843, the law regarding the criminal responsibility of insane persons was established in England in Mc Naughten's case.



## CHAPTER 2

# LEGAL PROCEDURE

**Indian Penal Code (I.P.C.), 1860:** It deals with substantive criminal law of India. It defines offences and prescribes punishments.

**Criminal Procedure Code (Cr.P.C.), 1973 :** It provides the mechanism for punishment of offences against the substantive criminal law. It deals with police duties in arresting offenders, dealing with absconders, in the production of documents, etc. and in investigating offences. It provides for different class of Courts. It deals with actual procedure in trials, appeals, references, revisions, and transfer of criminal cases.

**Indian Evidence Act (I.E.A.), (1872):** It deals with Law of Evidence (different categories of evidence, the procedure of collection, preservation and use of different evidences) and applies to all judicial proceedings in any Court. It is common to both the criminal and civil procedure.

**Criminal law** deals with offences which are considered to be against the public interest, such as offences against the person, property, public safety, security of the State, etc. Here the State is a party represented by public prosecutor, and the accused is the other party.

**Civil law** deals with disputes between two individuals or parties. The party bringing the action in a civil case is called "plaintiff". The accused is called "defendant" in both criminal and civil cases.

**Common law** is made by judges when they deliver decisions in individual cases.

**INQUEST :** An inquest is an inquiry or investigation into the cause of death. It is conducted in cases of suicide, murder, killing by an animal or machinery, accidents, suspicious (unnatural) death and death due to anaesthesia or operation. Two types of inquests are held in India.

(1) The police inquest.

(2) The Magistrate's inquest.

(1) **POLICE INQUEST :** The officer-in-charge (usually sub-inspector) of a police station conducts the inquest (S.174, Cr.P.C.). The police officer making the inquest is known as Investigating Officer (I.O.). When the officer-in-charge of a police station receives information that a person has committed suicide, or has been killed by another or by an

animal or by machinery or by an accident, or has died under circumstances raising a reasonable suspicion that some other person has committed an offence, he immediately gives intimation about it, to the nearest Executive Magistrate empowered to hold inquests, and proceeds to the place where the body of such deceased person is. There, in the presence of two or more respectable persons (*panchas*) makes an investigation (S.175, Cr.P.C.). He prepares a report of the apparent cause of death, describing wounds, fractures, bruises, and other marks of injury found on the body, and stating in what manner, or by what weapon or instrument, such injuries appear to have been inflicted. The inquest report (*panchanama*) is then signed by the investigating police officer and by the *panchas*. If no foul play is suspected, the dead body is handed over to the relatives for disposal. In cases of suspected foul play or doubt, the body is sent for post-mortem examination to the nearest authorised Government doctor, together with a requisition and a copy of the inquest. The report is forwarded to the Magistrate.

Private medical institutions can undertake medicolegal examination of the living and the dead with the permission of the State Government.

The police officer may summon persons who appear to know the facts of the case for investigation purposes. The summoned person is bound to attend and answer questions put to him. Refusal to answer questions is punishable with imprisonment up to six months, under S. 179; I.P.C. Statements made to Police Officer, if reduced to writing are not to be signed (S.162.I.P.C.).

(2) **MAGISTRATE'S INQUEST :** This is conducted by a District Magistrate (Collector/Deputy Commissioner), Tahsildar (MRO), Sub-divisional Magistrate(RDO), or any other Executive Magistrate, especially empowered by the State Government (Executive Magistrates). It is done in case of (1) death in police custody, and while under police interrogation, (2) death due to police firing, (3) death in prison, reformatories, Borstal school, (4) death in a psychiatric hospital, (5) dowry deaths, and (6) exhumation (S. 174 (4) and S.176, Cr.P.C.). In any case of death, a Magistrate may conduct an inquest,



instead of or in addition to the police inquest (S.176, Cr.P.C.).

**CORONER'S INQUEST :** This is a type of inquest done in U.K., some States in U.S.A., and some other countries, but not in India. Coroner conducts inquest in all unnatural and suspicious deaths. The doctor is summoned to his Court to give evidence at the inquest. Coroner's Court is a Court of enquiry, wherein Jurors are sworn to give a true verdict according to the evidence. He has some judicial powers.

**MEDICAL EXAMINER'S SYSTEM :** This is a type of inquest conducted in most of the States in the United States of America. A medical practitioner known as Medical Examiner is appointed to perform the functions of Coroner. He does not have any judicial functions similar to the Coroner and he has no authority to order the arrest of any person. As the doctor visits the scene of crime and conducts the inquest, it is superior to Coroner's and police inquest.

**JURY :** Jury is a group of responsible, educated persons of good social position called "jurors". It is composed of an uneven number of persons. Their verdict is binding on the Judge, but if the Judge differs, the matter is referred to the High Court. Trial by jury has been abolished in India.

**COURTS OF LAW :** Sections 6 to 25 of Cr.P.C. deal with constitution of Criminal Courts and Offices. Courts of law are of two types : (1) Civil, and (2) Criminal. The Criminal Courts in India are of four types.

(1) The **Supreme Court** is the highest judicial tribunal, and is located in New Delhi. It has power of supervision over all Courts in India. The law declared by it is binding on all Courts (Article 134 of Constitution of India).

(2) The **High Court** is usually located in the capital of every State and is the highest tribunal for the State. (Article 214, Constitution of India). It may try any offence and pass any sentence authorised by law (S.28,(1) Cr.P.C.).

Supreme Court and High Courts act as Courts of appeal only in criminal cases, and do not hold trial *prima facie*.

(3) The **Sessions Court** is established by the state Government (S.9, Cr.P.C.) and is located at the district headquarters. It can only try cases which have been committed to it by a Magistrate (S.193, Cr.P.C.). It can pass any sentence authorised by law, but a sentence of death passed by it must be confirmed by the High Court (S.28 (2) and S. 366, Cr.P.C.). An **Assistant Sessions Court** can pass

Table (2-1). Powers of Magistrates (S.29, Cr.P.C.)

Class of Magistrate	Imprisonment	Fine
Chief Judicial Magistrate	Up to seven years	Unlimited (S.63, I.P.C.)
I Class Judicial Magistrate	Up to three years	5000 rupees
II Class Judicial Magistrate	Up to one year	1000 rupees

sentence of imprisonment up to ten years and unlimited fine (S.28 (3), Cr.P.C.).

(4) **Magistrates are of three types.**

- (1) Chief Judicial Magistrate.
- (2) First Class Judicial Magistrate.
- (3) Second Class Judicial Magistrate.

In metropolitan cities with more than one million population, the Chief Judicial Magistrate and First Class Judicial Magistrate are designated as Chief Metropolitan Magistrate and Metropolitan Magistrate respectively (S.8, Cr.P.C.).

**Juvenile Courts:** They try offences committed by juveniles.

**Offence** means any act or omission made punishable by any law (S.2(n) Cr.P.C. & S.40, I.P.C.).

**Cognisable Offence (S.2(c) Cr.P.C.) :** It is an offence in which a police officer can arrest a person without warrant from the Magistrate, e.g., rape, murder, dowry death, ragging, death due to rash or negligent act, etc. In such offences, the individual is sent by the police to the doctor for medical examination (S.2C & 154 Cr.P.C.) In non-cognisable offences, the injured person may go direct to the doctor, or he may file an affidavit in the Court of a Magistrate who will send him to the doctor for examination and report (S.41, Cr.P.C.).

**Punishments:** The sentences authorised by law are : (1) death, (2) imprisonment for life, (S.55 & 57, I.P.C.) (3) imprisonment: (a) rigorous, i.e., with hard labour, including solitary confinement (S.73, and 74, I.P.C.). (b) simple, (S.60, I.P.C.). (4) forfeiture of property, (5) fine (S.53, I.P.C.).

When a person is convicted at one trial for two or more offences, twice the amount of punishment, which a Magistrate is authorised can be passed (S.31, Cr.P.C.).

Any sentence awarded by a Court may be enhanced or decreased by a higher Court. Government has power to suspend, repeal or commute any



sentence passed by a Court of law (S.432 & 433 Cr.P.C.).

**Capital Punishment:** The various methods of carrying out death sentence are: hanging, electrocution, lethal injection (i.v. sodium thiosulphate, pancuronium bromide and potassium chloride), gas chamber, and garrotting.

According to Article 20 (2) Constitution of India, a person shall not be charged and convicted more than once for the same offence.

The President of India has the power to grant pardons, remissions of punishments and commutation of death sentence.

**SUBPOENA OR SUMMONS :** Sections 61 to 69 of Cr.P.C. deal with summons. Subpoena (sub = under; poena = penalty) is a document compelling the attendance of a witness in a Court of law under penalty, on a particular day, time and place, for the purpose of giving evidence. It may also require him to bring with him any books, documents or other things under his control, that he is bound by law to produce in evidence (S.91, & 349, Cr.P.C., S.162, I.E.A., & S.175, I.P.C.). It is issued by the Court in writing, in duplicate, signed by the presiding officer of the Court and bears the seal of the Court. (S.61, Cr.P.C.). Crime number and name of the accused person are mentioned. It is served on the witness by a police officer, by an officer of the Court or other public servant, by delivering to him one of the copies of the summons. The person should sign a receipt on the back of the other copy (S.62 Cr.P.C.). It can also be served by registered post, or fixed on some conspicuous part of the house in which the person resides. If the person summoned is in the active service of the Government, the Court issuing the summons shall usually send it in duplicate to the head of the office in which such person is employed. Such head shall cause the summons to be served on such person and shall return it to the Court under his signature with the endorsement required by that section (S.66, Cr.P.C.). A summons must be obeyed, and the witness should produce documents if asked for (S.91, Cr.P.C.). 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. (2) In criminal cases, the Court may issue notice under S.350, Cr.P.C. and after hearing the witness, if it finds that the witness neglected to attend the Court without any justification,

may sentence him to a fine, or the Court may issue bailable or non-bailable warrants to secure the presence of the witness. (S.172 to 174, I.P.C. & S.87, Cr.P.C.).

Criminal Courts have priority over civil Courts. If a witness is summoned by two Courts on the same day, one of which is criminal and other civil, he should attend the Criminal Court and inform the Civil Court of his inability to attend, giving his reasons. Higher Courts have priority over the lower. If he is summoned from two Courts of same status, he must attend the Court from where he received the summons first, informing the other Court about it. He can attend the second Court after finishing his evidence in the first Court.

**CONDUCT MONEY :** It is the fee offered or paid to a witness in civil cases, at the time of serving the summons to meet the expenses for attending the Court. If the fee is not paid, or if he feels that the amount is less, the doctor can bring this fact to the notice of the Judge before giving evidence in the Court. The Judge will decide the amount to be paid.

In criminal cases, no fee is paid to the witness at the time of serving the summons. He must attend the Court and give evidence because of the interest of the State in securing justice; otherwise he will be charged with contempt of Court. However, in criminal cases, conveyance charges and daily allowance can be claimed by the doctor according to Government rules.

### MEDICAL EVIDENCE

Evidence means and includes: (1) all statements which the Court permits or requires to be made before it by witnesses, in relation to matters of fact under inquiry, (2) all documents produced for inspection of the Court (S.3, I.E.A.). For the evidence to be accepted by the Courts, it must be properly identified as to what it is, and where it was found. The evidence of eyewitnesses is positive. The evidence of doctor or an expert is only an opinion which is corroborative.

**Types :** (1) **Documentary:** It includes all documents produced for the inspection of the Court. Document means any matter expressed or described upon any substance by means of letters, figures or marks, which may be used for the purpose of recording that matter (S.29, I.P.C.). Sections 61 to 90 of Indian Evidence Act, 1872, deal with documentary evidence. The contents of the documents



may be proved either by primary or by secondary evidence (S.61, I.E.A.). Primary evidence means the document itself produced for inspection of the Court (S.62, I.E.A.). Documents must be proved by primary evidence except in certain cases (S.64, I.E.A.). Secondary evidence means, certified copies, copies made from the original by mechanical processes, copies made from or compared with the original, oral account of the contents of a document (S.63, I.E.A.). Evidence must conform to the matters in issue, and is admitted on the basis of relevance and admissibility. (2) **Oral.** (3) **Direct** : Evidence of a fact which is actually in issue, e.g., an electric blanket that has caused injury, prescription, or a consent form. (4) **Indirect or Circumstantial** : It is not the direct testimony of an eye witness, but has a bearing upon the fact of the other and subsidiary facts which are relied upon as consistent (S.6, I.E.A.), e.g., in case of alleged murder of A by B at certain place on a particular day and time, the circumstantial evidence would be that C saw B with a knife on that day at that place, a few minutes before the murder. Circumstantial evidence requires the Court to draw logical or reasonable inferences from the information presented. (5) **Hearsay** : It is any statement made by any person other than the witness giving evidence in Court, which is presented in the Court in order to assert that the facts contained in the statement are true, e.g., A gives evidence in the witness box stating that B had informed him that he had seen C committing a crime. In such case direct evidence can be given only by B that he had seen C committing a crime.

**DOCUMENTARY EVIDENCE** : It is of three types.

(1) **Medical Certificates** : They refer to ill-health, insanity, age, death, etc. They are accepted in a Court of law, only when they are issued by a qualified registered medical practitioner. The certificate of ill-health should contain exact nature of illness, and probable period of expected absence. The signature or left thumb impression of the patient should be taken at the bottom of the certificate. 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 Births and Deaths Act, 1970). Death certificate should not be issued by a doctor without inspecting the body and satisfying himself that person is really dead. The

certificate should not be delayed, even if the doctor's fees is not paid. 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.

**The Medical Certification of Death** : In India, the International Statistical Classification of Diseases, Injuries and Causes of Death is used. The cause of death is divided into two main sections. (1) Immediate cause. This is subdivided into three parts, namely (a), (b), (c). If a single morbid condition completely explains death, this will be written on line (a) of part I, and nothing more need be written in the rest of Part I or in Part II, e.g. lobar pneumonia. Next consider whether the immediate cause is a complication or delayed result of some other cause. If so, enter the antecedent cause in Part I line (b). Sometimes there will be three stages in the course of events leading to death. If so line (c) will be completed. The underlying cause to be tabulated is always written last in Part I. (II) Other significant conditions contributing to the death but not related to the disease or condition causing it.

(2) **Medico-legal Reports** : They are reports prepared by a doctor on the request of the investigating officer, usually in criminal cases, e.g., assault, rape, murder, etc. The examination of an injured person or a dead body is made, when there is a requisition from a police officer or Magistrate. These reports consist of two parts: (1) the facts observed on examination (all relevant, objective descriptions including important negative findings), (2) the opinion drawn from the facts. These reports will be attached to the file relating to the case and the file is produced in the Court. The report will be open to the scrutiny of the defence lawyer. It will not be admitted as evidence, unless the doctor attends the Court and testifies to the facts under oath. Great care should be taken in writing the reports to avoid any loose wording or careless statement. This gives a chance to the defence lawyer to use them to his own advantage. The doctor should sign or initial at the bottom of each page, if the report exceeds one page in length. The report should give the date, time and place of examination and the name of individuals who identified the person or the dead body. Exaggerated terms,



superlatives, etc. should not be used. The opinion should be based on the facts observed by himself, and not on information obtained from other sources. In an injury case, if it is not possible to give an opinion immediately, the person should be kept under observation, and necessary investigations should be done before giving the report. The report should show competence, lack of bias and offer concrete professional advice. The report should be made soon after the examination. It should be clear, concise, complete, legible and it should avoid technical terms as far as possible. Relevant negative information should also be given.

**Exhibits** : Clothing, weapons, etc., sent for medical examination should be described in detail, sealed and returned to the police, after obtaining a receipt.

**(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 (S.32, I.E.A.). If there is time, a Magistrate should be called to record the declaration. Before recording the statement, the doctor should certify that the person is conscious and his mental faculties are normal (*compos mentis*). If the condition of the victim is serious, and there is no time to call a Magistrate, the doctor should take the declaration in the presence of two witnesses. The statement can also be recorded by the village headman, police or any other person, but its evidential value will be less. While recording the dying declaration, oath is not administered, because of the belief that the dying person tells the truth. The statement should be recorded in the man's own words, without any alteration of terms or phrases. Leading questions should not be put. The declarant should be permitted to give his statement without any undue influence, outside prompting or assistance. If a point is not clear, question may be asked to make it clear, but the actual question and the answer received should be recorded. It should then 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 statement is written by the declarant himself, it should be signed by him, the doctor and the witnesses. The statement made must be of fact and not opinion. If the declaration is made in the form of an opinion or conclusion, questions should be asked by the recorder to bring

out the facts that are the basis for the conclusion. While recording the statement, if the declarant becomes unconscious, the person recording it must record as much information as he has obtained and sign it. If the dying person is unable to speak, but is able to make signs in answer to questions put to him, this can be recorded and it is considered as a "verbal statement". The declaration is admissible not only against an accused who killed the declarant, but also against all other persons involved in the same incident which resulted in his death. In India, if the declarant is in a sound state of mind at the time of making the declaration, it is admissible in Court as evidence, even if the declarant was not under expectation of death at that time. The declaration is sent to the Magistrate in a sealed cover. It is produced at the trial and accepted as evidence in case of death of the victim in all criminal and civil cases, where the cause of death is under enquiry. The person recording the declaration will have to give evidence in the Court to prove it. If the declarant survives, the declaration is not admitted but has corroborative value, and the person is called to give oral evidence. The statement is important to identify the offender or to clear innocent persons.

**DYING DEPOSITION** : It is a statement of a person on oath, recorded by the Magistrate in the presence of the accused or his lawyer, who is allowed to cross-examine the witness. This procedure is not followed in India.

**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 fact under enquiry. "Fact" means: (1) any thing, state of things, or relation of things, capable of being perceived by the senses, (2) any mental condition of which any person is conscious (S.3, I.E.A.). In all cases, oral evidence must be direct (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. If it refers to an opinion or to the grounds on which the opinion is held, it must be the evidence of the person who holds that opinion on those grounds. If oral evidence refers to any material thing, the Court may require the production of such a thing for its inspection, e.g. a bloodstained weapon or article of clothing, a portion of eliminated poison, etc. (S.60, I.E.A.). All facts, except the contents of documents, may be proved by oral



evidence (S.59, I.E.A.). A deaf and mute witness may testify by signs, by writing or through an interpreter (S.119, I.E.A.). Oral evidence is more important than documentary evidence, as it permits cross-examination. Documentary evidence is accepted by the Court only on oral testimony by the person concerned.

**Exceptions to Oral Evidence :** (1) Dying declaration (S. 32 & 157, I.E.A.). Statements, verbal or written, of relevant facts made by a person who is dead, who cannot be found, who has become incapable of giving evidence, or whose attendance cannot be procured without unreasonable delay and expenditure, is admissible as evidence (S. 32, I.E.A.). (2) Expert opinion expressed in a treatise may be proved in Court by producing such book if the author is dead or cannot be found or cannot be called as a witness without unreasonable delay or expense (S. 60, I.E.A.). (3) Evidence of a doctor recorded in a lower Court is accepted in a higher Court, provided it is recorded and attested by Magistrate in the presence of the accused. But he is liable to be summoned, if the evidence is deficient or needs further explanation (S. 291 Cr.P.C.). (4) Evidence given by a witness in a previous judicial proceeding is admissible in subsequent judicial proceeding, when the witness is dead or cannot be found, or is incapable of giving evidence, or cannot be called without undue delay or unreasonable expense (S. 33, I.E.A. & S.291 Cr.P.C.). (5) Evidence of Mint officers or an officer of the India Security Press (S. 292, Cr.P.C.). (6) Reports of certain Government scientific experts : (a) Chemical Examiner or Assistant Chemical Examiner. (b) Chief Inspector of Explosives. (c) Director Fingerprint Bureau, (d) Director, Central Forensic Science Laboratories or State Forensic Science Laboratories. (e) Director, Haffkine Institute, Mumbai. (f) Serologist to the Government (S. 293(1), Cr. P.C.). The Court has the power to summon and examine any such expert. The prosecution and defence has also a right to demand the Court to summon and examine any such expert (S.293(2) Cr.P.C.). (7) Public records : A record kept in a public office, e.g., birth and death, certificates of marriage, etc., is admissible in evidence without oral testimony (S. 35, 74, 76 and 78, I.E.A.). (8) Hospital records: Routine entries, such as dates of admission and discharge, pulse, temperature, treatment given, etc., are admissible without oral evidence. But the cause of the disease or diagnosis

are not accepted without oral testimony.

**Chain of Custody:** It is a method to verify the actual possession of an object from the time it was first identified until it is offered as evidence in the Court. Each specimen when obtained, should be labelled with the victim's name, the time and date, the nature of the specimen, identification number, and signed by the doctor. This information must be documented each time the material is handled by another person, and that person must give receipt for the material and be included in the chain of custody. The evidence must not be damaged, contaminated, or altered in any significant way. The shorter the chain the better.

**WITNESSES:** Sections 118 to 134 of I.E.A., deal with witnesses. All persons are competent to testify unless they are prevented from understanding the questions put to them, or from giving rational answers to those questions, due to tender years or extreme old age or disease (S.118, I.E.A.).

**Types:** Witnesses are of two types : (1) Common, and (2) Expert.

(1) **Common witness** (witness of fact; occurrence witness) is a person who gives evidence about the facts observed or perceived by him. He must show that he was capable of perceiving the fact by one of his own senses, and that he actually observed this fact. This principle is commonly known as the "**first-hand knowledge rule**", which may be used to establish the exact circumstances of the case for the Court, e.g., A has seen B and C, fighting with sticks on a certain road on particular day and time. In a case of traffic accident the person who witnessed the accident becomes a common witness.

(2) **Expert witness** is a person who has been trained or is 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, fingerprints expert, handwriting expert, etc. (S. 45, I.E.A.).

An expert witness may give his opinion (1) upon facts which are either admitted, or proved by himself or other witnesses at the trial, (2) on matters of common knowledge, and (3) on hypothetical questions based thereon. Hypothetical questions may be asked to extract an opinion from the expert, after he assumes certain facts to be true, even though he may not have first-hand knowledge of the actual case. The expert should hesitate for a moment, so as to give the opposing lawyer an opportunity to



object to the question. The answer should be given only after completely understanding the question. The main obligation of an expert is to point out professional estimate which his observations seem to justify, e.g., whether or not an injury is caused in the manner alleged or from the causes assumed; the possible consequences; the reasonable estimate of damages, etc. The expert must be familiar with the phrase "reasonable medical certainty". The opinion on a key question must be given in a more guarded manner using terms, such as that the findings are "consistent with" an alleged form of trauma, such as a fall against a hard object or with the striking of the head with a blunt instrument of a particular type or a blow from a fist. It does not exclude other mechanisms which could reasonably or possibly have caused the same findings. If he is so excessively cautious as to confuse possibilities, probabilities and certainties, his testimony will become ineffective. Conclusions must be based on facts. Conclusions are much more important than opinions. The expert who in spite of provocation, answers questions with goodwill and accuracy, and who does not make statements that he cannot defend, will be successful under such attack. Clear presentation, and ability in expressing a relatively firm opinion are helpful for success of the expert.

**The medical evidence does not itself establish the guilt or innocence of the accused.** In the majority of cases, it provides expert opinions based upon objective, indisputable facts, which help to evaluate the reliability and credibility of other witnesses. The expert evidence is of little value, when there is a conflict of opinion between experts. In such cases, the Courts usually accept that opinion which is not in conflict with direct opinion.

If there is difference between medical evidence of two doctors, one of whom examined the injured person and the other conducted the autopsy on the injured person after his death, as to the injuries, or the weapon used, or the time of infliction of injuries, etc., the accused gets the benefit of doubt. Where the direct evidence is not trustworthy, conviction may result on medical evidence, if that is trustworthy. An expert witness may refer to books to refresh his memory, or to correct or confirm his opinion (S. 159, I.E.A.). Books as such are not evidence, but if an expert refers to specific passages as representing his views, they may be taken down as his own evidence. A witness may adopt the views of any

authority as his own, provided he has an honest belief in them. The opinion of an expert can be proved false by standard books on the subject.

A doctor can be both a common and expert witness. When he describes the wounds on the body, he acts as a common witness. But when he says that the wounds were ante-mortem or post-mortem, or they were suicidal, homicidal, or accidental, or gives opinion regarding the cause of death, he acts as an expert witness.

**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.). The Court will declare a witness as hostile on the suggestion of the lawyer of the party who has summoned the witness or prosecution lawyer. On declaration of a witness as hostile, he can be cross-examined by the same side lawyer. Any of the above two types of witness can be hostile.

The medical witness is allowed to sit in the Court if the lawyers of the accused do not object.

**RECORD OF EVIDENCE** : The evidence of the witness is recorded as follows (S. 138 to 159, I.E.A.).

**Oath** : The witness has to take an oath in the witness box before he gives his evidence. He should take the oath as follows : "I do swear in the name of God, that what I shall state shall be the truth, the whole truth, and nothing but the truth". If the witness is an atheist, he has to "solemnly affirm" instead of "swearing in the name of God." (S.51, I.P.C.).

Oath is a declaration required by the law, which is compulsory and holds the witness responsible for consequences of his evidence. A child below 12 years is not required to take an oath.

**PERJURY** : Perjury means giving wilful false evidence. Whoever, being legally bound by an oath, or by an express provision of law to state the truth, or being bound by law to make a declaration upon any subject, makes any statement which is false, and which he either knows or believes to be false or does not believe to be true, is said to give false evidence. (S.191, I.P.C. & 344, Cr.P.C.). The witness is liable to be prosecuted for perjury, and the imprisonment may extend to seven years (S. 193, I.P.C.).

(1) **Examination-in-chief (direct examination)** (S.137, I.E.A.) : This is the first examination of a witness. It consists of questions put to him by the



lawyer (counsel or advocate) for the side which has summoned him. In criminal acts committed by an individual or group, the State becomes a party instead of the aggrieved person, and starts criminal prosecution, which is titled as "State versus A". In a criminal trial, the burden to prove is always on the prosecution, and the accused is presumed to be innocent till the contrary is proved against him. In Government prosecution cases, the public prosecutor first examines the witness. If witness is called by private party, he is first examined by the lawyer of that party. The object is to elicit all relevant, convincing medical facts (S.138, I.E.A.), and the conclusions which the doctor has drawn from the facts. The doctor may have to interpret the findings of non-medical ancillary investigations provided by scientific laboratories, analysts and serologists, in all cases where the medical aspects are at issue. Before giving evidence, it is advisable that the doctor meets the public prosecutor, and discuss the previously prepared report, the certificate of death, photographs, etc., that the witness intends to show in the Court, and an outline or pattern should be worked out for the best way to elicit his testimony. If the witness intends to modify any of his findings or conclusions, these should be pointed out to the lawyer. The doctor should help the prosecutor in framing proper questions in proper sequence, so that all essential facts are elicited. The lawyer will be able to advise the doctor, about the anticipated content of cross-examination. In this leading questions are not allowed, except in those cases, where the Judge is satisfied that a witness is hostile (S.142 and 154, I.E.A.). A **leading question** is one which suggests to the witness the answer desired, or which includes a material fact, and admits of a conclusive answer by a simple "Yes" or "No" (S.141, I.E.A.). Did A attack the deceased? "Was the length of cut 3 cm?". "Was it on the front of the abdomen?". They are all leading questions, as they suggest the answer "Yes" or "No". The proper questions should be: Who attacked the deceased? What was the length of the cut?. Where was it seen?". The method of examination is by question and answer. The questions are usually short and demand some specific fact and short answer. But the answer can be given in narrative form, if it would be more informative and convincing. The effect of the questions and answers is recorded indirectly and not in the form of the question and answer (S.275 & 276, Cr.P.C.)

(2) **Cross-examination** : In this, the witness is questioned by the lawyer for the opposite party, i.e., lawyer for the accused (defence lawyer). In a murder trial, the defence witness is cross-examined by public prosecutor. The main objects are (1) to elicit facts favourable to his case, (2) to test the accuracy of the statements made by the witness (S.146, I.E.A.), (3) to modify, or explain what has been said, (4) to develop new or old facts, (5) to discredit the witness, and (6) to remove any undue or excessive emphasis which may have been given to any of them. In doing this, the lawyer may try to weaken the evidence by showing that the evidence given is inconsistent, inaccurate, ill-founded, contradictory, and untrustworthy. The cross-examination need not be confined to the facts to which the witness testified in his examination-in-chief (S.143, I.E.A.). The competence and credibility of the witness is tested by questioning his qualifications, experience and the number of cases of the kind under consideration he has personally observed, and by testing his memory or powers of observation. When material is available, the lawyer may attack the character of the witness (S.148, I.E.A.). The witness may be asked questions on his bias or impartiality, his previous conviction, his reputation for untruthfulness and on any handicap he may have which would affect the reliability of his evidence (S.153 & 155, I.E.A.). The Court will decide whether the witness should answer any particular question, when asked for a ruling. The Court may forbid any questions which it regards as indecent or scandalous, unless they relate to facts in issue (S.151, I.E.A.). The Court also has the power to disallow questions which are intended to insult or harass or offensive in form (S. 152, I.E.A.), but if they are relevant to the facts in issue, the Court cannot disallow them. The witness has to answer any question relevant to the matter in issue, even though the answer will expose or prove his guilt directly or indirectly, e.g., which would reveal that he has committed an illegal operation (S.146, I.E.A.). If a witness is forced to give an answer admitting his guilt, he cannot be arrested or prosecuted for it, and also it is not taken as proof against him in any criminal proceeding (S.132, I.E.A.). A witness is completely immune from actions for defamation (libel or slander), for anything he says in the witness box.

Answers favourable to the defence side should



be given as promptly as those given on examination-in-chief. There are few observations in medicine which are capable of only one explanation. If the defence puts points to the doctor which must be conceded, the doctor should reply that alternative explanations were considered, and on balance he prefers the conclusions already expressed. Admit omissions, e.g. an examination of a drunken person may not require the use of all tests described in a treatise. This can be explained to the Court. Objectivity and impartiality are important against destructive cross-examination.

If a question is not audible, the witness should ask the lawyer to repeat the question. If the question is not understood, the witness should ask the lawyer to explain it better. If a question contains several different questions, each requiring a separate answer, the medical witness should ask the lawyer to break the question into individual components. The medical practitioner should not be dogmatic about his opinion and the lawyer should not expect him to be so. The witness should be clear, direct and precise in his answer, as far as possible. He should not volunteer unrelated information. The defence lawyer may ask the witness, whether he talked about this case with anyone. The answer should be "Yes". If asked with whom he talked, he should give the name of the lawyer by whom he was called to give evidence. If a further question is put, "What did you talk about?", the most effective answer would be: "He told me to tell the truth". Sometimes, a previously published statement of his own, which may be in disagreement with what he is now stating is quoted against him (S.145, I.E.A.). The effective answer should be, "medicine advances with the times, and I try to advance with its progress".

If the defence succeeds in embarrassing or humiliating the witness, he may become tense, frightened, angry, hostile or aggressive, due to which his intellectual faculties suffer, and he will not be able to think clearly and effectively. When the reply to a question appears to damage the defence case, the lawyer may attempt to interrupt doctor's answer by asking a new question. The witness should say that he has not yet completed his answer to the preceding question. If the Judge rules in favour of the new question, the lawyer for the prosecution side will usually make a note of the question and its answer and will give the doctor an opportunity to complete his reply in re-examination.

The witness must answer a hypothetical question, but he cannot be compelled to answer a question that is based wholly or in part upon a subject, regarding which he cannot conscientiously reply. Leading questions are permissible during cross-examination. Cross-examination has no time limit, and may last for hours or even days. The Judge can always disallow irrelevant questions.

**Objection to Testimony :** When a question is asked of a witness, the opposing lawyer may say, "I object", and give his reasons for the same. The witness should not answer the question until the Court gives a ruling on the objection. If the Judge says, "Objection overruled", the answer has to be given.

The defense lawyer should not ask a question to which he does not know the answer, for the reply may strengthen the case of the opposite side and seriously hurt his own. Sometimes, cross-examination may act as a double-edged sword, i.e., it may damage the defence as much as the prosecution, especially if lawyer is not familiar with the subject and the witness is efficient and honest.

**(3) Re-examination (Re-direct examination):** This is conducted by the lawyer for the side which has called the witness. The object is to correct any mistake or to clarify or add details to the statements the witness has made in cross-examination. It is an opportunity for the witness to explain more fully some answer which might appear damaging to his direct evidence, because of skilful questioning or tactics by the cross-examiner. The witness should not bring in any new matter at this stage. The opposing lawyer has right of re-cross-examination on the new point raised (S.138, I.E.A.). Leading questions are not allowed.

**(4) Questions by Judge :** The Judge may ask any question, in any form, about any fact relevant or irrelevant, at any stage of the examination to clear up doubts. The Court is also empowered to recall and re-examine any witness already examined, if his evidence appears to the Court to be essential to the just decision of the Court (S.165, I.E.A. & S. 311, Cr.P.C.).

The deposition of the witness is handed over to him. The witness after carefully going through it, is required to sign at the bottom of each page, and on the last page immediately below the last paragraph, and to initial any corrections (S.278, Cr.P.C.). The witness should not leave the Court



without taking permission of the Judge.

### CONDUCT AND DUTIES OF THE DOCTOR IN THE WITNESS BOX

The following rules help a doctor in the witness box. (1) Be well prepared with the details of your evidence before entering the box; anticipate certain likely questions on it and be prepared to answer these in advance. It may be necessary to study the literature on the subject about which he is likely to be cross-examined. (2) Take all records, and relevant reports that may have to be quoted in the box, e.g., original notes, autopsy report, photographs, X-rays, toxicology and blood grouping reports, copy of the death certificate, drawings or diagrams, special reports on swabs or smears, culture studies, serology and various receipts to prove the chain of custody of the items of evidence. The photographs are useful in the Court: (a) to refresh memory of the findings, (b) to establish the identity of the deceased, (c) to explain the findings conveniently, and (d) to provide true-to-life picture of the investigative findings. The records should be in chronological order, and the doctor should have full knowledge of the contents of his file. (3) Be well dressed and modest. (4) Do not discuss the case with anyone in the Court, except the lawyer by whom you were asked to testify. (5) Stand up straight. (6) Be relaxed and calm and not frightened or nervous. (7) Never attempt to memorise. The law allows to refresh your memory from copies of reports already submitted or from case notes and similar records made at the time of examination. An expert may refresh his memory by reference to professional treatises (S.161, I.E.A.). A writing which is used to refresh the memory of a witness must be shown to the opposite party, if he requires it. Such party may cross-examine the witness thereupon (S.161, I.E.A.). (8) Speak slowly, distinctly, and audibly so that the Judge can record your evidence. It is advisable to watch the pen of the Judge so that the Judge is able to record all the evidence, without asking the witness to pause. (9) Look people in the eye when you speak, for it gives the impression of honesty. (10) Speak with assurance. Be confident but not over-confident or arrogant. (11) Use simple language, avoiding technical terms to the best of your ability. Practice this in advance. (12) Avoid superlatives and exaggerations, e.g., very large bruise, frightful injury, savage blow, most agonising pain, etc. (13) Do not fumble in referring to case notes, records, etc. The

less you fumble, the more the Court is likely to be impressed by you. (14) Address the Judge by his proper title, such as "Sir" or "Your honour". (15) Avoid difference between your record and your testimony. If an error or slight contradiction has been made in the testimony, admit and correct it. (16) Do not underestimate the medical knowledge of the lawyers. (17) Be pleasant, polite and courteous to the lawyer. Appearance, professional manner, and general behaviour are important. (18) Do not avoid a question. Say I do not know, if it is so, for no one can be expected to know everything. It indicates honesty. (19) Never become hostile, angry, rude or sarcastic during questioning. (20) Do not lose your temper. An angry witness is often a poor witness, and the effectiveness of his testimony is diminished or destroyed. (21) Defence lawyer may irritate the witness into anger by unfair questions, abuse and unfair remarks. The witness should remain calm and keep his temper. Do not argue, just disagree if you do not agree; disagree firmly and repeatedly. (22) Don't be too anxious to please or too eager to fight. (23) Retain independence of your mind. Be honest, impartial, unbiased and truthful. A biased expert is a useless expert. Be frank to admit any points in favour of the accused if that is the truth. Speak only of facts which come within your personal knowledge. (24) Do not alter your findings to what is said in statements to be the facts. The doctor should "tell it as it is", and should not choose sides. (25) Listen carefully to the questions. Do not hesitate to ask to have the question repeated, if you do not understand it. If still it is not clear, say so frankly, for the lawyer to reframe the question. Give yourself time to think. (26) Avoid long discussion. Answer should be brief and precise and in the form of "Yes" or "No". Never nod your head to indicate "Yes" or "No". In many medical matters, the answer requires an explanation and the doctor should resist to answer with a simple 'Yes' or 'No'. The witness is not bound simply to answer yes or no, but may qualify his answer if it is necessary for accuracy and completeness, even though the lawyer may try to demand a yes or no answer. The Court usually rules that the doctor may explain his reply. (27) Consider all aspects of the question before answering it. Answer only what is asked. (28) If you believe the question is unfair or that the lawyer is teasing you excessively, look at your lawyer before answering. If he fails to object,



turn to the Judge and ask whether you should answer the question. (29) Do not overemphasise replies to questions from the cross-examining lawyer. (30) You may use an opportunity to insert a positive point that you have omitted during your chief-examination; but be careful not to provoke a new line to questioning. (31) Watch for double question and questions that include an assumption of facts which have not been proven. The answer to each part of the double question may be different. This should be emphasised by the witness. He should also state that the assumed facts are not necessarily true. (32) You are an authority in this particular case, as you have examined the patient or the dead body and have specific medical knowledge about it. What applies to many cases in general may not apply to this particular case. (33) Express an opinion from your own knowledge and experience. Say, "In my opinion ...." Do not use phrase such as "I think", or "I imagine". Be prepared to give reasons for your opinion if asked. Never express an opinion on the merits of the case. (34) When the opinion relates to quantity or number, it should be stated within certain limits, unless an exact answer can be given, e.g., the age of an individual. Keep the opinions within the limits of reasonable medical certainty. (35) Do not be drawn outside your particular field of competence. Avoid speaking on a subject in which you have little or no practical experience, e.g., pathologist is not the right person to give evidence on clinical problems or dispensing. A general practitioner is not qualified to give evidence on the pathology of a tumour or on blood group inheritance. In such cases, he should explain that this is not a matter in which he has particular knowledge, and that he is not qualified to answer it. (36) When asked to comment upon the competence of a colleague, avoid any insulting remarks. If he is competent, say so but without superlatives. If you do not wish to make any statement, say that you have "no opinion". (37) An expert may adopt the published opinion of the writers on the subject as his own opinion. The published work need not be produced in the Court. (38) When lawyer quotes a passage from a textbook, and asks the witness whether he agrees with it, the doctor must always take the precaution before answering, of reading the portion which is quoted to him and also of reading a paragraph before and after the quoted passage since it may be taken out of context, and he should

satisfy himself that the edition of the book is recent and the views expressed by the author are current. There is no need to accept everything that is written; do not hesitate to disagree. (39) Textbooks of established repute can be produced in evidence, even though the witness refuses to recognise the authority, or to acknowledge familiarity with its contents. (40) A medical witness has no professional privilege, and therefore he must answer any question. He must first obtain a ruling from the Judge and if directed to answer, he must do so without further delay. (41) **Volunteering of information** : Information should not be volunteered beyond that asked for in the question. The answer should also be limited to the expert's knowledge. Volunteered information is often not well prepared, and is liable to cross-examination. As an expert witness, a medical practitioner may volunteer a statement, if he thinks that injustice will result if he fails to make the statement.

**MEDICO-LEGAL MASQUERADES** : Things are not always what they seem to be at first sight. Many cases of homicide go undetected because of the lack of suspicion and improper or inadequate investigation. All cases of death should be regarded as unnatural, until proved otherwise. Violent deaths may show minimal or no external evidence of injury, and conversely natural deaths can occur under such circumstances as to suggest falsely that violence was used. Accidental deaths and suicides can occur under circumstances which suggest homicide. A person who appears to have died from acute alcoholic poisoning or from the combined effects of alcohol and other drugs, may have committed suicide by using drugs, or rarely he may have been poisoned criminally. In a suicide case, alterations may be made at the scene because of disgrace. In a homicide case, the scene may be altered or rigged to suggest that death resulted from suicide or accident. Upset furniture, overturned lamps and other disturbances, and blood stains on walls and floors are consistent with a struggle between assailant and victim. However, similar disturbance may be seen in case of suicide committed while the victim was acutely intoxicated by alcohol or some drug, or he was possessed by some form of psychotic excitement. The doctor must look for any possible inconsistencies between the apparent death scene and his actual scientific findings. In a case of hanging, the manner in which a ligature is applied to the neck, or the mode of suspension of a body may determine the manner of death. In such cases, the real cause of death can be established by complete autopsy and police



investigation. The investigating officer should obtain information about the circumstances of death and the background of the deceased.

### INVESTIGATION OF THE SCENE OF DEATH

The basic rules for investigation of any scene of crime are : (1) Verify that a crime has been committed. (2) Look for signs of how it was committed, and (3) Recover and preserve evidence that might lead to the arrest and conviction of the guilty.

The answers to the following questions (6W's) have to be found to prove the guilt and convict the accused.

- (1) Who is the victim? (identification).
- (2) When the death and injuries occurred? (time of death and injuries).
- (3) Where the death occurred? (scene and circumstances of death).
- (4) What injuries are present? (description of injuries).
- (5) Which injuries are significant? (major, minor, true, artefacts, post-mortem injuries).
- (6) Why and how injuries were produced? (mechanism and manner of death, i.e., natural, accidental, suicidal or homicidal). If unnatural, determine the means or agent causing death, e.g., knife, firearm, poison, etc., and if homicide assist in identifying the person responsible for death.

**CONDUCT AND DUTIES OF THE DOCTOR AT THE SCENE OF CRIME :** It is the responsibility of the police to preserve and protect the scene of crime. The doctor should carry with him a hand lens, measuring tape and ruler, gloves, slides, swabs, chemical thermometer, and envelopes if possible. Complete and accurate recording of the scene as it was found is very important. This can be done by accurate diagrams, notes and photography. The scene may show evidence of a struggle, and on the body vital trace evidence may be present. The examination at the scene should be limited to a search for such evidence which might be dislodged or possibly lost during the transfer of the body to the mortuary. If a doctor sees the dead body for the first time in the autopsy room, he may form incorrect opinions about the origin of various injuries. Seeing the body at the scene of crime with the various surrounding objects, helps to avoid such mistakes. The visit to the scene of death is more valuable if the body shows a patterned injury, the origin of which is in doubt. Even a retrospective visit to the scene enables the doctor to have a true appreciation of the nature of the surroundings, which are usually found to differ

from the impression formed from the descriptions of other persons, and will be of help in interpretation of the findings in the victim. The scene of a violent death usually shows significant findings for understanding, reconstructing and solving problems. The finding of a dead body together with evidence of burglary indicates murder. Disturbance of furniture may be seen sometimes, if a person dying suddenly and naturally falls down and injures himself. The sequence of events preceding death must be reconstructed logically to support or contradict inferences from other areas of investigation. The fatal injuries should be evaluated to find out how much purposeful action and walking, the victim could have carried out before he became disabled and died. In every case, priority must be given to the injured, and to any action designed to prevent further casualties. Evidence to connect victim, suspect and location of the murder may be found at the scene of the incident, on the clothing or bodies of victim and suspect, or some other place to which the body was transported.

- (1) If the victim of an assault is living when first seen, the doctor must do everything to save the life.
- (2) If death is about to occur, he should obtain a dying declaration, for otherwise valuable information will be lost, e.g., in criminal abortion.
- (3) He should also retain any material which is relevant, e.g. in cases of suspected poisoning, he must look for and retain any specimens, such as vomit, left over poison, or drinking utensils.
- (4) He must make sure that death has occurred.
- (5) If he suspects foul play, the police should be informed.
- (6) He must obtain all possible information regarding the crime.
- (7) He must identify the body, which should also be identified by the relatives and the police.
- (8) He must enquire whether the body has been moved at all before he first saw it.
- (9) Never touch, change, or alter anything until identified, measured and photographed. He should ask the investigating officer before moving anything. Photograph the scene from several angles. He should follow but not lead the police around the scene.
- (10) He should not give opinions without proper thought.
- (11) He should make adequate notes which should include: (a) Date, time, address or location. (b) Name and sex of deceased. (c) A list of all persons present. (d) General observation about the scene; any evidence of struggle, such as overturned furniture or trampled ground. If outside, record the type of weather, the state of ground and the vegetation present. (e) Temperature of the surroundings, and rectal temperature of the deceased should be taken. (f) Make a sketch noting such points of importance as direction and position of blood (pools or splashes), position of the body and any weapons. If the weapon is in the



hand of the deceased, note whether it is loosely held or tightly grasped. A correlation should be attempted between injuries present and possible weapons or other objects which might have caused them. The distribution of blood stains and their shape, which may point to the site of injury should be noted. Note the amount of bleeding at the scene. It makes the evaluation of injuries more accurate and may give indication as to the length of survival after the injuries. The plan need not be scale accurate, but the relative measurements should be accurate. Describe the clothing and note any tears, cuts, missing buttons, etc. Do not put objects through defects in clothing or wounds. Examine the hands and forearms for defence wounds. Make note of injuries and record them on body diagrams. (g) Position and appearance of the body, rigor mortis, post-mortem lividity, etc., which assist in estimating the time of death. (h) Free hair, fibres or other foreign matter which is likely to be dislodged when the body is moved, should be searched and removed with adhesive tape. (i) If there are any bite marks, they should be swabbed with a cotton wool swab moistened with saline. Saliva swabs may be taken after wearing gloves to prevent the soiling of the swab with sweat. (j) The pubic hair should be combed *in situ* in cases of sexual assault, and loose hair collected. (k) In cases of rape and suspected abortion, an absorbent pad should be strapped over the vulva to collect any fluid which may run out during the transfer of the body. (l) The objects on premises, e.g., dates on mail and newspapers, condition of food on table, etc. to determine the time of death. (m) Photograph any ligature before removal, cut if necessary leaving the knots intact. (n) If a weapon is found, handle it with care to preserve fingerprints, blood stains, hair, fibres, etc. (o) Leave firearms in the condition they are found. Note position of each bullet and casing. (p) Bullets, etc., should be marked for identification. (12) Use a pencil or other objects to open doors and cabinets. If the weapon is not found at the scene of death, advise the police about the type of weapon that is likely to have been used. (13) He should not smoke or throw cigarette stubs, matches or anything at the place of suspected crime, as trace evidence including small items left behind by a suspect, may play a large part in the proof of the crime. Saliva on cigarette ends may be grouped to include or exclude suspects. (14) The scene should be examined by fingerprint examiner, followed by a trace evidence specialist. (15) Transfer the body to the mortuary wrapped in a large sheet of plastic or other clean cloth so as to retain any loose objects, hairs, fibres, etc. (16) The police should be advised not to remove the clothing, etc. from the body.

**PHOTOGRAPHS:** They should show (1) General relations of the scene of body to its surroundings. (2) Special relationships between the deceased and weapon or blood stains, overturned furniture, etc. (3) Means of possible entrance to and exit from the scene. (4) Position and posture of the victim.

Take a scaled photograph of the scene as it was first viewed. A second scaled photograph should be taken, locating in the field of camera with suitable markers any small objects, such as fired cartridge case, bullet holes in walls, etc. A scaled drawing of the room or the area of interest in the investigation should be made. The dead body should be photographed from different angles.

Photographs of all injuries, major and minor, are essential, including ruler to provide a scale. To indicate important features, markers or pointers can be inserted. If the powder residues are on the clothing, the clothing should be preserved by wrapping in clean paper. If they are on the victim's skin, a scaled photograph should be made, including the entire area over which the powder residues exist. Photographs help the investigating officer and the doctor to refresh their memories for giving evidence in the Court. They also convey essential facts to the Court.

**DISADVANTAGES OF THE DOCTOR NOT VISITING THE SCENE ARE :** (1) When the body is transferred to mortuary, fresh abrasions may be produced on it during transit. (2) Clothing will be disarranged, blood stains will form on parts of clothes originally free from them. When the body is lying on the back with a stab wound on the front of the chest or abdomen, the external blood loss is minimal or absent. When the body is turned, large amount of blood may escape through the wound and stain the clothes. (3) Fresh tears in clothes may be produced from rough handling. (4) Existing rigor mortis may be broken down at least partially.

**Basic Rules for Preservation of Medico-legal Evidence :** For evidence to be legally accepted by the Courts: (1) It must be obtained in a legal manner. (2) It must be relevant to the issue. (3) The chain of custody of the item must be intact and known. (4) It must be evaluated by qualified experts.

**COLLECTION OF EVIDENCE:** (1) Collect every article even remotely likely to be helpful in the investigation. Note the source and the relative location of the exhibits at the time they were recovered. (2) Collect any item likely to carry fingerprints. (3) Use separate container for each item. (4) Every article collected must bear identifying marks. Two marking methods are commonly used. (A) Direct, in which marks are put on the item of evidence itself. (B)



Indirect, in which notations of identification are placed on a container in which the evidence is placed. The container should be labelled. The data to be recorded on the label are: case number, location and description of the recovered evidence, a specific number, person who recovered the evidence, date of recovery and initials. The disadvantage of attaching a tag is, it can be accidentally torn off or intentionally removed as the evidence is handled or examined forensically. (5) Exhibits must be protected against mutilation, alteration, or contamination. If any alteration has been made between the time the exhibit was recovered and the time it was offered in evidence, this must be justified by the laboratory technician.

**FOR PRESERVATION OF PHYSICAL EVIDENCE, USE:** (1) Card board "pillbox" type of containers. (2) Envelopes. (3) The pharmacist fold using paper. (4) Film containers (35mm). (5) Plastic vials and jars are useful for small samples, e.g. hair, bullets, blood and organs. (6) Plastic bags for organs, clothing and larger articles, and to cover the hands or other parts of the body. (7) Larger plastic bags may be used for bodies.

Avoid excessive handling of the evidence that is gathered as it may cause contamination or loss of transitory materials.

#### **PROCEDURE OF CRIMINAL TRIAL**

The proceedings of investigations by the police in criminal offences are sent to the Judicial Magistrate of the area. All offences punishable with death, imprisonment for life, or for a term exceeding two years are tried as warrant cases. All other cases are tried as summons cases.

**Standard of proof:** In criminal cases, the prosecution must provide evidence of a sufficient quality to convince the Court "beyond reasonable doubt" that the accused is guilty. In civil cases the standard is based on the "balance of probabilities", so that the Court should be certain of more than 50% of the defendants culpability.

**Summons Cases :** When the accused appears before the Court, he is given the details of the charged offence and asked whether he pleads guilty or not. If the accused pleads guilty, his plea is recorded and he is convicted. If he does not plead guilty, the Magistrate takes all the evidence supporting the prosecution, and takes the evidence produced in defence. On a consideration of all this evidence, he either finds the accused guilty and convicts him, or not guilty, and acquits him. (S.251 to 255, Cr.P.C.).

**Warrant Cases :** In cases filed by the police, when the accused is brought before the Court, the Magistrate

must make sure that the accused has received all the required documents. The Magistrate considers the documents, examines the accused, and hears the prosecution and defence. If he finds the charge groundless, he records his reasons and discharges the accused. If there are grounds for believing that an offence has been committed, he frames a written charge against the accused, which is read out and explained to the accused, who is asked to plead. If he pleads guilty, the plea is recorded and he may be convicted on that plea. If he pleads not guilty, a date is fixed for the examination of the witnesses, and the prosecution evidence is recorded, during which the accused is permitted to cross-examine the prosecution witnesses. Next, the defence evidence is recorded, during which the prosecution is allowed to cross-examine the defence witnesses. After this, the lawyers for prosecution and defence make oral arguments before the Court in regard to the evidence, and the conclusion therefrom, regarding the guilt or innocence of the accused. If the Magistrate finds the accused guilty, he passes the sentence, otherwise he acquits him (S.238 to 249, Cr.P.C.).

**SESSIONS TRIAL :** If the Magistrate is of the opinion that the accused should be committed to trial by Sessions Court, he frames a charge of the offence, which is read and explained to the accused, and passes an order committing the accused to trial by Court of Sessions, and records briefly the reasons for such commitment. A warrant is issued to keep the accused in custody. The Magistrate sends the charge, the record of enquiry and any weapon or other thing which is to be produced in evidence, to the Court of Sessions (S.207 to 209, Cr.P.C.). The Magistrate has power to take bond from any witness for appearance in his Court or any other Court to which the case may be transferred for trial (S.88, Cr.P.C.). At the first hearing, the public prosecutor opens the case by describing the charge against the accused and stating the evidence by which he proposes to prove the accused guilty of the offence charged. If after going through the record, and hearing the submissions of the defence and the prosecution, the Judge considers that there is no sufficient ground for proceeding against the accused, he discharges him, recording his reasons for doing so. Otherwise, the Judge frames a charge which is read out and explained to the accused and his plea is recorded. If he pleads guilty, he may be convicted, otherwise a date is fixed for hearing. The prosecution witnesses are called. Each witness is



examined by the prosecutor, and may be cross-examined by the defence, and re-examined by the prosecution, as well as questioned by the Court. If, after hearing the prosecution evidence, examining the accused, hearing the prosecution and the defence, the Judge considers that there is no evidence that the accused committed the offence, he passes an order of acquittal. If the accused is not acquitted, he is asked to defend himself. Any written statement submitted by the accused is filed with the record. The defence witnesses are then called. Each witness is examined by the defence, and may be cross-examined by the prosecutor and re-examined by the defence, and as well as questioned by the Judge. The evidence of all the witnesses is recorded in writing either by Judge himself or by his dictation

in open Court. At the conclusion of the evidence, the prosecution sums up the case and the accused or his lawyer is entitled to reply, and the prosecutor may enter his submissions if permitted by the Judge. If the accused is found guilty, he is convicted, otherwise he is acquitted (S.225 to 235, Cr.P.C.). The judgement in every trial shall be pronounced in open Court (S.353, Cr.P.C.). Copy of judgement is given to the accused (S.363, Cr.P.C.). Both the prosecution and defence can appeal to a superior Court against an acquittal or conviction in a lower Court. When the Court of Sessions passes the sentence of death, the proceedings are submitted to the High Court for confirmation of the sentence (S.366, Cr.P.C.).



## CHAPTER 3

# MEDICAL LAW AND ETHICS

The medical profession is governed by legislation and by a Code of Ethics and Etiquette. Ethics is a voluntarily self-imposed code of conduct by the medical profession. The broad principles of medical ethics are formulated by National and State Medical Councils and the World Medical Association. Enforcement of the Code is done by the Medical Councils.

**Indian Medical Degrees Act, 1916 :** This Act was passed to regulate the grant of titles implying qualification in Western Medical Science. Certain authorities mentioned in the Act, have the right to grant medical degrees, diplomas, licenses, and certificates, implying that the grantee or recipient thereof is qualified to practice Western Medical Science. The false assumption and use of a medical title are punishable under the Act.

**HOMOEOPATHY CENTRAL COUNCIL ACT, 1973 :** The Act was passed to regulate the profession of Homoeopathy and to constitute Central Council. The constitution of the Council and its functions are similar to Indian Medical Council.

**INDIAN MEDICINE CENTRAL COUNCIL ACT, 1970:** It was enacted to lay down minimum standards of education and practice of Indian system of medicine. It includes Ayurveda, Siddha, Unani, Tibbi and Ashtang.

**THE INDIAN MEDICAL COUNCIL ACT, 1956 :** The Medical Council, constituted under the Act, consists of following members, namely : (a) One member from each State to be nominated by the Central Government in consultation with the State Government concerned. (b) One member from each university, to be elected from among the members of the medical faculty of the university, by members of the Senate or by members of the Court of the University. (c) One member from each State in which a State Medical Register is maintained, to be elected from among themselves by persons enrolled on such register. (d) Seven members to be elected from among themselves by persons enrolled on any of the State Medical Registers. (e) Eight members to be nominated by the Central Government. They hold office for a term of five years. A president and a vice-president are elected from among these members. The Council appoints

a Registrar who acts as secretary and may also act as treasurer, who looks after the day to day work. The Executive Committee consists of president, vice-president and 7 to 10 other members. Other committees for general or special purposes are constituted from among its members. The First Schedule of the Act contains the recognised medical qualifications granted by universities in India; the Second Schedule those granted outside India. Part I of the Third Schedule contains those granted by medical institutions not included in the First Schedule; part II of the Third Schedule those granted outside India, but not included in the Second Schedule.

### INDIAN MEDICAL COUNCIL

**Functions : (1) Medical Register :** The Council maintains a register of medical practitioners, known as the Indian Medical Register. It contains the names of all persons who are enrolled on any State Medical Register. If the name of a person enrolled on a State Medical Register is removed from the Register, the Council also removes such person's name from the Indian Medical Register.

**(2) Medical Education :** The Council has the authority to prescribe standards of postgraduate medical education for the guidance of the universities. It may advise the universities in maintaining uniform standards for postgraduate medical education throughout India. A Postgraduate Medical Education Committee, consisting of nine members is constituted for this purpose. Prior approval of IMC is necessary before starting a new medical college or to increase the number of seats and a new postgraduate medical course in any discipline. If this mandatory regulation is not followed, the qualification will not be recognised by I.M.C.

The Council maintains the standards of undergraduate medical education. The Council may prescribe the minimum standards of medical education required for granting recognised medical qualifications by universities or medical institutions in India. It appoints Medical Inspectors to attend at any or all examinations held by universities or institutions in India, for the purpose of recommending to the Central Government, recognition of medical qualifications. The Inspectors have no power to interfere with the conduct of any training or



examination. The Inspectors report to the Council on the adequacy of the standards of medical education, including staff, equipment, accommodation, training, and other facilities prescribed for giving medical education and on the sufficiency of every examination they attended. The Council forwards a copy of any such report to the university or medical institution concerned for its remarks. A copy with the remarks of the university or institution is sent to the Central Government. If the Council is not satisfied with the standards, it can make a representation to the Central Government to withdraw recognition of any medical qualifications of any College or University. The Council on getting assurance for future rectifications of all deficiencies by the institution, can send its recommendation to the Central Government for reconsideration. The Central Government will again refer it to the council, which in turn will send its inspectors to visit the institutions for verifying the implementation of assurances and will send the reports accordingly.

Any university which grants a medical qualification not included in the First Schedule may apply to the Central Government to recognise the qualification. The Central Government, after consulting the Council, may by notification in the Official Gazette amend the First Schedule so as to include such qualification therein.

**(3) Recognition of Foreign Medical Qualifications :** If an Indian national obtains a foreign qualification which is not included in part II of the Third Schedule, he can apply to the Central Government. The candidate is required to provide full information with regard to the course of study, syllabus, duration of the course, etc. This is forwarded to I.M.C., which has authority to enter into negotiations with any of the Medical Councils of the foreign countries, and can recognise such foreign qualifications on reciprocal basis. The Central Government may, by notification in the Official Gazette, amend the part II of the Third Schedule so as to include such qualification therein.

**(4) Appeal Against Disciplinary Action :** If the name of any person is removed from the State Medical Register, he may appeal to the Central Government, after exhausting all the remedies under the State Medical Council Act. Every such appeal should state the grounds of the appeal and accompanied by all relevant documents within 30 days from the date of the decision appealed against.

The decision of the Central Government, which is given after consulting the Indian Medical Council, is binding on the State Government and the State Medical Council.

**(5) Warning Notice:** The Council may prescribe standards of professional conduct and etiquette and a Code of Ethics for medical practitioners. It can issue Warning Notice containing certain practices which are regarded as falling within the meaning of the term, "serious professional misconduct."

#### STATE MEDICAL COUNCILS

The State Medical Councils are autonomous bodies established under the State Medical Council Act. Each of these Medical Councils consist of members elected by the registered medical practitioners and those nominated by the State Government. The president and the vice-president of the Council are elected by the members from among themselves.

**Functions: (1) Medical Register:** The Council appoints a Registrar, who keeps a Register of medical practitioners. Any person having any of the recognised medical qualification, can get his name registered. The name, residence, qualifications and the date on which each qualification was granted of every person who is registered under this Act are entered in the Register on payment of prescribed fees. After passing the qualifying examination, it is necessary to undergo a period of training, before such qualification is granted to him. A provisional registration in a State Medical Register is given to such person on application to enable him to practice medicine in an approved institution for the required period. Any additional qualification obtained later, can also be registered. The Registrar should inform the Indian Medical Council without delay of all additions and other amendments in the State Medical Register made from time to time.

The general principles mentioned in the **Hippocratic Oath** have been brought up-to-date by the World Medical Association. The modernised version of the Hippocratic Oath are the **Declaration of Geneva**, as adopted by the Third General Assembly of World Medical Association at Geneva, Switzerland, in September, 1948, (amended in 1983), and the **International Code of Medical Ethics**, as adopted by the General Assembly of the World Medical Association held in London, in October, 1948.



**THE DECLARATION OF GENEVA :** At the time of registration, each applicant shall be given a copy of the following declaration by the Registrar concerned and the applicant shall read and agree to abide by the same. (1) I solemnly pledge myself to consecrate my life to the service of humanity. (2) I will maintain the utmost respect for human life from the time of conception. Even under threat, I will not use my medical knowledge contrary to the laws of humanity. (3) I will not permit consideration of religion, nationality, race, party politics, or social standing to intervene between my duty and my patient. (4) I will practise my profession with conscience and dignity. (5) The health of my patient will be my first consideration. (6) I will respect the secrets which are confided in me. (7) I will give to my teachers the respect and gratitude which is their due. (8) I will maintain by all the means in my power, the honour and noble traditions of the medical profession. (9) I will treat my colleagues with all respect and dignity. (10) I shall abide by the Code of Medical Ethics as enumerated in the Indian Medical Council (professional conduct, etiquette and ethics) Regulations, 2002. I make these promises solemnly, freely and upon my honour.

Signature, name, place, address, date.

**(2) Disciplinary Control:** They have the disciplinary control over the medical practitioners. They have the power to remove the names of medical practitioners permanently or for a specific period from their Registers when after due enquiry they are found to have been guilty of serious professional misconduct. They are also authorised to direct the restoration of name so removed.

(3) They can issue **warning notice** similar to that of the Indian Medical Council.

**Judicial Procedure of State Council :** These proceedings are started: (1) When information reaches the office of the Council that a registered medical practitioner has been convicted of a cognisable offence or has been censured by judicial or other competent authority in relation to his professional character, or has been found guilty of conduct which *prima facie* constitutes serious professional misconduct. (2) By a complaint being made by some person or body against the practitioner. The Council has the same powers as Civil Courts under Code of Civil Procedure, 1908. This makes all the enquiries on the misconduct of doctors to be judicial proceedings within the meaning of S.193, 219 and 228 of I.P.C.

The Registrar of the Council submits the complaint to its president. The matter is referred to the Sub-committee or to the Executive Committee, which considers the complaint, causes further investigation and takes legal advice. If no *prima facie* case is made out, the complainant is informed accordingly. If an enquiry is to be made, a notice is issued to the practitioner specifying the nature and particulars of the charge and directing him to answer the charge in writing, and to attend before the Council on the appointed day. At the hearing, the complainant or his legal adviser, and the practitioner must be present. After the conclusion of evidence, vote is taken and the judgement given. If the majority vote confirms that the charge has been proved, the Council must vote again and decide whether the name of the practitioner should be removed from the register or he should be warned, not to repeat the offence.

Deletion from the register shall be widely published in local press as well as in the publications of different Medical Associations/Societies, Bodies.

**Erasure of Name :** The name of the doctor is removed from the medical register: (1) After the death of the registered practitioner. (2) Entries which are made in error or as a result of fraud. (3) **Penal erasure:** The main cause for erasure is serious professional misconduct, and this is known as penal erasure. It is sometimes termed "**the professional death sentence**". It deprives the practitioner of all the privileges of a registered practitioner.

**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. It involves an abuse of professional position.

**WARNING NOTICE:** A registered medical practitioner is required to observe certain prescribed rules of the conduct contained in Code of Medical Ethics, published by the Medical Council of India, and by several State Medical Councils. The Council gives examples of offences which constitute serious professional misconduct, but it stresses the fact that it is not a complete list. The Council can also consider any form of alleged professional misconduct, which does not come within any of the offences contained in the Warning Notice. Each case has to be decided on its specific facts and merits. If



any one is found guilty of any of the following offences mentioned in the Warning Notice issued by the Medical Council of India, his name can be erased from the Medical Register.

(1) **Adultery** (voluntary sexual intercourse between a married person, and a person married or not, other than his or her spouse).

(2) **Improper conduct or association with a patient or member of the patient's family.**

(3) **Conviction by a Court of Law for offences involving moral turpitude and criminal acts.**

(4) **Issuing a false, misleading or improper certificate in connection with sick benefit, insurance, passport, attendance in Court, public services, etc.**

(5) **Withholding from health authorities information of notifiable diseases.**

(6) **Performing or enabling an unqualified person to perform an abortion or any illegal operation for which there is no indication.**

(7) **Contravening provisions of the Drugs and Cosmetics Act and regulations.**

(8) **Prescribing steroids/psychotropic drugs when there is no absolute medical indication. (b) Selling schedule H and L drugs to the public except to his patients.**

(9) **Not displaying the registration number given to him by State Medical Council in his clinic, prescription and certificates, etc. issued by him.**

(10) **Dichotomy or fee-splitting, i.e., receiving or giving commission or other benefits to a professional colleague or manufacturer or trader in drugs or appliances or a chemist, dentist, etc. A physician shall not give, solicit or receive nor shall he offer to give, solicit or receive any gift, gratuity, commission or bonus in consideration of or return for the referring, recommending or procuring of any patient for medical, surgical or other treatment.**

(11) **Using of touts or agents for procuring patients.**

(12) **Disclosing the secrets of a patient that have been learnt during his professional experience, except in a Court of law and notifiable diseases, and privileged communications.**

(13) **Covering, i.e., assisting someone who has no medical qualification to attend, treat, or perform an operation on some person in cases requiring professional discretion or skill.**

(14) **Association with manufacturing firms : (a) A physician may patent surgical instruments, appliances and medicines or copyright application**

methods and procedures. However, it shall be unethical if the benefits of such patents of copyright are not available in situations where the interest of large population is involved. (b) He should not solicit or receive rebates or commission from prescribing of any agent used therapeutically. (c) A physician must not write prescriptions in private formulae of which only he or a particular pharmacy has the key. He can keep certain lotions or mixtures, as long as the formulae of the same are available.

(15) **Advertising :** (a) A physician should not publish on his own in the lay press, reports of cases treated or operated on by him. He should not sanction the publication of any certificates for drugs, or appliances issued by him. (b) A physician can write to the lay press under his own name on matters of public health, hygienic living or can deliver public lectures, give talks on the radio, TV/internet, chats, for the same purpose. (c) A physician can announce in lay or professional press, his starting of practice, interruption or restarting it after a long interval, a change of his address, temporary absence from duty, change of type of practice, resumption of another practice, or succeeding to another practice. (d) An institution, such as a maternity home, a sanatorium, a house for the crippled or blind, nursing home, private hospital, rehabilitation centre or any type of training institution, etc. may be advertised in the lay press but it should not contain anything more than the name of institution, type of patients admitted, type of training and other facilities offered and the fees. (e) It is improper for a physician, to use an unusually large signboard and to write on it anything other than his name, qualification, titles, and name of his speciality. The same should be the contents of his prescription paper, which may in addition contain his address, registration number, and telephone number. It is improper to affix a signboard on a chemist's shop, or in places where he does not reside or work. (f) A physician must not exhibit publicly the scale of fees except in his consulting or waiting room. (g) He should not advertise himself through manufacturing firms directly or indirectly. (h) Printing of self photograph, or any such material of publicity in the letter head or on sign board or the consulting room or any such clinical establishment shall be regarded as acts of self advertisement.

(16) **Professional association with bodies or**



societies of unqualified persons formed for the purpose of turning unqualified practitioners.

(16) Running an open shop for sale of medicines, for dispensing prescriptions of other doctors, or for sale of medical or surgical appliances. Manufacturing or sale of proprietary medicines, whose formulae are not displayed on the label.

(17) A physician shall not refuse on religious grounds alone to give assistance in or conduct of sterility, birth control, circumcision, MTP, unless the physician feels himself incompetent to do so.

(18) Drunk and disorderly so as to interfere with proper skilled practice of medicine.

(19) The physician shall not aid or abet torture nor shall he be a party to either inflict mental or physical trauma or concealment of torture inflicted by some other person or agency in clear violation of human rights.

(20) A physician shall not publish photographs or case reports of his patients without their permission by which their identity could be made out. If the identity is not to be disclosed, consent is not needed.

(21) Sex determination test shall not be undertaken with the intent to terminate the life of a female foetus.

(22) Failure to obtain consent of both husband and wife in an operation which may result in sterility.

(23) No act of in vitro fertilisation or artificial insemination shall be undertaken without the informed consent of the female patient, her husband and the donor.

(24) Violation of existing ICMR guidelines in clinical drug trials or other research involving patients or volunteers constitutes misconduct.

The important offences may be described as "the 6 A's". (1) Adultery arising out of professional relationship. (2) Advertising. (3) Abortion (unlawful). (4) Association with unqualified persons in professional matters. (5) Addiction. (6) Alcohol.

**Indian Medical Council (Professionals Conduct, Etiquette and Ethics) Regulations (2002):**

(1) Doctors shall not refer their patients for consultation by other doctors or clinical investigations, unless it is absolutely essential and even when making such reference there shall be no involvement of any commission or payback. (2) Physicians are free to choose their patients, but they shall not arbitrarily refuse treatment, and shall not refuse any request for help in an emergency. (3) Once having taken up a case, the doctor should not neglect the patient or withdraw

from the case without giving adequate notice to the patient and his family. (4) Doctors should display their fees and other charges on a board, and in case if the physicians themselves dispensed any medicines it must be reflected clearly in the prescription. (5) Doctors should not give any sort of endorsement for any drug or equipment even if no financial consideration was involved. (6) Drugs that are prescribed should explicitly state the proprietary formulae and their generic names. (7) Doctors should not undertake any sex determination test with an intention to destroy a female foetus; in the case of a nursing home run by physicians where assistants are employed, the ultimate responsibility would rest on the doctor. (8) Doctors should not subject their patients for trial of any drugs and therapies, unless it is according to the guidelines of I.C.M.R., even if consent was taken from the patients. (9) Doctors should maintain records of indoor patients for three years in a format prescribed by the Council. (10) If any request is made for the records by patients or their authorised agents or legal authorities, they should be handed over in 72 hours. (11) Doctors are required to undergo at least 30 hours of continuing medical education programme every five years. (12) Every physician shall display the medical registration number in his clinic and in all his prescriptions, certificates, money receipts given to his patients. (13) A physician should expose without fear or favour incompetent or corrupt, dishonest or unethical conduct on the part of the members of the profession. (14) A physician should consider it as a pleasure and privilege to render gratuitous service to all physicians and their immediate family dependants. (15) Physicians should disseminate advice on public health issues.

**Rights and Privileges of Registered Medical Practitioners:**

(1) Right to practice medicine. (2) Right to choose a patient. (3) Right to dispense medicines. (4) Right to possess and supply dangerous drugs to his patients. (5) Right to add title, descriptions, etc., to the name. (6) Right to recovery of fees. (7) Right for appointment to public and local hospitals. (8) Right to issue medical certificates. (9) Right to give evidence as an expert. (10) Exemption from serving as a juror at an inquest.

Physicians can suffix to their names only recognised medical degrees/diplomas and membership/honours, which confer professional knowledge or recognise any exemplary qualifications/achievements.

**RED CROSS EMBLEM :** The Geneva Convention Act, 1960, under S.12, prohibits use of Red Cross and other allied emblems such as "Red



Crescent", "Red Crystal" for any purpose without approval of the Government of India, and S.13, lays down the penalty for unauthorised use with a fine up to Rs. 500/- and forfeiture of the goods upon which emblem was used. It is the right only of members of medical service of any army.

### DUTIES OF MEDICAL PRACTITIONERS

The following are the various types of duties:

**(I) Duty to Exercise a Reasonable Degree of Skill and Knowledge :** The duty of care arises simply by examining someone for signs of illness or trauma or even by accepting a patient onto a list of existing patients. For hospitals, a duty will usually arise once the patient has been admitted, but in the case of an accident or emergency unit, a general duty of care is owed to the patient. He owes this duty to the child even when engaged by his father. He owes this duty even when patient is treated free of charge. It neither guarantees cure nor an assured improvement. A practitioner is not liable because some other doctor of greater skill and knowledge would have prescribed a better treatment or operated better in the same circumstances.

**CASE: (1) WHITEFORD V. HUNTER AND GLEED (1950):** A consulting engineer of London was examined by a consulting surgeon who diagnosed enlarged prostate by doing rectal examination and advised operation. The surgeon did not use a cystoscope or make a biopsy. On opening the bladder, he found an inoperable carcinoma and opined the expectancy of life to be only a few months. The patient gave up his business and went to U.S.A., where a cystoscopic examination showed a prostate with a median bar, and the pathological examination revealed chronic cystitis. An operation was performed and the calcareous material was removed from the diverticulum. There was no evidence of cancer. The patient sued the doctor for negligence and was awarded damages. The surgeon appealed and the Court of Appeal held that a mistake in diagnosis was not enough to justify negligence.

**(2) WOOD V. CHARING CROSS HOSPITAL:** A drunken person was hit by a lorry. The doctor who examined him found no clinical evidence of bone injury or any abnormality, but the stethoscope was not used. The patient died 2 days later, and the autopsy showed fracture of one clavicle and 9 ribs on each side and congestion of lungs. The Court found the doctor negligent in not exercising reasonable care in his examination.

**(3) PAYNEE V. HELIER:** A patient was kicked in the abdomen by a horse. He went to the hospital

9 hours after the injury, where he was examined by the Casualty Officer, who was qualified 2 years ago. He found a bruise in the right iliac fossa, but did not find any body or visceral injury. The patient was sent home, who became very ill after some days and was operated but died later. The Court found the doctor negligent as he made a wrong diagnosis due to his failure to exercise reasonable skill and care.

**(II) Duties with Regard to Attendance and Examination:** When a practitioner agrees to attend a patient, he is under an obligation to attend to the case as long as it requires attention. He can withdraw only after giving reasonable notice or when he is asked by the patient to withdraw. He cannot withdraw without the consent of the patient except for valid reasons, such as: (1) That he himself becomes sick. (2) That he is convinced that the patient is malingering. (3) Remedies other than those prescribed by him are being used. (4) That his instructions are being ignored. (5) That previous financial obligations are not being fulfilled by the patient. (6) That another practitioner is also attending the patient. (7) That the patient persists in the use of intoxicants or poisons.

If a physician is unable to treat the patient when his services are needed, he may provide a qualified and competent substitute doctor to give the services. If the practitioner cannot cure a patient, he need not withdraw, if the patient desires his services. He should not get his patient examined or operated upon by another doctor without his permission. If the doctor is called by the police to attend a case of accident, he may give first aid and advice, but here no doctor-patient relationship is established. A medical practitioner need not accept as patients all who come to him for treatment. He may arbitrarily refuse to accept any person as a patient, even though no other physician is available. However, he should know that the Code of Ethics requires that in an emergency, no physician should refuse to treat a patient. There is no law to compel a doctor to attend a patient except during military necessity.

**Case: NEWTON V. CENTRAL MIDDLESEX G.H.M.S.:** Newton was taken to the hospital after an accident. A doctor examined him but failed to diagnose the fractured patella and wrote, 'No clinical fracture' on the hospital card. Later, the patient saw two other doctors at the hospital, who relying on the hospital card, did not examine the knee, though the patient had complained of pain in the knee. The patient sued both the doctors for negligence. The Court



held that the first doctor was not guilty because the patient went to him only for a dressing. The second doctor was held negligent as he failed to examine the knee himself.

**(III) Duty to Furnish Proper and Suitable Medicines :** If the doctor has his own dispensary, he should furnish the patient with suitable medicines. Otherwise, he should give a legible prescription, mentioning full and detailed instructions. The doctor is held responsible for any temporary or permanent damage in health, caused to the patient due to wrong prescription.

**(IV) Duty to Give Instructions:** The doctor should give full instructions to his patients or their attendants regarding the use of medicines and diet. He should mention the exact quantities and precise timing for taking medicines. Patients should be instructed regarding the adverse reactions and to stop the drug in case of reaction, and to approach the doctor immediately.

**Case: BALL V. HOWARD:** The plaintiff was operated for appendicitis. The surgeon did not call another surgeon for consultation (though the patient requested for the same as he developed some complications), and went away without leaving proper instructions as to what was to be done. The patient called another surgeon, who performed a second operation after which the patient made a good recovery. The Court held that the first surgeon was negligent in not attending to the patient with reasonable promptness and in going away without giving instructions.

**(V) Duty to Control and Warn :** A physician has to warn patients of the dangers involved in the use of a prescribed drug or device. If the doctor fails to inform the patient of the known or reasonably foreseeable dangerous effects of a drug or device, he becomes liable not only for the harm suffered by the patient, but also for injuries his patient may cause to third parties. If a drug is administered which might affect a patient's functional ability, such as driving a car or operating machinery or equipment, the doctor should explain the danger to the patient, and/or to someone who can control the patient's activities, such as the family, an employer, or the authorities. Similarly, when a doctor detects a medical condition that may impair the patient's ability to control his activities, the doctor has a duty to warn the patient, family, employer or authorities.

The doctor has a duty to warn the patient about his medical condition and treatment that could injure others, e.g. the doctor treating epileptic patient may be liable for injury to others caused by his patient, due to failure to advise the patient of the risks of engaging in dangerous activities, under the concept of "Reasonable foreseeability".

**(VI) Duty to Third Parties :** If a patient suffers from an infectious disease, the doctor should warn not only the patient, but also third parties known to be in close contact with the patient. These include relatives, friends, co-workers, and/or proper authorities who can protect these potential victims.

**(VII) Duty Towards Children and Adults incapable of taking care of themselves :** When applying hot water bottles to children, special care should be taken, for the child may be injured. Special precautions should be taken in case of adults who are incapable of taking care of themselves due to insanity or some physical disability.

**Case:** A woman was placed in a bed after an operation in which a hot water bottle was negligently left, due to which she was severely burnt between her shoulders. The surgeon came to see her while she was recovering from the anaesthetic. She complained to the surgeon about the pain between her shoulders, but he paid no attention to her. The Court held the doctor negligent and awarded damages.

**(VIII) Duty to Inform Patient of Risks :** A mentally sound adult patient must be told of all the relevant facts. If the treatment or operation proposed carries special risks which are known to the doctor but are probably not known to the patient, the doctor should inform the patient of these risks and obtain his consent. But under certain conditions arising out of psychological factors, some facts have to be withheld.

**Case: KANKAN V. BEHARELAL:** A prescription was given to Kankan for ear trouble, which was used as directed by the doctor. The patient developed pain and acute sensation in the ear after a year, and on examination the drum of his right ear was found destroyed. The evidence showed that the doctor has prescribed a new and dangerous mixture for a petty complaint, and if the mixture had been used after thorough shaking, no harm would have resulted. The High Court held the doctor negligent, as he failed to warn the patient of the risk involved.

**(IX) Duty with Regard to Poisons :** Poisons should be handled carefully. Each poison should



be kept in a separate bottle, properly labelled and kept in a separate cupboard or upon a separate shelf. When a doctor is called upon to treat a case of poisoning : (1) he should give immediate treatment, and (2) he should assist the police in determining whether the poisoning is accidental, suicidal or homicidal.

**(X) Duty to Notify Certain Diseases :** A doctor is bound to give information of communicable diseases (smallpox, chickenpox, cholera, plague, typhoid, measles, diphtheria, yellow fever, food poisoning) births, deaths, etc., to the Public Health authorities. If a doctor fails to conform to the statutory or administrative requirements, he will be liable not only for criminal penalties, but also for negligence in civil suits brought by injured parties.

**(XI) Duties with Regards to Operations :** (1) He should explain the nature and extent of operation and take consent of the patient. (2) He should take proper care to avoid mistakes, such as performance of operations on the wrong patient or on the wrong limb. (3) When a surgeon undertakes to operate, he must not delegate that duty to another. (4) He must not experiment. (5) He must be well-informed of current standard practice and must follow it. (6) He must operate with proper and sterilised instruments. (7) He should make sure that all the swabs, instruments, etc., put in are removed. (8) He should take proper postoperative care and should give proper directions to his patient when discharging him.

**(XII) Duties Under Geneva Conventions :** In Geneva, in 1949, four conventions were agreed upon. Each convention lays down that the persons it protects, whether the wounded or sick of the armed forces (first convention), ship-wrecked persons (second), prisoners of war (third), or civilians of enemy nationality (fourth), are to be treated without any adverse distinction based on sex, race, nationality, political opinions or any other similar criteria. Priority is authorised only for urgent medical reasons.

**(XIII) Duties with Regard to Consultation:** Consultation should be advised preferably with a specialist in the following conditions. (1) If the patient requests consultation. (2) In an emergency. (3) When the case is obscure or has taken a serious turn. (4) If the quality of the care or management can be considerably enhanced. (5) When an operation or a special treatment involving danger to life is to be undertaken. (6) When an operation affecting

vitality of intellectual or generative functions is to be performed. (7) When an operation is to be performed on a patient who has received serious injuries in a criminal assault. (8) When an operation of mutilating or destructive nature is to be performed on an unborn child. (9) In homicidal poisoning. (10) When a therapeutic abortion is to be procured. (11) When a woman on whom criminal abortion has already been performed has sought advice for treatment.

The consent of the patient must be taken. The doctor must tell the patient, whether he is being transferred to the consulting physician or only consulting, or it will be joint participation, and whether it will be on a continuous or intermittent basis. A referring physician is relieved of further responsibility when he completely transfers the patient to another physician. The referring physician may be held liable under the doctrine of 'negligent choice', if it can be proved that the consultant was incompetent or had a reputation as an "errant" physician. All information about the patient must be transferred to the consultant by the referring physician. The consultant should advise the patient to return to the practitioner who has referred him. If the patient refuses, the consultant should talk to the referring doctor and settle the matter.

**Case: MOLSEWORTH'S CASE:** The patient engaged a senior surgeon for hernia operation, but he was operated upon by a house-surgeon. The Court held that the house-surgeon had operated without the plaintiff's consent; that for an unauthorised person to do, in competent manner, an act which another was authorised to do, was technical form of trespass and patient was awarded nominal damages.

**(XIV) Duty in Connection with X-ray Examination :** As far as possible, all cases of accident, unless they are very minor, should be X-rayed. Wrong interpretation of an X-ray has been held negligent.

**Case: FRASER V. VANCOUVER GENERAL HOSPITAL:** A patient was X-rayed after a traffic accident. The casualty officer, who was not competent, gave opinion that the neck was not broken. The Court held him negligent in not diagnosing a broken neck.

**(XV) PROFESSIONAL SECRECY (confidentiality) :** It is an implied term of contract between the doctor and his patient. The doctor is obliged to keep secret, all that he comes to know concerning the patient in the course of his professional work. Its disclosure would be a failure of trust and



confidence. It assumes that without confidentiality, patients will not reveal everything during a consultation, esp. intimate details, due to which the clinical history may be deficient or even misleading. The patient can sue the doctor for damages if the disclosure is voluntary, has resulted in harm to the patient and is not in the interest of the public.

The following points may be noted : (1) A doctor should not discuss the illness of his patient with others without the consent of the patient. (2) If the patient is major, the doctor should not disclose any facts about the illness without his consent to parents or relatives even though they may be paying the doctor's fees. In the case of a minor or an insane person, guardians or parents should be informed of the nature of the illness. (3) A doctor should not answer any enquiry by third parties even when enquired by near relatives of the patient, either with regard to the nature of the illness or with regard to any subsequent effect of such illness on the patient without the consent of the patient. (4) Even in the case of husband and wife, the facts relating to the nature of illness of the one, must not be disclosed to the other, without the consent of the concerned person. (5) In divorce and nullity cases, no information should be given without getting the consent of the person concerned. (6) A doctor should not disclose any information about the illness of his patient without the consent of the patient even when requested by a public or statutory body, except in case of notifiable diseases. If the patient is a minor or insane, consent of the guardian should be taken. (7) When a domestic servant is examined at the request of the master, the doctor should not disclose any facts about the illness to the master without the consent of the servant, even though the master is paying the fees. (8) When a doctor examines a Government servant on behalf of the Government, he cannot disclose the nature of illness to the Government without the patient's consent. (9) The medical officer of a firm or factory should not disclose the result of his examination of an employee to the employers without the consent of the employee. (10) Medical officers in Government service are also bound by the code of professional secrecy, even when the patient is treated free. (11) A person in police custody as an undertrial prisoner has the right not to permit the doctor who has examined him, to disclose the nature of his illness to any person. If a person is convicted, he has no such right and the

doctor can disclose the result to the authorities. (12) The medical examination for taking out life insurance policy is a voluntary act by the examinee, and therefore consent to the disclosure of the finding may be taken as implied. A doctor should not give any information to an insurance company about a person who has consulted him before, without the patient's consent. Any information regarding a dead person may be given only after obtaining the consent from the nearest relative. (13) In reporting a case in any medical journal, care should be taken that patient's identity is not revealed from the case notes or photographs. (14) In the examination of a dead body certain facts may be found, the disclosure of which may affect the reputation of the deceased or cause mental suffering to his relatives, and as such, the doctor should maintain 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. To be privileged, the communication must be made to a person having interest in it, or in reference of which he has a duty. If made to more than one person, or to a person who has not a direct interest in it, the plea of privilege fails. The doctor should first persuade the patient to obtain his consent before notifying the proper authority. If the doctor discloses professional secrets for the purpose of protecting the interest of the community, he will not be liable to damages.

The following are the examples of privileged communication, or in other words, exceptions to the general rule of professional secrecy.

(1) **Infectious Diseases :** If a patient suffering from an infectious disease is employed as cook or waiter in a hotel, or a food-handler with an enteric infection, or a teacher with tuberculosis or other infective disease, or as children's nurse, etc., he should be persuaded to leave the job until he becomes non-infectious. If the patient refuses to accept this advice, the doctor can inform the employer about the illness of his patient.

(2) **Servants and Employees :** An engine driver or a bus driver or a ship's officer may be suffering from epilepsy, high blood pressure, alcoholism, drug addiction, or colour blindness. The doctor should persuade the patient to change his employment, because of the dangers of his present occupation, both to himself and to the public. If this fails, the



doctor should inform the employer, that the patient is unfit for that kind of employment.

**(3) Venereal Diseases :** If a person is suffering from syphilis and is about to marry, it is the duty of the doctor to advise the patient not to marry till he is cured; if the person refuses, the doctor can disclose the syphilitic condition of the patient to the woman concerned or to her parents. Swimming pools should be prohibited to those having syphilis or gonorrhoea, but if the person refuses, the authorities can be informed. The doctor can inform the warden of a hostel, if any boarder is suffering from venereal disease.

**Case:** A V.D. specialist saw a young man suffering from syphilis about to enter a public bath. The specialist tried to dissuade the person from entering the bath, but he refused. The physician reported the matter to the attendant who did not allow the young man to bathe. The patient brought a suit against the doctor for breach of professional confidence, but the Court dismissed the case on the ground that the doctor acted in the interest of the community.

**(4) Notifiable Diseases :** A medical practitioner has a statutory duty to notify births, deaths, infectious diseases, etc., to the Public Health authorities.

**(5) Suspected Crime :** Every person, aware of the commission of, or of the intention of any other person to commit any offence shall immediately give information to the nearest Magistrate or police officer of such commission or intention (S.39, Cr.P.C.). If the doctor learns of a serious crime, such as murder, assault, rape, etc. by treating the victim or assailant, he is bound to give information to the police. Thus, if a doctor treats a person suffering from gunshot or stab wounds due to criminal assault, he must inform the police.

**(6) Self-interest :** Both in civil and criminal suits by the patient against the doctor, evidence about the patient's condition may be given.

**(7) Patient's own Interest :** The doctor may disclose the patient's condition to some other person, so that he may be properly treated, e.g., to warn the parents or guardians of signs in the patient of melancholia, suicidal tendencies, etc.

**(8) Negligence Suits :** When a physician is employed by the opposite party to examine a patient who has filed a suit for negligence, the information thus acquired is not privileged (no physician-patient relationship), and the doctor may testify to such information.

**(9) Courts of Law :** In a Court of law, a doctor cannot claim privilege concerning the facts about the illness of his patient, if it is relevant to the inquiry before the Court. The doctor should appeal to the Court if he is asked to reveal any professional secret. If the Court does not accept this plea, he may request the Court that he may be allowed to give the answer in writing so that the public may not know it. If this is denied by the Court, the doctor has to answer the questions about the patient's confidential matters to avoid risk of penalties for contempt of Court. In all cases, the doctor should appeal to the Judge before disclosing a professional secret. The doctor may request the Judge that he will give the information in writing, so that it is not made public. The witness should not voluntarily disclose information either in Court or out of it, but for the actual evidence demanded by the Court, he is protected from civil action against breach of confidence. Under S. 126, and 129, I.E.A., a lawyer can claim privilege in a Court of law with regard to any communication made to him by his client.

A doctor can disclose and discuss the medical facts of a case with other doctors and paramedical staff, such as nurses, radiologist, physiotherapist, etc. to provide better service to the patient.

**Physician's Responsibility in Criminal Matters:** A doctor who is aware of the commission of crimes, such as murder, dacoity, waging war against the lawful Government, helping the escape of prisoners, etc., is legally bound to report them to the nearest Magistrate or police officer (S. 39, Cr.P.C., S. 176, I.P.C.). The doctor knowing or having reason to believe that an offence has been committed by a patient whom he is treating, intentionally omits to inform the police, shall be punished with imprisonment upto 6 months (S.202, I.P.C.). But, if he treats a person who has attempted to commit suicide, he is not legally bound to report, but if the person dies he has to inform the police. The practitioner's responsibility in case of criminal abortion and poisoning have been described in the relevant chapters.

**Duties of a Patient :** (1) He should furnish the doctor with complete information about past illness, and family history of diseases and the facts and circumstances of his illness. (2) He should strictly follow the instructions of the doctor as regards diet, medicine, mode of life, etc. (3) He should pay a reasonable fee to the doctor.



**PRIVILEGES AND RIGHTS OF THE PATIENTS:** Every patient has right to: (1) Choice: To choose his own doctor freely. (2) Access: (a) To health care facilities available regardless of age, sex, religion, economic and social status. (b) to emergency services. (3) Dignity: To be treated with care, compassion, respect and dignity without any discrimination. (4) Privacy: To be treated in privacy during consultation and therapy. (5) Confidentiality: All information about his illness and any other be kept confidential. (6) Information: To receive full information about his diagnosis, investigation and treatment plans and alternative. (7) Safety: Right to information should also include safety of procedures/diagnosis/therapeutic modality, complications/side effects/expected results as well as facilities available in the institution and other places. (8) Right to know: Day to day progress, line of action, diagnosis and prognosis. (9) Refusal: Right to consent or refuse any specific or all measures. (10) Second opinion: At any time. (11) Records: Access to his records and demand summary or other details pertaining to it. (12) Continuity: To receive continuous care for his illness from the physician/institution. (13) Comfort: To be treated in comfort during illness and follow up. (14) Complaint: Right to complain and rectification of grievances. (15) Compensation: Obtain compensation for medical injuries/negligence.

#### TYPES OF PHYSICIAN-PATIENT RELATIONSHIP

(I) THERAPEUTIC RELATIONSHIP: A doctor is free to accept or refuse to treat the patient subject to constraint of his professional obligations in emergencies. Some of the examples where doctor may refuse to treat the patient could be: (1) Beyond his practising hours. (2) Not belonging to his speciality. (3) Illnesses beyond the competence and qualification of the doctor or beyond the facilities available in his set-up/institution. (4) Doctor is unwell or any other family member is ill. (5) Doctor having important social function in the family. (6) Doctor has consumed alcohol. (7) Patient has been defaulting in payment. (8) Patient or his/her relations are non-cooperative, violent or abusive. (9) Malingerer. (10) Patient refuses to give consent/accept risk. (11) Patient demanding specific drugs like amphetamine, athletics/body-builders demanding steroids, etc. (12) Patient rejecting low-cost remedies in favour of high-cost alternatives. (13) At night on grounds of security, if the patient is not brought to him. (14) An unaccompanied minor patient or female patient. (15) Any new patient, if he is not the only doctor available.

**Special duty of a doctor in Emergency Cases:** In emergency he has moral, ethical and humanitarian duty to do his best to help the patient in saving his life.

In medico-legal injury cases, a doctor is obliged to give necessary medical aid and to save the life of the patient and render all help to see that the person reaches the proper expert/institution as early as possible.

(II) FORMAL RELATIONSHIP: The formal relationship between the doctor and the patient pertains to the situations where the third party has referred the person for impartial medical examination, like pre-employment, insurance, yearly medical check-ups, cases of rape, victims of crimes, intimate body searches and other medico-legal cases, in certain psychiatric/mental illnesses referred by Courts/police.

In these situations, the doctor is not under obligation to provide any information about his report and has to comply with the directives of the party demanding such examinations. However, if a clinical fact requiring urgent treatment is detected which is not known to the patient earlier, it may be conveyed to his family physician or the third party who has sent the patient with instructions to inform the patient.

### PROFESSIONAL NEGLIGENCE (MALPRAXIS)

Professional negligence is defined as absence of reasonable care and skill, or wilful 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 one is not supposed to do, or failing to do something that one is supposed to do.

**Due Care:** It means such reasonable care and attention for the safety of patient as their mental and physical condition may require. It should be proportionate with the known inability of the patient to take care of himself. Breach of standard of care occurs either by omission or commission. A physician fails to comply with the standard of care applicable to him in two situations: (1) when he improperly, i.e., unjustifiably deviates from accepted practices (methods, procedures, and treatments), and (2) when he employs accepted practices but does so unskillfully.

**CIVIL NEGLIGENCE:** The question of civil negligence arises: (1) When a patient, or in case of death, any relative brings suit in a civil Court for getting compensation from his doctor, if he has suffered injury due to negligence. (2) When a doctor brings a civil suit for getting his fees from the patient or his relatives, who refuse to pay the same alleging professional negligence.

Liability for negligence arises if the following conditions are satisfied: (1) **Duty:** Existence of



a duty of care by the doctor. (2) **Dereliction** : The failure on the part of the doctor to maintain care and skill. (3) **Direct causation**: The failure to exercise a duty of care must lead to damage (proximate cause). (4) **Damage** : The damage which results must be reasonably foreseeable.

Any absence of proper skill or care that causes the patient's death, diminishes his chances of recovery, prolongs his illness or increases his suffering, constitutes injury in a legal sense. Even if the doctor is negligent, patient cannot sue him for negligence if no damage has occurred. The patient must suffer some loss which can be measured and compensated in terms of money. The amount of damage done is a measure of the extent of the liability. Some examples are : (1) Loss of earning, either due to absence from work or prevention or impairment of his ability to carry out his occupation. (2) Expenses incurred, e.g., hospital expenses, special diet, etc. (3) Reduction in expectation of life. (4) Reduced enjoyment of life, such as loss of function of limb or sense. (5) Pain and suffering, either physical or mental. Suffering includes fright, humiliation and embarrassment. (6) Loss of potency. (7) Death.

**Personal injuries** include any disease or any impairment of a person's physical or mental conditions.

#### INSTANCES OF MEDICAL NEGLIGENCE:

(1) Failure to obtain informed consent. (2) Failure to examine patient himself. (3) Failure to inform the patient of the risks of refusal for treatment. (4) Failure to immunise and to perform sensitivity tests when indicated. (5) Not ordering X-ray examination where the history suggests the possibility of a fracture, or dislocation or presence of a foreign body in a wound. (6) Not reading the X-ray film correctly or in failing to get it read by a competent person. (7) Failure to attend the patient in time, or failure to attend altogether. (8) Making a wrong diagnosis due to absence of skill or care. (9) Negligent management of procedures. (10) Failure to provide a substitute during his absence. (11) To delegate his duty of treating or operating upon a patient to another doctor without the consent of the patient. (12) Failure to give proper post-operative care. (13) Failure to give proper instructions. (14) Failure to keep well informed of advances in medical sciences. (15) Failure to warn the patient of side-effects. (16) Failure to obtain consultation where appropriate. (17) Experimenting on patient without consent.

(18) Giving overdose of medicine and giving poisonous medicines carelessly. (19) If his negligence causes others to catch a disease from his patient. (20) Continue a practice regarding which several warnings as to its dangers have been given. (21) Iatrogenic medical complications during diagnosis or treatment. (22) Prematurely discharging the patient.

A doctor is not liable: (1) For an error of judgement or of diagnosis, if he has secured all necessary data on which to base a sound judgement. For the treatment of a disease or injury, the doctor may adopt the one which in his judgement, will be more effective and appropriate. In such case, the doctor is not liable for an injury resulting from an error in his judgement. (2) For failure to cure or for bad result that may follow, if he has exercised reasonable care and skill. (3) If he exercises reasonable care and skill, provided that his judgement conforms to the accepted medical practice, and does not result in the failure to do something or doing something contrary to accepted medical practice.

In order to establish liability by a doctor, where a departure from normal practice is alleged, it must be established : (a) that there is a usual and normal practice, (b) that practice was not adopted, and (c) that the course adopted is one no professional man of ordinary skill would have taken, if acting with ordinary care. Some risks are inherent in any form of treatment and the doctor will not be negligent if they cause damage, provided that he has taken proper precautions, e.g., broken needle during injection. If the needle breaks, the patient should be informed and arrangements made to remove the broken piece. The doctor becomes negligent, if he fails to observe that the needle has broken, or having noted this, does not inform the patient or make arrangements to prevent further damage.

A doctor who agrees to give medical advice and treatment, impliedly undertakes that he is possessed of skill and knowledge for the purpose. Such a person when consulted by a patient owes him certain duties, viz. a duty of care in deciding whether to undertake the case, a duty of care in deciding what treatment to give, or a duty of care in the administration of that treatment. A breach of any of those duties becomes negligence. The practitioner must possess a reasonable degree of skill and knowledge and must exercise a reasonable



degree of care. Neither the very highest nor a very low degree of care and competence judged in the light of the particular circumstances of each case is what the law requires. The doctor no doubt has a discretion in choosing treatment which he proposes to give to the patient, and such discretion is relatively ample in cases of emergency.

The doctors are expected to keep well-informed of changing concepts and new developments and to follow general lines of treatment, though they are not expected to be aware of every development in medical science. The degree of competence is not a fixed quality, but varies according to the status of the doctor. A house-surgeon is not expected to possess the same skills as a consultant surgeon, but he is expected to limit his activities (except in emergencies) to a level of medical care which is within his competence. A general medical practitioner is expected to use only the average degree of skill and knowledge possessed by doctors of similar status practising in the locality. A specialist must maintain standards of skill in diagnosis and treatment above those of the ordinary general practitioner. If a doctor claims to possess superior skill, knowledge, experience or training, he will be judged according to those standards even in its absence. If a general practitioner treats as a specialist a case that clearly lies within a specialised medical field, he will be held liable for failure to use skill equal to that of a specialist. In a personal injury case, the fact that the patient's injuries become serious by his own predisposition or weakness does not diminish the extent of damages. Duty of care does not arise when the doctor attends on behalf of a third party to examine the patient for non-therapeutic purposes, e.g., evaluation of disability, insurance, drunkenness, etc., for the doctor is not there in his capacity as a healer but the doctor has a duty not to harm the patient.

Bad results are not necessarily due to negligence, e.g. some patients may be keloid formers. The law considers the doctor negligent only when (1) he did not consider the possibility that such a complication might occur, (2) that he failed to watch for it carefully or to recognise it promptly, or (3) to treat in a timely and appropriate fashion.

The burden of proving negligence lies on the plaintiff (patient). In order to establish negligence, it is not necessary to prove that the negligent party had bad motive or intention.

**CASE: (1) WHITAMORE V. RAO:** A suit was filed against the doctor for negligent treatment. The charge was that the doctor injected sulphostab or sulfarsenol, though the patient was not syphilitic. Evidence was given by the defendant doctor and other doctors that patient's blood contained parasites of malignant malaria and he had sores on his face. The Court held that the doctor was not negligent.

**(2) CRIVON V. BARRET GROUP HOSPITAL COMMITTEE:** The plaintiff was operated for the removal of a small breast tumour, and the pathologist reported that it looked like cancer. Intensive X-ray therapy was given to the patient, due to which the skin surface was destroyed and there was the possibility of potential hazards. The patient on knowing the diagnosis suffered great pain and worry. Later it was found that the diagnosis was not correct. An expert pathologist gave evidence that he might have also given the same diagnosis. The Court held that the pathologist was not negligent as the interpretation of the slide was difficult and debatable. It also held that surgeon was not negligent in not taking a second opinion, as the speed of treatment was essential in the case.

**(3) ROE V. MINISTRY OF HEALTH:** Two persons were operated upon under nupercain spinal anaesthetic, who developed permanent spastic paraplegia. The nupercain was contained in glass ampoules, which was responsible for the paraplegia. At that time this risk of percolation was not known to anaesthetists in general, and the Court held that it was only a misadventure and not negligence.

**THE DOCTRINE OF RES IPSA LOQUITUR:** Ordinarily, the professional negligence of a physician must be proved in Court by the expert evidence of another physician. The patient need not prove negligence in case where the rule of *res ipsa loquitur* applies, which means "the thing or fact speaks for itself". The rule is applied when the following conditions are satisfied: (1) that in the absence of negligence the injury would not have occurred ordinarily; (2) that the doctor had exclusive control over the injury producing instrument or treatment; (3) that the patient was not guilty of contributory negligence.

This enables the patient's lawyer to prove his case without medical evidence. Some of the examples are: (1) Failure to give anti-tetanic serum in cases of injury causing tetanus. (2) Burns from application of hot water bottles or from X-ray therapy. (3) Prescribing an overdose of medicine producing ill-effects. (4) Giving poisonous medicine carelessly.



(5) Breaking of needles, (6) Blood transfusion misadventure. (7) Failure to remove the swabs during operation which may lead to complications or cause death. (8) Loss of use of hand due to prolonged splinting. This doctrine is applied both to civil and criminal negligence. It does not apply where common knowledge or experience is not sufficiently extensive to know that the patient's condition would not have existed but for the doctor's negligence. It cannot be applied against several defendants only one of whom, who cannot be identified could have caused patient's injury. The doctrine is rarely used successfully by patients.

**Case: MOHN, V. OSBORNE:** An abdominal operation was performed by resident surgeon and at its conclusion, the surgeon was informed that the swab count was correct. Two months later, a further operation was done and a swab was found under the liver. The patient died later. The mother of deceased sued the surgeon for damages. The Court held the doctor negligent on the ground that the doctrine of *res ipsa loquitur* applied to the case.

**"CALCULATED RISK" CASES :** The theory of the calculated risk doctrine is that *res ipsa loquitur* should not be applied when the injury complained is of a type that may occur even though reasonable care has been taken. This doctrine is an important defence to any doctor sued for professional negligence, who can produce expert evidence or statistics to show that the accepted method of treatment he employed had unavoidable risks.

**DOCTRINE OF COMMON KNOWLEDGE :** This doctrine is based on the assumption that the issue of negligence in the particular case is not related to technical matters which are within the knowledge of the medical profession, e.g. the doctor will be held responsible for the lack of application of common sense, such as failure to give fluids in dehydration, or failure to give ATS in case of injuries. It is a variant of *res ipsa loquitur*. In *res ipsa loquitur*, the patient need not produce evidence as to both the standard of care and specific act or omission. In doctrine of common knowledge, the patient must prove the causative act or omission, but he need not produce evidence to establish the standard of care.

**Medical Maloccurrence :** Medicine deals with human beings, and there are many biological variations which cannot always be explained, expected or prepared for. In some cases, inspite of good medical attention and care, an individual fails to respond properly or may suffer from adverse reactions of the drug. This is called medical

maloccurrence. The injured person cannot get monetary compensation in every mishap or accident which results in injury, if the doctor has taken appropriate measures to overcome the undesirable foreseeable effects. Accident can be defined as an unpredictable event resulting in a recognisable injury. **Inevitable accident** is an accident not avoidable by any such precautions as a reasonable man can be expected to take. e.g., breaking of a needle during intramuscular injection due to sudden muscular spasm, or damage to the recurrent laryngeal nerve during thyroidectomy.

**NOVUS ACTUS INTERVENIENS :** A person is responsible not only for his actions, but also for the logical consequences of those actions. This principle applies to cases of assault and accidental injury. If the doctor is negligent, which results in a deviation from the logical sequence 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*" (an unrelated action intervening). Most of such interventions are of a medical nature, e.g., leaving of a swab or a surgical instrument in the abdomen after the repair of an internal injury; accidental substitution of poisonous drug for therapeutic drug, etc. For a plea of *novus actus*, an element of negligence is essential. It will depend on the extent to which it comes to be regarded as causally significant in itself. This plea is rarely accepted by the Courts.

Death resulting from an operation or injection of any drug producing anaphylaxis by a quack is considered criminal negligence.

**CRIMINAL NEGLIGENCE:** The question of criminal negligence may arise: (1) When a doctor shows gross absence of skill or care during treatment resulting in serious injury to or death of the patient, by acts of omission or commission. (2) When a doctor performs an illegal act. (3) When an assaulted person dies, the defence may attribute the death to the negligence or undue interference in the treatment of the deceased by the doctor.

Criminal negligence occurs when the doctor shows gross lack of competence, or gross inattention or inaction, gross recklessness, or gross negligence in the selection and application of remedies. It involves an extreme departure from the ordinary standard of care. Criminal negligence cases are very rare, and are practically limited to cases in which



the patient has died. In order to establish criminal liability, the facts must be such that the negligence of the accused went beyond a matter of compensation between persons and showed such disregard for the life and safety of others as to amount to a crime against the State, and conduct deserving punishment. A doctor will not be criminally liable if a patient dies due to an error of judgement or carelessness or want of due caution though he can be liable to pay compensation. Most of such cases are associated with drunkenness or with impaired efficiency due to the use of drugs by doctors. S. 304 A., I.P.C. deals with criminal negligence. "Whoever causes the death of any person by doing any rash or negligent act not amounting to culpable homicide shall be punished with imprisonment up to 2 years, or with fine, or with both". The following are some of the examples : (1) Amputation of wrong finger or operation on wrong limb or wrong patient. (2) Leaving instruments, tubes, sponges or swabs in abdomen. (3) Grossly incompetent administration of a general anaesthetic by a doctor addicted to the inhalation of anaesthetic. (4) Gross mismanagement of the delivery of woman especially by a doctor under the influence of drink or drugs. (5) Performing criminal abortion. (6) Administration of a wrong substance into the eye causing loss of vision.

Criminal negligence is more serious than the civil. For criminal negligence, 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 prosecution must prove all the facts to establish civil negligence (except monetary loss), and gross negligence and disregard for the life and safety of the patient. Contributory negligence is not a defence in criminal negligence.

Case: (1) A hakim gave a penicillin injection to a person who died due to it. The Court held that the ignorance of the hakim alone about penicillin injections, would make his act of giving treatment rash and negligent.

(2) **KOBIRAJ V. EMPRESS:** A quack cut the internal piles of a patient with an ordinary knife, who died of haemorrhage. He was charged under section 304-A, I.P.C. The quack contended that he had performed similar operations before, and that he was entitled to the benefit of section 88, I.P.C., as he operated in good faith, and patient had accepted the risk. The Court held the accused criminally negligent as he was not educated in surgery.

(3) **DESOUZA V. EMPEROR:** The accused was in charge of a dispensary which was badly managed with mixing up of poisonous and non-poisonous medicines. To prepare a mixture of quinine hydrochloride, the accused removed a bottle from the non-poisonous medicines cupboard and tore open the wrapper without looking at it, on which the word 'poison' was printed. Then without reading the label on the bottle, on which was printed 'Strychnine Hydrochloride', prepared a mixture and gave it to several persons, all of whom except one died within a short time. He was convicted for criminal negligence under Sec. 304-A, I.P.C.

(4) In 1958, a German doctor went on a trip to India without getting himself vaccinated against smallpox. On return to Germany, he resumed his practice, although he showed symptoms of smallpox and did not take any precautionary measures to see that he did not infect others. 18 of the patients caught the disease and two of whom died. The doctor was charged with criminal negligence and was punished with four months imprisonment and fine.

(5) A doctor while he was drunk, operated upon a woman for eclampsia. Two days later, the woman died due to the injuries produced during operation. The doctor was sentenced to one year imprisonment for want of reasonable care and skill due to intoxication.

A physician may be liable to both civil and criminal negligence by a single professional act, e.g., if a physician performs an unauthorised operation on a patient, he may be sued in civil Court for damages and prosecuted in criminal Court for assault.

#### CAUSES OF ACTION BY THE PATIENTS:

They are: (I) Physician related: (1) Breakdown in physician-patient relationship; or utter disregard for the life and safety of the patient (poor and ineffective communication with the patient and his relatives). (2) Rude behaviour of the physician. (3) Less frequent house calls. (4) Complex invasive procedures for diagnosis and treatment with resulting death or disability. (II) Patient related: (1) Unrealistic expectations of cure. (2) Poor compliance with medical recommendations. (3) Frequent self-destructive behaviour (heavy smoking, drinking, use of drugs, poor dietary management). (4) Increasing awareness of rights. (5) Comments on the treatment by another doctor. (6) Lack of consent. (7) Lack of documentation, such as provisional diagnosis, relevant findings, etc. (8) Not taking second opinion whenever there is a problem and not informing relatives if patient is serious. (9) Misperception of physician's role in the society, or his affluence. (III) Media related: Biased publicity of



negligent suits and the size of awards. (IV) Attorney related: (1) Lack of experience. (2) Monetary considerations. (V) Economic: (1) Increased cost of medical care. (2) Payment by insurance companies. (VI) Social: (1) Mobile population. (2) Consumers rights. (3) General increase in litigation.

**Defensive medicine:** Defensive medicine is ordering every test or X-ray on a patient to have a good background of hard data, and avoiding using a potentially risky treatment which may offer much benefit to the patient. This may lead to withholding of beneficial treatment to the majority of patients because of a statistical risk to the minority. The physician must not practice "defense by denial", and claim that the patient is not his, which becomes abandonment.

**PREVENTION:** (1) Establish good rapport with the patient, also with patient's families, with fellow physicians and with nursing and paramedical personnel, who may commit errors. The patient should be told of everything. Complications should be spotted out and treated. (2) Rationale: The doctor should use all available and relevant information to make diagnosis and formulate the treatment (history, physical examination, laboratory tests, X-rays, etc.). An error

in judgement is not negligence. Seek consultation where appropriate. (3) Maintain complete accurate, legible medical records. Records are the most important evidence (diagnostic and therapeutic). (4) Obtain informed consent of the patient. Do not criticise any member of the treatment team in front of the patient. Do not criticise another physician. (5) Establish hospital injury prevention programme. If an untoward result occurs, explain to the patient and treat it. Transfer the patient if the facility is incapable or inadequate to handle his problem. If a patient suffers damage due to negligence, it is better to compensate the patient. (6) Respect: An attitude of care and concern, a relationship that suggests thoughtful professionalism and a humanistic approach many times solves problems. Treat the patient as the physician would wish himself or a member of his family to be treated. (7) Risks: Inform the patient of all side-effects and anticipated risks. Risks must be identified carefully, controlled and managed to prevent injury to patients, i.e. good, desirable and achievable "patient care". The patient and his family should be told of the possible outcome of the treatment, available alternatives, and the result to be anticipated if nothing is done. (8) Maintain good records on accidents, suicides, medication errors, or problems. (9)

Table (3-1). Difference between Civil and Criminal Negligence

Trait	Civil negligence	Criminal negligence
(1) Offence :	No specific and clear violation of law need be proved.	Must have specifically violated a particular criminal law in question.
(2) Negligence :	Simple absence of care and skill.	Gross negligence, inattention or lack of competency.
(3) Conduct of physician:	It is compared to a generally accepted simple standard of professional conduct.	Not compared to a single test.
(4) Consent for act:	Good defence; cannot recover damages.	Not a defence; can be prosecuted.
(5) Trial by :	Civil Court.	Criminal Court.
(6) Evidence :	Strong evidence is sufficient.	Guilt should be proved beyond reasonable doubt.
(7) Punishment :	Liable to pay damages.	Imprisonment.

Table (3-2). Difference between Professional Negligence and Infamous Conduct

Trait	Professional negligence	Infamous conduct
(1) Offence :	Absence of care and skill or wilful negligence.	Violation of Code of Medical Ethics.
(2) Duty of care :	Should be present.	Need not be present.
(3) Damage to person :	Should be present.	Need not be present.
(4) Trial by :	Courts; civil or criminal.	State Medical Council.
(5) Punishment :	Fine or imprisonment.	Erasure of name or warning.
(6) Appeal :	To higher Court.	To State and Central Governments.



**Continuing education of physicians. (10) Participation in medico-legal seminars.**

**CORPORATE NEGLIGENCE :** It is the failure of those persons who are responsible for providing the accommodation, facilities and treatment to follow the established standard of conduct. It occurs when the hospital provides defective equipment or drugs, selects or retains incompetent employees, or fails in some other manner to meet the accepted standard of care, and such failure results in injury to a patient to whom the hospital owes a duty. In the corporate sector (hospital, nursing home, etc.), where more than one person in more than one level fails to render appropriate service to the patient, may result in some damage to patient. Here the treating doctor and also other category of persons who were negligent will be held responsible. If a hospital knows or should have known, that one of the patient is likely to be a victim of professional negligence by a doctor on its staff, the hospital is liable, even though that doctor is an independent with staff privilege at the hospital. If the doctor is employed by a patient in his private capacity, and the hospital only provides facilities for treatment, the doctor alone is held responsible for any negligence.

**ETHICAL NEGLIGENCE :** Ethical negligence is the violation of the Code of Medical Ethics. In this, no financial compensation is payable unless there is also civil negligence. If a complaint is made and the facts proved, the name of the doctor may be erased from the Medical Register. This term should be better avoided.

**Precautions against Negligence :** To prove that reasonable care and skill has been exercised, the following precautions should be taken.

- (1) Obtain informed consent of the patient.
- (2) Establish good rapport (relationship or communication) with the patient.
- (3) Keep full and accurate and legible medical records.
- (4) Employ ordinary skill and care at all times.
- (5) Confirm diagnosis by laboratory tests.
- (6) Take skiagrams in bone or joint injuries, or when diagnosis is doubtful.
- (7) Immunisation should be done whenever necessary, particularly for tetanus.
- (8) Sensitivity tests should be done before injecting preparations which are likely to produce anaphylactic shock.
- (9) In suspected cases of cancer, all laboratory investigations should be done without delay to establish early diagnosis.
- (10) No female patient should be examined unless a third person is present.
- (11) Keep yourself informed

of technical advances and use standard procedures of treatment. (12) Seek consultation where appropriate. (13) Do not criticise or condemn the professional ability of another doctor, especially in the presence of the patient. (14) Do not make a statement admitting fault on your part. (15) Do not exaggerate nor minimise the gravity of the patient's condition. Avoid from overconfident prognoses and promising too much to patient. (16) Never guarantee a cure. (17) Do not fail to exercise care in the selection of assistants and allotting duties to them. (18) The patient must not be abandoned. (19) Do not leave patient unattended during labour. (20) Inform the patient of any intended absence from practice, or recommend or make available, a qualified substitute. (21) Transfer the patient if facilities are inadequate to handle his problem. (22) Do not order a prescription over telephone because of possibility of misunderstanding as to the drugs or their dosage. (23) The drug should be identified before being injected or used otherwise. (24) Obtain consent for an operation or giving anaesthesia and to use discretion in obscure cases. (25) Frequently check the condition of equipment, and use available safety installations. (26) In a criminal wounding, operation should not be performed unless it is absolutely necessary. (27) Proper instructions should be given to the patient, and proper postoperative care should be taken. (28) In the case of death from an anaesthesia or during operation, the matter should be reported to the police authorities for holding a public inquiry. (29) Anaesthesia should be given by a qualified person. Only generally accepted anaesthesia should be given after clinical and laboratory examinations of the patient. The patient should be watched until he fully recovers from its effect. (30) No experimental method should be adopted without the consent of the patient. (31) No procedure should be undertaken beyond one's skill. (32) Do not fail to secure the consent of both husband and wife, if an operation on either is likely to result in sterility.

**Defences against Negligence :** (1) No duty owed to the plaintiff. (2) Duty discharged according to prevailing standards. (3) Misadventure. (4) Error of judgement. (5) Contributory negligence. (6) **Res judicata** (S. 300, Cr.P.C.). If a question of negligence against a doctor has already been decided by a Court in a dispute between the doctor and his patient, the patient will not be allowed to contest the same



question in another proceeding between himself and the doctor. (7) **Limitation.** A suit for damages for negligence against the doctor should be filed within two years from the date of alleged negligence. A suit filed after two years will be dismissed as being beyond the period of limitation.

#### **CONTRIBUTORY NEGLIGENCE :**

Contributory negligence is any unreasonable conduct, or absence of ordinary care on the part of the patient, or his personal attendant, which combined with the doctor's negligence, contributed to the injury complained of, as a direct, proximate cause and without which the injury would not have occurred. These include (1) failure to give the doctor accurate medical history, (2) failure to cooperate with his doctor in carrying out all reasonable and proper instructions, (3) refusal to take the suggested treatment, (4) leaving the hospital against the doctor's advice, (5) failure to seek further medical assistance if symptoms persist. As such, the doctor's negligence is not the direct, proximate cause of the injury suffered by the patient. Proximate cause means, that which in natural and continuous sequence unbroken by any efficient intervening cause produces the injury, and without which the result would not have occurred. If the doctor and the patient are negligent at the same time, it is a good defence for the doctor. The doctor cannot plead contributory negligence, if he fails to give proper instructions. The extent of contributory negligence may vary and with it will vary the doctor's liability, from complete non-liability to a substantial liability for damages. Normally, contributory negligence is only a partial defence, and the Court has right to fix liability between the parties, and damages awarded may be reduced accordingly. The burden of proof lies entirely on the doctor. If a patient consent's to take the risk of the injurious event actually taking place, he cannot claim damages. If a doctor is not negligent, but if a patient is negligent which results in injury, it is called negligence of the patient.

**LIMITATIONS TO CONTRIBUTORY NEGLIGENCE :** (a) **The last clear chance doctrine :** Under this rule, a person who has negligently placed himself in a position of danger may recover damages, if the doctor discovered the danger while there was still time to avoid the injury or failed to do so. (b) **The avoidable consequences rule:** This is applicable where the negligence of the injured person occurs after that of the doctor being sued and increases the severity of injury. In such cases, the patient is not guilty of

contributory negligence, since his actions were not a cause of the injury.

**CASE:** A surgeon was sued for not removing a swab from the vagina of patient. The patient complained about pain in the vagina to a nurse some time after the operation. The nurse examined the vagina and removed the swab. The patient did not inform the surgeon about the swab in the vagina. The Court held that the doctor was guilty of contributory negligence.

**THERAPEUTIC MISADVENTURE:** A misadventure is mischance or accident or disaster. Misadventure is of three types: (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). Therapeutic misadventure 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 the hospital.

Almost every therapeutic drug and every therapeutic procedure can cause death. Injection of serum, antibiotics, etc. may cause anaphylaxis in sensitive persons. History of sensitivity should be obtained before injecting such substances. Negative history and negative test does not rule out rare possibility of anaphylactoid reaction and even death. A physician is not liable for injuries resulting from adverse reaction to drug unless some negligence on his part contributed to cause the injury. Ignorance of the possibility of a reaction, or continuation in the prescribing of a drug with adverse reaction amounts to negligence. While prescribing a drug that has adverse side-effects, the doctor must be certain that the prescribed drug was the proper one for the disease. If there is any other drug which would be effective in treating the disease and is less likely to cause an allergic reaction, it should be prescribed. The doctor should particularly tell a patient of possible drowsiness or similar accident-producing reaction caused by many drugs. Some examples are: (1) Hypersensitivity reaction, sometimes serious or fatal, may be caused by penicillin, aspirin, tetracycline, etc. (2) Excessive administration of an antidote to a poisoned patient, may cause death. (3) Prolonged use of stilboesterol may cause breast cancer. (4) I<sup>131</sup> therapy may cause thyroid cancer. (5) Electric equipment, hot water pads, and heating pads may produce burns. (6) Blood transfusion may cause serious or fatal complications from bleeding resulting from



haemolytic reaction due to hypofibrinogenaemia, hypothrombinaemia and thrombocytopenia. Other complications are haemosiderosis, viral hepatitis, hyperkalaemia and hypocalcaemia. (7) Radiological procedures used for diagnostic purposes may prove fatal, e.g., poisoning by barium enema, traumatic rupture of the rectum and chemical peritonitis during barium enema. (8) Foetal and neonatal deaths in utero may occur from drugs administered to the mother during pregnancy, e.g., dicumarol, diabenese, serpasil, iodides, synthetic vitamin K, thiazide diuretics, etc.

**NEOPLASIA INDUCED BY MEDICAL TREATMENT:** It is difficult to prove a cause and effect relationship between the therapy and trauma. (1) Haemangioendo-thelioma of liver induced by thorium dioxide is the classic example. (2) Radiation will cause leukaemia. (3) X-radiation or radium application to the head, neck or upper thorax for various non-malignant conditions during childhood have an increased risk of developing thyroid gland cancer and also of the salivary glands and other head and neck structures. (4) Chlornaphazine and phenacetin may cause urinary tract carcinoma. (5) Contraceptive steroids can cause adenomas of the liver in females, and if continued unintentionally during pregnancy, the infant may develop a benign liver tumour. (6) Diethylstilboesterol causes vaginal adenosis and clear cell carcinoma of the vagina. (7) Exposure to pesticides cause skin and vulvar carcinoma.

To avoid a therapeutic misadventure in prescribing drugs, the following points should be noted. (1) Before prescribing any drug known to cause any adverse reaction, the doctor should make a reasonable effort to determine if any adverse reaction is likely to occur. (2) Sensitivity tests should be done before injecting preparations which are likely to produce anaphylactic shock. (3) The doctor should warn the patient of side-effects which may occur while he is taking the drug. (4) The doctor should inform the patient about the possibilities of permanent side-effects.

**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). Three conditions must be satisfied: (1) There must be an employer-employee relationship, (2) the employee's conduct must occur within the scope of his employment, and (3) while on the job.

(1) In general practice, the principal doctor becomes responsible for any negligence of his assistant. Both may be sued by the patient, even though the principal has no part in the negligent act. The same applies where the principal employs non-medical servants. (2) When two doctors practice as partners, each is liable for negligence of the other, even though he may have no part in the negligent act. (3) When two or more independent doctors are attending on a patient, each may be held liable for the negligence of others that he observes, or in the ordinary course should have observed and allows it to continue without objection.

**"Borrowed servant doctrine":** An employee may serve more than one employer, e.g., the nurse employed by a hospital to assist in operations may be the "borrowed servant" of the operating surgeon during the operation, and the servant of the hospital for all other purposes. In this case, the lending employer temporarily surrenders control over his worker and the borrowing employer temporarily takes over control. (4) A doctor may be associated temporarily with another doctor with the establishment of an employee-employer relationship between them. Thus, if one doctor assists another in the operating room for a fee, the assistant is considered as an employee of the principal surgeon. (5) If a physician has supervisory control and the right to give orders to a hospital employee in regard to the particular act, in the performance of which the employee is negligent, the physician becomes legally liable for the harm caused by the employee. (6) If a swab, sponge, instrument, etc., is left in the patient's body after the operation, the surgeon is liable for damages. (7) A hospital, as an employer, is responsible for negligence of its employees who are acting under its supervision and control. (8) Hospital management will be held responsible for the mistakes of resident physicians and interns in training, who are considered employees when performing their normal duties. (9) A physician is responsible for the acts of the interns and residents carried out under his direct supervision and control. (10) When employers provide medical services to their employees, or conduct pre-employment examination of prospective employees, they may be liable for the negligence of their doctors. (11) Insurers who have contracted to provide medical services may be liable for the negligence of their physicians. (12) The employer



or the insurer of employees covered by Workmen's Compensation Act, may be liable for the negligence of their doctors. (13) Ordinarily a surgeon is not liable for the negligence of anaesthetist, and the anaesthetist is not liable for the negligence of the operating surgeon. (14) Physicians and surgeons are not responsible for the negligent acts of competent nurse or other hospital personnel, unless such acts are carried out under their direct supervision and control. (15) When a doctor recommends another doctor to his patient after due care, he is not liable for the negligence of the new physician, but he becomes liable if he knowingly refers his patient to an incompetent surgeon. (16) When a sick or injured person consults his own doctor for diagnosis and treatment, and the latter recommends hospitalisation, the hospital to which the patient is admitted is not liable for the doctor's negligence resulting in injury to the patient. (17) Hospitals cannot be held responsible for the negligent acts of members of the superior medical staff in the treatment of patients, if it can be proved that the managers exercised the due care and skill, in selecting properly qualified and experienced staff. (18) If a physician has written a prescription properly, he is not liable for a pharmacist's negligence in preparing it, but he may be liable when he orders a prescription over the telephone resulting in misunderstanding as to the drugs or their dosage.

Both the employer and employee are sued by the patient, because the employee may lack funds for paying the damages. Usually, liability will be fixed upon those actually at fault, and those whose control over the negligent is proved. The employer may be ordered by the Court to pay compensation to the injured patient. In such cases, the employer can engage in "third party proceeding", against the negligent doctor or employee asking for repayment.

### MEDICAL RECORDS

Medical records may be required in cases of professional negligence, for claims of third party payment under health and accident insurance, life insurance policies, policies for disability, accidental deaths, Workmen's Compensation Act, traffic accidents, etc. They are also useful for follow-up of the patients, evaluation of drug therapy and cost accounting.

The minimum requirements of accurate medical records are: (1) Name, father's name, age, sex, occupation and address. (2) Date and hour of visiting

the doctor/nursing home/hospital. (3) Brief history of present illness and relevant past history. (4) Findings of general physical and systemic examination. (5) Diagnostic aids used and any reports received concerning the patient. (6) Date and hour of consultation with details and opinion of consultant. (7) Clinical impression with provisional and final diagnosis. (8) Details of treatment including any procedures/operations recommended or performed. (9) In emergency cases, specific clinical data, and observations should be noted periodically. (10) Progress of the patient. (11) In in-patients, the condition at the time of discharge, i.e. whether cured or relieved of complaints or referred to any other hospital or discharged on request or absconded should be noted.

The medical records must be accurate, appropriate, chronological, factual, relevant and complete. Nothing should be altered, deleted, substituted or added from the record, i.e. tampering should not be done. If tampering is done patient may be awarded large sums, even though there has been no negligence. The omission of essential details from the notes may cast a doubt on the truthfulness of the witness. If a correction has to be made of a prior entry on the record, it should not be totally obliterated, but a single line should be drawn through the word to be changed, and the correct information should be written above and initialled.

Good notes are of great value, not only when handing a patient over to another doctor, but also in meeting any criticism that may arise. If a patient refuses to accept the advice of his doctor, this fact should be recorded in writing. When there is a conflict of evidence, the Court will attach importance to the notes written at the time. Good notes may be of the greatest importance in supporting the doctor's evidence as against that of the plaintiff and his witnesses.

Patient has the right to know what is in his records and is entitled to a copy of his hospital record on discharge, by paying the cost of reproduction. The next of kin can get the record in case of patient's death. Hospital has the responsibility to supervise the maintenance of appropriate, accurate, timely and up-to-date patient's records. The rights of patients to have their hospital medical records regarded as confidential must be respected. If in the doctor's judgement making the record available to the patient would be harmful or dangerous to the



patient, or not in his best interest (professional or therapeutic discretion"), the hospital can avoid to issue the record to the patient. The medical records of a patient (in-patient or out-patient) should not be given to any person without the consent of the patient. The police do not have a right to demand medical records except when there is statutory provision for such requisitions. The patient's record cannot be used in educational or diagnostic conferences or clinics or for publications, without the patient's consent. Hospitals have right to use the medical records without the consent of patient for statistical purposes and quality of care determinations. In the absence of agreement to the contrary, X-ray plates are the property of the treating doctor as part of his case record. The patient buys the skill and treatment rather than the X-ray films. The records should be maintained at least for 3 years.

#### Format for Medical Record

(Regulation 3.1 of M.C.I.)

Name of the patient	Age
Sex	Address
Date of first visit	Occupation
Clinical note (summary) of the case	
Provisional diagnosis	
Investigations advised with reports	
Diagnosis after investigation	Observations
Advice	
Follow up	
Date	Signature in full
	Name of treating physician

### PRODUCTS LIABILITY

Products liability refers to the physical agent which caused the injury or death of the patient during treatment by the doctor. The injury or death of the patient may result from the unexpected by-product of faulty, defective, or negligently designed medical or surgical instruments or inadequate operating instructions. In such cases, the manufacturer becomes responsible for injury or death. The doctor must prove that the manufacturer departed from standards of due care, with respect to negligent design, manufacture, assembly, packaging, failure to test and inspect for defects, or failure to warn or give adequate instructions. If the instrument functioned satisfactorily in previous operations or for several previous years in the hospital's possession, it is a proof that it was not defective at the time of supplying. Later, if the instrument develops a defect through ordinary and

gradual wear and tear, or if the physician or the hospital misuses the manufacturer's medical products, the hospital or physician owner are liable for the failure to inspect, test and repair such defects. But the manufacturer becomes responsible, if the doctor can prove that the subsequent development of this defect was due to negligent design, structurally inferior component material, or improper assembly. An adequate warning cautions the user to follow directions, and may also notify the risk of disregarding directions.

The manufacturer of a drug keeps a "package insert" in the drug carton or attaches it to the label of the immediate container. It bears adequate information for its use, including indications, effects, dosages, routes, methods and frequency and duration of administration, and any relevant side effects, hazards, contraindications and precautions under which registered practitioners can use the drug safely and for the purposes for which it is intended, including all purposes for which it is advertised or represented. The burden of proving the safety and effectiveness of a new drug or new uses of an approved drug rests with the manufacturer.

The manufacturer of medicines has a legal duty to use care in research and development of drugs. The manufacturer is liable, if a patient is injured due to a drug reaction due to the negligence or breach of warranty on the part of manufacturer. The manufacturer is also liable due to the harm caused by the contamination of a drug. Once the physician has been warned about possible side-effects, the manufacturer has no duty to ensure that the warning reaches the patient under normal circumstances. From the information received from the manufacturer, and other medical sources, the doctor is required to inform the patient of those reasonably expected side-effects likely to occur in the particular circumstances. If the doctor has or should have information, knowledge, or suspicion from any source that a certain drug is likely to produce serious side-effects, he may become legally liable for prescribing it, if any substituted drug would have been adequate and satisfactory.

The manufacturer, seller or anyone in the chain of sale, may be sued by the buyer, by another user of the product or by some third party, whose bodily injury is caused by the product. The patient has to prove that a defect in production and testing in the product existed, before it left the manufacturer's hands and that the defect was the proximate cause



of the patient's injury. Evidence will have to be produced as to the drug's physical and chemical qualities, so as to show a need to warnings. The product would be defective, if a drug manufacturer knew or should have known the presence of certain adverse effects and then failed to warn. Causal connection should be established between the lack of warning and resulting harm.

**MEDICAL INDEMNITY INSURANCE** : It is a contract under which the insurance company agrees, in exchange for the payment of premiums, to indemnify (reimburse to compensate) the insured doctor as a result of his claimed professional negligence. The objects of Medical Indemnity Insurance are: (1) To look after and protect the professional interests of the insured doctor. (2) To arrange, conduct and pay for the defence of such doctors. (3) To arrange all other professional assistance including pre-litigation advice. (4) To indemnify the insured doctor in respect of any loss or expense directly arising from actions; claims and demands against him on grounds of professional negligence, misconduct, etc. When any dispute or allegation of negligence arises, the society must be contacted before any admissions or correspondence are entered into.

**EUTHANASIA (mercy killing)**: It means producing painless death of a person suffering from hopelessly incurable and painful disease.

**Types**: (1) Active or positive. (2) Passive or negative. **Active euthanasia** is a positive merciful act, to end useless suffering or a meaningless existence. It is an act of commission, e.g. by giving large doses of drugs to hasten death. **Passive euthanasia** means discontinuing or not using extraordinary life-sustaining measures to prolong life. This includes acts of omission, such as failure to resuscitate a terminally ill or hopelessly incapacitated patient or a severely defective newborn infant. It is not using measures that would probably delay death and permits natural death to occur. **Voluntary euthanasia** means at the will of the person, and **involuntary** means against the will of the person, i.e., compulsory. **Non-voluntary** refers to cases of persons incapable of making their wishes known, e.g., in persons with irreversible coma or severely defective infants. Euthanasia advocates the administration of lethal doses of opium or other narcotic drugs. It has no legal sanction.

Netherlands is the first country to legalise

euthanasia from April, 2002 in persons above 12 years. Strict rules govern assisted suicide. Patients must face a future of unbearable, interminable suffering and must make a voluntary, well-considered request to die. Another physician must be consulted first and life must be ended in a medically appropriate way.

**Iatrogenic Diseases**: Iatrogenic diseases can be defined as a disease that results from administration of a drug, or medical or surgical acts for prophylaxis, diagnosis or treatment.

**Deaths due to Medical Care**: Deaths may occur due to : (1) Complications of anaesthesia. (2) Complications of surgery. (3) Nosocomial infections. The use and/or misuse of urinary catheters, techniques and equipment employed in intravenous therapy, hyperalimentation, and respiratory therapy cause most of these infections. (4) Therapeutic misadventure. (5) Professional negligence.

### CONSENT IN MEDICAL PRACTICE

Consent means voluntary agreement, compliance or permission. To be legally valid, it must be given after understanding what it is given for, and of risks involved.

**Reasons for obtaining Consent** : (1) To examine, treat or operate upon a patient without consent is assault in law, even if it is beneficial and done in good faith. The patient may recover damages. (2) If a doctor fails to give the required information to patient before asking for his consent to a particular operation or treatment, he may be charged for negligence.

**Kinds of Consent** : Consent may be : (1) Express, i.e., specifically stated by the patient, or (2) Implied. Express consent may be (a) verbal, or (b) written.

An adult patient of sound mind who (1) knows that he can either agree or refuse to submit to treatment or an operation, (2) knows or has been fully or fairly informed by his doctor as to what is to be done, and (3) then cooperated with the physician, has impliedly consented in words. The fact that a patient attends the hospital or calls the doctor to his house complaining of illness, implies that he consents to a general physical examination, to determine the nature of the illness. Consent is implied when a patient holds out his arm for an injection. Such implied consent is the consent usually given in routine practice.

**Full Disclosure** : The facts which a doctor must disclose depends on the normal practice in his community, and on the circumstances of the case.



The doctor has to decide, after taking into consideration all aspects of the patient's personality, physical and mental state, how much can be safely disclosed. The doctor need not disclose risks of which he himself is unaware. A physician need not inform the patient of risks that a person of average intelligence would be aware of, or in an emergency situation. In general, the patient should ordinarily be told everything. The physician need not give information to those patients who waive their rights, but the waiver should be clearly written in the record.

**Therapeutic privilege:** This is an exception to the rule of "full disclosure". Full disclosure could result in frightening a patient who is already fearful or who is an emotionally disturbed individual, and who may refuse the treatment when there is really little risk. It is only in the case of frank psychosis or extreme psychoneurosis that the patient will be incapable of accepting the information. In these cases, the doctor may use discretion as to the facts which he discloses. The doctor should carefully note his decision in the patient's record, explaining his intentions and the reasons. He should request a consultation to establish that the patient is emotionally disturbed. The presence of a malignancy, or a unavoidable fatal lesion may not be disclosed, if the doctor feels the patient is not able to tolerate the knowledge. If possible, the physician should explain the risks to the patient's spouse or next of kin.

**Prudent patient rule,** i.e. what a prudent person in the patient's position would have decided if adequately informed about all the reasonably foreseeable risks.

**INFORMED CONSENT :** Informed consent implies an understanding by the patient of (1) the nature of his condition, (2) the nature of the proposed treatment or procedure, (3) the alternative procedure, (4) the risks and benefits involved in both the proposed and alternative procedure, (5) the potential risks of not receiving treatment, and (6) the relative chances of success or failure of both procedures, so that he may accept or reject the procedure. All disclosures must be in language the patient can understand. This disclosure will very much reduce litigation, when the results are unsatisfactory or unexpected. The patient must show that the doctor did not adhere to accepted medical standards to prove liability for lack of

informed consent.

**Informed Refusal :** The physician has a duty to disclose adequately and appropriately to the patient, the risks or possible consequences of refusal to undergo a test or treatment. After understanding all the facts, the patient can refuse to submit to treatment or an operation.

**Paternalism** is an abuse of medical knowledge so as to distort the doctor-patient relationship in such a way that the patient is deprived of his autonomy, or of his ability to make a rational choice. This is seen in the context of disclosure to the patient.

**RULES OF CONSENT :** (1) Consent is necessary for every medical examination. Ordinarily, formal consent to medical examination is not required, because the patient behaves in a manner which implies consent.

(2) Oral consent should be obtained in the presence of a disinterested third party, e.g., nurse.

(3) Written consent is not necessary in any case. However, it should be taken for proving the same in the Court if necessity arises. Written consent should refer to one specific procedure, and not blanket permission on admission to hospital. Written consent should be in proper form and suitably drafted for the circumstances. The consent form should include specific consent to the administration of a general anaesthetic. The nature of the operation should be entered on the form as precisely as is consistent with the best interests of the patients. The wording should include a phrase to confirm that the patient has been informed of the nature of the procedure, before signing takes place. The written consent should be witnessed by another person, present at the signing to prevent any allegation that the consent was forged or obtained under pressure or compulsion.

(4) Any procedure beyond routine physical examination, such as operation, blood transfusion, collection of blood, etc. requires express consent. It must be taken before the act, but not at the time of admission into the hospital.

(5) The doctor should explain the object of the examination to the patient, and patient should be informed that the findings will be included in a medical report.

(6) The doctor should inform the patient that he has right to refuse to submit to examination and that the result may go against him. If the patient refuses, he cannot be examined.



(7) The consent should be free, voluntary, clear, intelligent, informed, direct, and personal. There should be no fraud, misrepresentation of facts, undue influence, compulsion, threat of physical injury, death or other consequences.

(8) In criminal cases, the victim cannot be examined without his/her consent. The Court also cannot force a person to get medically examined, against his will. (A) In cases of rape, the victim should not be examined without written consent. (B) In medico-legal cases of pregnancy, delivery and abortion, the woman should not be examined without her consent.

(9) A person is arrested on a charge of committing an offence, and there may be reasons for believing that an examination of his person will provide evidence as to the commission of an offence. A registered medical practitioner can examine such person, even by using reasonable force, if the examination is requested by a police officer not below the rank of sub-inspector. If the accused refuses examination, this may go against him in criminal proceedings. (B) In the case of a female, the examination should be made only by or under the supervision of a female registered medical practitioner (S.53, Cr.P.C.). Under S.54, Cr.P.C. an arrested person at his request may be examined by a doctor to detect evidence in his favour.

(10) In cases of drunkenness, the person should not be examined and blood, urine, or breath should not be collected without his written consent. But, if the person becomes unconscious or incapable of giving consent, examination and treatment can be carried out. The consent of guardian or of relatives if available, should be taken. The person can be examined without consent, if requested by the sub-inspector of police.

(11) A person above 18 years of age can give valid consent to suffer any harm, which may result from an act not intended or not known to cause death or grievous hurt (Sec.87,I.P.C.).

**A person may be suffering from a disease which is certain to shorten his life. He can give free and informed consent to take the risk of operation which though fatal in the majority of cases is the only available treatment. The surgeon cannot be held responsible, if the patient dies.**

(12) 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 (Sec. 88, I.P.C.).

**If a surgeon operates on a patient in good faith and for his benefit, even though the operation is a risk, he cannot be held responsible if the patient dies.**

S.87 and 88, I.P.C. are ambiguous and are not specific for medical treatment. The implication is that consent of parents or guardians is necessary for surgical or medical procedures if the patient is a minor.

(13) A child under 12 years of age and an insane person 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 the parent or guardian should be taken (Sec.89,I.P.C.). If they refuse, the doctor cannot treat the patient even to save the life.

**A father giving consent for an operation on the child in good faith and for the child's benefit, even though the operation is risky, cannot be held responsible if the child dies.**

**Loco Parentis** : In an emergency involving children, when their parents or guardians are not available, consent is taken from the person-in-charge of the child, e.g., a school teacher can give consent for treating a child who becomes sick during a picnic away from home town, or the consent of the headmaster of a residential school.

(14) A consent given by a person under fear of injury, or due to misunderstanding of a fact is not valid. The consent given by an insane or intoxicated person, who is unable to understand the nature and consequences of that to which he gives his consent is invalid (Sec. 90, I.P.C.).

**To represent to a patient that an operation is necessary to save life or to preserve health when that is not the case or to indicate that it will give greater relief than there is any reasonable prospect of obtaining is to perpetrate a fraud on the patient that vitiates his consent.**

(15) Any harm caused to a person in good faith, even without that person's consent is not an offence, if the circumstances are such that it is impossible for that person to signify consent, and has no guardian or other person in lawful charge of him from whom it is possible to obtain consent in time for the thing to be done in benefit (Sec. 92, I.P.C.). Nothing is said to be done in good faith which is done without due care and attention (S.52, I.P.C.).

**A person may be involved in an accident, which may necessitate an amputation; if it is done without his consent, it is not an offence. In an emergency, the**



law implies consent. An emergency is defined as a medical situation, such as to render immediate treatment advisable either to save life or to safeguard health.

(16) Any communication made in good faith for the benefit of a person is not an offence, if it causes harm to that person to whom it is made (S.93, I.P.C.).

A physician in good faith tells a patient that he cannot live. The patient dies in consequence of the shock. The physician has not committed any offence.

(17) The doctor should inform reasonably to the patient about the nature, consequences and risks of the examination or operation before taking the consent. In an obscure case, the doctor should obtain an open consent to use his discretion. When there are two or more methods of treatment, the patient should be allowed to choose and give consent for any method.

If in the course of an operation to which the patient has consented, the physician discovers conditions that had not been anticipated before the operation began, and which would endanger the life or health of the patient if not corrected, the doctor would be justified in extending the operation to correct them, even though no express consent was obtained. If an anaesthetist administers a type of anaesthetic expressly prohibited by the patient, he will be responsible for damages resulting from an unfortunate occurrence caused by the anaesthetic, even though there is no negligence in its administration.

(18) Consent of the inmates of the hostel, etc., is necessary if they are above 12 years. Within 12 years, the head master or warden can give consent. If an inmate above 12 years refuses treatment, and he is likely to spread the disease, he can be asked to leave the hostel. However, if he stays in hostel, he can be treated without his consent.

(19) When an operation is made compulsorily by law, e.g., vaccination, the law provides the consent.

(20) A prisoner can be treated forcibly without consent in the interest of the society.

(21) Consent given for committing a crime or an illegal act, such as criminal abortion is invalid.

(22) Consent is not a defence in cases of professional negligence.

(23) The nature of illness of a patient should not be disclosed to any third party without the consent of the patient.

(24) For contraceptive sterilisation, consent of both the husband and wife should be obtained.

(25) The consent of one spouse is not necessary for an operation or treatment of other. A husband has no right to refuse consent to any operation, including a gynaecological operation, which is required to safeguard the health of his wife. The consent of wife is enough. It is advisable to take the consent of the spouse whenever practicable, especially if the operation involves danger to life, may destroy or limit sex functions, or may result in the death of an unborn child.

(26) It is unlawful to detain an adult patient in hospital against his will. If a patient demands discharge against medical advice, this should be recorded and his signature obtained.

(27) A living adult person can give consent for donating one of his kidneys to be grafted into another person. The donor must be informed of the procedure involved and possible risks. The donation should not be accepted, if there is any risk of life of donor.

(28) If any person has donated his eyes to be used for therapeutic purpose after his death, the eyes can be removed only with the consent of guardian or legal heirs.

(29) If any person has donated his body to be used for therapeutic or research purposes after his death, it is not binding on his spouse or next of kin. For organ transplantation, the organs of the dead person, such as heart, kidney, liver, etc. should not be removed without the consent of the guardian or legal heirs. Precautions should be taken to preserve the anonymity of both donor and recipient.

(30) Pathological autopsy should not be conducted without the consent of the guardian or legal heirs of the deceased. If the autopsy is done without consent, the doctor is liable for damages for the mental anguish suffered by heirs due to the mutilation of the body. Specific authorisation should be obtained for retention of organs and parts of the body. In medico-legal autopsies (statutory authorisation), consent is not required and the doctor can remove from the cadaver anything that is essential for purposes of examination.

**CASE : (1) MOSS V. RISHWORTH:** A 11 year old girl was taken to surgeon for removal of tonsils and adenoids by her two adult sisters. The child died under anaesthetic. The Court held that there was no emergency which would excuse the need for parental consent, and the father could recover damages.

(2) **JOCKOVACH V. YOCUM:** The arm of a 7 year old boy was crushed by a train. The boy's arm



was amputated immediately as the doctors could not contact parents. The consent of the parents was implied by the emergency.

(3) **WELLS V. MC GEHEE**: A 7 year old child died under anaesthesia for treatment of a broken arm, which was given without the consent of the mother as she could not be contacted. The Court held that an emergency existed.

(4) **DRUMMOND'S CASE**: Drummond sued a woman patient for recovery of fees. The patient counterclaimed damages as a drug was administered to her, without her consent. She alleged that phenobarbitone, which she refused to take, was mixed in soup and meat and given to her daily, which prolonged her stay in the nursing home, as a psychological consequence for 16 weeks. The Court held that the administration of a drug to a person without that person's knowledge and consent was assault, and awarded nominal damages as the drug did not cause substantial harm.

#### **PENAL PROVISIONS APPLICABLE TO MEDICAL PRACTICE:**

**S. 118, I.P.C.** : Concealing design to commit offence punishable with death or imprisonment for life.

**S. 175, I.P.C.** : Omission to produce document to public servant by person legally bound to produce it (imprisonment one to six months).

**S. 176, I.P.C.** : Omission to give notice or information to public servant by person legally bound to give it (imprisonment up to one month).

**S. 177, I.P.C.** : Furnishing false information (imprisonment up to six months).

**S. 178, I.P.C.** : Refusing oath or affirmation when duly required by public servant to make it (imprisonment up to six months).

**S. 179, I.P.C.** : Refusing to answer public servant authorised to question (imprisonment up to six months).

**S. 182, I.P.C.** : False information with intent to cause public servant to use his lawful power to the injury of another person (imprisonment up to six months).

**S. 191, I.P.C.** : Giving false evidence.

**S. 192, I.P.C.** : Fabricating false evidence.

**S. 193, I.P.C.** : Punishment for false evidence (imprisonment up to seven months).

**S. 194, I.P.C.** : Giving or fabricating false evidence with intent to procure conviction of capital offence (imprisonment up to ten months).

**S. 195, I.P.C.** : Giving or fabricating false

evidence with intent to procure conviction of offence punishable with imprisonment for life or imprisonment.

**S. 197, I.P.C.** : Issuing or signing false certificate (imprisonment up to seven months).

**S. 201, I.P.C.** : Causing disappearance of evidence of offence, or giving false information to screen offenders (imprisonment up to ten years).

**S. 202, I.P.C.** : Intentional omission to give information of offence by person bound to inform (imprisonment up to six months).

**S. 203, I.P.C.** : Giving false information respecting an offence committed (imprisonment up to two years).

**S. 204, I.P.C.** : Destruction of document to prevent its production as evidence (imprisonment up to two years).

**S. 269, I.P.C.** : Negligent act likely to spread infection of disease dangerous to life (imprisonment up to six months).

**S. 270, I.P.C.** : Malignant act likely to spread infection of disease dangerous to life (imprisonment up to two years).

**S. 39, Cr. P.C.** : Every person, aware of the commission of, or of the intention of any other person to commit any offence punishable under I.P.C. shall forthwith give information to the nearest Magistrate or police officer of such commission or intention.

**S. 160, Cr.P.C.** : Police officer has the power to summon any witness (doctor) to police station for recording a statement.

**S. 161, Cr.P.C.** : The police has the power to examine witnesses.

**S. 162, Cr.P.C.** : Oral statements made to the police and recorded by the police should not be signed.

**Legal protection** to medical doctors is provided by S. 88 to 93, I.P.C.

**MALINGERING** : Malingering or shamming means conscious, planned feigning or pretending a disease for the sake of gain. Diseases may be feigned for several reasons, such as by soldiers or policemen to avoid their duties, by prisoners to avoid hard work, by businessmen to avoid business contracts, by workmen to claim compensation, by beggars to attract public sympathy, by criminals to avoid legal responsibility, etc. The diseases that may be feigned are many, e.g., dyspepsia, intestinal colic, ulcers, spitting of blood,



ophthalmia, diabetes, rheumatism, lumbago, neurasthenia, aphasia, sciatica, vertigo, epilepsy, insanity, paralysis of the limbs, burns, artificial bruises, etc. Patients can distort or exaggerate their symptoms but true simulation is very rare. (1) The patient may injure his nasopharynx with a sharp instrument, swallow the blood and regurgitate it in front of the doctor to mimic haematemesis. (2) A skilful puncturing of the anal or vaginal mucosa, may produce bleeding. (3) Excessive intake of digitalis may simulate a heart condition. (4) Eating of large amount of carrot will produce carotinaemia and may simulate jaundice. (5) Chronic ingestion of coumarin will induce a haemorrhagic diathesis. In many cases detection is easy, but in some cases it is difficult.

The history of the case should be taken from the person himself, and his relatives or friends, and any inconsistencies in his description of the symptoms noted. Usually, the signs and symptoms do not conform to any known disease. Malingering can be diagnosed by keeping the patient under observation and watching him without his knowledge. A complete examination is essential after removing the bandages if any, and washing the part. Rarely an anaesthetic may be given to detect malingering.

## HUMAN EXPERIMENTATION

**DECLARATION OF HELSINKI :** World Medical Association drew up a Code of Ethics on human experimentation in 1964 which was revised in 1975.

(1) **Basic Principles :** Bio-medical research involving human subjects must conform to the moral and scientific principles that justify medical research, which should be based on scientifically established facts and animal and laboratory experiments. It must be conducted by qualified medical and other personnel and should be preceded by careful assessment of inherent risks in comparison to expected advantages to the subject or others. Particular care should be taken in research liable to lead to personality changes.

(2) **Clinical Research Combined with Professional Care :** The doctor must be free to use a new therapeutic measure which is likely to save a patient's life, re-establish health or alleviate suffering and may be continued if justified by its therapeutic value for the patient, provided consent has been taken of the patient or his legal guardian.

(3) **Non-therapeutic Clinical Research :** A doctor's duty is to remain the protector of the life and health of a person, and as such, in a purely scientific clinical research, the involved risks should be explained and

a free written consent should be taken from him or his legal guardian, with a proviso of his right to withdraw from the investigations whenever he likes. The right of parents or guardian to give consent is being questioned.

Human experimentation may be: (1) Therapeutic experimentation is concerned primarily with improving the condition of a particular patient under treatment. (2) Research experiment is concerned primarily with using a human subject as a means of expanding scientific knowledge for the benefit of humanity. (3) Innovative experiments are therapeutic procedures that have not yet earned a place in medical practice.

Experimental procedures should not vary too radically from accepted methods, and they must be tried only after the failure of customary methods. The innovator must show that he possessed sufficient prior knowledge of the probability of success of the medical technique and of its collateral risks. He must know whether the probable success of the technique outweighs its collateral risks. Extensive animal research is an absolute pre-requisite to the use of an innovative technique in the treatment of human beings. The most difficult innovative cases will be those in which prior animal research is impossible or would be uninformative. Any appraisal of an innovative technique's propriety must be made in the light of the patient's interests. The treatment should be given cautiously and its after-effects should be noted and appreciated. Experiment on volunteers can only be justified if they do no significant harm to the subject and the results are likely to be beneficial.

It would be unethical to do something merely by way of experimentation, i.e. which is not strictly related to the cure of the patient's illness. There must also be no great risk in the proposed experimentation, even if the patient consents to run the great risk. A new experiment should not be undertaken merely to find out its efficacy, if there is already a treatment which is equally efficient. The experimentation should be stopped as soon as ill-effect is noted which should be immediately remedied. In considering whether a new treatment is as efficacious as an old one, side-effects of the two treatments and their cost should be considered.

**THE WORKMEN'S COMPENSATION ACT, 1923 :** This Act provides for the payment of compensation to workmen for injuries sustained by them by accident, arising out of and in the course of employment. If a workman is killed, his dependants will be entitled to compensation for his death. Under the Act, if a workman contracts any disease



specified therein as an occupational disease peculiar to that employment (anthrax, primary cancer of the skin, pathological manifestations due to X-rays, radium, etc., pneumoconiosis, poisoning by lead, phosphorus, mercury, arsenic etc.), it is deemed to be an injury by accident for purpose of compensation. The amount of compensation depends upon whether the injury has caused death, permanent total disablement, or permanent partial disablement.

Legally, disability is physical defect or impairment and the resulting actual or potential deterioration of social or economic status. Disability amounts to inability or incapacity to meet established standards of efficiency and social, occupational, or economic responsibility. Any reasonable medical sequence that connects a disability or death with an event at work is legally adequate grounds for awarding compensation. The employer will not be liable to pay compensation in respect of any injury which does not result in death or permanent total disablement, caused by an accident if the workman at the time of sustaining injury was under the influence of drink or drugs, or wilfully disregarded or removed any safety guard or other device provided for the safety. The workman is obliged to get himself examined by a qualified medical practitioner free of charge, either on the request of the employer or as directed by the Commissioner.

In all industrial diseases and injuries, medical evidence will be necessary. As such, it is important for a doctor to keep complete records of any injury sustained by an employee during the course of employment. It should be determined whether or not there is any causal relationship between an accident or injury and a death and of acceleration or aggravation of a pre-existing natural disease process. He should diagnose and evaluate the presence and extent of occupational disease. The medical certificate required to be issued in all these cases should be conscientious, accurate and without any favour.

#### **CONSUMER PROTECTION ACT, (CPA/ COPRA) 1986 (Amended in 2002)**

This Act seeks to provide for better protection of the interests of consumers and for that purpose provides for the establishment of Consumer Councils and other authorities for the settlement of consumer's disputes and for matters connected therewith. The Act covers all private, corporate and public sector enterprises. Services availed for commercial purposes have been excluded, thereby making them oriented only to the disputes of ordinary consumers. The District, State and National Commission (quasi-

judicial bodies) have been established who look into the complaints of consumers, where defect or deficiency of services have come to the notice of the consumer. Defect means any fault, imperfection, or short-coming in the quality, quantity, potency, purity or standard. Deficiency means any fault, imperfection, short-coming or inadequacy in the quality, nature and manner of performance. They provide speedy and simple solution to consumers disputes. These quasi-judicial bodies observe the principles of natural justice, and are empowered to give reliefs of a specific nature, and award wherever appropriate compensation to consumers. It also prescribes penalties for non-compliance of the orders.

**Consumer Disputes Redressal Agencies:** (1) District Forum. (2) State Commission. (3) Central Commission. (1) District Forum consists of 3 members, (two members nominated by the State Government from among well-known public citizens), presided by a serving or retired District Judge. It entertains claims up to twenty lakhs. (2) State Commission consists of 3 members, presided by a serving or retired High Court Judge, and entertains claims between 20 lakhs to one crore. (3) National Commission consists of 5 members presided by a retired Supreme Court Judge, and entertains claims of over rupees one crore. Provision has been made for the National Commission and the State Commission to establish multiple benches for speedy disposal of cases.

It has been made mandatory for the State Governments to establish State Consumer Protection Councils. Similarly, they shall establish District Consumer Protection Councils under the chairmanship of District Collector to promote and protect consumer interest.

**Manner in which complaint shall be made:** A complaint, in relation to any goods sold or delivered or any service provided or agreed to be provided may be filed with a District Forum by (a) consumer, (b) recognised consumer association, (c) one or more consumers, (d) Central or State Government. If the consumer dies, the legal heir or a representative can file the complaint. Each complaint made in a District Forum shall be charged a fee fixed by the State Government.

**Procedure:** Every complaint is heard as early as possible. If the complaint relates to any services, the District Forum shall refer a copy of such complaint to the opposite party within 21 days of the admission date, directing him to give his version of the case within a period of thirty days. Notices



can be served even by fax. It is not necessary for the parties to be represented by lawyers. The dispute is settled on the basis of evidence brought to its notice by the complainant and where the opposite party denies or disputes the allegations contained in the complaint, or on the basis of evidence brought to its notice by the complainant where the opposite party omits or fails to take any action to represent his case. The District Forum has the same powers as are vested in a Civil Court (First Class Magistrate), under the Code of Civil Procedure, 1908. Every proceeding before the District Forum, shall be deemed to be a judicial proceeding within the meaning of S.193 and 228 of the Indian Penal Code, 1860, and the District Forum shall be deemed to be a Civil Court. Ordinarily, no adjournment is granted unless sufficient cause is shown. The reasons for adjournment are recorded and the orders for the costs of adjournment are passed.

If the District Forum is satisfied that the goods complained against suffer from any of the defects specified in the complaint or that any of the allegations contained in the complaint about the services are proved, it will issue an order to the opposite party directing him to remove the defect or replace the goods, or to provide adequate costs to parties. District Forum has the power to pass interim order, if required. It has the power to award punitive damages where deemed necessary, as a deterrent when pecuniary loss is substantial. Where a complaint is frivolous, the complaint is dismissed and complainant ordered to pay costs to opposite party not exceeding ten thousand rupees. The aggrieved person can prefer an appeal to the State Commission within a period of thirty days from the date of the order. Further appeals can be made to National Commission and finally to Supreme Court, within a period of 30 days from the date of the order.

**Before preferring an appeal in the State Commission or in the National Commission, the appellant should deposit 50% of the amount ordered by the Forum or Rs. twenty five thousand, whichever is less, in the case of a State Commission, and Rs. thirty five thousand in the case of the National Commission, to avoid prolonging the disputes and causing harassment to the consumers. The National Commission is empowered to review its orders, to avoid to rush to the Supreme Court. The State Forum can perform its functions at any notified place besides the State**

capital from time to time. It has power to transfer any complaint from one district forum to another.

**To make sure that the complainants get the relief by the Consumer Courts, they can attach the property of the opposite party and subsequently dispose it to recover the amounts due to the complainant. The District Collector will play a vital role for recovery of the amount from the opposite party.**

**Limitation Period:** The District Forum, State Commission or National Commission shall not admit a complaint unless it is filed within two years from the date on which the cause of action has arisen.

The doctors and hospitals who render service as medical practitioners are liable for any act of 'medical negligence' and they can be sued for compensation under the Consumer Protection Act. Service rendered to a patient by a medical practitioner by way of consultation, diagnosis and treatment, both medical and surgical, at a Government hospital, health centre or dispensary, or at a non-government hospital or nursing home where charges are required to be paid by all persons or persons who are in a position to pay, and the persons who cannot afford to pay are rendered free of charge, fall within the purview of this Act. Service rendered at a Government hospital, health centre or dispensary, or at a non-government hospital or nursing home by a doctor attached or employed in a hospital or nursing home where no charge, whatsoever, is made from any person availing the services and all patients (rich and poor) are given free service is outside the purview of the Act. The payment of token amount for registration purpose only at the hospital or nursing home would not alter the position.

No change is brought about in the substantive law governing claims for compensation on the ground of negligence. The principles which apply to determination of such a claim before the Civil Court would equally apply to consumer dispute before the Consumer Dispute Redressal Agencies established under the Act. The doctors are liable to pay compensation to the patient, if their professional negligence results in injury or death of the patient. As there is no scope for testimony by medical experts, and the District Forum or State Commission comes to its own conclusions, there is every likelihood of the justice being miscarried. A large number of frivolous cases are also likely to be filed against the doctors.



### **THE TRANSPLANTATION OF HUMAN ORGANS ACT, 1994 (amended in 2002)**

There are three main aspects of the Act: (1) It aims at putting a stop to live unrelated transplants. (2) In the case of a live related transplant, it defines that the donor and recipient are genetically related, with an exception if the transplant is done with prior approval of the Authorisation Committee on an application jointly made by the donor and recipient. (3) It accepts the brain stem death criterion. Certification of death by a panel of experts consisting of medical officer-in-charge of the hospital, an independent medical specialist, a neurologist or neurosurgeon, and the doctor treating the patient is essential. The Act defined human organ as any part of the human body consisting of a structured arrangement of tissues, which if wholly removed cannot be replicated by the body. Bone marrow transplant is outside the purview of the Act. The organs that can be donated after death are: kidney, heart, liver, lungs, pancreas, eyes, eardrums and ear bones. The organs can be removed from the dead body of any donor at any place. The eyes or the ears may be removed at any place from the dead body of any donor. Removal of the organs from the donors may be done on his authorisation or that of the person lawfully in possession of the body. In case of unclaimed bodies in hospital or prison, organs can be removed after 48 hours. The organ removed should be preserved according to current and accepted scientific methods to ensure viability. The human organs cannot be removed for any purpose other than therapeutic purposes. The doctor should not remove organs unless he had explained all possible effects, complications and hazards connected with the removal and transplantation, to the donor and recipient respectively. The Act imposes compulsory registration of hospitals engaged in the removal, storage or transplantation of human organs. The Central and State Government are empowered to appoint Appropriate Authority which can grant registration of hospitals, renew, suspend or cancel the registration, etc. and to specify conditions for the same. The Government is also empowered to appoint Authorisation Committee or Committees with nominated members for the purpose of imposing restrictions on the removal and transplantation of human organs, etc.

The Act also provides, besides provision for appeal, punishments for unauthorised removal of

human organs, or for commercial dealings thereof, or for contravention of any other provisions of the Act. Such punishments range from removal of names of the erring medical practitioners from the Registers of the State Medical Council for 2 years for the first offence and permanently for subsequent offence, or imprisonment up to 5 years and fine of Rs. 10,000/- based on the nature and degree of the offence. An offence under the Act is cognisable only when a complaint has been made by either the Appropriate Authority or a person who has given notice to such Appropriate Authority about the alleged offence and his intention to make a complaint to the Court, in that regard.

A set of rules entitled "Transplantation of Human Organs Rules, 1995" along with 13 statutory forms have also been framed by the Central Government.

The Ear Drums, Ear Bones Act, 1982 and Eyes Act, 1982, have been repealed.

### **THE PROTECTION OF HUMAN RIGHTS ACT, 1993:**

The Act provides for constitution of a National Human Rights Commission. (N.H.R.C.) and State Human Rights Commission (S.H.R.C.). The purpose of the Act is to provide better protection of human rights and for matters connected therewith or incidental to that. The NHRC may enquire any case on complaint or suo-moto, if there is reason to suspect that human right has been violated in a case. It can summon any person to give evidence and cause production of any document before it. It makes its recommendation for action, to the concerned Government, after completion of enquiry. It encourages functioning of different non-governmental organisations for protection of human rights. The functions of S.H.R.C. are similar to N.H.R.C. They will not inquire into any matter after expiry of one year from the date on which the act constituting violation of human rights is alleged to have been committed.

In 1993, National Human Rights Commission has required all District Magistrates/Superintendents of police to report any instance of custodial death/torture or rape directly to it, within 24 hours of its occurrence, failing which, it will presume that an effort was being made to suppress the occurrence.

In 1995, NHRC has made it clear that the use of third degree methods in investigation constitutes violation of rights of citizens of India. If any person



is arrested, the information should be given to the relative or friend about the arrest and place of detention. The compensation due to the next of the kin of those who have suffered custodial death should be the liability both of the State and the erring police officials.

Videography of autopsy is necessary only when the preliminary inquest by the Magistrate raises suspicion of any kind of foul play or where a complaint alleging any foul play has been made to the authorities or there is any other suspicion of foul play. The cassette has to be sent to the Commission.

**ANIMALS IN RESEARCH :** All animal experiments should be carried out for advancement of knowledge that is expected to be useful for saving

or prolonging human life, alleviating suffering and combating disease, whether of human beings or animals or plants. Animals lowest on the phylogenetic scale (least degree of awareness), which may give scientifically valid results are to be preferred for experiments. Minimum number of animals should be used to give statistically valid results. Alternatives not involving animal testing should be given due consideration. The researchers should avoid or minimise pain and suffering to animals. All scientific procedures that may cause more than momentary pain should be performed with sedation or anaesthesia. After experimentation, euthanasia can be performed only when the animal is unable to perform its natural functions.



## CHAPTER 4

# IDENTIFICATION

Identification is the determination of the individuality of a person based on certain physical characteristics, i.e. exact fixation of personality. In partial or incomplete identification, certain facts are determined, e.g., race, age, sex, stature, etc., while other characters are not known. Identification is necessary in: (1) Living persons. (2) Recently dead persons. (3) Decomposed bodies. (4) Mutilated bodies, and (5) Skeleton. It is necessary: (1) In criminal cases like persons accused of assault, murder, rape, etc., interchange of newborn babies in hospitals, impersonation, etc. (2) In civil cases like marriage, inheritance, passport, insurance claims, disputed sex, missing persons, etc. At least two identification marks should be noted by the doctor in all medico-legal cases. Before identifying the accused person in the Court, the doctor should verify the identification marks noted by him.

The police have to establish the identity of a person. In some cases, the doctor may be able to supply the police with certain facts about an individual, a dead body or fragmentary remains, which help the police to complete identification.

Visual identification becomes difficult or impossible in cases of fires, explosions, advanced decomposition, mutilation, aircraft accidents, earthquakes, etc. Identification of a dead victim often helps the police to trace the victim's movements, to know his background, talk to his friends and find out his enemies.

**THE CORPUS DELICTI:** The corpus delicti (the body of offence; the essence of crime) means, the facts of any criminal offence, e.g., murder. The corpus delicti of murder is the fact that a person died from unlawful violence. It includes the body of the victim and other facts which are conclusive of death by foul play, such as a bullet or a broken knife-blade found in the body and responsible for death. Clothings showing marks of the weapon, and drawings and photographs of the deceased showing fatal injuries are also included in this term. 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. The case against the accused cannot be

established unless there is convincing proof of these points. If the victim's identity is not known, it becomes difficult for the police to solve the crime. The identification of a dead body and proof of corpus delicti is essential before a sentence is passed in murder trials, as unclaimed, decomposed bodies, or portions of a dead body, or bones are sometimes produced to support false charge. However, cases have occurred where the death sentence was passed even when the body was not found or was not identified.

### IDENTIFICATION DATA

- (1) Race and religion.
- (2) Sex.
- (3) Age.
- (4) General development and stature.
- (5) Complexion and features.
- (6) External peculiarities, such as moles, birthmarks, malformations, scars, tattoo marks, wounds, occupation marks, etc.
- (7) Anthropometric measurements.

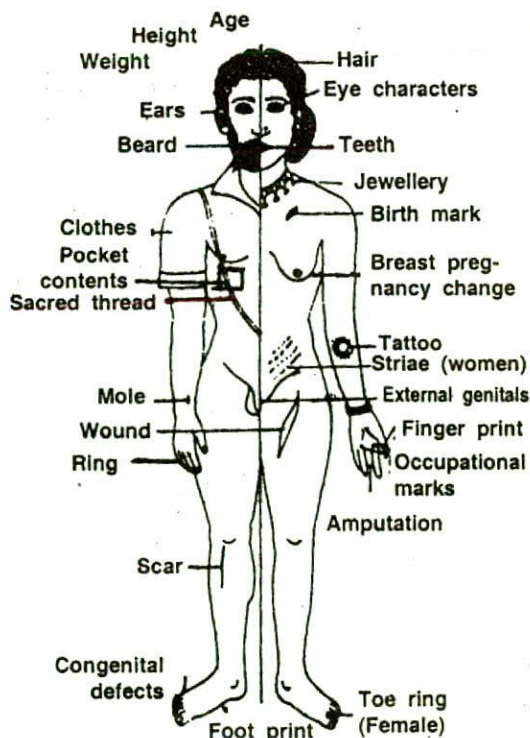


Fig. (4-1). Identification data.



- (8) Fingerprints and footprints.
- (9) Teeth.
- (10) Personal effects : clothes, pocket contents, jewellery, etc.
- (11) Handwriting.
- (12) Speech and voice.
- (13) Gait, tricks of manner and habit.
- (14) Memory and education.

11 to 14 are useful only in the living. As no single feature is reliable for identification, a combination of features is taken. Sex, age, and stature are primary characteristics of identification.

**RACE** : It can be determined by :

(1) **Complexion** : It is of limited value. The skin is brown in Indians, fair in Europeans and black in Negroes. Skin colour is changed by decomposition, burning, etc.

(2) **Eyes**: Indians have dark eyes, a few have brown eyes. Europeans have blue or grey eyes.

(3) **Hair**: Indians have black, thin hair. Europeans fair or light brown or reddish. Indians, Mongolians and Europeans have straight or wavy hair. Negroes have woolly hair (i.e., arranged in tight spirals). Mongolian hair is coarse and dark and usually circular on cross-section, and has a dense uniform pigmentation and dark medulla. Negro hair is elongated, oval on cross-section and has a dense pigment with an irregular distribution. Caucasian hair has round or oval shape on cross-section with uniform distribution of fine or coarse pigment.

(4) **Clothes**: The dress may be helpful sometimes.

(5) **Skeleton**: The Cephalic Index (C.I.) or Index of Breadth is important.

$$\text{C.I.} = \frac{\text{Maximum breadth of skull}}{\text{Maximum length of skull}} \times 100$$

The length and breadth are measured by calipers between both parietal eminences, and between glabella and external occipital protuberance, and not by measuring tape. The skull of an Indian is Caucasian with a few Negroid characters. From the various measurements of the skull, race can be determined in 85 to 90% of cases. Because of racial mixing, all the skulls may not be correctly differentiated into the three races.



Fig. (4-2). Shape of the nasal aperture.

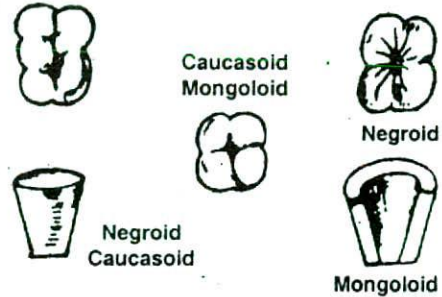


Fig. (4-3). The molars and upper incisor teeth.



Fig. (4-4). Diagram of the shapes of upper jaw.



Fig. (4-5). Diagram of the shapes of orbits.

**Caucasian (white)**: Skull rounded, orbits triangular, nasal aperture elongated, palate triangular, upper and lower limbs normal in proportion to body.

**Mongolian (yellow)**: Skull square, orbits rounded, nasal aperture rounded, palate rounded, upper and lower limbs smaller.

**Negro (black)**: Skull narrow and elongated, orbits square, nasal aperture broad, palate rectangular, upper and lower limbs longer.

Brachycephaly is due to fusion of coronal suture.

Racial mixing has been and is constant, and as such pure races are uncommon. The Mongoloids include native-Americans, Asiatic orientals, such as Koreans, Japanese, Chinese and Southeast Asians.

Table (4-1). Racial difference in the skull

Type of Skull	Cephalic Index	Race
(1) Dolico-cephalic (long-headed)	70 to 75	Pure Aryans, Aborigines and Negroes.
(2) Mesati-cephalic (medium-headed)	75 to 80	Europeans and Chinese.
(3) Brachy-cephalic (short-headed)	80 to 85	Mongolian.



**RELIGION :** Hindu males are not circumcised.

*Sacred thread*, necklace of wooden beads, caste marks on forehead, tuft of hair on back of head, and piercing of ear lobes if present are helpful. Hindu females may have vermilion (cinnabar) on head, silver toe ornaments, *thali*, tattoo marks, nose-ring aperture in left nostril, few openings for ear-rings along the helix. Muslim females may have nose-ring aperture in septum only, several openings in the ears along helix and usually no tattoo marks. Muslim males are circumcised and may have marks of corns and callosities on lateral aspects of knees and feet.

## SEX

Sex has to be determined in cases of (1) heirship, (2) marriage, (3) divorce, (4) legitimacy, (5) impotence, (6) rape, etc.

A normal person has 46 chromosomes. The chromatin pattern in male is XY and in female XX. Masculine and feminine characteristics most directly depend on the level of circulating sex hormones.

**SEX CHROMATIN :** It is a small planoconvex mass, lying near nuclear membrane (Barr body, demonstrated by Dixon and Tarr). In the buccal smear, the percentage of nuclei containing chromatin body ranges from zero to four in males and 20 to 80 in females. In females, neutrophil leucocytes contain a small nuclear attachment of drumstick form (Davidson body) in up to six percent of cells. (Fig.4-6). This is absent in males. In decomposed bodies sex chromatin cannot be made out.

Exact sex determination can be made using a single specimen of buccal smear, saliva or hair follicle, by the combined treatment of quinacrine dihydrochloride staining for Y chromosome which is seen as bright fluorescent body in the nuclei of male cells, and fluorescent Feulgen reaction using acriflavin Schiff reagent for X chromosomes, which is seen as bright yellow spot in the nuclei. The percentage of quinacrine positive bodies ranges from 45 to 80% in males, and 0 to 4% in females. With Feulgen reaction technique fluorescent bodies are found in 50 to 70% of cells in females, and 0 to 2% in males.

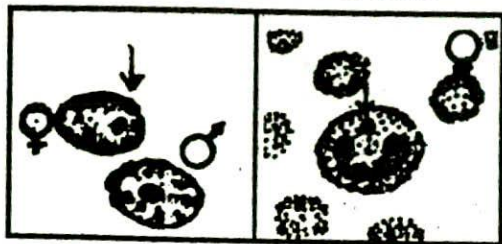


Fig. (4-6) The sex chromatin.

By using fluorescent dyes Y chromosome can be demonstrated in dental pulp tissue up to one year. F-bodies are seen in 30 to 70% of cells in males and 0 to 4% in females.

Sex can be determined from dental pulp, bone marrow and amniotic fluid. Karyotyping (study of chromosomal constitution of the nucleus of a cell for sex determination) of foetus may be done from lymphocytes, amniocytes and fibroblasts.

In normal cases, sex determination is easy from external examination only, but it is difficult in cases of (1) hermaphroditism, (2) concealed sex, (3) advanced decomposition, and (4) skeleton.

**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 condition, the testes or ovaries have never developed. The nuclear sex is negative.

(2) **Gonadal Dysgenesis:** In this condition, the external sexual structures are present, but at puberty the testes or the ovaries fail to develop.

(A) **Klinefelter's Syndrome :** In this condition, the anatomical structure is male, but the nuclear sexing is female. The sex chromosome pattern is XXY (47 chromosomes). It is usually diagnosed when there is a delay in onset of puberty, behavioural disorders and mental retardation. Axillary and pubic hair are absent, and hair on chest and chin are reduced. Gynaecomastia, azoospermia, low levels of testosterone, sterility, increased urinary gonadotrophins, signs of eunachoidism and increased height are common. Testicular atrophy with hyalinisation of seminiferous tubules is seen histologically.

(B) **Turner's Syndrome :** In this condition, the anatomical structure is female, but the nuclear sexing is male. It can be recognised at birth by oedema of the dorsum of the hands and feet, loose skin folds in the nape of the neck, low birth weight and short stature. It is characterised by primary amenorrhoea, sterility, lack of development of primary and secondary sexual characteristics, increased urinary gonadotrophin excretion, pigmented naevi, a short fourth metatarsal, webbed-neck, shield-chest, wide-set nipples, high-arched palate, low-set ears, slow growth, learning problems, spina bifida, coarctation



Table (4-2). Traits diagnostic of sex from skeleton

Trait	Male	Female
	<b>GENERAL</b>	
(1) General size :	Larger, more massive.	Smaller, slender.
(2) Long bones :	Ridges, depressions and processes more prominent. Bones of arms and legs are 8% longer.	Less prominent.
(3) Shaft:	Rougher.	Smoother, thinner with relatively wider medullary cavity.
(4) Articular surfaces :	Larger.	Smaller.
(5) Metacarpal bones :	Longer and broader.	Shorter and narrower.
(6) Weight :	4.5 kg.	2.75 kg.
	<b>SKULL</b>	
(1) <u>General appearance</u> :	Larger, longer (dolichocrania).	Smaller, lighter, walls thinner; rounder (brachycrania), and smoother.
(2) Capacity :	1500 to 1550 ml.	1350 to 1400 ml.
(3) <u>Architecture</u> :	Rugged; muscle ridges more marked, esp. in occipital and temporal areas.	Smooth.
(4) Forehead :	Steeper, less rounded.	Vertical, round, full, infantile.
(5) Glabella :	More prominent.	Small or absent.
(6) Frontonasal junction :	Distinct angulation.	Smoothly curved.
(7) <u>Orbits</u> :	Square, set lower on the face, relatively smaller, rounded margins.	Rounded, higher, relatively larger, sharp margins.
(8) <u>Supraorbital ridges</u> :	Prominent.	Less prominent, or absent.
(9) Cheek bones :	Heavier, laterally arched.	Lighter, more compressed.
(10) Zygomatic arch :	More prominent.	Less prominent.
(11) Nasal aperture :	Higher and narrower. Margins sharp.	Lower and broader.
(12) External auditory meatus:	Bony ridge along the upper border is prominent.	Often absent.
(13) Frontal eminences :	Small.	Large.
(14) Parietal eminences :	Small.	Large.
(15) Frontal sinuses :	Much developed.	Less developed.
(16) <u>Occipital area</u> :	Muscle lines and protuberance prominent.	Not prominent.
(17) <u>Mastoid process</u> :	Medium to large, round, blunt.	Small to medium, smooth, pointed.
(18) Base :	Sites of muscular insertions more marked.	Less marked.
(19) Digastric groove :	More deep.	Less deep.
(20) Condylar facet :	Long and slender.	Short and broad.
(21) Occipital condyles :	Large	Small.
(22) <u>Palate</u> :	Larger, broader, tends more to U-shape.	Smaller, tends more to parabola.
(23) Foramina :	Larger.	Smaller.
(24) Foramen magnum :	Relatively large and long.	Relatively small and round.
(25) Teeth :	Larger.	Smaller.
	<b>MANDIBLE</b>	
(1) General size :	Larger and thicker.	Smaller and thinner.
(2) <u>Chin</u> :	Square.	Rounded.
(3) Body height :	At symphysis greater.	At symphysis smaller.
(4) Ascending ramus :	Greater breadth.	Smaller breadth.
(5) Angle of body and ramus :	Less obtuse (under 125°); prominent, and everted.	More obtuse; not prominent, inverted.
(6) Condyles :	Larger.	Smaller.
(7) Mental tubercle:	Large and prominent.	Insignificant.



Table (4-3). Traits Diagnostic of Sex from Skeleton

Trait	Male	Female
<b>PELVIS</b>		
(1) Bony framework :	Massive, rougher, marked muscle sites. Stands higher and more erect.	Less massive, slender, smoother.
(2) General :	Deep funnel.	Flat bowl.
(3) Ilium :	Less vertical; curve of iliac crest reaches higher level and is more prominent.	More vertical; distance between iliac crests is less; iliac fossae shallow; curves of crest well marked.
(4) <u>Preauricular sulcus</u> : (attachment of anterior sacroiliac ligament).	Not frequent; narrow, shallow.	More frequent, broad and deep.
(5) Acetabulum :	Large, 52 mm. in diameter; directed laterally.	Small, 46mm. in diameter; directed anterolaterally.
(6) Obturator foramen :	Large, often oval with base upwards.	Small, triangular with apex forwards.
(7) <u>Greater sciatic notch</u> :	Smaller, narrower, deeper.	Larger, wider, shallower.
(8) Illeo-pectineal line :	Well marked and rough.	Rounded and smooth.
(9) Ischial tuberosity :	Inverted.	Everted; more widely separated.
(10) Body of pubis :	Narrow, triangular.	Broad, square; pits on posterior surface if borne children.
(11) Ramus of pubis :	It is like continuation of body of pubis.	Has a constricted or narrowed appearance and is short and thick.
(12) Ischiopubic rami :	More everted.	Less everted.
(13) Symphysis :	High	Low and distance between two pubic tubercles greater. The dorsal border is irregular and shows depressions or pits (scars of parturition).
(14) <u>Subpubic angle</u> :	V-shaped, sharp angle 70° to 75°.	U-shaped, rounded, broader angle, 90 to 100°.
(15) <u>Pelvic brim or inlet</u> :	Heart-shaped.	Circular or elliptical; more spacious; diameters longer.
(16) Pelvic cavity :	Conical and funnel-shaped.	Broad and round.
(17) Pelvic outlet :	Smaller.	Larger.
(18) Sacroiliac articulation :	Large, extends to 2½ to 3 vertebrae.	Small, oblique, extends to 2 to 2½ vertebrae.
(19) Sacroiliac joint surface:	Large and less sharply angulated.	L-shaped and elevated anteriorly.
(20) Sacrum :	Longer, narrower, with more evenly distributed curvature; promontory well marked. Body of first sacral vertebra larger.	Shorter, wider; upper half almost straight, curve forward in lower half; promontory less marked. Body of first sacral vertebra small.
(21) Coccyx :	Less movable.	More movable.
(22) <u>Ischiopubic index</u> : Pubic length in mm. x 100 Ischial length in mm.	73 to 94.	91 to 115.
(23) <u>Sciatic notch index</u> : Width of sciatic notch Depth of sciatic notch x 100	4 to 5.	5 to 6.



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**THORAX**

(1) General :	Longer and narrower.	Shorter and wider.
(2) Sternum :	Body longer and more than twice the length of the manubrium; upper margin is in level with lower part of the body of second thoracic vertebra; breadth more. Length more than 149 mm.	Shorter and less than twice the length of the manubrium; upper margin in level with lower part of the body of third thoracic vertebra; breadth less. Length less than 149 mm. (Ashley's rule)

Sternal index :

$$\frac{\text{Length of manubrium}}{\text{Length of body}} \times 100$$

46.2

54.3

(3) Ribs :	Thicker; lesser curvature, and are less oblique.	Thinner; greater curvature, and more oblique.
(4) Clavicle:	Longer, broader, heavier, less curved.	Smaller, narrow, lighter, more curved.

**VERTEBRAL COLUMN**

(1) Atlas, breadth :	7.4 to 9.9 cm.	6.5 to 7.6 cm.
(2) Length of vertebral column:	73 cm.	60 cm.
(3) Corporobasal index of sacrum :		
$\frac{\text{Breadth of first sacral vertebra}}{\text{Breadth of the base of sacrum}} \times 100$	45	40.5

**FEMUR**

(1) Head :	Larger and forms about 2/3 of a sphere. Vertical diameter more than 47 mm.	Smaller and forms less than 2/3 of a sphere. Vertical diameter less than 45 mm.
(2) Neck :	Obtuse angle with the shaft, about 125°.	Less obtuse angle with the shaft.
(3) Bicondylar width :	74 to 89 mm.	67 to 76 mm.
(4) Angulation of shaft with condyles:	Around 80°	Around 76°

**SCAPULA**

(1) Height :	More than 157 mm.	Less than 144 mm.
(2) Glenoid cavity :	Height greater (39.2 cm).	Height less (32.6 cm).

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of aorta, septal defects, renal defects, Cushing's syndrome and a high incidence of diabetes mellitus. The ovaries do not contain primordial follicles (ovarian dysgenesis). The sex chromosome pattern is XO (45 chromosomes).

(3) **True Hermaphroditism** : This is a very rare condition of bisexuality in which an ovary and a testicle or two ovotestis are present with the external genitalia of both sexes. The gonad may be abdominal, inguinal or labio-scrotal in position. There may be uterus. Phallus may be penile or clitoral; the labia may be bifid as in female or fused

resembling the scrotum of the male. Neither gonad is completely functional. The somatic sex chromatin may be male or female (fig.4-6).

(4) **Pseudo-hermaphroditism** : In this condition gonadal tissue of only one sex is seen internally, 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 characters towards male are seen, due to adrenal hyperplasia.



Table (4-4). Sex Characteristics

Trait	Male	Female
(1) Gonads :	A functioning testis. The penis, prostate, etc., are only appendages.	A functioning ovary. The uterus, vagina, etc., are only appendages.
(2) Build:	Larger with greater muscular development.	Smaller with less muscular development.
(3) Shoulders:	Broader than hips.	Narrower than hips.
(4) Waist:	Ill-defined.	Well-defined.
(5) Trunk:	Abdominal segment smaller.	Abdominal segment longer.
(6) Thorax:	Dimensions more.	Shorter and rounded.
(7) Limbs:	Longer.	Shorter.
(8) Arms:	Flat on section.	Cylindrical on section.
(9) Thighs:	Cylindrical.	Conical, due to shorter femur and greater deposition of fat.
(10) Gluteal region:	Flatter.	Full and rounded.
(11) Wrists & ankles :	Not delicate.	Delicate.
(12) Breasts:	Not developed.	Developed.
(13) Pubic hair :	Thick and extends upward to the umbilicus (rhomboidal).	Thin, horizontal and covers mons veneris only (triangular).
(14) Body hair :	Present on face and chest.	Absent on face and chest.
(15) Head hair:	Shorter, thicker and coarser.	Longer, thinner and finer.
(16) Larynx :	Prominent. Length 4.8 cm.	Not prominent. Length 3.8 cm.

**Concealed Sex :** Criminals may conceal their sex to avoid detection by changing dress or by other methods. This can be detected by physical examination.

In advanced putrefaction, sex can be determined by identifying uterus or prostate which resist putrefaction for a long time.

**SKELETON :** Human skeleton is both exo-and endoskeleton. Recognisable sex differences do not appear until after puberty except in the pelvis, and the accuracy from this bone is about 75 to 80%.

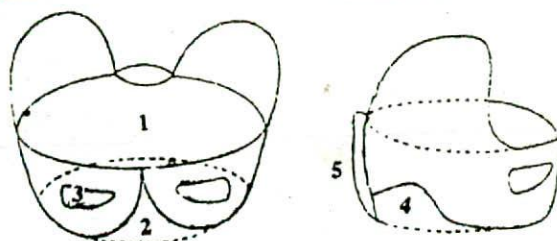


Fig. (4-8). Female pelvis: (1) General pelvic shape—flat bowl. (2) Subpelvic arch—obtuse. (3) Obturator foramen—oval. (4) Sciatic notch—obtuse; (5) Sacrum—short and flat.

Male skull

Female skull

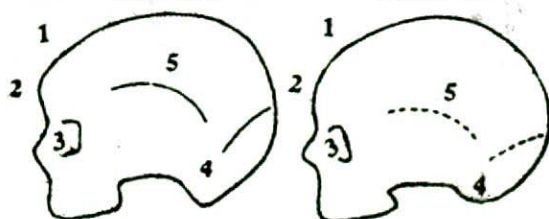


Fig. (4-7). Male Skull: (1) Forehead—receding. (2) Orbital ridges—prominent. (3) Orbits—square. (4) Mastoid process—large. (5) Muscle ridges—marked. Female Skull: (1) Forehead—high. (2) Orbital ridges—not marked. (3) Orbits—rounded. (4) Mastoid process—small. (5) Muscle ridges—faint.

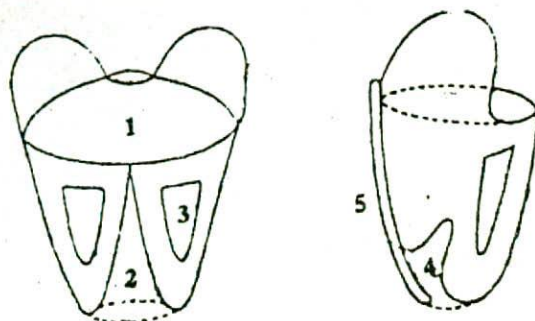
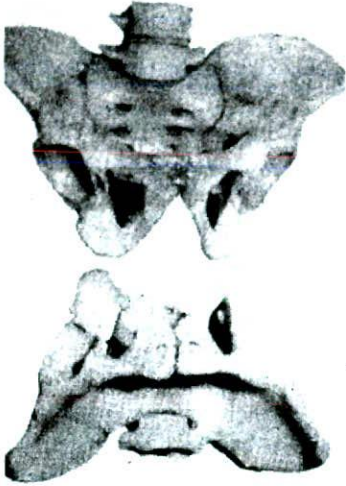
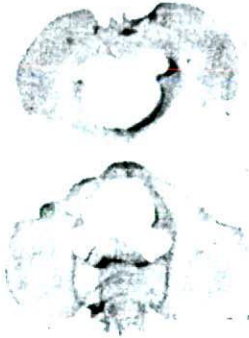


Fig. (4-9). Male pelvis: (1) General pelvic shape—deep funnel. (2) Subpelvic arch—acute. (3) Obturator foramen—triangular. (4) Sciatic notch—acute. (5) Sacrum—long and curved.

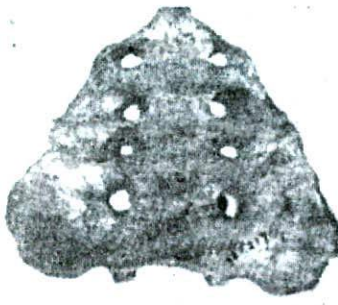
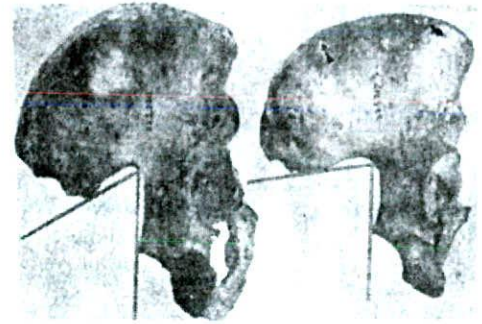




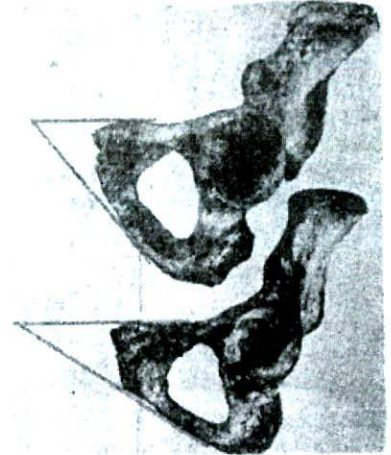
**Fig. (4-10).** Male (upper), female pelvis (lower). The V-shaped subpubic angle and smaller pelvic outlet in male in contrast to U-shaped subpubic angle and larger pelvic outlet in female.



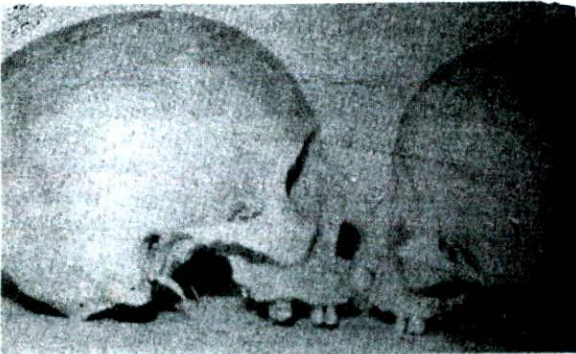
**Fig. (4-11).** Innominate bone. The angle formed by the greater sciatic notch is more acute in the male (left) than the female (right).



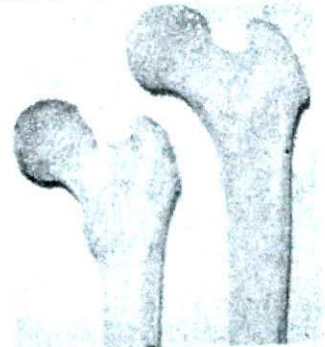
**Fig. (4-12).** Sacrum. It is narrower in the male (left) than in the female (right).



**Fig. (4-13).** Innominate bone. Male (above), female (below) Acetabulum is larger in the male. Body of pubis is narrow and triangular in male and broad and quadrangular in female. Inferior ramus of pubis has convex border in male and concave border in female.



**Fig. (4-14).** Male (left) and female (right) skulls, showing more sloping forehead and more prominent mastoid process in the male in contrast to vertical, round forehead and less prominent mastoid process in female.



**Fig. (4-15).** Male (right) and female (left) femurs. The angle of the neck of femur is more obtuse in the male.





Fig. (4-16). Male and female mandibles

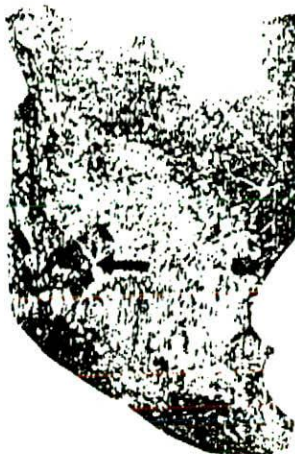


Fig. (4-17). A parturition pit on the dorsal surface of pubic bone adjacent to pubic symphysis.

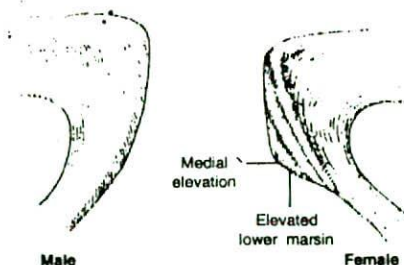


Fig. (4-18). The symphyseal block is triangular in male and rectangular in female.

The determination of sex is based mainly upon the appearances of the pelvis, skull, sternum and the long bones. (Fig. 4-7 to 4-18). In the skull sexual features are modified by senility. In the pelvis, sex features are independent of each other and one may even contradict the other in the same pelvis. The male pelvis stands higher and more erect than the female pelvis. Perforated olecranon fossa is more common in females on the left side. Additional information may be obtained from the scapula and metacarpal bones.

In females, subpubic angle, greater sciatic notch, pelvic inlet and outlet are more than in male, but obturator foramen is smaller and curve of ilium is less. The sternal index, ischiopubic index and sciatic notch index are more in females. Greater sciatic notch is the ideal feature to determine the sex of a female child.

**Medullary Index of bones :** The sex of the long bones can be determined on the basis of their medullary index (Diameter of medulla ÷ diameter of whole bone x 100) from tibia, humerus, ulna and radius.

According to Krogman, the degree of accuracy in sexing adult skeletal remains is:

Entire skeleton	100 percent
Pelvis alone	95 percent
Skull alone	90 percent
Pelvis plus skull	98 percent
Long bones alone	80 percent

### AGE

The age of an individual especially in earlier years can be determined from : (1) teeth, (2) ossification of bones, (3) secondary sex characters, and (4) general development in case of children.

**TEETH : Tooth Development and Eruption:** The alveolar cavities which contain teeth are formed around the third or fourth month of intrauterine life. Development of the tooth begins with the formation of cellular tooth germ within the alveolar bone, in the shape of the crown. Apposition and calcification of enamel and dentin take place within this germ, and the crown is completely formed and calcified before any positional changes occur. At birth, the rudiments of all the temporary teeth and of the first permanent molars may be found in the jaws. Root formation begins after completion of the crown, and as the root becomes longer the crown erupts through the bone, and finally comes out of the jaws. Neonatal line is wellformed on teeth at birth. The root is completed some time after the tooth is in full functional occlusion. The teeth calcify from crown to neck to roots. During eruption of a permanent tooth, the overlying root of its deciduous predecessor simultaneously undergoes absorption until only the crown remains. During eruption of a permanent tooth, the overlying root of its deciduous predecessor simultaneously undergoes absorption until only the crown remains. The unsupported crown then falls off.

Teeth are useful for age determination (a) by the state of development, and (b) by secondary changes.



**Temporary Teeth :** Temporary, deciduous or milk teeth are 20 in number: 4 incisors, 2 canines, and 4 molars in each jaw. In ill-nourished children, and especially in rickets, and in hypothyroidism, dentition may be delayed, while in syphilis, teeth may be premature or even present at birth. At about four years, there is usually spacing between the deciduous teeth. About the sixth or seventh year, first permanent molar teeth erupt behind the second temporary molars. After this, the temporary teeth begin to fall off. Between 7 to 12 years 24 teeth are present. At age nine, 12 permanent teeth are in the mouth; 8 incisors and 4 first molars. Deciduous molars and canines are present. At the age 11, there are 20 permanent teeth: 8 incisors, 8 premolars and 4 molars. Mixed dentition is seen up to 12 years. Between 7 to 12 years 24 teeth are present. At the age 14, there are 28 permanent teeth, and no deciduous teeth.

If there is doubt whether a particular tooth is temporary, take an X-ray. If it is temporary tooth, germ of the permanent tooth can be seen underneath.

**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. They erupt behind the temporary teeth. All the permanent molars are superadded permanent teeth. The first permanent molar tooth of each side erupts, while all the other deciduous teeth are present in the jaw. Superadded permanent teeth are six in each jaw. (2) **Successional permanent teeth** are those which erupt in place of deciduous teeth. Permanent premolars erupt in place of deciduous molars. Successional teeth are ten in each jaw.

**Morphology of Permanent Teeth :** Each tooth has a crown, a neck and a root embedded in the jaw bone. Teeth are composed of dentin, covered on the crown by enamel and on the root by cementum, which is attached to the alveolar bone by periodontal membrane.

**Incisors:** The crown is shaped like chisel and is convex on its labial surface and concave on its lingual surface, except near the neck, where the surface becomes convex. The neck is slightly constricted. The root is single.

**Canines:** They are larger than the incisors. The crown is large and conical, very concave on its labial surface and slightly concave on its lingual surface. Its masticatory edge tapers to a blunt point, which projects slightly beyond the level of the other teeth. The root is single, larger and thicker than that of an incisor.

**Premolars or Bicuspid:** They are smaller and shorter than the canines. The crown of each is nearly circular in cross-section and slightly compressed mesio-distally. The chewing surface has two cusps. The root is usually single, but may be double.

**Molars:** They are largest with broad crown. The crown is cubical; convex on its labial and lingual surfaces, and flattened on its mesial and distal surfaces. It has three, four or five cusps. Each upper molar has three roots and lower two.

**Deciduous Teeth:** They resemble in form the teeth which bear the same names in the permanent set.

In both deciduous and permanent teeth, dentition occurs earlier in lower jaw except for the lateral incisors which erupt earlier in upper jaw. The lower permanent incisors, premolars and molars erupt about one year earlier than do the corresponding teeth in the upper jaw. Wisdom tooth first erupts in the lower and on the left side and then on the right side. The number and eruption of deciduous teeth is more regular than the permanent dentition. Eruption is not always bilaterally symmetrical. Tooth

Table (4-5). Difference between temporary and permanent teeth

Trait	Temporary teeth	Permanent teeth
(1) Size :	Smaller, lighter, narrow, except temporary molars which are longer than permanent premolars, replacing them.	Heavier, stronger, broader, except permanent premolars replacing temporary molars.
(2) Direction :	Anterior teeth are vertical.	Anterior teeth are usually inclined a little forward.
(3) Crown :	China-white colour.	Ivory-white colour.
(4) Neck :	More constricted.	Less constricted.
(5) Root :	Roots of molar are smaller and more divergent.	Roots of molars are larger and less divergent.
(6) Ridge :	A ridge or thick edge at the junction of the crown with the fangs present.	No ridge.



Table (4-6) Calcification and eruption of deciduous teeth

Tooth	Calcification begins	Eruption	Calcification of root completed	Resorption of root begins
Central incisor :				
Lower :	5 to 6 months	6 to 8 months	1½ to 2 years	4th year
Upper :	"	7 to 9 months	1½ to 2 years	5th year
Lateral incisor :	"			
Upper :	"	7 to 9 months	1½ to 2 years	5th year
Lower :	"	10 to 12 months	1½ to 2 years	5th year
First molar :	"	12 to 14 months	2 to 2½ years	6th year
Canine :	"	17 to 18 months	2½ to 3 years	8th year
Second molar :	"	20 to 30 months	3 years	7th year

Table (4-7) Calcification and eruption of permanent teeth

Tooth	Calcification begins	Eruption	Calcification complete
First molar :	At birth	6 to 7 years	9 to 10 years
Central incisor :	3 to 4 months	6 to 8 years	10 years
Lateral incisor :	1 year	7 to 9 years	11 years
First bicuspid :	1½ years	9 to 11 years	12 to 13 years
Second bicuspid:	2 years	10 to 12 years	12 to 14 years
Canine :	4 to 5 months	11 to 12 years	12 to 13 years
Second molar :	2½ to 3 years	12 to 14 years	14 to 16 years
Third molar :	8 to 10 years	17 to 25 years	18 to 25 years

eruption in female may be one year before that of males. Females have smaller teeth (esp. lower canines) than males. In general, the dental and skeletal ages, correspond closely in the male, but in the female the skeletal age is generally one year ahead of the dental age. Heredity, environment, endocrine reactions, and nutrition all play a part in the eruption and calcification of teeth. Eruption tends to occur earlier in warmer climates and in urban areas.

From birth to fourteen years of age, the degree of formation of root and crown structures, the stage of eruption and the intermixture of temporary and

permanent teeth are useful in age estimation. Dental X-rays show the developmental status of unerupted teeth and the degree of root completion in erupted teeth. From 14 to 20 years, dental age estimation is based upon the stage of development of the third molar. There is much variation in these, and the accuracy of dental age estimation during this period varies by about plus/minus three years. The body of the jaw grows posteriorly, and the ramus is elongated after eruption of second molar teeth. If third molars are absent, it should be noted whether there is a space in the jaw behind the second molar

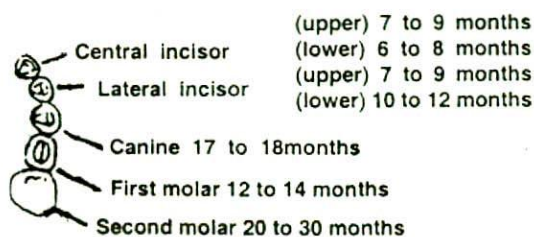


Fig. (4-19). Eruption of temporary teeth.

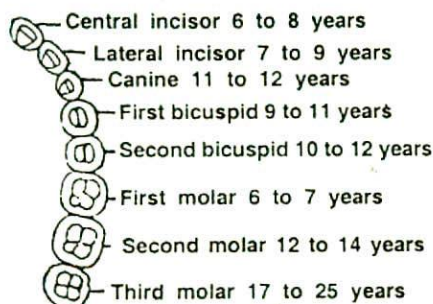


Fig. (4-20) Eruption of permanent teeth.



teeth. If third molars are fully erupted, it indicates that an individual is above 17 years of age. In some persons due to inadequate jaw space, the third molars never erupt into the oral cavity, particularly the mandibular third molars. Such trapped teeth are known as **impacted teeth**.

**GUSTAFSON'S METHOD** : The age estimation of adult over 21 years depends on the physiologic age changes in each of the dental tissues (Fig.4-21).

(1) **Attrition** : Due to wear and tear from mastication, occlusal (upper) surface of the teeth is destroyed gradually, first involving the enamel, then dentin and at last pulp is exposed in old age. It depends on the functional use of teeth and also upon the hardness of the enamel.

(2) **Paradentosis** : Regression of the gums and periodontal tissues surrounding the teeth takes place in advancing age, gradually exposing the necks and the adjacent part of roots, due to which the teeth become loose and fall off. Poor oral hygiene increases paradentosis.

(3) **Secondary dentin** : It may develop from the walls within the pulp cavity, and decrease the size of the cavity. First it is deposited at the pulp chamber and gradually extends downwards to the apex, and may completely fill the pulp cavity: This is partly due to ageing and partly due to pathological conditions like caries, and paradentosis.

(4) **Cementum apposition** : The cementum increases in thickness particularly due to changes in the tooth position, especially near the end of the root. Secondary cementum is slowly and continuously deposited throughout life, and forms incremental lines. Incremental lines (devised by **Boyde**) appear as cross-striations on the enamel of teeth due to cementum apposition, and are thought to represent daily increments of growth. They can be seen on histological section. The age can be calculated by counting the number of lines from the neonatal line onwards. This is mainly applicable to infants.

(5) **Root resorption** : It involves both cementum and dentin which show characteristically sharp grooves. Absorption of the root starts first at the apex and extends upwards. It usually occurs in late age. It may be due to pathological process.

(6) **Transparency of the root** : It is not seen until about 30 years of age. The canals in the dentin are at first wide. With age they are filled by mineral, so that they become invisible and the dentin becomes

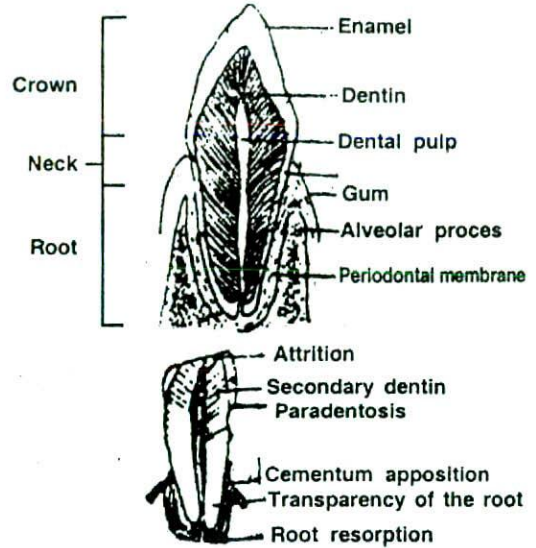


Fig. (4-21) (A) Vertical section of an incisor tooth.  
(B) Physiological age-processes in teeth.

transparent. It is the most reliable of all criteria.

Before the tooth is extracted from a body, the degree of paradentosis is estimated. The tooth is ground down on glass slabs from both sides of the tooth to about one mm. which allows the estimation of transparency. Then the section is ground further down to about one-fourth mm. for microscopic examination. Anterior teeth are more suitable than the posterior teeth, and the merit decreases from incisors to premolars, while third molar is quite unsuitable. All changes are absent at 15 years. Arbitrarily, 0 to 3 points are allotted to indicate the degree of any of these changes. Stage 0 indicates no change; 1 beginning of change; 2 obvious change; and stage 3 maximum change, occurring in the dental tissues. The result corrected for standard deviation, etc., gives an estimate of the age of the person. The error is said to be  $\pm 4$  to 7 years. The limit of error increases above 50 years of age.

Further modifications of this method is known as *Gustafson's formula*. Age can also be determined by directly reading from the graph on which the regression line is plotted.

**GROWTH IN INDIVIDUAL BONES** : The bones of the human skeleton are preformed in hyaline cartilage. This soft tissue model is gradually converted into hard osseous tissue by the development of osteogenesis, frequently in a central position, from which the process of transformation spreads,



until the whole skeleton is ossified. The appearance of such centres of ossification is spread over a long period of time. A large number are first seen in embryonic life, some appear much later in prenatal life, and others appear after birth. The earliest centres of ossification appear at the end of second month 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. This shows that 600 centres of bone growth have disappeared, i.e., they have united with the adjacent centres to form the adult bone. The process of appearance and union has a sequence and a time. As a rule, ossification begins centrally in an epiphysis and spreads peripherally as it gets bigger. At first it is entirely amorphous, rounded and pinhead sized. As it grows, it takes on the osteological details of the bone. Some bones are ossified from a single centre, e.g. carpus and tarsus. The ossification centres in carpal bones appear as follows: capitate 1; hamate 2, triquetrum 3, lunate 4, scaphoid and trapezoid 5, trapezium 6, pisiform 11 years. Most bones are ossified from several separate centres, one of which appears near the middle of the future bone. This centre is concerned with progressive ossification towards the bone ends. In all such bones, their ends are cartilaginous at birth. These terminal regions are ossified by separate centres, sometimes multiple; they are said to be secondary centres.

Typically, a long bone such as the tibia has become ossified throughout its shaft (diaphysis) at birth; whereas its two ends (epiphyses), are later ossified by secondary centres. A layer of hyaline cartilage persists between the diaphysis and epiphysis. The bone increases in length at this epiphyseal plate or disc (growth plate or growth cartilage), until its final dimensions are attained. The process of union of epiphysis and diaphysis is called fusion. Union is a process, not an event. The long limb bones show epiphysal arrangements at both ends, while metacarpals, metatarsals, phalanges, clavicles and ribs possess an epiphysis at one end only. In some bones, the epiphysal centres at one or both ends are more complex, e.g., in the proximal end of the humerus, which is wholly cartilaginous at birth, three separate centres appear during childhood. They soon unite to form a single epiphysal mass, which later fuses to the diaphysis.

Growth cartilages do not grow at the same rate at all points throughout their substance. By differential

rates of growth, the two bony surfaces usually become reciprocally curved, commonly in such a way that the epiphysis fits like a shallow cap over the convex end of the shaft. There may be maturity imbalance between bones from different parts of the same individual.

For determining the age, skiagrams of the shoulder, elbow, wrist, hip, knee, ankle, pelvis and skull should be taken in anteroposterior direction.

In biology, stability is the exception, variability is the rule, i.e., there really is no average. There is only a central tendency with a normal range of variability. The variability increases with age. As a general rule, the ageing of bones is more accurate with respect to the appearance of centres of ossification than it is with respect to the union of epiphyses. A study of various anatomical authorities shows that there is a considerable variation regarding the ages at which the various centres of ossification in the epiphyses fuse with their respective diaphyses.

In the long bones of upper limbs, the union occurs earlier in the elbow joint and later at the wrist. Head of the humerus is the last long bone epiphysis to unite. In the long bones of the lower limbs, the union occurs later at the knee joint and earlier at the hip and ankle joints.

The epiphyseal lines on the long bones of a young individual appear as circular grooves around the ends of the bones, and on radiographs as irregular lines resembling a fracture. In skeletal remains of a young person where the bones have become completely dry, the epiphyses often separate from the shaft, which should not be mistaken for fractures.

Figures 4-22 to 4-39 show the process of ossification in males. They only indicate an average. Too much reliance should not be placed on them, as variations occur depending on the health, hereditary, nutritional, endocrine and environmental factors. Multiple criteria of skeletal age should be employed whenever possible. The dentition may be used as a check during the first two decades of life. An estimated skeletal age based on appearance of ossification centres and union of epiphyses must always be expressed in plus or minus terms, e.g.,  $10 \pm 1$  (ten years, plus or minus one year). Skeletal development in the female can be in advance of the male up to one year, while dental development may differ only from one to four months.

Union of epiphyses in cartilaginous bone occurs



Table(4-8). Appearance of centres of ossification and union of bones and epiphyses

Age	Appearance of centre of ossification	Union of bone and epiphyses
5th year	: Head of radius, trapezoid, scaphoid.	Greater tubercle fuses with head of humerus.
6th year	: Lower end of ulna, trapezium.	Rami of pubis and ischium unite.
6th to 7th year	: Medial epicondyle of the humerus.	
9th year	: Olecranon.	
9th to 11th year	: Trochlea of humerus.	
10th to 11th year	: Pisiform.	
11th year	: Lateral epicondyle of humerus.	
13th year	: Separate centres in triradiate cartilage of acetabulum.	
12th to 14th year	: Lesser trochanter of femur.	
14th year	: Crest of ilium; head and tubercles of ribs.	Medial epicondyle of humerus; lateral epicondyle with trochlea; patella complete.
15th year	: Acromion.	Coracoid with scapula; triradiate cartilage of acetabulum.
16th year	: Ischial tuberosity.	Lower end of humerus; olecranon to ulna; upper end of radius; metacarpals; proximal phalanges.
17th to 18th year	: s	Head of femur; lesser and greater trochanter of femur; acromion; lower end of ulna.
18th to 19th year	: Inner end of clavicle.	Lower end of femur; upper end of tibia and fibula; head of humerus; lower end of radius.
18th to 20th year	:	Iliac crest.
21st year	:	Inner end of clavicle; ischial tuberosity, head of the ribs.

slightly earlier (by about one year) in the female than in the male, but the reverse is seen in the closure of the sutures of the skull. Under tropical conditions ossification is observed earlier than in temperate areas.

The union of epiphyses as seen in radiographs appear earlier approximately about plus or minus six months than the periods of fusion indicated by anatomical evidence. This is due to the fact, that towards the end of the growth period, the epiphyseal plate of the cartilages become very thin and irregular in outline and may not show on radiograph. In a

film, a persistent scar is not evidence of incomplete union or even of recent union. In an individual bone, once union has begun, it will be completed in about 12 to 18 months. In radiographs of growing long bones, one or more transverse lines are often observed at the diaphyseal ends. This is thought to be evidence of growth disturbance (e.g. scurvy, rickets), and are called "**scars of arrested growth**".

**SYMPHYSIS PUBIS** : The pubic symphysis is probably the best single criterion for determining age from third to fifth decades. (Fig. 4-37). It requires bones that are free of cartilage. The surface

Table (4-9). Difference between mandible in infancy, adult life and old age.

Trait	Infancy	Adult	Old age
(1) Body	: Shallow.	Thick and long.	Shallow.
(2) Ramus	: Short and oblique; forms obtuse angle with body.	Less obtuse angle (almost straight) with the body.	Obtuse angle with the body, about 140°.
(3) Mental foramen	: Opens near the lower margin.	Opens midway between upper and lower margins.	Opens near the alveolar margin.
(4) Condylloid process	: At a lower level than coronoid process.	Elongated and projects above coronoid process.	At a lower level than coronoid process.



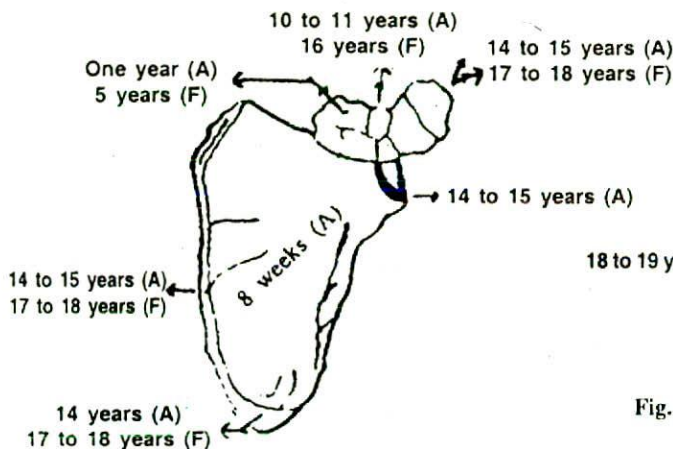


Fig. (4-22). Appearance and fusion of epiphyses in scapula.

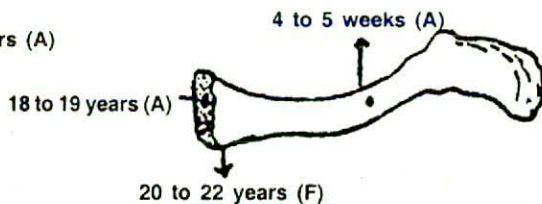


Fig. (4-23). Appearance and fusion of epiphyses in clavicle.

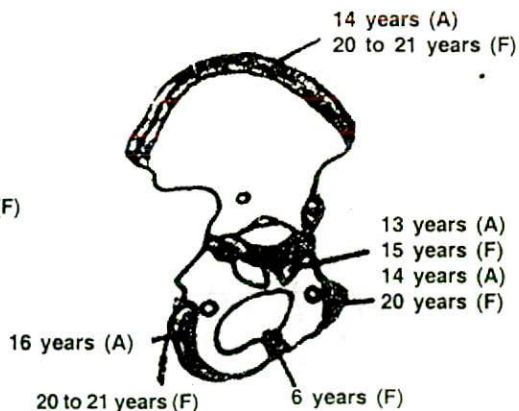
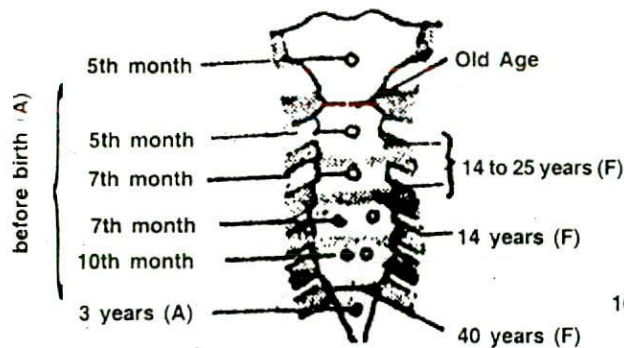


Fig. (4-24). Appearance and fusion of epiphyses in sternum and hip bone.

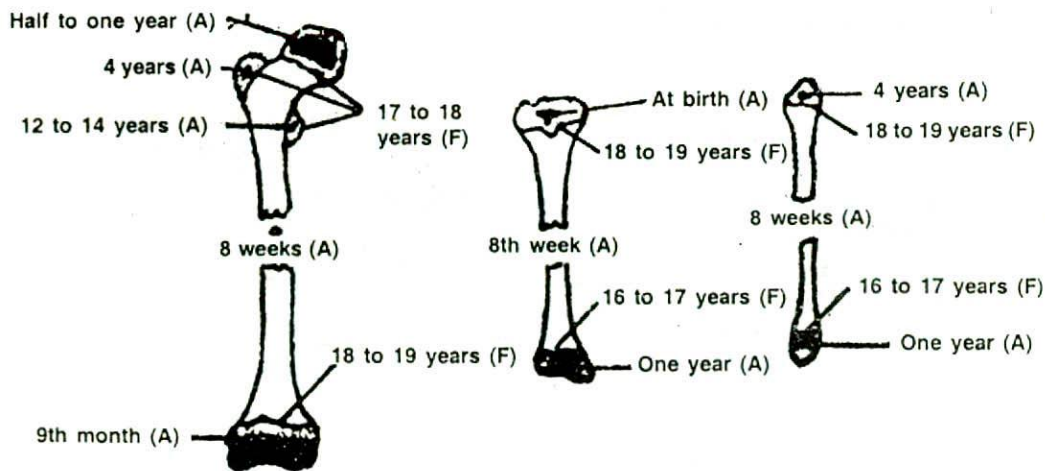


Fig (4-25). Appearance and fusion of epiphyses in femur, tibia and fibula.



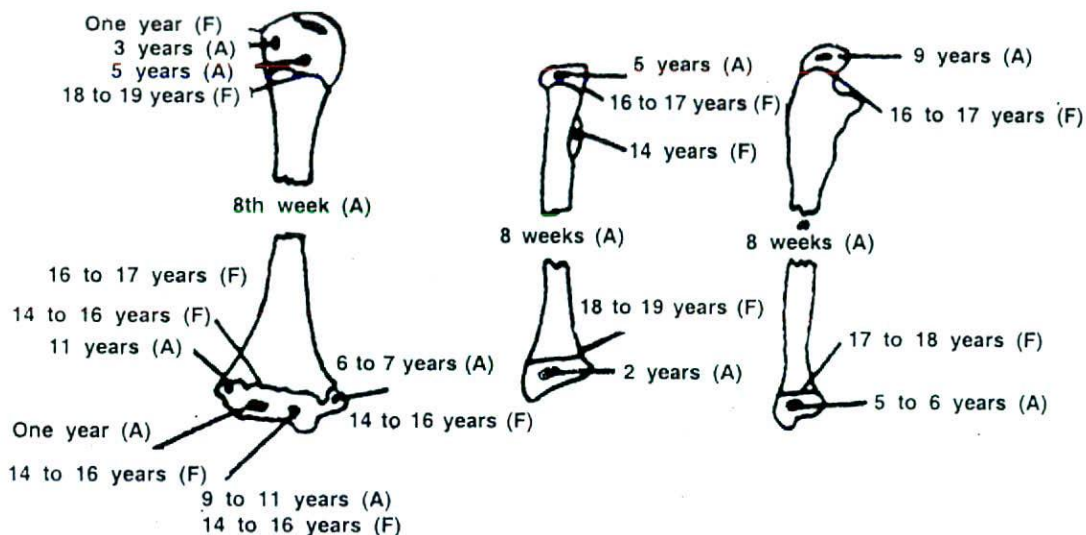


Fig. (4-26). Appearance and fusion of epiphyses in humerus, radius, and ulna.

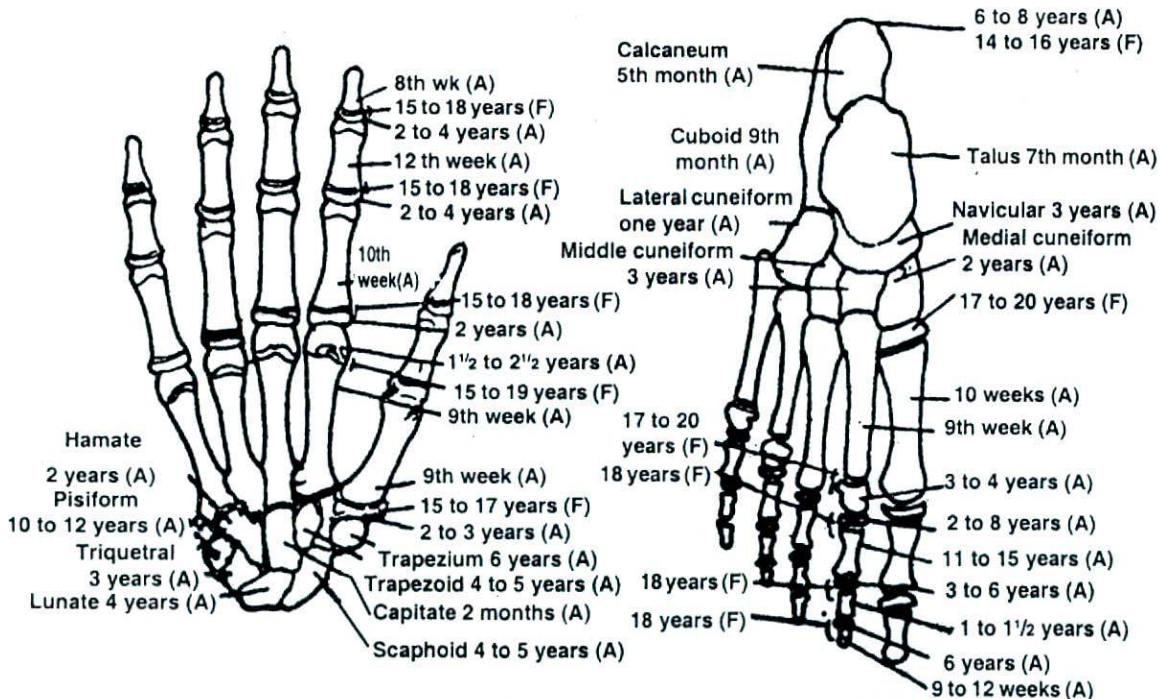


Fig. (4-27). Appearance and fusion of epiphyses in bones of hand.

Fig. (4-28). Appearance and fusion of epiphyses in bones of foot.





Fig. (4-29). X-ray photograph of the shoulder. The acromion, coracoid and head of the humerus not united with the shaft.  
Age 15 to 18 years.



Fig (4-30). X-ray photograph of the elbow. The medial and lateral epicondyles of the humerus, olecranon and the head of the radius are not united with the shafts.  
Age between 11 to 14 years.

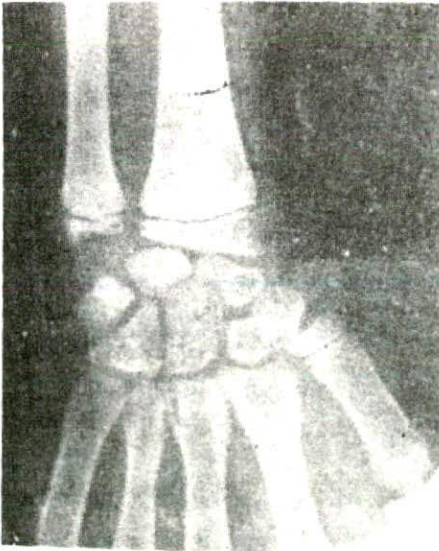


Fig. (4-31). X-ray photograph of the wrist and hand. All the carpal bones are seen. The lower epiphyses of first metacarpal not united with the shaft.  
Age between 12 to 15 years.



Fig (4-32). X-ray photograph of the hip. Triradiate cartilage not obliterated. Greater trochanter of femur not united with upper end.  
Age below 14 years.





Fig. (4-33). X-ray photograph of the pelvis and hip. Ischial tuberosity and iliac crest have appeared but not fused. Upper end of the femur has united.  
Age 17 to 18 years.



Fig. (4-34). X-ray photograph of the knee. The epiphyses of the lower end of the femur and upper ends of tibia and fibula not united with the shafts.  
Age below 18 years.



Fig (4-35). X-ray photograph of the knee. Fusion of the epiphyses of the lower end of femur and upper end of the tibia nearing completion.  
Age about 18 to 19 years.



Fig. (4-36). X-ray photograph of the ankle. Secondary centre for the calcaneum appeared but not fused. The epiphyses of the lower ends of tibia and fibula not united with the shafts. Age between 6 to 14 years.



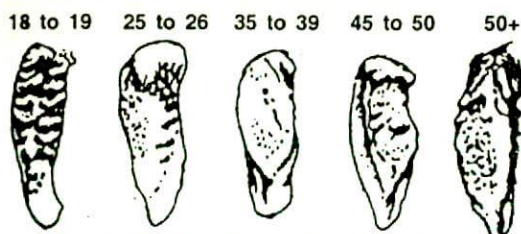


Fig. (4-37). Age changes in symphysis pubis.

features are blurred if there is erosion by drying and damage. The symphyseal surface before 20 years has a layer of compact bone near its surface. At about 20 years, it is markedly irregular or uneven, and the ridges run transversely across the articular surface. Between 24 and 36 years, the ridges gradually disappear and the surface has a granular appearance and ventral (outer) and dorsal (inner) margins are completely defined. Early in the fifth decade, the symphyseal face has an oval, smooth surface with raised upper and lower ends. Towards the end of the fifth decade, a narrow beaded rim develops on the margins. During the sixth decade, erosion of surface and breakdown of ventral margin begins. In the seventh decade, the surface becomes irregularly eroded. If the male criteria are used for females, the age would be underestimated by about ten years (Gilbert, 1973).

**STERNUM** : The four pieces of the body of the sternum fuse 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.

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

**SKULL** : Bones of the calvaria are 8 in number: parietal 2, frontal one, temporal 2, occipital one,

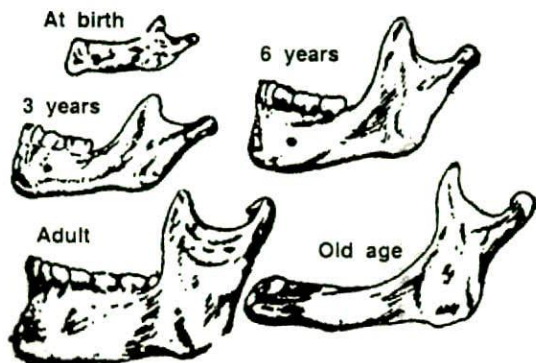


Fig. (4-38). The mandible at different periods of life.

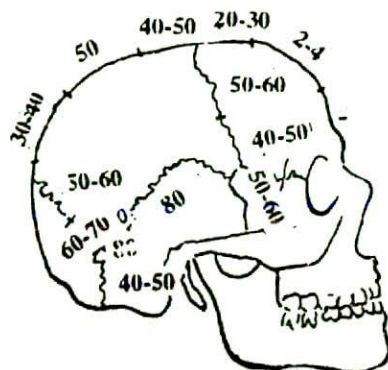


Fig. (4-39). Age of closure of cranial vault.

sphenoid one, and ethmoid one. Bones of the face and jaws are 14 in number: maxilla 2, zygomatic 2, nasal 2, lacrimal 2, palatine 2, inferior nasal concha 2, mandible one, and vomer one. The flexible cartilaginous joints of early life are replaced with interlocking connections between bones in maturity. (Fig. 4-39). Lateral and occipital fontanelles usually close within the first two months. The anterior fontanelle closes and the two halves of the mandible unite at the second year. The condylar portions of occipital bone fuse with the squama at the third year, and with the basioccipital at the fifth year. The metopic suture closes about the third year, but in 5 to 10% cases it persists. 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. The coronal, sagittal, and lambdoid sutures start to close on their inner side at about the age of 25 years. On the outer side, fusion occurs in the following order: posterior one-third of the sagittal suture at about 30 to 40 years; anterior one-third of the sagittal and lower half of the coronal at about 40 to 50 years; and middle sagittal and upper half of the coronal at about 50 to 60 years. The lambdoid suture starts closing near the lambda and the union is often completed at about 45 years. The squamous part of the temporal bone usually fuses with its neighbour by age of 60 years. Suture closure in skull occurs later in females than in males. Estimation of age of skull from suture closure is not reliable. It can be given only in a range of decade. Beginning union in the vault sutures may be identified by irregular radio-opacity on each side of the suture. The most successful estimate is done from sagittal suture, next lambdoid and then coronal.



A lateral head film is preferable for the observation of coronal and lambdoid sutures. Ectocranial suture closure is very variable. Sometimes, there may not be ectocranial suture closure. This is called "**lapsed union**". This occurs most often in the sagittal suture. With lapsing there is slight bony elevation on either side of the incompletely closed suture.

**OTHER AGE CRITERIA IN THE SKULL :** A young adult skull is smooth and ivory in color on both inner and outer surfaces. At about  $40 \pm 5$  years, the surface begins to assume a "matted" granular, rough appearance. From 25 years onwards muscular markings become increasingly evident, especially on the side of the skull (temporal line), on the occiput (nuchal lines), and on the lateral side of the mandible (masseteric attachment). On the inside of the skull, on either side of the sagittal suture, certain pits or depressions (pacchionian depressions) become more marked with age, both in depth and in frequency. The grooves of the middle meningeal artery become deeper. After 50 years, the diploe becomes less vascularly channelled and there is increasing replacement by bone. There is no consistent age change in the thickness of the vault bones.

**SACRUM :** The five sacral vertebrae are separated by cartilage until puberty, when the lateral portions grow together. After this, fusion of epiphyses takes place and ossification of intervertebral discs extends from below upwards. The sacrum becomes a single bone between 21 and 25 years. A gap may persist between S1 and S2, until 32 years due to "lapsed union".

**VERTEBRAE :** The immature vertebral body has a series of deep radial furrows both on the upper and lower surfaces. This feature increases in prominence up to the age of ten, and then gradually fades at from 21 to 25 years. After 45 years, osteoarthritic changes in the form of lipping of the vertebrae are seen.

**SCAPULA :** Between 30 to 35 years lipping starts on the ventral margin of the glenoid cavity. By 35 to 40 years irregular lipping occurs around the clavicular facet and inferior surface of the acromion process. By 45 years, localised bony atrophy can be seen. Cristae scapulae occur by 50 years.

**SECONDARY SEX CHARACTERS :** In the male, at about fourteen years, fine hair begins to appear on pubis, the testes become larger and firmer and the penis begins to enlarge. At about fifteen years, hair is moderately grown on pubis, and hair

begins to grow in axilla. At about 16 years, hair on pubis is well grown and the external genitals have an adult appearance. Hair begins to appear on the face between 16 and 18 years and voice becomes hoarse. In the female, the breasts begin to develop about thirteen years, and some fine, pale, downy hair appears on mons veneris two months later. The labia develop and menstruation starts. At about 14 to 15 years the pubic hair is well grown and hair appears in the axilla.

### ESTIMATION OF AGE AS A WHOLE

For the approximate estimation of age, the following paragraphs should be correlated with what has already been described. Doctor's estimate about age is not proof but merely an opinion.

**First Fortnight :** The changes in the umbilical cord and the skin.

**First Six Months :** Weight and height, partial closure of anterior fontanelle and fusion of the two halves of the mandible. Ossification centres in capitate appears during second month after birth.

**Six Months to two Years :** The eruption and calcification of temporary teeth is the best guide and the appearance of certain ossific centres and their size in heads of humerus, femur, tarsus and carpus.

**Two to six Years.:** Ossification of tarsus and carpus and appearance of centres in epiphyses of long bones. The number of carpal bones seen on X-ray indicate the approximate age in years.

**Six to thirteen Years :** Eruption and calcification of permanent teeth is very helpful. Alterations occur in the centres that have already appeared and additional centres appear.

**Thirteen to 16 Years :** The changes of puberty and ossification of bones, especially in the region of the elbow joint.

**Sixteen to 25 Years :** The union of epiphyses of most of the long bones with the shafts take place. The union of epiphyses of clavicles, ends of ribs and iliac crest occur during this period. Between 20 to 30 years, incisors, tips of canines and cusps of premolars show slight to moderate wear. In the early twenties, the sternal rib shows a scalloped rim around a deepening V-shaped pit in both sexes.

**25 to 35 Years :** The coronal, sagittal and lambdoid sutures of the skull start to close. The changes in the symphysis pubis are very important.

**35 to 50 Years :** There is further progress in the changes in the symphysis pubis. Between 30 to 40 years, tooth cusp wear may be moderate to severe. The medullary cavity of the humerus may have increased upward to the level of the lower end of the tuberosity



Wrinkles about the eyes, eyebrows and in front of ears appear about 35 to 40 years. Xiphoid process unites with the sternum at about forty years. Between 40 to 50 years, the vault sutures are all united both endocranially and ectocranially. The cortex of the long bones becomes thinner and less dense. In the humerus, the medullary cavity may extend upward to almost the surgical neck. Atrophic areas in the scapula and iliac fossa are of moderate to almost large size. The margins of the bodies of the lumbar vertebrae, and the inner borders of the ischial tuberosities show lipping by 40 years, which becomes well marked by 45 years. Later, it becomes more marked here and in the joints of the extremities. By the end of fifth decade, bony projections from the superior and/or inferior margins of the rib is fairly well marked in males, and the pit deepens and widens. In females, the pit is relatively shallow and the bone itself is thinner. Ossification of laryngeal and costal cartilages and hyoid bone usually begin. Early changes in the articular surfaces of many bones may appear; they include lipping, reduction of joint space, and the presence of punched-out areas of osteoporosis on X-ray examination. The skull bones gradually change from an ivory-like to granular appearance and feel.

An arcus senilis (a grey opaque ring surrounding the margin of the cornea, due to degenerative changes), but separated from the margin by an area of clear cornea, may appear as a result of lipid degeneration about fifty years or later, but is not complete before sixty years. When it occurs in young adults due to hyperlipidaemia, it is called arcus juveniles. Greying of the hair is variable and not of much value. Head hair may become grey after forty years, first at the temples. Later it involves the beard and chest hair and eyebrows, but pubic hair, does not become grey before 50 to 55 years.

**50 to 60 Years :** The external tables of the vault become slightly thinner. The molar crowns of the teeth are usually worn flat to a single plane. If all molar cusps are so worn that the crown is a flat plane, an age of fifty plus may be concluded.

**After sixty Years :** Further sutural closure of skull occurs. The linea and tuberosities of muscle attachment may show small osteophytic "spurs" or "spikes" in the fifties and sixties and are well advanced in the seventies. Joint changes become more extreme in character and osteoporosis is more marked. The joint between the manubrium and the body of the sternum may fuse, and calcification of the laryngeal and costal cartilages becomes more visible. The predominant features of this period are pathological skeletal changes. The hair may become silvery-white. A completely edentulous

upper and lower jaws usually indicate an age of over 70 years.

Loss of collagenous stroma occurs in old age due to which the bone becomes lighter. The stroma is lost first in the outer cortex and the zone around the marrow cavity. The ends of long bones adjacent to the joints are the first to appear fragile and brittle. Radiological thinning of the cortex and progressive rarefaction of the apex of the medullary cavity in the head of the humerus and femur are helpful in the determination of age.

Loss of elasticity of skin, wrinkling and discolouration of the skin of buttocks and abdomen, atrophy of uterus and ovaries, brown atrophy of the heart, and atherosclerotic change in the arteries give an indication of old age.

**The estimation of age becomes more uncertain after the age of 25 years.** It is difficult to achieve an accuracy of even five years. A careful examination of all factors may enable the doctor to make a fair approximation to the decade within which a person may be. Any closer approximation must be made with considerable reservation.

**Premature ageing** may be produced due to illness, malnutrition, suffering, anxiety or worry. White hair may be produced in quite young people from grief or shock.

**Procedure for Determination of Age :** In medico-legal cases, the age of a person is determined by medical officer on requisition from the police officer or Magistrate. Written consent of the person should be taken. The following particulars should be noted. (1) Name, father's name, age alleged by the person, sex, occupation, and address. (2) Date, time and place of examination. (3) Name of the police constable accompanying the person. (4) Marks of identification. (5) Name of the nurse or attendant present at the medical examination. (6) Height, and weight. (7) General build and changes of puberty. (8) Radiological examination of the bones.

The opinion about the age should be given based on the findings of physical, dental and radiological examination. Multiple criteria of skeletal age should be used.

#### MEDICO-LEGAL IMPORTANCE OF AGE

**(1) Criminal Responsibility :** A child above five years is liable for punishment for any unlawful act under Indian Railways Act. 1890, S.118. Any act which is done by a child under seven years of age is not an offence (Sec. 82, I.P.C.). A child between seven and 12 years is presumed to be



capable of committing an offence, if he attained "sufficient maturity of understanding to judge the nature and consequences of his conduct on that occasion" (Sec. 83, I.P.C.). This maturity is presumed in a child, unless proved otherwise by the defence. A child under 12 years cannot give valid consent to suffer any harm which may occur from an act done in good faith and for its benefit (Sec. 89, I.P.C.). A person above 18 years can give valid consent to suffer any harm which may result from an act not intended or not known to cause death or grievous hurt (Sec. 87, I.P.C.). Persons with XYY chromosomal pattern are of aggressive and of criminal nature.

**(2) Judicial Punishment :** According to the Juvenile Justice (Care and protection of children) Act, 2000 "juvenile or boy" means a person (boy or girl) who has not completed eighteenth year of age. Juvenile Justice Boards exercise powers in relation to juveniles in conflict with law. The board may advise or admonish the juvenile, or order to participate in group counselling or perform community service, or to be released on probation of conduct or to pay a fine, or to make an order directing the juvenile to be sent to a special home for the period until he becomes major. No juvenile in conflict with law shall be sentenced to death or life imprisonment, or committed to prison.

**(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, I.P.C.).

**(4) Kidnapping :** S. 361 to 369, I.P.C. deal with kidnapping. Kidnapping means taking away a person by illegal means. 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 ten years (Sec. 369, I.P.C.); (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 (Sec. 361, I.P.C.); (c) to kidnap or maim a minor for purposes of begging (363-A), (d) kidnapping, abducting or inducing woman to compel her marriage (366, I.P.C.), (e) to procure a girl for prostitution, if her age is under 18 years (Sec. 366-A, I.P.C.); and (f) to import into India from a foreign country a female for purposes of illicit intercourse, if her age is less than 21 years (366-B, I.P.C.).

**(5) Employment :** A child below 14 years cannot be employed to work in any factory or mine

or in other risky employment. A person completing 15 years (adolescent) is allowed to work in a factory as an adult, if a fitness certificate is issued by a certifying surgeon.

**(6) Attainment of Majority :** A person attains majority on the completion of 18 years, but when a person is under the guardianship of Court of Wards, or is under a guardian appointed by the Court, he attains majority on the completion of 21 years (Sec. 3, Ind. Majority Act, 1875).

**(7) Evidence:** Competency for giving evidence depends on understanding but not on age. A child of any age can give evidence if the Court is satisfied that the child is truthful (S. 118, I.E.A.).

**(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 seven months of intrauterine life.

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

**(11) Identification :** An approximate age is important in any chain of identity data, e.g., when a few days old child is alleged to be the newborn child.

**(12) Impotence and Sterility :** A boy is sterile though not impotent before puberty. Women become sterile after menopause.

#### AGE OF THE FOETUS

The term developing ovum is used for the first seven to ten days after conception, i.e., until the implantation occurs. It is called an 'embryo' from one week to the end of the second month, and later it is called 'foetus'. It becomes an infant when it is completely born.

**End of first month :** Length one cm; weight two-and-half g. The eyes are seen as two dark spots, and the mouth as a cleft. Nucleated red cells begin to form in placenta.

**End of second month:** Length four cm; weight ten g. The hands and feet are webbed. The placenta begins to form. The anus is seen as a dark spot.

**First ossification centre in a foetus appears in clavicle (4 to 5 weeks), followed by maxilla (6 weeks).**

**End of third month :** Length nine cm; weight thirty g. The eyes are closed and the pupillary membrane appears. Nails appear and the neck is formed

**End of fourth month : Length 16cm; weight 120**



g. Sex can be recognised. Lanugo hair is seen on the body. Convolutions begin to develop in brain. Meconium is found in the duodenum.

**End of fifth month :** Length 25 cm; weight 400 g. Nails are distinct and soft. Light hair appears on head. Skin is covered with vernix caseosa. Meconium is seen at the beginning of the large intestine.

**End of sixth month :** Length 30 cm; weight 700 g. Eyebrows and eyelashes appear. Skin is red and wrinkled and subcutaneous fat begins to be deposited. Vernix caseosa is present. Meconium in transverse colon. The testes are seen close to the kidneys.

**End of seventh month :** Length 35 cm; crown-rump length 23 cm; foot length 8 cm; weight 900 to 1200 g. Nails are thick. Eyelids open and pupillary membrane disappears. Skin is dusky-red, thick and fibrous. Meconium is found in the entire large intestine. Testes are found at external inguinal ring. Gall-bladder contains bile and caecum is seen in the right iliac fossa. Ossification centre is present in the talus.

**End of eighth month :** Length 40 cm; weight one-and-half to two kg. Nails reach the tips of fingers. Scalp hair is thicker, 1.5 cm. in length. Skin is not wrinkled. Left testis is present in the scrotum. Placenta weighs 500 g.

**End of ninth month :** Length 45 cm; weight 2.2 to three kg. Scalp hair is dark and 4 cm. long. Meconium is seen at the end of large intestine. Scrotum is wrinkled and contains both testes. Placenta weighs 500 g. Ossification centres are usually present in the lower end of the femur.

**End of tenth month: (fullterm child) :** Length 48 to 52 cm; crown-rump length 28 to 32 cm; weight 2.5 to 5 kg; average about 3.4 kg. The length is much less variable than the weight. The male infant weighs about 100 g. more than the female. The circumference of the head is 33 to 38 cm. At full term the head of a child is nearly one-fourth of the whole length of the body. The surface of the brain shows convolutions, and the grey matter begins to form. The scalp hair is dark, 3 to 5 cm long. The face is not wrinkled. Lanugo is absent except on the shoulders. The skin is pale and covered with vernix caseosa. The nails project beyond the end of fingers but reach only the tip of the toes. The cartilages have formed in the nose and ears. The testes are present in the scrotum; vulva is closed and labia minora are covered by fully developed

labia majora. The rectum contains dark brownish, green or black meconium. The placenta is 22 cm. in diameter, one-and-half cm. thick at the centre, and weighs about 500 gm. The umbilicus is situated midway between pubis and xiphoid cartilage. The umbilical cord is 50 to 55 cm. long, and one cm. thick. The centre of ossification is found in the lower end of femur and sometimes in the cuboid and in the upper end of the tibia. Six fontanels are usually present in the neonatal skull. The anterior fontanel (bregma) is located at the junction of sagittal and coronal sutures. The posterior fontanel (occipital) lies at the junction of sagittal and lambdoid sutures. At each sphenoparietal junction, a lateral fontanel is present. The posterolateral fontanels (mastoid) are located at the mastoid-occipital junctions. Anterior fontanelle is 4 x 2.5 cm.

**Ossification Centres :** (1) **Sternum :** It is placed flat on a wooden board and cut with the cartilage knife in its long axis in midline.

(2) **Lower end of femur and upper end of tibia :** The leg is flexed against the thigh and a transverse or vertical incision is made into the knee joint. The patella is removed. The end of the femur is pushed forward through the wound, and a number of parallel cross-sections are made through the epiphysis starting from its articular surface and continuing until the largest part of ossific centre is reached. The centre is seen as a brownish-red nucleus surrounded by bluish-white cartilage. Further sections are made through plain cartilage above it until the diaphyseal centre is reached. The centre appears about the 36th week. Its diameter is about four to five mm. at 37 to 38 weeks, and 6 to 8 mm. at full term. The upper end of tibia is similarly examined. In 80 percent of full term infants, a centre is present in the upper end of tibia, but in other cases it appears after birth.

(3) **Bones of the foot :** The foot is grasped in the left hand behind the heel, the toes pointing towards the dissector. An incision is made between the interspace of third and fourth toes with a long knife, backwards through the sole of the foot and heel. If centre in calcaneum and talus are not exposed, thin slices of cartilage of these bones should be cut until the presence or absence has been shown. Centre in the calcaneum appears at the end of the fifth and in talus at the end of seventh month of intrauterine life. A centre may be present in cuboid at birth, or it may appear shortly afterwards.



**RULE OF HAASE (1895):** This is a rough method of calculating the age of the foetus. The length of the foetus is measured from the crown to the heel in centimetres. During the first five months of pregnancy the square root of the length gives the approximate age of the foetus in months, e.g. a foetus of 16 cm. is four months. During the last five months, the length in cm. divided by five gives the age in months, e.g., foetus of 35 cm. is 7 months.

After birth, the length of an infant is 50 cm; 60 cm. at the end of six months; 68 cm. at the end of first year, and 100 cm. (double its length at birth) at the end of fourth year. Birth weight doubles by about five months of age and triples by about one year. Head circumference increases by about twelve cm. in the first year of life. In infants and children, height and weight may be compared with standard tables.

**STATURE:** Stature varies at different times of the day by one-and-half to two cm. It is less in the afternoon and evening due to the reduced elasticity of the intervertebral discs and the longitudinal vertebral muscles. Both malnutrition and advancing years reduce stature. After the age of thirty, the natural processes of senile degeneration cause gradual decrease in stature by about 0.6 mm. per year on an average. The stature is greater by one to three cm. on lying. On an average, the body lengthens after death by about two cm. due to complete loss of muscle tone, relaxation of large joints and loss of tensioning effect of paraspinal muscles on intervertebral discs.

If the body has been dismembered, the approximate stature may be determined by: (1) The length from the tip of the middle finger to the tip of the opposite middle finger, when arms are fully extended, closely equals the height. (2) Twice the length of one arm, with 30 cm. added for two clavicles, and four cm. for the sternum, is equal to the height. (3) The length from the vertex to the symphysis pubis is roughly half of stature. After 14 years of age the symphysis pubis lies about halfway up the body. Before 14 years the trunk is longer than the lower limbs. (4) The length from the sternal notch to symphysis pubis multiplied by 3.3 gives the stature. (5) The length of forearm measured from tip of olecranon process to tip of the middle finger is equal to 5/19 of the stature. (6) The height of head measured by the vertical distance from the top of the head to the tip of the chin is about one-seventh

and the length of skull is about one-eighth of the total height. (7) The length of vertebral column is 35/100 of the height. (8) To the length of entire skeleton add two-and-half cm. to four cm. for the thickness of the soft parts. (9) Maximum foot length divided by 0.15 gives stature.

**ANTHROPOMETRY (Bertillon system):** It is based on the principle that after the age of 21 years, the dimensions of the skeleton remain unchanged and also that the ratio in size of different parts to one another varies considerably in different individuals. As such, this is applicable only to adults. This system includes: (1) Descriptive data: such as colour of hair, eyes, complexion, shape of nose, ears, chin, etc. (2) Body marks: such as moles, scars, tattoo marks. (3) Body measurements: such as height, anteroposterior diameter of head and trunk, the span of outstretched arms, the length of left middle finger, left little finger, left forearm, left foot, length and breadth of right ear and colour of left iris. The photographs of a front view of the head and a profile view of the right side of head are also taken. As a sole means of identification, photographs are not always reliable, and they may be a source of error even when they are inspected by experts. This system has now been replaced by dactylography.

**DACTYLOGRAPHY (fingerprint system; dermatoglyphics; Galton system):** This system was first used in India in 1858, by Sir William Herschel in Bengal. Sir Francis Galton systematised this method in 1892. Fingerprint Bureau was first established in Kolkata. Fingerprints are impressions of patterns formed by the papillary or epidermal ridges of the fingertips. At birth a fine pattern of ridges is seen on the skin of the bulbs of the fingers and thumbs, parts of the palms and the soles of the feet.

**Classification:** (1) Loops (about 67 percent), (a) radial, (b) ulnar. (2) Whorls (about 25 percent), (a) concentric, (b) spiral, (c) double spiral, (d) almond-shaped. (3) Arches (about 6 to 7 percent), (a) plain, (b) tented, (c) exceptional. (4) Composite form (about one to two percent), (a) central pocket

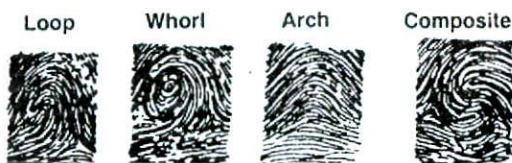


Fig. (4-40). Primary types of fingerprint.



loops, (b) lateral pocket loops, (c) twinned loops, (d) accidentals (Fig. 4-40).

In a whorl the ridges form a series of circles or spirals around the core. In a composite, there are a combination of two or more of the types, namely arches, loops or whorls.

The final identification of any fingerprint is made by comparison of many details of characteristics which occur throughout the ridge areas and by the sequence in which these characteristics occur, but not by comparing the patterns. The characteristics may take the form of ridge endings, bifurcations, lake formations, or island formations. In practice 16 to 20 points of fine comparison are accepted as proof of identity. The patterns are not inherited and paternity cannot be proved through fingerprint patterns. The details of these can be accurately teleprinted. The fingerprint patterns are distinctive and permanent in individuals. The fingerprint system is the only guide to identity which is unailing in practice. The pattern is different even in identical twins. Palm and footprints also provide similar material.

**Poroscopy:** This is further study of fingerprints, described by Locard. The ridges on fingers and hands are studded with microscopic pores, formed by mouths of ducts of subepidermal sweat glands. Each millimetre of a ridge contains 9 to 18 pores. These pores are permanent and unchanged during life and vary in size, shape, position, extent and number over a given length of ridge in each individual. This method of examining pores is called poroscopy, and is useful when only fragments of fingerprints are available.

**The Individuality of Fingerprints:** The fingerprints are capable of endless variation so that it has been speculated that there is one chance in sixty-four billions of two persons having identical fingerprints.

**Mode of Production:** A constant stream of sweat covers the skin and when the person is excited, the output of sweat increases. Sweat contains about 99% water and one% solids, which include salt, urea, fatty acids, formic acid, acetic acid, butyric acid and sometimes a little albumin. The fingerprint may also contain oil exuded by the sebaceous glands, which is present on the fingertips through touching the face, neck, hair, scalp, etc. If any part of finger is applied to a smooth surface, a greasy impression of its pattern is made on it.

**Techniques of Fingerprinting:** The hands are washed, cleaned and dried, as otherwise the print will be blurred. The fingerprints are recorded on unglazed white paper using printer's ink. (1) A plain print is taken by applying ink to the tips of the fingers and placing the fingers directly on paper. (2) The rolled fingerprint is taken by rolling the fingers on paper from outward to inward in such a way as to obtain an impression of the whole tip. If rigor mortis is well developed, incision into the palmar surface of the fingers at the proximal interphalangeal joint will enable the fingers to be straightened, and printing can be carried out.

**Types:** (1) The **latent print** is an invisible or barely visible impression left on a smooth surface. (2) **Visible prints** are formed by fingers stained with blood or ink or other medium. (3) The **plastic print** is an impression made on a soft surface, such as soap, cheese, etc.

Burnt skin of the fingers on healing shows its original pattern. In manual labourers working with lime, sand, and cement the ridges on the bulbs get unduly rubbed and become broken and indistinct. Ridge impressions get malformed if the quality of ink is poor, when the ink is too liquid and spreads into the depressions, if the digit is rolled often or pulled, and when the paper is placed upon an uneven or rough surface.

Fingerprints may be taken from almost any surface with which the fingers come in contact, including certain fabrics and human skin. A latent print may be developed by dusting the area with coloured powders to provide a contrast, and its pattern is recorded by photography. It can also be examined by oblique lighting. The commonly used powder is 'grey' powder (chalk and mercury), but white powders (lead carbonate or French chalk) are used for dusting dark surfaces. Fingerprints on paper, wood and fabrics are developed by treating them with 5% silver nitrate solution and then fixing them with sodium thiosulphate. Fingerprints on paper can also be developed by exposing it to the vapours of iodine or osmium tetroxide. Electron autoradiography method uses a high energy beam of X-rays to irradiate the lead dust on fingermarks. The scanning electron microscope visualises latent fingerprints on metal and glass.

**LIFTING OF FINGERPRINTS:** Fingerprints on a large immovable hard surface is developed, photographed and then adhesive surface of cellophane tape is pressed on the print, taken out gently and pasted against a cardboard sheet for permanent preservation.



The fingerprints of an assailant will remain on the victim only after death. During pre-death struggle both the assailant and the victim will sweat, and one exudate will cancel out the other. After death, the victim will not sweat, but the nervous tension of the assailant will produce sweating, due to which the fingerprints will be left on the body. Sweating from exertion is seen on the forehead, axilla, small of the back, etc. whereas nervous sweating is almost confined to the hands and feet.

**Fingerprints in Decomposed Bodies:** Ridges are present both in dermis and epidermis. In advanced putrefaction and in cases of drowning, the skin is frequently found loose like a glove, which should be removed, preserved in formalin and used for impressions. Prints can be obtained from the dermis after epidermis is lost. Histological sections up to a depth of 0.6 mm. from the surface of the skin give satisfactory fingerprints. In dead bodies, the palmar skin of the terminal phalanx of each finger should be removed separately from both hands, and after labelling, placed in separate containers, containing 10% formalin, and sent to the fingerprint bureau, if it is not possible to take the prints. If the fingers are shrivelled, they should be immersed in 20% acetic acid for 24 to 48 hours, which will cause the shrivelling to swell to normal size. If the fingers are sodden, wrinkled or mummified, their outline can be made level by injecting liquid paraffin, or even formalin, within the tissues of the palmar aspects of the terminal phalanx of each finger.

**Persistence of Impression at Scene of Crime:** Impressions may persist for years, if undisturbed by cleaning. Even outside the house, they may persist for weeks. On glazed paper they persist for more than three years.

**MUTILATION OF FINGERPRINTS:** Criminals sometimes attempt to mutilate the pattern by self-inflicted wounds or burns, application of corrosives or erosion against a hard surface, but they are not destroyed unless the true skin is completely destroyed. They produce additional characteristics. It leaves some part of the skin undamaged, unless skin grafts are made. In most cases of coeliac disease, there is moderate epidermal ridge atrophy and even loss of pattern. Incomplete atrophy of the ridges is usually seen in dermatitis. Ridge alteration occurs in eczema, acanthosis nigricans, scleroderma, and dry or atrophic skin. Permanent impairment of the fingerprint pattern occurs in leprosy, electric injury and after exposure to radiation. In infantile paralysis, rickets and acromegaly, though the pattern is not altered, the distance between

the ridges can be changed. Fingerprints are better protected than other parts of the body, e.g. in case of burns they are bent inwards against the palm of the hand.

**Computerisation:** Fingerprint reader (FINDER) is a computerised automatic fingerprint reading system which can record each fingerprint data in half second. Prints of eight fingers are recorded excluding little fingers. The light reflected from a fingerprint can be measured and converted to digital data which is classified, codified and stored in the computer.

**Medico-legal Importance:** (1) The recognition of impressions left at a scene of crime, e.g., on weapons, furniture, doors, utensils, clothes, etc., establish the identity of the criminal. (2) The identification of suicides, deserters, persons suffering from loss of memory or those dead or unconscious after being involved in an accident and of decomposing bodies. (3) Identification in case of accidental exchange of newborn infants. (4) The prevention of impersonation. (5) To maintain identity records. (6) Cheques, bank notes and other legal documents can bear a fingerprint.

In criminals, impressions of all the ten fingers are taken, but for civil purposes the left thumb impression only is taken.

**FOOTPRINTS (Podogram):** The skin patterns of toes and heels are as distinct and permanent as those of the fingers. Footprints of newborn infants are used in some maternity hospitals to prevent exchange or substitution of infants. A fresh footprint of suspected person is taken and compared with the original. Any peculiarities in the foot, such as a flat foot, supernumerary toes, scars or callosities are likely to be found in the footprint. In case of bootmark the pattern and arrangement of nails or holes in the sole may be useful. A footprint produced by walking is usually larger than one produced by standing. The imprint on soft and loose material like sand is smaller than the foot, and the imprint produced on mud or clay is larger.

A footmark expert may identify a shoe with a mark made at the scene of crime, and by general examination may find out the number of persons involved, their actual movements at the scene and their point of entry. Individual impressions, especially in yielding soil, will indicate the shoe size and approximate weight of the person and any peculiarity of gait. A partial footmark may be quite sufficient to positively identify a shoe. Footmarks are recorded by photography, casts or lifting or by a combination.





Fig. (4-41) Superimposition technique.

(A) Skull photograph in the same position as face in B. (B) Photograph of missing person. (C) Result when photograph B is superimposed on the photograph A, showing resemblance in the contour of the face and skull.

Casts can only be taken when there is a footmark in depth. As they are three dimensional, they can be easily compared with the suspect's shoes even by lay persons.

**PALATOPRINTS:** In the anterior part of the palate, the structural details like the rugae are individual specific and permanent. The palatoprints can be used in the same way as fingerprints.

**LIPPRINTS: (Cheiloscopy):** They are useful in personal identification. Lipprints are divided into eight patterns which are specific to the individual; vertical, branched, intersected, reticular patterns, etc. Minor differences can be noted between the right and the left and upper and lower lips.

**EAR PRINTS:** The shapes of ear lobes and the tips of ears are of various types. The suspected person is asked to press the ear on a glass pane in a door. The print is made visible as in the case of fingerprints and a photograph of the print is taken. The same process is applied to the ear prints from the scene. Photocopies of both known and unknown ear prints are produced on plain and transparency overlays. The transparency overlay is put on the top of the unknown print and taped to the top of a light box. If the tragus point, crus of the helix points and antitragus point fit, look at the lower and upper crura of the antihelix and the helix rim. If all details coincide the prints are from the same source.

**NOSE PRINTS:** The lines on the nose and the shape of the tip are helpful in identification.

**SUPERIMPOSITION:** Superimposition is the technique applied to determine whether the skull is that of the person in the photograph. (Fig. 4-41). The photograph need not be front view of the face; even lateral and semi-lateral view of face can be used. A recent photograph is better. If the negative of photograph is not available, negative of the available photograph is prepared by recopying it. The photograph is enlarged to natural size from the presence of some standard thing in the photograph of the missing person to indicate the scale. In the absence of a standard for the measurement of face in the photograph, photographs of the skull and face are superimposed by adjusting the magnifications until the interpupillary distances correspond, on the assumption that the interpupillary distance in one individual is the same always when the eyes move in different directions. The negative is placed under the ground-glass of camera and salient features of the face are marked out carefully on the glass. The soft parts are removed from the skull. A comparison can be made even in the absence of the lower jaw. The skull is mounted on an appropriate skull rest, so as to align as accurately as possible with the outline of the head on the ground-glass in the corresponding portrait, making due allowance for the soft tissues covering the bone. The distance of the camera is adjusted so that the one inch scale on the ground-glass of the camera is exactly equal



to the scale on the skull. This, when photographed, gives a life-sized negative of the skull. The negatives of the photographs and the skull are superimposed by aligning the characteristic points in the negatives.

The following points are then compared. (1) The eyes within the orbital plates, with the two pairs of canthuses properly aligned. (2) The nasion. (3) The prosthion in the central line. (4) The nasal spine in the centre which is a little above the tip of the nose. (5) The lower border of the nose. (6) The lower border of the upper jaw, i.e., below the tip of the nose. (7) The zygomas below the eyes. (8) Supraorbital ridges. (9) Angle of the jaw. (10) External auditory meatus. (11) Teeth.

The two superimposed negatives are then photographed on bromide paper. The resulting superimposed photograph brings out the points of similarity or dissimilarity between the photograph and the skull. The superimposition is correct, if the outlines and the size of the skull accurately correspond to the face in the photograph. A clear effect of the superimposed area can be obtained by combining the negative of the skull with the positive of the portrait. For this, positive portrait and negative of the skull are rephotographed on X-ray film, thus producing a transparent positive of the skull. Finally, the two films are bound together in register and thus superimposed; they are then re-photographed on X-ray film by transmitted light.

This test is of a more negative value because it can definitely be stated that the skull and the photograph are not those of the same person. If they tally, it can only be stated that the skull could be that of the person in the photograph, because of the possibility that another skull of that size and contour may tally with the photograph.

**Video Superimposition:** The skull is mounted on an adjustable support allowing movement in three planes. The photograph is also mounted similarly. A coloured video camera is aligned at right angles to the photograph and a second camera is aligned to the skull. The individual video signals from each camera are fed into a vision mixer. By this superimposition and negative simulation can be done. In cases where sufficient anterior teeth remain on the cranium, and a photograph showing suspected deceased smiling is available, image superimposition can be done. Digital image manipulation technique is better.

#### IDENTIFICATION BY RECONSTRUCTION OF

**FEATURES :** (1) Iliis, determined the average thickness of the soft parts of the face at a series of fifteen, i.e., nine median and six lateral pre-determined points. Using these data, attempts at reconstruction have involved the application of clay or plastic in appropriate thickness over the landmarks, contouring the facial outlines and building up the soft features of the nose, mouth and ears. The restorer must rely on various artistic cannons, personal experience, skill and intuition. It may help to eliminate certain suspected persons, or support an identification based on other skeletal evidence. (2) 20,000 measurements can be taken using video and laser equipment, which can be stored in 30 seconds. The data from an unknown skull are then electronically 'clothed' with standard soft tissues from the memory bank and modified on screen to produce various images, which can be rotated electronically to produce various profiles. To recognise a missing person by a viewer a variety of stored eyes, ears and noses can be added, and any feature altered instantaneously.

**COMPUTER PICTURES:** Several curves for each of facial creases, prominences, shape of forehead, eyes, ears, nose, cheek, lips, teeth projections, scalp hair, moustache and beard are stored in a computer. Depending on the descriptions of the different features by the persons who have seen the criminal, hundreds of varieties of face can be drawn on the screen of the computer within a few minutes. An almost exact appearance of the face can be drawn by additions and alterations of curves, which can be printed out. A major problem is that features which give individuality to a face, such as the eyes, lips and facial hair, are not very dependent upon the underlying bone structure.

**PHYSIOGNOMIC RESTORATION :** (1) Sculptural to give a three-dimensional bust, and (2) artistic to give drawing in two views, facial and profile, to show cephalic and facial details. Both methods try to achieve an individual likeness which will lead to identification of the suspect.

**NORMAL AND ABNORMAL BONE COMPARISONS:** When previous X-ray films of the skull are available for comparison with post-mortem films, measurements of the skull and a detailed comparison of the frontal, sphenoidal and maxillary sinuses, sella turcica and mastoid area are useful for identification in adults. No two pairs of sinuses are the same. The frontal sinuses are individual specific. The scalloped upper margins of the sinuses are used for comparison, these being smaller and more numerous in the female. The sphenoid complex and the mastoid area are also very useful criteria of individuality. **Abnormal bones**, such as cervical and lumbar ribs, wormian bones (small bones in the skull caused by



abnormal suture patterns leaving islands of bone surrounded by sutures, sometimes referred to as 'sutural' or 'intrasutural bones'), and sesamoid bones (bones included in tendons, frequently seen in the hands and feet) may provide definite points for comparison and positive identification. The trabecular fine structure of all bones (excluding the bones of the skull) may be defined with enough precision by xero-radiography to permit comparisons. Congenital abnormalities, e.g., absence of bones, displacement and malformations are very rare. Fusion of the ribs may be noted. Radiographs of the carpal bones show individual details. The presence of surgical prostheses or of supportive implants, such as plates, pins or orthopaedic screws and of trephine or other operative defects of the skull are very useful. The contours of the second rib are unique. Dental radiography may show significant root shapes, socket outlines or abnormalities of tooth eruption, development or decay. Unusual calcification of tuberculous origin in the lungs or lymph nodes, or due to degenerative changes in the uterus, calcified mitral or aortic valve, phlebolith, granuloma, etc. are characteristic.

**SKULL SUTURE PATTERN AND VASCULAR GROOVES :** The suture patterns of the skull appear to be quite individualistic. The sagittal and lambdoid sutures are especially complicated and quite different from one person to another. However, the suture patterns are not useful for comparison because (1) the sutures close, and the pattern obliterated with age, and (2) the suture patterns are not well demonstrated in those post-mortem X-ray films most commonly available.

The vascular grooves, such as those related to the middle meningeal vessels, are much more apt to be visible in X-ray films than are the suture lines, are useful for comparison to establish identity.

**X-rays :** (1) They are useful in identification by determining the sex, age, superimposition, and identification of the person by detecting old fractures, diseases, or congenital bony changes. (2) In investigation of cases of battered baby syndrome, burns, drowning and decomposition. (3) To detect air embolism, and pneumothorax. (4) To locate missiles in the body, direction of firing, depth of the wound and type of firearm. (5) To detect parts of the mechanism of bombs and explosive devices that are embedded in the tissues. (6) To locate foreign bodies, bullet emboli, etc. (7) To detect fractures. (8) To detect pregnancy, foetal death or abnormality, hydatidiform mole, etc. (9) Electrocution. (10) Lead poisoning.

**VEINS ON THE BACK OF HANDS :** Tamassia suggests that there is complete individuality in the arrangement of the veins of the back of the hands.

**STOMACH PICTURES :** Barium meal X-ray of the stomach is said to be individual.

**NAILS :** Longitudinal striations are present on both the convex and concave surfaces of human fingernails and toenails. Parallel striations on the surface of the fingernail are significantly different for each individual. The striation pattern becomes more prominent with advancing age, but remains otherwise unchanged during the life of the person. Nails grow at the rate of about 3.2 mm. per month.

**DEFORMITIES:** They may be congenital or acquired. Congenital deformities, such as hare-lip, cleft palate, talipes, polydactylism, web-fingers or toes, undescended testicles, etc. are frequently treated surgically, and are therefore losing some of their past importance. Old amputations, spinal defects, old fractures and deformities of the bones and nails, either from injuries or disease and surgical prostheses, such as implanted artificial heart valves, plates in the skull, etc., should be described.

**Mongolian spots** (congenital marks) appear as dark blue or violet, single or multiple macules in the lumbosacral region in some young children of Asiatic and African origin.

### SCARS

A scar is a fibrous tissue covered by epithelium without hair follicles, sweat glands or pigment, produced from the healing of a wound. Injury to the dermis produces a scar, while superficial injuries involving only the epidermis do not produce a scar. Scars are permanent.

**Examination :** Good lighting is essential. The description should include their number, site, size, and shape, the level it bears to the body surface, fixed or free, smoothness or irregularity of the surface, colour, and the presence or absence of glistening and tenderness. The condition of the ends, whether tapering or not, and the probable direction of original wound should be determined. The application of heat, filtered ultraviolet light or surface friction, makes faint scars readily visible. Old scars may become unrecognisable. A magnifying glass is very useful. Suspected scars in the dead body can be proved by microscopy, by a section stained to show the elastic tissue, which is absent in a scar. Elastic tissue is present in striae gravidarum.



**Characters :** Scars may indicate the type of injury which produced them. (1) Incised wounds produce linear scars. If healing is secondary, the scar is wider and thicker in the centre than in the periphery. (2) Scars from lacerated wounds, and from wounds which have suppurated are firmer, irregular, more prominent, and are attached to the deeper tissues. (3) Stab wound due to a knife-blade produces oval, elliptical, triangular, or irregular scars which are depressed but may be elevated due to keloid formation. (4) A bullet wound causes a circular depressed scar. (5) Scars from scalds are spotted in appearance, tend to be continuous, often run downwards and show evidence of splashing about the main injury. (6) Scars due to corrosive acids, burns or radiation, cause irregular scars, and keloid may develop in the scar tissue, especially in Negroes. (7) Vaccination scars are circular or oval, flat or slightly depressed. (8) Many skin diseases, smallpox, syphilis, etc., cause multiple scars on the skin.

**Growth :** Scars produced in childhood grow in size with the natural development of the individual, especially if situated on the chest or limbs.

**Age of Scars :** Firm union occurs in from five to six days, producing a reddish or bluish "angry" scar. By the end of 14 days, the scar becomes pale. It is still soft and sensitive; there is no further change up to the end of second month. In about two to six months, the scar becomes white and glistening, it becomes tough and may be wrinkled. After this, there is no further change.

**Erasure :** The scar can be erased by excision and skin grafting, or suture of the edges of the excised area. This results in a scar which is less clearly seen.

**Medico-legal Importance :** (1) They form important marks for identification of a person. (2) The age of the scar is important in a criminal offence. If the age of a wound corresponds with the date of the attack it may have value as circumstantial evidence. (3) The shape of the scar may indicate the nature of weapon or agent that caused the injury. (4) If a person is disfigured due to scars, it becomes a grievous hurt. (5) Scar causing contracture at or around a joint restricting movement or functions of the joint becomes grievous hurt. (6) The accused may attribute scars of wounds to disease or therapeutic procedures. (7) To charge an enemy with assault, a person may claim that scars due to disease are

those of wounds. (8) Linea albicantes may indicate previous pregnancy.

**Moles** are usually round, brown or black, raised or flat with or without hair. The size and exact anatomical position should be noted.

### TATTOO MARKS

Tattoo marks are designs made in the skin by multiple small puncture wounds with needles or an electric vibrator dipped in colouring matter. The dyes commonly used are Indian ink, carbon (black), cinnabar or vermilion (mercuric sulphide) red, chromic acid (green), indigo, cobalt, prussian blue (ferric ferrocyanide), ultramarine (blue). Techniques and dyes vary from country to country. The most permanent pictures are made when the dye penetrates the dermis. If the dye is deposited into deeper layers of dermis, it will be removed by phagocytes. Most of the marks are found on the arms, forearms and chest, but may be present on any part of the body. If the pigment has been deposited below the epidermis, it will very slowly become fainter and certain pigments, such as vermilion, and ultramarine may disappear after about ten years. The rate of fading depends not only on the composition of the pigment, but also on the depth to which it penetrates the skin, and the site which is tattooed. Parts protected by clothing retain the design for longer period than the exposed parts of the body. Tattoos on the hands disappear early due to constant friction. A faded tattoo mark becomes visible by the use of ultraviolet lamp or rubbing the part and examining with magnifying lens. Infrared photography makes old tattoos readily visible. The marks are recognised even in decomposed bodies when the epidermis is removed. Lymph nodes near a tattoo mark show a deposit of a pigment. The colour, design, size and situation of tattoo marks should be noted. Drawing or photography is more useful.

**SYDNEY SHARK CASE :** James Smith disappeared on April 8, 1935. A shark was caught alive 14 days later, which vomited a human arm at the aquarium where it was kept. Medical examination revealed that the arm was severed from a dead body by a sharp weapon. Smith's wife and brother identified the arm from the tattoo of two men boxing. The identity was also confirmed by fingerprints. Later, Patric Brady was tried for his murder at Sydney.

**COMPLICATIONS:** Septic inflammation, erysipelas, abscess, gangrene, syphilis, AIDS, leprosy and tuberculosis may occur.

**ERASURE:** (1) Surgical methods : (a) Complete



excision and skin grafting, (b) production of burn by means of red hot iron, (c) scarification, and (d) carbon dioxide snow. (2) Electrolysis. (3) Caustic substances remove pigment by producing inflammatory reaction and a superficial scar, e.g., mixture of papain in glycerine, zinc chloride and tannic acid. (4) Laser beam: By exposure to laser beams, the particles of the dye get vapourised and expelled from the tissues in gaseous form. (5) Confluent smallpox and sometimes chronic eczema in children can obliterate tattoo marks.

**Medico-legal Importance :** Tattooing is useful in (1) Identity. If there are large number of tattoos, positive identification can be made by tattoos alone. Initials and dates, regimental or nautical details, identity numerals, one's own name, etc., provide more scientific basis for identification. (2) Religion. (3) God of worship. (4) Social status. (5) The distribution of tattooing and the nature of designs and figures may indicate a particular country or region. (6) The presence of indecent figures points to definite perversion in the individual. (7) They reflect travel, history, war, occupation, sex interest, etc. (8) Drug addicts may tattoo front of elbow or wrist to conceal needle puncture marks.

**WOUNDS :** Sometimes, the presence of wounds on the body may assist in connecting a suspected criminal with a given crime, e.g. a piece of skin adherent to a window glass may correspond with the wound on the thief, or rupture of fraenum of penis may be present in a person accused of rape. Dust, sand, etc., may be recovered from wounds and identified.

**DISEASE :** The finding of disease, e.g. gallstones, renal stones, calcified leiomyomata, silicosis, asbestosis and congenital anomalies like horseshoe kidney, are helpful. The unidentified body should be checked for amputations, body deformities, pace-makers, implanted heart valves, enlarged joints of the fingers due to arthritis, immovable joints due to disease, bowed-legs and curvature of the spine. X-rays will show the presence of healed fractures, metal pins, plates, or screw used in treating fractures. Commonly found missing organs at autopsy are tonsils, appendix, gallbladder, kidney, prostate, uterus and ovaries. Surgical scars may indicate hernia repair, circumcision or an operation upon the thyroid gland.

**STAINS :** Stains found on body or clothing of the accused and the victim may be the same and may be derived from the walls, doors, furniture, etc., at the scene of crime.

**OCCUPATION MARKS :** (1) Recent and Temporary: They include paint spots on painters,

grease on engineers and mechanics, flour on bakers and millers, dyes on dye workers, etc. The microscopical examination of dust and debris on clothing, in the pockets and trouser turnups, under the fingernails and in the ear wax, is important in identification of unknown bodies. They may also connect the body with a specific place where a crime was committed.

(2) Permanent : Thickening of the palmar skin of fingers are seen on the right hands of butchers. Cuts, scars, callosities and hyperkeratosis of the hands indicate manual labourers. Tailors have marks of needle punctures on their left index finger. Coal miners have multiple 'blue scars' on the face and arms due to coal-dust contamination of small lacerations. Blacksmiths have scars on the back of the hand caused by burns from hot fragments. Opticians have small cuts on the tips of index finger and thumb. Workers in chemicals and photography usually have discoloured, distorted fingernails. Carpenters have callosities on the thumb and index finger, on the palms, and one shoulder is usually higher than the other. Bricklayers have a flattening of the thumb and index finger of the left hand due to constant picking up of bricks. The violinist has hardened tips on the fingers of the left hand.

**COMPLEXION AND FEATURES:** The complexion may be fair, wheat-coloured, dark, brown, pale-brown or pale-yellow. Details of the features regarding eyes, nose, ears, lips, chin, and teeth should be noted. The features may change considerably from disease or even from worries of a long duration. Few persons can cleverly alter their features by changing the expression of their face. Expression is altered after death.

**BHOWAL SANYASI CASE :** Kumar Ramendra Narayan Roy, the second son of Raja Rajendra Narayan Roy of Bhowal estate in Dhaka, died in Darjeeling in 1909. In 1921, a Sadhu came to Dhaka and claimed one-third share of the Bhowal Raj Estate. He declared that he was Ramendra Narayan Roy, that after he went to Darjeeling, he was administered arsenic with the intention of killing him, due to which he became comatose and taken to be dead. His body was taken to cremation ground at night, but the funeral party left the cremation ground without lighting the pyre due to heavy storm. Some Naga Sanyasis revived him and carried him with them. He suffered from complete amnesia until 1921. After failing to regain his share of properties, he filed a suit in the Dhaka Court in 1930. Bibhabati Devi, the wife of the second son of the Raja Bahadur, and others contested the suit, on the ground that the plaintiff was an imposter. The



hearing lasted for more than two years. About 1,069 witnesses on the plaintiff side and 470 on the defence side were examined, and more than 2000 photographs and documents were exhibited. The Court declared the plaintiff as Kumar Ramendra Narayan Roy and granted one-third of the property. Later, this judgement was upheld by the Calcutta High Court and by the Privy Council.

In deciding the case, complexion and features, hair, eyes, syphilitic ulcers, broken tooth, photographs, boil marks, operation scar, tiger claw mark, mole on the dorsum of the penis, the gait, voice and expression, were taken into consideration to establish the identity.

**BECK CASE :** Adolf Beck was imprisoned for impersonation and fraud on women, after being identified by 15 out of 17 of the women. His handwriting also closely resembled that on some incriminating documents. After some years, he was released and rearrested. He was identified by 19 women. Another man was arrested for similar swindles whose handwriting was similar to that of Beck. Later, it was proved that Beck was innocent and was discharged and compensated.

**EYES: Medico-legal Importance :** (1) Identification: (a) artificial eyes, (b) absence of one or both eyes, (c) shape, (d) colour of iris, (e) setting : deep set, bulging or prominent, (f) squint, (g) nystagmus, (h) cataract. The look of the person will show whether he is conscious, unconscious, frightened, confused, etc.

(2) Asphyxia : (a) proptosis, (b) congestion, (c) petechial haemorrhages.

(3) Injuries : (a) Black eye (contusion of lids), (b) in fracture of anterior cranial fossa involving orbits, there may be effusion of blood into the orbits, proptosis, limitation of movement of eyeball and subconjunctival haemorrhage, (c) gouging of eyes, (d) lacerated wounds, (e) penetrating wounds, (f) foreign bodies, (g) chemical burns, (h) ulceration and opacity of cornea, (i) vitreous haemorrhages are likely to affect vision, (j) rupture of choroid and retina, (k) subluxation of lens and post-traumatic cataract.

(4) Poisoning : (a) Dilated pupils : datura, atropine, belladonna, cannabis, cocaine, alcohol, ergot, endrin, calotropis, strychnine, oleanders, HCN antihistamines, cyclic antidepressants, amphetamines. (b) Contracted pupils : opium, phenol, organophosphorus compounds, physostigmine, neostigmine, pilocarpine, strophanthin, nicotine, carbamates, barbiturates, benzodiazepines, caffeine, muscarine. (c) Alternate contraction and dilation: aconite. (d) Large and fixed: anticholinergic drugs, anoxia. (e) Small and fixed: opioids, cholinergic drugs. (f) Variable size and fixed: barbiturates,

glutethimide, hypothermia. (g) Nystagmus: ethanol, phenytoin, carbamazepine, barbiturates, benzodiazepines, phencyclidine.

(5) Natural disease : Blue sclerotics of osteogenesis imperfecta and odontogenesis imperfecta.

(6) Acuity of vision : for crimes committed during night.

(7) Workmen's Compensation Act.

**HAIR :** Trichology is the study of hair. Hair grows at the rate of 0.4 mm/day and nails at 0.1 mm/day. The examination of the hair is undertaken to find out:

(1) **HAIR OR SOME OTHER FIBRE ?** Hair consists of bulb or root and a shaft. Considerable force is required to pluck out a lot of healthy growing hair from scalp. An adult can be lifted or dragged by the hair and the scalp may even be torn from the skull. In most hair, there are three well-defined layers. (1) Cuticle: This is the outer layer and consists of thin, non-pigmented scales. (2) Cortex: This is the middle layer and consists of longitudinally arranged, elongated cells without nuclei. Within these cells are fibrils on which there may be granules of pigment. (3) Medulla: This is the inner layer composed of keratinised remains of cells.

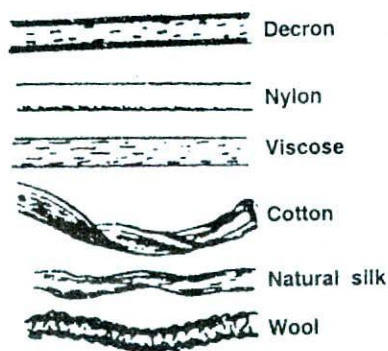


Fig. (4-42). Microscopic appearance of fibres.

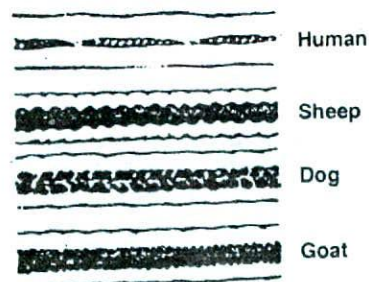


Fig. (4-43) Various hair.



Table (4-10). Difference between human and animal hair (Fig.43)

Trait	Human hair	Animal hair
(1) General	: Fine and thin.	Coarse and thick.
(2) Cuticle	: Cuticular scales are short, broad, thin and irregularly annular.	Cuticular scales are very large and have step-like or wavy projections.
(3) Cortex	: Thick, well-striated, and 4 to 10 times as broad as medulla.	Thin, rarely more than twice as broad as medulla.
(4) Medulla	: Varies considerably, usually narrow; continuous, fragmented, or entirely absent.	Continuous and wider.
(5) Pigment	: Evenly distributed.	Mostly present near medulla.
(6) Precipitin test	: Specific for human.	Specific for animal.
(7) Medullary index	: Below 0.3	Above 0.5

**FIBRES** : Cotton fibres are flattened and twisted tubes. They consist of long tubular cells, with thickened edges and blunt-pointed ends. Linen fibres show cross lines or folds about which the fibre is often swollen and has a narrow lumen. Fibres are straight and taper to a point. Jute fibres are smooth without transverse lines. The cell cavity is not uniform. The ends are blunt. Silk consists of long clear threads without any cells. They are smooth and finely striated. Wool fibres show an outer layer of flattened cells and overlapping margins. The interior are composed of fibrous tissue but sometimes medulla is present.(Fig 4-42)

(2) **Human or animal** : Table (4-10)Fig. 4-43)

Colour changes along the hair shaft called "banding" is seen in some animals.

**Medullary Index of Hair**: It is the ratio of diameter of medulla and diameter of the whole hair shaft. In humans it is less than 0.3 and in animals more than 0.5 The value varies in the hair of different parts of the body and as such it is also helpful to know the part of the body from which it is derived.

(3) **FROM WHAT PART OF THE BODY DERIVED?** Hair from the head is usually long and soft and taper gradually from the root to the tip. The beard and moustache hair are usually thicker than the hair of any other part of the body. The hair on the chest, axillae and pubic region is short, stout and curly. Hair from the axillae and pubic region also show split ends. Hair of the eyebrows, eyelashes and nostrils is stiff, thick and taper to a point. The hair on the other parts of the body is fine, short, and flexible and does not show pigment cells in the cortex.

(4) **Sex** : Sexing of human hair is difficult, except that of the beard and moustache. Male hair is usually thicker, coarser and darker. In human head hair, **Barr bodies** are found in hair follicles in a proportion of  $29 \pm 5$  percent in females and

$6 \pm 2$  percent in males.

(5) **Age** : Age can be determined sometimes from the hair, but only within wide limits, as between that of an infant or an adult. Roots of hair from children will dissolve rapidly in a solution of caustic potash, but in older people roots will resist the treatment.

Age	Diameter
Twelve days	0.024 mm
Six months	0.036 mm
Fifteen years	0.053 mm
Adults	0.07 mm

The body hair of the human foetus and the newlyborn child is fine, soft, non-pigmented (colourless) and non-medullated. This lanugo hair is replaced by hair which is coarser, pigmented, medullated, and has a more complex scale pattern. At puberty axillary and pubic hair grows which is at first fine, soft and curly and later becomes coarse, and pigmented. Adult hair have maximum pigmentation. Loss of scalp hair in men starts from the third decade. In women, there is often loss of axillary hair and an increase of facial hair, at about the menopause. Grey hair usually appears after forty years.

(6) **Has the hair been altered by dyeing, bleaching or disease ?** Bleached hair is brittle, dry, and straw-yellow. If the hair is coloured, the colour will not be uniform, the roots are of different colour and the hair rough, brittle and lustreless. The scalp will also be coloured. The colour of head hair will be different from the colour of hair on other parts of the body. The length of extra-follicular part of an uncoloured zone is used to determine the time of the colour last applied. Scalp hair grows at the rate of one to three mm. a week, average being two and half mm; beard hair has a slightly faster and



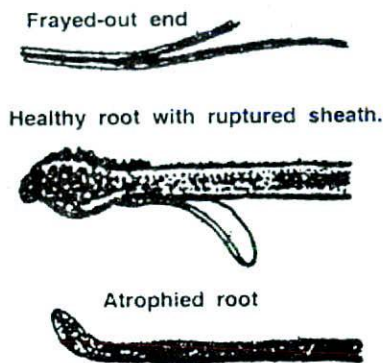


Fig. (4-44) Human hair.

other hair a slightly slower growth rate. Some hair can be examined chemically to find out any metal contained in the paint. Dyed hair shows characteristic fluorescence with ultraviolet light. With polarised light microscope, the undyed part appears much brighter than the rest.

**Blood Groups :** ABO groups can be determined in a single hair if hair bulb is present, from any part of the body by a modified absorption-elution technique or mixed agglutination technique with hundred percent accuracy.

**Identification :** Hair cannot provide a permanent record for identification, because the distribution and concentration of trace elements along the shaft of a hair varies as the hair grows. The colour of the hair may alter with disease. It is lighter in patients with malnutrition, ulcerative colitis, and Kwashiorkor; the normal colour appears when health is restored. The colour of hair becomes green from copper, blue from cobalt, and yellow from picric acid poisoning. The hair of copper smelters may be greenish, indigo workers and cobalt miners blue and aniline workers bluish. The colour of hair alters sometimes after burial.

**(7) Is the hair identical with the hair of the victim or the suspect?** By careful comparison, one can say that the hair could have come from a particular person. Debris, grease, etc., adherent to the hair is very important.

Hair is usually mounted on a glass slide for examination in a comparison microscope. For preparing cross-section, it is embedded in a wax or resin block and sliced finely. The impressions of the cuticle scales are made on cellulose acetate. Microscopically, the intimate structure of the dyed hair appears hazy, and shows uniformity in general

shade which is not seen in hair of natural colour. Because of diet and drug intake and atmospheric conditions, traces of eighteen elements are deposited in our hair in proportions quite different from other persons, which can be measured through neutron activation analysis. Only three out of one lakh persons will have comparable amount of the nine major trace elements. When hair is irradiated in a nuclear reactor, elements are converted to radioactive isotopes. Comparison of the radiation emitted from the hair with known standards provides quantitative comparison. Electrophoretic and electrofocusing methods to study proteins and enzymes in hair root sheath and matrix proteins are of considerable importance.

**(8) Did it fall naturally or was it forcibly removed?** The base must be examined to see whether the root is present. If the hair has fallen naturally, the root will be distorted and atrophied, and the root sheath absent. If the hair is forcibly pulled out, the hair bulb will be larger, irregular and the sheath will be ruptured. (Fig. 4-44).

**(9) What is the cause of the injury?** If the hair has not been cut, the tip is pointed and non-medullated, but repeated injury to the tip damages the cuticle, due to which the exposed and unprotected cortex splits and frays (Fig. 4-44). The hair of axilla, pubis and frequently brushed hair has ragged ends. Blows with blunt objects crushes the shaft with flattening and splitting. A sharp weapon produces a clean uniform cut surface. Recently cut hair shows a sharply cut edge with a projecting cuticle. After a week, the end becomes square, smooth and later rounded but blunt. After three to four months, the end becomes elongated, but the medulla is absent. Hair may get singed due to burns or firearm injury. Singed hair is swollen, black, fragile, twisted or curled and has a peculiar odour; carbon may be found deposited on it. The tip is swollen like a bulb.

**Medico-legal Importance :** (1) Hair is important in crime investigation, for it remains identifiable on the clothes, body and the alleged weapons in crimes committed long before. It often provides the only connection between a weapon or even the accused and the victim of an assault. (a) Motor vehicles responsible for injuries may be identified by the detection of hair on the vehicle. (b) In rape and sodomy, the pubic hair of the accused may be found on the victim or vice versa. In bestiality, animal



hair may be found on the body or underclothing of the accused, or his pubic hair may be found about the genitals of the animal. (c) Stains on the hair may indicate the nature of the assault, e.g., mud stains in struggle, seminal stains in sexual offences, salivary stains in asphyxial deaths, blood stains in injury, etc. Stains may be got from the walls, doors, furniture, etc., and may indicate the scene of crime. (2) Nature of weapon can be made out from the injuries to the hair, and hair bulb. (3) Age of a person may be determined from the growth of hair on different parts of body. (4) Sex may be determined from their distribution on body, texture and from Barr bodies. (5) Hair is useful in identification especially when there has been some known peculiarity of the hair, dyeing, bleaching or artificial waving. (6) Singeing of the hair indicates burns or a close range firearm injury. (7) It is helpful in differentiating scalds from burns. (8) In chronic poisoning with heavy metals, e.g., arsenic, the poison can be detected in the hair. (9) The time of death can sometimes be determined from the length of the hair on the face:

## FORENSIC ODONTOLOGY

**Forensic odontology** deals with the science of dentistry to aid in the administration of justice. Dental identification depends mainly upon comparison between records of the missing persons and the findings in the bodies in relation to : (1) Restorative work. (2) Unusual features. (3) Comparison of ante-mortem with post-mortem X-rays.

The following particulars should be noted : (i) The number, spacing and situation of the teeth present, with special note of (a) unerupted and deciduous teeth, (b) permanent teeth (surface and configuration), (c)

decayed teeth, (d) undersized or oversized teeth. (2) The number and situation of absent teeth. (3) Extraction: evidence of old or recent, healed or unhealed. (4) The general condition of teeth: (a) erosion, (b) cleanliness, (c) conservation, fillings and cavities, (d) colour, (e) periodontosis. (5) Peculiarities of arrangement: (a) prominence or reverse, (b) crowded or ectopic teeth, (c) overlapping, (d) malposition, (e) deformities, (f) rotation. (6) Supernumerary teeth. (7) Denture: full, partial, upper or lower, type, shape, restorative materials used. (8) Mesiodistal width of the teeth. (9) Any recognisable peculiarity of jaws, e.g., prognathism (prominence of the lower jaw). (10) Old injury or disease. Recently dislodged, loosened, chipped or broken teeth. (11) Special features, incisal edges, fractures, ridges, caries, etc. (12) Restoration and prostheses (surfaces, morphology, configuration and material). (13) Root canal therapy on X-ray examination. (14) Bone pattern on X-ray examination. (15) Oral pathology (tori, gingival hyperplasia).

Most workers believe that no two persons have identical dentitions. Conservative dental work or fillings is most reliable in identification and includes fillings of various materials, root fillings, inlays and crown and bridge work. These can be compared with dental records and radiographs if available. In some persons the lower teeth protrude beyond the upper incisors which is known as over-bite.

**PINK TEETH:** In a decomposed or skeletonised body, pink teeth may be noted especially near the gum-line, due to deposition of protoporphyrin, the cause of which is not known. Death is usually of an asphyxial nature and a damp environment is involved.

**RADIOGRAPHY:** X-Rays accurately reveal root shape, shape of pulpal canal, shape of fillings, abnormalities, bone trabeculation patterns, caries, tooth formation, and fractures. They are widely used in antemortem and postmortem comparisons. In mass disasters, a list of the possible persons involved is necessary. The more recent the antemortem record, the more reliable the evidence. If antemortem records are not available, dental information must be obtained from relatives and friends.

**Medico-legal Importance :** (1) Dental identification is the most sophisticated method of comparative identification, except dactylography, if there are some features to compare and some record of those features in a missing person. It is not of much help in developing countries as dentists often do not keep records. Teeth and jaws are usually protected from fire and mechanical trauma, and are highly resistant to post-mortem destruction and decomposition. Dental findings establish the

Table (4-11). Advantages and disadvantages of comparisons of teeth and fingerprints.

Trait	Teeth	Finger prints
(1) Burns:	Fire resistant.	Destroyed by fire.
(2) Putrefaction:	No changes.	Subject to putrefaction.
(3) Changes:	Compatible inconsistencies.	Unchanged.
(4) Proof:	No acknowledged criteria of proof.	Well established criteria.
(5) Records:	Useless without records.	Possible use of possessions.



identification of single individuals after accidental death or homicide, and differential identification of large numbers of individuals after mass disasters, such as explosions, house fires, aircraft accidents, earthquakes and shipwrecks. Identifications have been made from intact, mutilated, decomposed, skeletonised or even burnt material. Diseases such as caries, syphilis (Hutchinson's teeth) help in identification. (2) Teeth are useful in estimating the age of an individual. (3) Sex and blood group can be determined from cells of pulp cavity. (4) Loss of tooth due to assault is grievous hurt. (5) Dentures, partial or complete, are useful in identification, especially if they have the patient's name or code number included in them. (6) Criminals can be identified through bite marks left either in human tissues or in food stuffs. (7) Poisons (arsenic, mercury) can be detected. (8) Colour change occurs in sulphuric and nitric acid poisoning.

**In ante-mortem tooth loss or extraction**, the bony rim or the alveolus is sharp and feathered. A blood clot forms within the alveolar cavity and in one to two days there is early organisation. In about a week, socket is filled with organised clot, which is replaced by fibrous tissue in 2 weeks. In two to three weeks, soft tissues are healed and the socket is partially filled with new bone. Reparative bone resorption of the alveolar rim results in a smooth rounded rim of socket. In six months, the socket is filled with new bone, but the location of the root outline is visible. In one year, the whole socket is filled with a new bone and there is depression of the bone outline. If the entire tooth was knocked out, irregular edges of remaining bone, splintering of buccal or lingual plates, areas of compressed bone, or fracture of roots or crowns of adjacent teeth are seen. It is difficult to dislodge a healthy tooth without fracturing or loosening neighbouring teeth. These changes can be demonstrated by X-ray of the jaw adjacent to the dislodged teeth.

**BITE MARKS** : Human bites are usually semicircular or crescentic, caused by the front teeth (incisors and canines), with a gap at either side due to the separation of upper and lower jaw. The teeth may cause clear, separate marks or form a continuous or intermittently broken line. Bite marks may be abrasions, contusions or lacerations or a combination of any two or three. In forcible bite, the appearance is of two 'bows' with their concavities facing each other, and a gap at each end. The sucking action

reduces the air pressure over the centre and produces multiple petechial haemorrhages, due to rupture of capillaries and small venules in the subcutaneous tissues. If the bite is forcible, the petechiae are confluent and produce a contusion. If the bitten area is irregular or markedly curved, only part of the dental arch comes in contact with the tissues. Rarely, the bite mark may be linear in pattern, due to the scraping of the skin by the upper incisors, causing parallel tracks. Faint teeth marks become visible when examined under ultraviolet light in a dark room. In sexual bites, the teeth are used to grip during sucking; the resulting central or peripheral suck marks are seen as petechiae, producing reddening. In many such bites teeth marks are not seen. Love bites are usually seen on breast, neck, cheek, abdomen, arms, thighs and genitalia. In the living, these marks are seen from one to twenty-four hours after infliction. Swabs of the bite mark should be taken immediately, using a swab moistened with sterile water. A swab of control area adjacent to the mark, and a swab of victim's saliva should also be taken using swabs moistened with sterile water. If there is a delay in sending the swabs to the laboratory, they should be kept in the freezer compartment of the fridge. In child abuse, bite marks can be found anywhere on the body. Self-inflicted bite marks are usually seen on the shoulders and arms.

They are useful in identification because the alignment of teeth is peculiar to the individual. Bite marks may be found in materials left at the place of crime, e.g., foodstuffs, such as cheese, bread, butter, fruit, or in humans involved in assaults when either the victim or the accused may show the marks, usually on the hands, fingers, forearms, nose and ears.

**(1) PHOTOGRAPHIC METHOD:** The bite mark is fully photographed with two scales at right angle to one another in the horizontal plane. Photographs of the teeth are taken by using special mirrors which allow the inclusion of all the teeth in the upper or lower jaws in one photograph. The photographs of the teeth are matched with photographs or tracings of the teeth. Tracings can be made from positive casts of a bite impression, inking the cutting edges of the front teeth. These are transferred to transparent sheets, and superimposed over the photographs, or a negative photograph of the teeth is superimposed over the positive photograph of the bite. Exclusion is easier than positive matching.



(2) **CASTS:** A plastic substance, such as a rubber or silicone based medium containing catalytic hardener is laid over the bite mark, which produces a permanent negative cast. Plaster of Paris also can be used.

**CHARTING OF TEETH:** There are more than 150 different methods of identifying, numbering, and charting of teeth. The most widely used systems are:

(1) **Universal System:** Teeth are numbered 1 to 16 from upper right to upper left, and 17 to 32 from lower left to lower right. This follows the plan advocated by the American and International Society of Forensic Odontology.

Right	1 2 3 4 5 6 7 8	9 10 11 12 13 14 15 16	Left
	32 31 30 29 28 27 26 25	24 23 22 21 20 19 18 17	

(2) **Palmer's notation:**

Right	8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8	Left
	8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8	

(3) **Haderup System:** It is similar to Palmer's notation except that it uses a plus sign(+) to designate upper teeth, and a minus sign (-) for the lower.

(4) **FDI (Federation Dentaine Internationale) two-digit System:** It bears a slight resemblance to Palmer's system in that both utilise the same numbers, but the F.D.I. system substitutes a number for the quadrant side and that number is placed before the tooth number. Thus the lower right canine will be number 43 in this system.

Right	1   2	3	Left
	4	3	

(5) **Diagrammatic or anatomical chart:** In this each tooth is represented by a pictorial symbol that gives the same number of teeth surfaces as those on the same teeth in the mouth. The incisors and canines are represented by four surfaces, and the premolars and molars by five (due to the occlusal surface). The positions of crowns, caries, fillings, or other abnormalities are marked on these diagrams. The diagram also includes deciduous teeth.

**ANIMAL BITES :** Rodents gnaw (bite persistently) away tissue over fairly limited areas. They produce shallow craters of the borders of the areas by nibbling and leave long grooves. The bites by dogs which attack suddenly are usually clear-cut, showing narrow squarish arch anteriorly, as the animal bites to hold on to the attacked person. Teeth impressions are usually deep and small in area. Cat bites show small rounded arch with puncture marks made by canines, and are usually associated with scratch marks from claws. Rat bites

are usually very small and round.

**SEX :** In the male, the upper central and upper lateral incisors are equal in size, but in the female, the size varies. The canines are usually smaller and more pointed in the female, compared to male, especially in the lower jaw. In the female, the mandibular first molar has four cusps.

Y chromosome may be isolated in the tooth pulp cells up to three to five months post-extraction or post-mortem. Quinacrine staining is useful for this purpose.

The teeth are markedly resistant to heat. If heated suddenly or severely, they may disintegrate and fracture. If a dead body is burnt, the oral cavity and teeth have a better chance of remaining intact, but in a living person the lips may be drawn back exposing the anterior teeth. Depending on the temperature, intensity and duration of the fire, the crowns of anterior teeth may be scorched, ashed or explode at the gum line.

**OCCUPATION, HABITS AND SOCIAL POSITION :** Cobblers, carpenters, seamstresses, electricians, dress-makers, etc. have central notches in the incisal edge of the front teeth, due to the holding of the thread, needle, nails, etc. Musicians have localised attrition of their teeth. Some of them have wide defects on the front of the teeth, while others have defects on the incisal edges. In pipe smokers and cigarette smokers who use holders, there is a visible loss of material on the incisal edges of the teeth, mostly at the angle of the mouth. In heavy smokers, a black stain is deposited upon teeth. Loosening of certain teeth can be found in almost all those who habitually bite various objects or hold them in their teeth. The labial enamel and later the exposed dentin are dissolved in workers exposed to corrosive acids. Excessive chewing of acid foods causes erosion of all surfaces of teeth. Copper causes a green, silver a black, and lead, aniline and bismuth a bluish colour, particularly at the neck of the teeth or at the marginal part of the gum. Social position and sometimes the country of origin can be ascertained from the quality and type of restorations.

**CASE :**(1) Prinz (1915) reported the murder of a banker. A cigar- holder with a mouth piece of amber which had a tip worn down in a characteristic way was found near the body. The lesion was thought to have been caused by the teeth of the owner of the mouthpiece. The Judge saw this mouthpiece. During the trial when the Judge was questioning a witness, he noticed a deformity in the teeth of that man which reminded him of the defect in the cigar-holder. The witness, a cousin of the deceased, and his heir was shown how well the mouthpiece fitted the deformity in his own teeth and he finally admitted to being a murderer.



(2) A train loaded with petrol, and a passenger train ran into each other in Norway in 1944. The first carriage of the passenger train was engulfed in burning petrol for 12 hours, due to which only burnt remains of bodies were left. The teeth and dental restorations were little affected in some cases.

(3) Ried (1884) reported the murder of a doctor and his mother. The bodies were found in the kitchen. A few dislocated teeth were found, two of which did not belong to those murdered, which were later proved to belong to the murderer, who had lost them during the fight with his victims.

(4) Paulick (1949) reported the murder of an old man by whose side was found an apple with characteristic bite marks. The marks showed three teeth close to each other, two of which were broad and the third small, irregular, probably due to a carious tooth. The bite did not correspond to the teeth of the victim. A prostitute was arrested, and dental examination proved that the bite marks were produced by her teeth.

(5) Euler (1925) reported the investigation of multiple murders, in which a large number of extracted teeth were found. An insane person had collected only caries-free teeth from his victims. Out of the 351 teeth, Euler found 20 left lower canines. Considering all the teeth in relation to the curve for caries development, he arrived at the number of 29 individuals. Later, a note book was found which contained the names and ages of all the murdered numbering from one to 31.

**CLOTHES AND ORNAMENTS:** The clothing may indicate the social status to a certain extent from the texture and value. Any variety of uniform is very valuable for identification. Clothing may also indicate the occupation. The examination of clothing and personal effects is helpful in the identification of victims in mass disasters, such as fires, explosions and aircraft crashes. A detailed description of the size, colour, condition and type of each garment and a record of laundry marks, name tags and labels of tailors should be given. Photographs and examination for invisible laundry marks by ultraviolet light are useful. The clothing may contain keys, letters, bank

books, visiting cards, licenses or other documents which may give a clue to the name and address of the individual. Other personal effects like watches, rings, keys, belt buckles, etc., may be engraved with initials, names or dates. Eyeglasses may also be helpful. A criminal may interchange his identity with that of another person by clothing and personal effects. Bullet holes, tears, cuts or tyre marks found on clothing may give information regarding the cause and manner of death. The design of the ornaments varies from region to region. General cleanliness of the person and the state of the teeth, hands and feet give some idea of social status. If shoes are worn, the epidermis of the soles of the feet is thin and smooth without any fissures and cracks.

**HANDWRITING (Calligraphy):** Handwriting is characteristic of the individual, especially if it is written rapidly, but it may be disguised or forged. Mental and nervous disease and rheumatism alter the character. Evidence of handwriting experts is not conclusive, because it is opinion evidence.

**SPEECH AND VOICE :** Certain peculiarities of speech, e.g., stammering, stuttering, lisping and nasal twang become more evident when the individual is talking excitedly. Speech is also affected by nervous disease. To recognise a person from the voice is risky. It is possible for a person to alter his voice at will. Tape recording is useful. No two voices are really alike. All the frequencies produced by the utterance of a single syllable can be plotted on a time baseline, which gives an acoustic "Spectrogram", characteristic of the speaker. This is helpful in trapping anonymous telephone callers.

**GAIT :** Any identification based on recollection of physical characteristics of person in question by friends and relatives is unreliable. The gait may be altered by an accident or by design.

**TRICKS OF MANNER AND HABIT :** They are frequently hereditary, e.g., left-handedness. Jerky movement of shoulders or muscles of face is an individual characteristic.

**MEMORY AND EDUCATION :** They are sometimes useful, especially in cases of imposture.



## CHAPTER 5

# MEDICO-LEGAL AUTOPSY

Autopsy or necropsy means, post-mortem examination of a body. In every case the autopsy must be complete, all the body cavities should be opened, and every organ must be examined, because evidence contributory to the cause of death may be found in more than one organ. Partial autopsies have no place in forensic pathologic practice. A complete autopsy is necessary to substantiate the truth of the evidence of eyewitnesses. A poor autopsy is worse than no autopsy at all, as it is more likely to lead to a miscarriage of justice.

The autopsy should be carried out by the doctor, and not left to a mortuary attendant. The doctor should remove the organs himself. The attendant should prepare the body and help the doctor where required, such as sawing the skull cap, reconstruct the body, etc.

The approach of the **forensic pathologist** to the investigation of death is different from that of the hospital pathologist. The **hospital pathologist** has easy access to relevant information about the history, physical condition and course of the disease leading to death. The history directs the pathologist to the appropriate ancillary investigations. His main aim is to find morphologic changes explaining signs or symptoms of the disease. In **medico-legal autopsies**, often the clinical history is absent, sketchy, doubtful or misleading. In some cases, identity may not be known. He has to determine time of death and age of injuries. If there are any inconsistencies between the apparent death scene and his actual findings, he has to visit scene of crime. He has to carry out careful external examination including clothing, in the determination of the pattern of injuries and their relationship to the object or weapon causing them. He has also to determine the manner and mechanism of death.

**Objects :** (1) To find out the cause of death, whether natural or unnatural. (2) To find out how the injuries occurred. (3) To find out the manner of death, whether accidental, suicidal or homicidal. (4) To find out the time since death. (5) To establish identity when not known. (6) To collect evidence in order to identify the object causing death and to identify the criminal. (7) To retain relevant organs and tissues as evidence. (8) In newborn infants to

determine the question of livebirth and viability.

If autopsy is not done, the exact cause of death, the presence and extent of disease or injury, the incapacitation produced by them, and whether there was any pain or suffering becomes only speculation.

**Rules for Medico-legal Autopsies :** (1) The body should be labelled as soon as it arrives in the mortuary. (2) The autopsy should be conducted in a mortuary and never in a private room. However, it may become necessary to do an autopsy at the site, when the body is in an advanced state of putrefaction, and its transportation will be difficult, and materials of evidential value may be lost in transport. (3) It should be conducted only when there is an official order authorising the autopsy, from the police or Magistrate. (4) It should be performed as soon as possible after receiving requisition, without undue delay. (5) The medical officer should first read the inquest report carefully and find out the apparent cause of death, and obtain all the available details of the case from case sheet, accident register, etc., so that attention may be directed to the significant points, while doing the post-mortem examination and to carry out appropriate investigations, e.g. toxicology, microbiology, virology, radiology, etc. Lack of such information may result in loss of vital evidence. (6) The examination should be conducted in daylight as far as possible, because colour changes, such as jaundice, changes in bruises, changes in post-mortem staining, etc. cannot be appreciated in the artificial light. If the body is received late in the evening, a preliminary examination is done to note the external appearances, the body temperature, extent of post-mortem lividity and rigor mortis, etc. The actual post-mortem may be conducted on the next day as early as possible. (7) The body must be identified by the police constable who accompanies it. The names of those who identify the body must be recorded. In unidentified bodies, the marks of identification, photographs, and fingerprints should be taken. (8) No unauthorised person should be present at the autopsy. The investigating police officer may be present. (9) As the autopsy is conducted, details of examination should be noted verbatim by an assistant, and sketches made of all the important injuries. (10)



Nothing should be erased and all alterations should be initialled in the report. (11) Even if the body is decomposed, autopsy should be performed as certain important lesions may still be found. (12) Both positive and negative findings should be recorded. (13) After completion of autopsy, the body is handed over to the police constable. (14) P.M. report should not be issued to the party.

**The autopsy report consists of :** (1) **The preamble :** This should mention the authority ordering the examination, time of arrival of the body at the mortuary, the date and place of examination, the name, age and sex of the deceased and the means by which the body was identified. (2) **The body of the report :** This consists of a complete description of the external and internal examination of the body. It should contain a description of the nature, direction, exact situation and dimensions of the wounds. Number should be assigned to each of the wounds that are described. Diagrams are often of value. The report should include all of the positive findings and all of the relevant negative findings, because it may be taken to mean that it was not examined or specifically looked for. (3) **Conclusions :** The conclusion as to the cause of death must be given, based on the post-mortem findings. Conciseness and clear language are of high value in the expression of the opinion. The report should be honest, objective and scientific. This is followed by the signature and qualifications of the doctor. A properly performed autopsy furnishes objective facts which can disprove the weight and worth of misleading statements.

**AUTOPSY ROOM PHOTOGRAPHY:** (1) Photographs should be taken from above, and at right angles to the body to avoid perspective distortion. All objects, such as scalpels and scissors should be excluded. (2) The case number should be placed in a corner or along one edge of the photograph. A pointer, e.g. a narrow triangle of thin cardboard, may be used if a lesion is not readily visible. (3) In violent deaths, front and back views of the uncleaned body with its clothes and also after removal of the clothes should be taken. Then the body should be washed and in the naked body, a distant shot to indicate the location of injuries and close-up shots of major wounds to show details should be taken, keeping a scale to show the dimensions of the wound. (4) In an unknown body photograph of the face should be taken. (5) Victim's hands should be photographed to demonstrate electrical burns, defence cuts, etc. (6) Ligatures, gags and bindings should be photographed before removal from the body.



Fig (5-1). Method of measuring the height of a dead body.

**EXTERNAL EXAMINATION:** The external examination will provide most of the substance of the report, where death occurred due to trauma. It is important in interpretation, e.g. in a case of a pedestrian involved in a traffic accident, in which the vehicle involved has not been identified or where due to lack of witnesses, the circumstances of the accident are obscure. Both the issues might be clarified by a good description of the surface injuries. The following should be noted: (1) The clothing should be listed and examined, and described with regard to type of garment, its colour and consistence, tears, loss of buttons or disarrangement indicating a struggle, as each item is removed from the body. The clothes should be removed carefully without tearing them to avoid confusion of signs of struggle. If they cannot be removed intact, they should be cut in an area away from any bullet hole or objects, along a seam in the garment. Clothing removed from the victim should not be thrown on the ground or floor or otherwise discarded or destroyed. They should be handled as little as possible and without any deliberate shaking or dusting. Cuts, holes or blackening from firearm discharges should be noted and compared with the injuries on the body. Blood stains, seminal stains, grease stains, etc., should be described. Stains due to poison, vomit, etc. should be kept for analysis. Wet clothing should be hung up to dry, but should not be heat dried. Stained and unstained areas of clothes should not be allowed to come in contact to avoid additional soiling, and as such clothes should not be folded while stains are wet. The clothes should be placed into clean plastic bags or other suitable clean containers. Separate bags or containers should be used for each article. List the ornaments. Describe the type, design and colour of each (yellow or white metal; white, red or green stones, etc.). (2) Nail scraping should be taken. Any visible fibres or other matter in the hand or adherent to it should be removed and placed in envelopes. Ten small envelopes are labelled, one for each finger. A matchstick is cut, or the apex of a twice-folded filter paper is run under the nail. The finger is held over the envelope marked with its number as the material is removed, and then the scraper is dropped into the envelope, which is sealed. Contamination of the specimen with



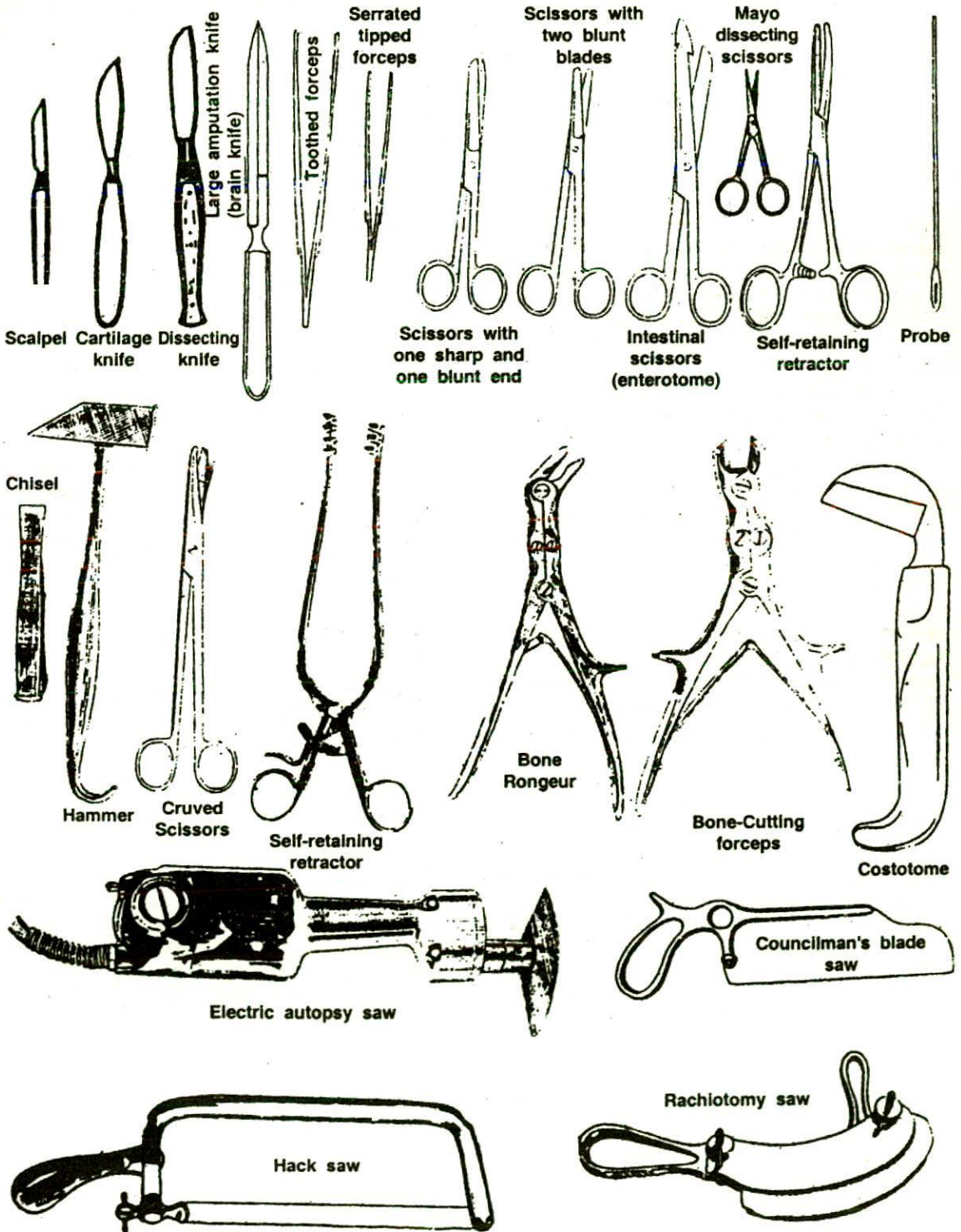


Fig. (5-2) Post-mortem instruments.



the epithelium or blood of the deceased should be avoided. (3) Height and weight of the body, and general state, body build, development and nourishment. If a weighing machine is not available, approximate estimate of the weight of an adult body can be made by measuring the stature and girth of chest and waist. (4) General condition of the skin (rash, petechiae, colour, looseness, turgor), asymmetry of any part of the body or muscular wasting. (5) General description: This includes sex, age, colour, race, build, stature, deformities, nutrition, hair, scars, tattoo marks, moles, pupils, skin disease, circumcision, amputations, deformities, etc. (6) Vaginal and anal swabs are taken and also swabs from areas of suspected seminal staining in all cases of sexual assault. Pubic hair should be combed through. Matted pubic hair should be cut out with scissors and samples of pubic hair taken. (7) Note the presence of stains on the skin from blood, mud, vomit, faeces, corrosive or other poisons, or gunpowder. They should be described precisely and in detail. (8) The presence of signs of disease, e.g., oedema of legs, dropsy, surgical emphysema about the chest, skin disease, eruptions, etc., are to be noted. (9) The time since death should be noted from rectal temperature, rigor mortis, post-mortem hypostasis, putrefaction, etc. (10) The head hair should be examined. Any foreign matter should be removed with forceps, and the hair combed through for trace evidence. Samples of both cut and pulled hair from at least six different areas of the scalp should be taken and labelled as to their origin. (11) The face should be examined for frothy fluid at the mouth and nose, cyanosis, petechial haemorrhages, pallor, etc. (12) The eyes should be examined for the condition of the eyelids, conjunctivae, softening of the eyeball, colour of sclerae, opacity of the cornea and lens, state and colour of pupils, artificial eyes, contact lenses, petechiae, and periorbital tissues for extravasation of blood. (13) The ears should be examined for leakage of blood, or CSF. (14) The neck must be examined for bruises, fingernail abrasions, ligature marks or other abnormalities. Observe degree of distention of neck vessels. (15) Thyroid : size, nodularity. (16) Lymph nodes : cervical, axillary, inguinal. (17) Thorax : symmetry, general outline. (18) Breasts: size, masses. (19) Abdomen : presence or absence of distension or retraction, striae gravidarum. (20) Back : bedsores, spinal deformity. (21) External genitalia : general development, oedema, local infection, position of testes. (22) The natural orifices, i.e., mouth, nostrils, ears, vagina, etc. should be examined for injuries, foreign matter, blood, etc. If the mouth cannot be opened, the masseter and temporalis muscles are divided above

their insertion into the mandible, to allow the jaw to become mobile. The state of the lips, gums and teeth, marks of corrosion, and injuries to inside of the lips and cheeks should be noted. The state of the tongue, position with relation to the teeth, and the presence or absence of bruising or bite marks should be noted. The presence of froth about the mouth and nostrils and smell of alcohol, phenol, etc., should be noted. (23) Note the position of all the limbs and particularly of the arms, hands and fingers. The hands should be examined for injuries, defence wounds, electric marks, etc., and if clenched to find out if anything is grasped in them. To open the hand completely, the flexor tendons of the fingers are cut at the wrist. The fingernails must also be carefully examined for the presence of any blood, dust or other foreign matter, indicative of struggle. Note for oedema, needle marks, ulcers, gangrene, tumours, digital clubbing, etc. (24) External wounds should be systematically examined taking up each part of the body in turn. The description of wounds should include nature, site, length, breadth, depth, direction, position, margins, base and extremities. The condition of their edges, presence of foreign matter, coagulated blood and evidence of bleeding into nearby tissues noted. Determine whether they were caused before or after death, and their time of infliction. Collect foreign materials, e.g., hair, grass, fibres, etc., that may be in the wound. If the injuries are obscured by hair, as on the scalp, the area should be shaved. Deep or penetrating wounds should not be probed until the body is opened. In burns, their character, position, extent and degree should be mentioned. The use of printed body sketches is very useful. Each injury can be drawn in, and measurement noted alongside each and distances from anatomical landmarks recorded. Photographs are useful. There is no substitute for a good colour photograph to preserve the appearance of a wound or injury. If the blood spots or smears on the skin are important, the area should be photographed before and after the skin is cleaned. Excluding stab and firearm wounds, all the injuries should be divided into two broad areas: external and internal. The position of the injuries should be filled in on the skeleton diagrams provided for the purpose. (25) The limbs and other parts should be examined for fractures and dislocations by suitable movements and by palpation and confirmed by dissection. (26) A list should be made of all articles removed from the body, e.g., clothes, jewellery, bullets, etc. They should be labelled, mentioned in the report and handed over to the police constable in a sealed cover after obtaining receipt. (27) The report should include all of the surgical procedures,



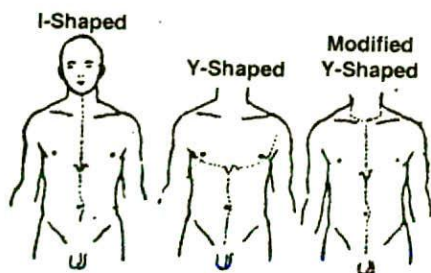


Fig (5-3). Primary skin incisions.

applied dressings and other diagnostic and therapeutic measures found on external examination.

In case of discrepancy between the injuries noted in the inquest report and the findings of the doctor during postmortem examination, the doctor should bring these facts to the notice of the officer who has conducted inquest so that necessary corrections may be done in the inquest report.

**INTERNAL EXAMINATION:** It is convenient to start the examination with the cavity chiefly affected. In a case of suspected cranial injury, the skull should not be opened until the blood has been drained out by opening the heart. The incision must be adopted to the special condition of the case, e.g., in stab wounds of the chest or abdomen, the usual incision may have to be altered to avoid such wounds.

**Skin Incisions :** Primary incisions are of three types (Fig.5-3).

(1) The "I"-shaped incision, extending from the chin straight down to the symphysis pubis, passing either to the left or right of the umbilicus. The umbilicus is avoided because the dense fibrous tissue is difficult to penetrate with a needle, when the body is stitched after autopsy.

(2) "Y"-shaped incision begins at a point close to the acromial process. It extends down below the breast and across to the xiphoid process. A similar incision is then made on the opposite side of the body. From the xiphoid process, the incision is carried downwards to the symphysis pubis.

(3) Modified "Y"-shaped incision: An incision is made in midline from suprasternal notch to symphysis pubis. The incision extends from suprasternal notch over the clavicle to its centre on both sides and then passes upwards over the neck behind the ear.

**ABDOMEN :** The pathologist should stand on the right side of the body, if he is right-handed. The recti muscles of the abdomen are divided about 5 cm. above symphysis. A small cut is made in the

fascia big enough to admit the left index and middle fingers, palmar surfaces up. The fingers are used to protect the underlying structures, and the peritoneum is cut up to the xiphoid. The thickness of the fat in the abdominal wall is noted. In fatty people, a few transverse incisions can be made on the inner side of the abdominal wall to divide muscle and fat, which allows lateral flaps to gape widely, and a full view of the abdomen can be had. The condition of the abdominal cavity and organs is observed before anything is disturbed or altered to find out if there is any blood, pus or fluid in the cavity, or perforation or damage to any organ. If blood, pus or any other fluid is present, its quantity is measured. If this precaution is not taken, the examiner will be frequently in doubt, as to whether any blood or damage to organs found at a later stage is a result of the opening of the body, or whether it was already present. Note the amount of fat in the mesentery and omentum. Note abnormalities and position of abdominal organs, adhesions, old operations, pathological processes, injuries and height of diaphragm in relation to the ribs. The peritoneum is examined for adhesions, congestion, inflammation or exudation.

**NECK :** A block 12 to 20 cm. high, should be placed under the shoulders, to allow the head to fall back and thus extend the neck. The skin is held with a toothed forceps and with a sharp, long-handled scalpel, the dissection is carried out immediately deep to the skin through the platysma. The subcutaneous dissection should be carried up to the lower border of the lower jaw, well laterally on the side of the neck and clavicle. The deep cervical fascia is incised and reflected from the cervical muscles and the submandibular gland. The sternomastoid muscle is freed from its clavicular and sternal attachments, separated from its underlying fascia and reflected on each side. The omohyoid, sternothyroid, and thyrohyoid muscles are exposed, inspected and reflected on each side. The thyroid gland and the carotid sheaths are freed by blunt dissection from their investing connective tissue. The larynx, trachea, pharynx and oesophagus are mobilised and pulled away from the prevertebral tissue by blunt dissection.

**MOUTH:** The mouth is opened, and the tip of the tongue pushed upwards and backwards with a forceps. The knife is inserted under the chin through the floor of the mouth. Cut along the sides



of the mandible to the angle of the mandible, dividing the neck muscles attached to the lower jaw. At the angles of the mandible, turn the blade inward to avoid cutting the carotid artery. The tongue is pushed down under the mandibular arch with the index and middle fingers. The soft palate is then cut to include the uvula and tonsils with tongue and neck organs to be removed. The knife is carried backwards and laterally on both sides of the midline to divide the posterior pharyngeal wall. The middle finger of the left hand is passed into the larynx and with the scalpel, the pharyngeal tissues are dissected from behind forwards and laterally, and the pharynx is pulled down to the upper part of the neck. The dissection is then carried distally through the prevertebral muscles on the anterior surface of the cervical vertebrae, until the whole of the neck structures are free to the level of suprasternal notch. The great vessels including the carotids should be divided in the neck.

**CHEST :** The muscles of the chest are dissected away, keeping the edge of the knife directed inwards towards the ribs, carried back to the midaxillary line, down to the costal margin and up over the clavicles. Cases of pneumothorax are demonstrated before the chest wall is opened. A pocket is dissected on the affected side between the chest wall and the skin, and is filled with water, and the wall is punctured with the knife under the water. The scalpel should be twisted a few times to make sure that the wound is open. If air under pressure is present, it will bubble out of the opening through the water. The amount of air in the pleural cavity can be measured by inserting a 16-gauge needle attached to a syringe filled with water through an intercostal space into the pleural cavity. The lung will be collapsed.

The ribs, sternum and spine should be examined for fractures, and the chest is opened by cutting the costal cartilages with a cartilage knife. Begin at the upper border of the second cartilage, keeping very close to the costochondral junctions. The knife should be inclined about 30° to the vertical. In old persons where the rib cartilages are calcified, a pair of rib shears or hand-saw are used. Then, disarticulate the sternoclavicular joint on each side by holding the knife vertically and inserting the point into the semicircular joint. The position of this joint can be made out by moving the shoulder tip with the left hand, which causes the joint capsule to move. To divide the joint capsule, the knife is put in

vertically and turned in a circular manner. The diaphragm is divided at its attachment to the lower ribs and sternum up to the spine.

The pleural cavity should be examined before complete removal of the sternum, to prevent leakage of blood from subclavian and jugular veins into the pleural cavity before inspection. Before removal of the thoracic organs, *in situ* inspection should include : (1) observation of the lumen of the main pulmonary vessels, (2) observation of the right atrium and ventricle for air embolism, (3) the state of distension or collapse of the lungs, (4) pleural cavities for the presence of fluid, blood or pus and pleural adhesions, (5) pericardium for cardiac tamponade and (6) collection of blood sample from the heart for toxicological examination.

The pericardial sac normally contains 20 to 50 ml. of straw-coloured fluid and the pericardium is smooth and glistening. White spots (milk spots) on the surface of the heart indicate healed pericarditis. In acute pericarditis, the sac contains large collections of serous or purulent fluid and fibrin deposits (bread-and-butter pericardium). Haemorrhagic fluid in the sac is seen in malignancy and rarely in tuberculosis, uraemia, bleeding diseases and secondary to myocardial infarction.

**AIR EMBOLISM :** If air embolism is suspected, the head should be opened first and the surface vessels of the brain examined for gas bubbles, which must be prominent and definite, but not segmental breakup of the blood in the vessels with collapsed segments between. Care should be taken to avoid pulling the sternum and ribs to avoid creating negative pressure in the tissues which may result in aspiration of air into vessels. Before handling the thoracic organs, the pericardium is opened, heart is lifted upwards and the apex is cut with a knife. The left ventricle is filled with frothy blood, if air is present in sufficient quantity to cause death. If the right ventricle contains air, the heart will float in water. Another method of demonstrating air embolism is by cutting the pericardium anteriorly and grasping the edges with haemostat on each side. The pericardial sac is filled with water and the heart is punctured with a scalpel and twisted a few times. Bubbles of air will escape if air is present. Air in inferior vena cava can be demonstrated by puncturing it under water, and looking for escape of bubbles of gas.

If fat embolism is suspected, the pulmonary



artery should be dissected under water and the escape of fat droplets noted.

There are two distinct methods of removing the viscera from the abdominal and thoracic cavities: (1) By removing each organ separately. (Virchow's method). (2) By removing all the organs *en masse*. (Rokitansky method).

The greater omentum lying across the small intestine is pushed upwards across the liver. The upper part of the small intestine is grasped in the left hand, and followed upwards until it disappears retroperitoneally to become the duodenum. The mesentery is penetrated with the point of the knife at the duodenojejunal flexure, and two pieces of string are passed through the hole. They are then brought upwards and tied separately and tightly around the gut. The gut is divided between these two ligatures. The coils of the intestine are pulled forwards by the left hand and the mesentery is cut close to the mesenteric border of the gut until the ileocaecal valve is reached. The caecum is mobilised, and the ascending colon pulled forwards and medially by the left hand, and its attachments with the posterior abdominal wall are cut with the knife up to the hepatic flexure. The omentum is pulled down and the transverse mesocolon is cut through with a knife, until the splenic flexure is reached. Then descending colon is freed in a similar manner until the sigmoid is also free. The upper part of the rectum is mobilised and cut through between two ligatures below the brim of the pelvis. The whole of the small and large intestine is removed from the abdominal cavity.

Next, the axillary bundles which lie behind the clavicles and first rib are cut, by passing the knife upwards on each side from the thoracic cavity into the neck. Pleural adhesions between the lungs and the chest wall if any, should be cleared of by fingers or knife. Slip the fingers of both hands between the lateral portion of one lung and the inner side of the chest wall. The left hand works up to the apex, the right down to the base, and they meet at hilum. The neck structures are grasped *en masse* in the left hand and pulled downwards, cutting the structures on the front of the spinal column to the level of the diaphragm. After this, the thoracic organs are put back in the thorax. The stomach and spleen are pulled medially by the left hand and the diaphragm is removed by cutting through its attachment to the ribs on both sides. The thoracic

organs are pulled down by gentle traction on the neck structures and the cruciate ligament which attaches the diaphragm to the spine is cut. The organs are then put back into the thorax.

The spleen and the tail of the pancreas are held in the left hand, and dissection is carried behind them to the midline. The diaphragmatic surface of the spleen is held in the palm, and the vessels at the hilum are cut after they have been inspected. The liver is pulled medially and the knife is passed behind it to free it from attachments. The peritoneum and fat are cut just outside the lateral border of the kidney which is then grasped in the left hand and mobilised by dissection behind it to the midline, freeing it from the anterior surface of the iliopsoas muscle. The ureter is identified and freed all the way down to its entry to the bladder. Both kidneys are then taken in the left hand, and the knife is carried down the midline behind the aorta to the pelvis. The knife is passed around the side wall of the pelvis, dividing the lateral attachments of the bladder, each side of the pelvis being dissected downwards to the midline. The anterior surface of the bladder is freed with the fingers from the pubic bone. The femoral vessels are cut at the level of the brim of the pelvis. The contents are pulled upwards and the urethra and vagina divided as low as possible. The whole block of thoracic and abdominal organs are pulled forward and removed *en masse*.

The atlanto-occipital joint should be examined by moving the head on the spine, to note any fracture-dislocation. Examine the cervical spine for fractures. The so-called "**undertaker's fracture**" is caused due to the head falling backwards forcibly after death, which tears open one of the intervertebral disc usually around C-6 and C-7, due to which subluxation of the lower cervical spine occurs. The thoracic and lumbar spine should be examined by pushing a hand under the body to raise up the spine forward, which will show any abnormal movement at the site of fracture. The cervical spine can be tested by manual manipulation. To detect fractures of the sacroiliac joints or of the pelvic bones, the pelvis should be squeezed from side to side by pressure on each iliac crest.

**EXAMINATION OF ORGANS :** The *en masse* chest and abdominal organs are kept on a wooden board with posterior surface upwards and the tongue facing the operator.

**DESCRIPTION OF AN ORGAN :** A description



of the organ systems should be limited to a clear, concise, objective description of shape, colour, and consistency and the presence or absence of any lesions other than those systematically described under trauma. The microscopic description may be limited to the positive findings. The pathologist should indicate those tissues he had examined and the number of sections he has taken in any one tissue.

(1) **Size** : Measure by tape. In the liver, blunting of the inferior border points to enlargement, and sharpness to atrophy. A usually tense capsule is in favour of enlargement, and loose capsule with laxness. A straight course of superficial vessels as on heart shows increased size, while undue tortuosity means decrease.

(2) **Shape** : Note any departure from normal.

(3) **Surface** : Most organs have a delicate, smooth, glistening, transparent capsule of serosa. Look for any thickening, roughening, dullness or opacity.

(4) **Consistency** : The softness or firmness as measured by pressure of the finger.

(5) **Cohesion** : It is the strength within the tissue that holds it together. It is judged by the resistance of the cut surface to tearing, pressure or pulling. An organ with reduced cohesion is friable, while when it is increased, the tissue seems to be tough or leathery. If a small toothed forceps bites into a testis it should pull away threads composed of tubules.

(6) **Cut surface** : (A) **Colour** : Every organ (except brain) is basically some shade of grey, but this is altered by the red contributed by its blood supply. Other colours can be added by jaundice or fatty infiltration (yellow), lipofuscin or haemosiderin (brown), malarial pigment (grey-brown). Anaemia causes pallor, while congestion adds a blue tinge. (B) **Structure** : This is a factor of the particular organ, e.g., cortex and medulla in the kidney. In disease these may become indistinct or greatly exaggerated.

**ORAL CAVITY** : Examine the tongue for any disease or injuries, especially bite marks which are usually seen along the sides, and less commonly at the tip. A small haemorrhage is seen under intact mucosa in bite marks. Serial incisions should be made through the tongue for the presence of bruises. The pharynx, epiglottis and glottis should be examined, especially for a foreign object. The condition of the tonsils should be noted.

**NECK STRUCTURES** : A large blunt-pointed scissors is used to cut open the oesophagus from the posterior surface up to the cardiac end of the stomach. The lower end often shows post-mortem erosion, due to the regurgitation of gastric juice

through the relaxed cardiac sphincter. Note for the presence of any capsules, tablets, powders, etc., which should be preserved. If the oesophagus is cut at the lower end, blood will drain from varices, which would then collapse and may be missed. When death occurs from rupture of oesophageal varices, the break should be demonstrated. A blunt-ended fine probe is helpful in cases where milking of the veins does not force a little blood through the tear. Injection of saline or coloured fluid into a varix is useful to find the leak from the tear.

The larynx, trachea and bronchi are examined by cutting them open from the posterior surface. The presence of blood, mucus, foreign bodies, vomited matter, tumours, inflammation, mucopus, etc., in them should be noted. The thyroid is removed and examined. Sections are made in both lateral lobes along their longest diameter. The parathyroids are examined. The carotid arteries must be examined for the presence of thrombosis particularly at the bifurcation near the skull. The hyoid bone, thyroid and cricoid cartilage are examined.

**JAWS** : The masseter and temporalis muscles can be divided above their insertion into the mandible, to allow the jaw to become mobile. To remove the jaws, the upper jaw is excised by sawing along a horizontal line placed above the hard palate. The mandible is disarticulated.

**LUNGS** : Place the lungs with the anterior surfaces uppermost and open the pulmonary artery and continue into the lung tissue as far as small scissors will allow one to go. Look for thrombi, emboli and atherosclerosis. Trace the course of pulmonary veins into the lung, looking for evidence of thrombosis. An ante-mortem embolus may sometimes be coiled, and when straightened out resembles a cast of the vessel from which the thrombus originated, usually in the leg. There may be side-branches and it does not fit the vessel in the lung. Massive pulmonary emboli completely block either the main trunk of the pulmonary artery or impact in one of the major pulmonary vessels, more commonly the right side.

To separate the lungs, the long-bladed knife is placed blunt-edge upwards under the hilum of each lung and turned around so that the sharp edge is upward. Then with a short sawing motion, the hilum is completely cut through. The lung is held on the upper surface by the left hand (or by an interposed



sponge) and the organ cut across from apex to base with the large brain knife, held parallel to the board. This produces an anteroposterior slice. The lungs are examined for consolidation, oedema, emphysema, atelectasis, congestion, Tardieu spots, emboli, tumour, infarction, etc. The smaller bronchi are examined for mucosal thickening, infection and blockage. The smaller pulmonary arteries are examined for thrombosis or embolism.

For fixation of lungs, a cannula is held or tied into the bronchus and 10% formal-saline is perfused through a tube from a reservoir held one metre above the lung. The lung is then put in formalin solution.

**AORTA :** The scissors is passed into the iliac vessels, and the whole length of the aorta is cut on its posterior surface around the arch, up to the aortic valve. Note for any chronic aortitis with plaque formation which obstructs the mouths of the coronary arteries.

**HEART :** It is held at the apex and lifted upwards and pulmonary vessels, superior and inferior vena cavae, and the ascending aorta are cut as far away as possible from the base of the heart. The heart is examined externally for adhesions, pericarditis, discolouration of an underlying infarct and for aneurysms. The pulmonary arteries should be palpated before they are cut and looked for an embolus when they are incised. The pericardium is examined and incised with the tip of the scissors and the heart is exposed. Any blood or fluid in the pericardium is noted. The isolated heart is studied as follows (fig.5-4). It is opened in the direction of the flow of blood with the enterotome. The right atrium is cut between the openings of superior and inferior vena cavae. A small secondary incision is made to open the auricular appendage to detect thrombi. In opening the right ventricle, the lateral margin of right ventricle faces the dissector, the atria being directed towards him. The enterotome introduced into the right atrium, cuts through the tricuspid orifice, and opens the right ventricle along the lateral margin. The circumference of an intact valve of heart can be measured by inserting specially made graduated cones, marked at various levels with the circumference. The heart is held in the palm of the hand so that the pulmonary valve is horizontal and neither collapsed nor stretched. To demonstrate the competence of the pulmonary valve, a gentle stream of water is directed on to the

valve. After the blood is washed away, it can be observed how well the cusps come into apposition, and whether water leaks into the already opened ventricle. The competence of tricuspid and mitral valve cannot be satisfactorily tested post-mortem. In opening the pulmonary valve, the heart is placed so that the apex is directed towards the examiner. The enterotome is introduced into the right ventricle close to the apex, and the conus pulmonalis and pulmonary valve are cut about 15 mm. to the right of, and parallel to the interventricular septum in the anterior wall of the right ventricle. The interventricular septum is identified by the anterior descending branches of the coronary vessels crossing down the epicardium. The incision should extend into the pulmonary trunks and the left pulmonary artery. Note whether the contents of the right ventricle and auricle are fluid blood, currant-jelly clot or chicken-fat clot. The left atrium is cut between the openings of the pulmonary veins. Then, the left atrium is cut along its lateral wall. This incision extends through the mitral orifice, and passes along lateral margin of the left ventricle up to the apex. The next incision extends from the apex along the interventricular septum into the aorta, opening the aortic valve. The water competency of the aortic valve can be tested after cutting the aorta transversely. Both auricular appendages should be examined for the presence of thrombi. The heart should be weighed, after the blood clots in the

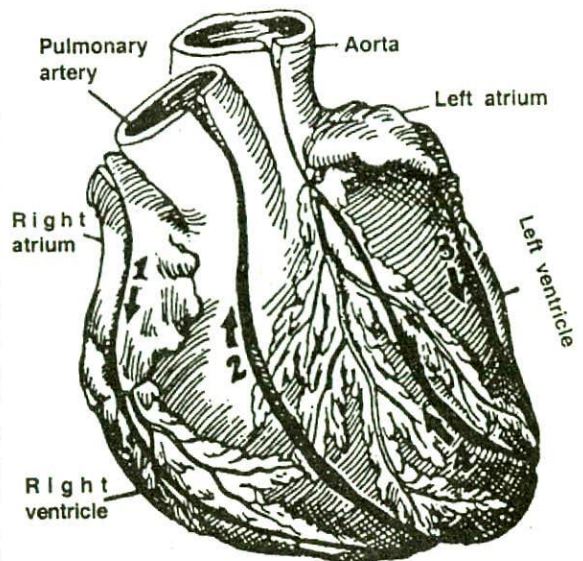


Fig. (5-4). Incisions into the isolated heart.



cavities are removed, and measurements of the circumference of valves and of thickness of right and left ventricle should be taken. Chordae tendinae are attached to papillary muscles and cusps of valves.

The anatomy of coronary arteries varies considerably. Usually, there is a short main trunk of the left coronary artery, which soon bifurcates into the circumflex branch, and the anterior descending branch. **The coronary arteries** are examined by making serial cross-sections along the entire course of the major vessels about 2 to 3 mm. apart, using a scalpel. This method demonstrates narrowing (percentage stenosis) of the vessel, and any ante-mortem thrombus in its lumen, without danger of dislodging it. The coronaries should not be opened by passing a scissors through them from the ostia, as they have a crushing and cutting action and produce so much distortion that any thrombus is obscured, and also the thrombus may be pushed along with the point of the scissors. The anterior descending branch of the left coronary artery is cut downwards along the front of the septum, then the circumflex branch on the opposite side of the mitral valve. The right coronary artery is followed from the aorta to the cut near the pulmonary valve, and then above the tricuspid valve. The presence of acute coronary lesions, e.g. plaque rupture, plaque haemorrhage, or thrombus should be noted. The muscle of the right and left ventricles is incised in a plane parallel to epicardial and endocardial surfaces, which reveals infarction and fibrosis most clearly. In death due to ventricular fibrillation heart is flabby.

#### **SUBENDOCARDIAL HAEMORRHAGES:**

The haemorrhages are seen in the left ventricle, on the left side of the interventricular septum and on the opposing papillary muscles and adjacent columnae carnae. The haemorrhages are flame-shaped, confluent and tend to occur in one continuous sheet rather than patches. When the bleeding is severe, it may raise the endocardium into a flat blister. The mechanism of production is obscure. They are nonspecific finding and are seen: (1) after sudden severe hypotension due to severe loss of blood or from shock, (2) after intracranial damage, such as head injury, cerebral oedema, surgical craniotomy or tumours, (3) death from ectopic pregnancy, ruptured uterus, ante-partum or post-partum haemorrhage, abortion, (4) various types of poisoning, especially arsenic.

Antemortem blood clots (thrombi) are dark red, firm but friable, dry, pale, granular, adherent to vessel wall and on section show alternate layers of platelets and fibrin (coralline platelet thrombus). Dark lines are composed of red cells and a network of fine white lines of fibrin. The postmortem thrombus is dark red, glistening and very friable.

**AGONAL THROMBI :** In case of a person dying slowly with circulatory failure, a firm, stringy, tough, pale-yellow thrombus forms in the cavities, usually on the right side of the heart. The process may begin in the atrial appendage, in the apex of the ventricle or in the angles of the ventricular surfaces of tricuspid valve. It extends and fills the right auricle and ventricle and spreads into the pulmonary artery and its branches like a tree-like cast. In the left ventricle, agonal thrombi are not so big.

**POST-MORTEM CLOTS :** Two types are seen: (1) when blood clots rapidly, a soft, lumpy, uniformly dark-red, slippery, moist clot is produced ("black currant-jelly"). (2) When red cells sediment before blood coagulates, the red cells produce a clot similar to the first type. Above this, a pale or bright-yellow layer of serum and fibrin is seen ("chicken-fat"). The fibrin clot may be soft or jelly-like, but is elastic, when the amount of fibrin is greater. Usually, a mixture of the two types of clot is seen. Post-mortem clots are moist, smooth, shiny, rubbery, homogeneous, loosely or not at all attached to the underlying wall, and there are no fine white lines of fibrin (striae of Zahn). Postmortem fibrinous clots in heart are known as cardiac polyps.

**Unclotted Blood :** In sudden death, the clots are greatly reduced in amount. The blood is fluid in certain cases of septicaemia, in CO poisoning, in rapid death from asphyxia, with large doses of anticoagulants, in hypofibrinogenaemia due to amniotic fluid embolism, retained abortion or puerperal sepsis.

**ABDOMEN :** For examining the abdominal organs, keep the organs on the board with the liver away from the operator and the anterior surface upwards.

**STOMACH :** The stomach is removed after applying double ligatures at each end, and is placed in a clean dish. It is opened along its greater curvature, from the cardiac to pyloric end. Note the size of pyloric ring with a finger, and open the duodenum along the anterior wall. The contents are examined for nature of any food which may be present, and its state of digestion, smell, colour,



character and also for the presence of foreign or suspicious matter. The contents are washed out and mucous membrane is examined for the presence of congestion, haemorrhage, ulceration or other abnormal conditions.

The gastric contents are yellow or yellow-green in regurgitation of bile from the duodenum. In paralytic ileus, a foul-smelling, copious, thick fluid, dirty-green, brown or black is found. In gastrocolic fistula, faecal material may be found. In massive haemorrhage, the stomach is filled with large soft clots which may take the form of a cast of the gastric outline. Small haemorrhages are partially digested and have "coffee-ground" appearance. Blood may be swallowed from the lungs, oronasopharynx or oesophagus.

**INTESTINES** : Examine the small and large intestine for serosa, diameter of the various portions, colour, consistency of wall, adhesions, herniae or other abnormalities. The superior mesenteric vessels are examined for any disease, thrombi or emboli. Hold the upper cut end in the left hand and apply the sharp edge of knife against the attachment of the mesentery to the jejunum. Long, sweeping, to-and-fro movements will separate the intestine due to the mere weight of the knife. The inferior mesenteric vessels are examined and the transverse colon and pelvic mesocolon are separated from the mesentery. The small intestine is opened along the line of mesenteric attachment, and the large intestine along the anterior taenia. They are examined for congestion, inflammation, erosion, ulcers, perforation, etc. The contents are also examined.

**LIVER** : It is removed by itself or attached to the stomach and the duodenum when bile ducts are to be examined. Its weight, size, colour, consistency and the presence of any pathologic process or injury is noted. It is cut into slices 2 cm. thick, which run in the long axis.

In chronic venous congestion, the cut-section has a granular (nutmeg) appearance. Amoebic abscesses are usually single, large and confined to the right lobe. Pyogenic abscesses are multiple. In fatty liver, the cut-section is greasy. In portal cirrhosis, the liver is studded with nodules, 1 to 3 mm. in diameter. In post-hepatic cirrhosis, nodules of varyig sizes, 4 to 10 mm. or more are seen. In biliary cirrhosis, the liver is granular and olive-green in colour.

The anterior wall of the second part of the

duodenum is opened and the ampulla of Vater is identified. Squeeze the gall bladder gently and note if bile enters the duodenum. The common bile duct is opened with a fine scissors. Look for tumours, calculi and strictures. The portal vein and hepatic artery are opened. The condition and nature of lymph nodes in the neighbourhood are noted.

**SPLEEN** : The spleen is removed by cutting through its pedicle. Note size, weight, consistency, condition of capsule, rupture, injuries or disease. It is sectioned in its long axis, and the character of parenchyma, follicles and septa noted. Look for accessory spleens.

In congestive splenomegaly, the pulp is very soft and can be scraped easily. In portal hypertension, it is greatly enlarged and firm. It is also enlarged in malaria, Kala-Azar, portal vein thrombosis, leukaemia, reticulosis, schistosomiasis, etc.

**PANCREAS** : The pancreas is usually removed together with the stomach and duodenum. It is sliced by a series of cuts at right angles to the long axis, which gives the best exposure of the ductal system. The duct can be probed and opened by scissors in its full length before any cuts are made. In acute haemorrhagic pancreatitis, areas of fat necrosis will be seen as small, round, opaque areas around the pancreas and in the mesentery.

**KIDNEYS** : The abdominal aorta is opened along its anterior midline. The renal artery ostia are examined for thrombi, emboli or atherosclerosis. Renal veins are also examined for thrombus. Note size and weight of kidney. The capsule is stripped with toothed forceps. The capsule strips with difficulty in chronic nephritis, hypertensive nephrosclerosis and pyelonephritis. In these conditions, the kidneys are reduced in size, and their surface is granular. Hold the kidney in the left hand between the thumb and fingers, the ureter passing between ring and middle fingers. The kidney is sectioned longitudinally through the convex border into the hilum so as to split in half and open the pelvis. The pelvis is examined for calculi and inflammation. The ureters are split by fine scissors.

**ADRENALS** : They are identified by their relationship to the upper pole of each kidney. If the right kidney is taken in the left hand and pulled forward, the adrenal will be projected forwards in the tissues between the upper pole and the undersurface of the liver, which tends to fall backwards when the kidney is pulled forward. The



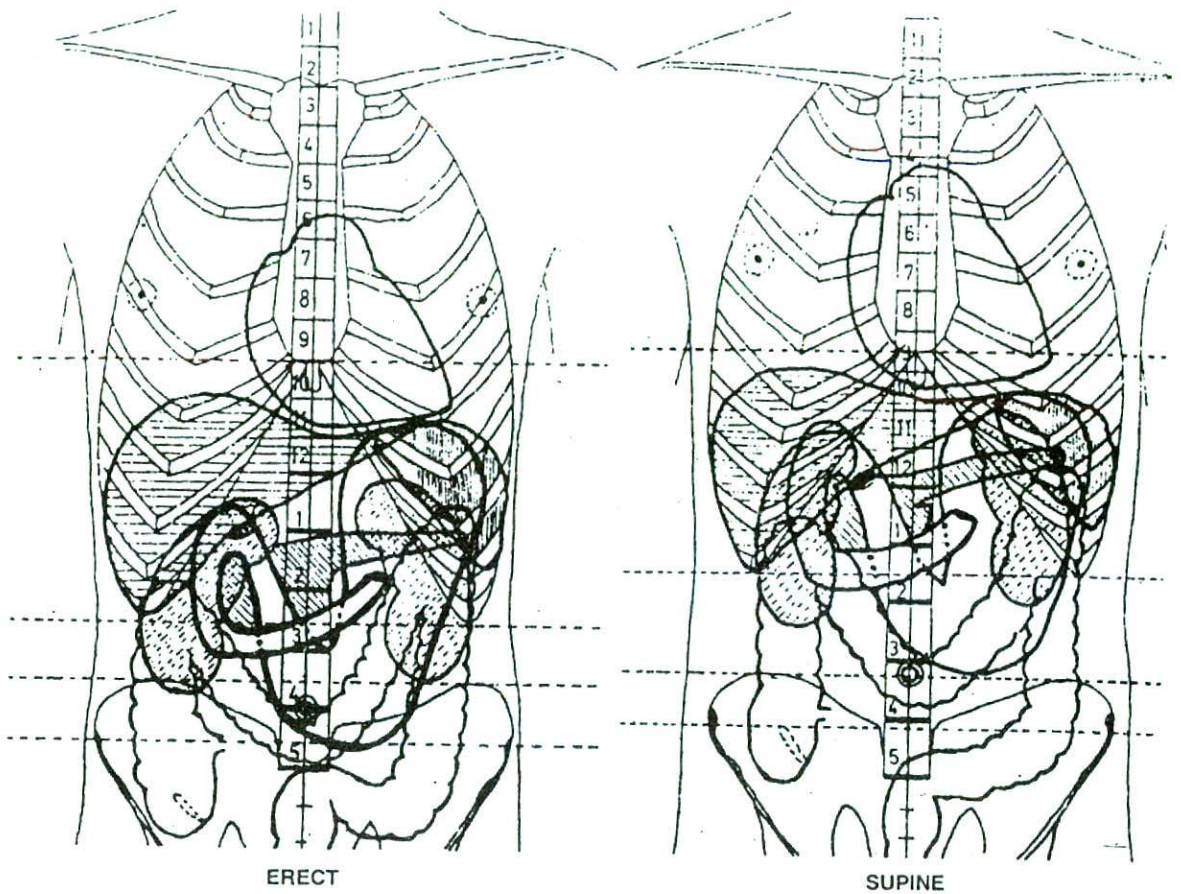


Fig. (5-5). Changes in positions and interrelationships of the organs in erect and supine positions.

left adrenal lies much more medially in relation to the kidney, and can be found by pushing the medial border of the left kidney forwards, and cutting into the tissues between the kidney and spleen. The periadrenal fat is gripped with a forceps and cut, and adrenal removed. Cut the gland gently with a scalpel without applying undue pressure. Haemorrhage is seen in meningococcal septicaemia, bleeding disease, hypertension, birth trauma, pregnancy, etc.

**BLADDER** : It is opened from the fundus and incision extended into the urethra. The condition of the wall and amount and character of urine are noted. In acute cystitis, the mucosa is red, swollen and covered with fibrin and pus. In chronic cystitis, the mucosa is covered with much mucus and pus and may show ulcerations.

**PROSTATE** : It is examined for enlargement

or malignancy. Vertical cross-section through the lateral and median lobes are made with knife. In prostatitis the organ is firm, and in carcinoma it is hard and granular.

**TESTES** : Incise the inguinal canal from the peritoneal aspect and pull out a loop of vas with finger. Free the vas to the internal inguinal ring. Push the testis up out of the scrotum with the right hand, and pull the vas with the left hand. The testis usually comes out without difficulty or damage. The testis and epididymis are held with the left hand and are cut longitudinally with knife. Note for the presence of any clotted blood inside the scrotum and around the testis. Normal seminal tubules can be lifted like thin long filaments by toothless pointed forceps. In acute orchitis and epididymitis, the organ is swollen and firm and may show small abscesses. In chronic orchitis, the organ is firm, nodular and



reduced in size.

**FEMALE GENITALIA :** The tubes, ovaries and uterus are freed from the pelvis and are removed. The anterior vaginal wall is cut from below upwards, exposing the cervix. The fornices are examined. The uterus is opened from the external os to the fundus. Two short incisions are made in the fundus from main longitudinal incision towards each cornu, to expose endometrium. The ovaries are sectioned longitudinally, and the tubes are cut across at intervals. If the uterus contains a foetus, its age should be determined.

**HEAD :** A wooden block is placed under the shoulders so that the neck is extended and the head is fixed by a head rest, which should have a semicircular groove to hold the back of the neck.

A coronal incision is made in the scalp, which starts from the mastoid process just behind one ear, and is carried over the vertex of the scalp to the back of the opposite ear (Fig. 5-6). The incision should penetrate to the periosteum. The scalp is reflected forwards to the superciliary ridges, and backwards to a point just below to the occipital protuberance. Any bruising of the deeper tissues of the scalp or injury to the bone should be noted. The temporal and masseter muscles are cut on either side, for sawing the skull. The saw-line is made in slightly V-shaped direction, so that the skull cap will fit exactly back into the correct position. The saw-line should go through the bones along a line extending horizontally on both sides, from about the centre of the forehead to the base of the mastoid process, and from these latter points backwards, and upwards to a point a little above the external protuberance (Fig.5-7). Thickness of the skull varies in different parts, being thinner where protected by thick muscles. The average thickness is 3 to 5 mm. Care should be taken to avoid sawing through the meninges and brain. To avoid this, stop when saw meets little resistance. A chisel and hammer should not be used to loosen the skull completely. Heavy hammering may cause false fractures, or extend any existing fractures. Skull cap is removed by gently inserting and twisting the chisel at various places through the cut. Fixation of dura to bone is much firmer in children, in whom it tends to dip into the sutures. The meninges are examined for congestion, disease, etc. In old persons, the meninges over the vertex are often white and thickened, with little calcified patches (arachnoid granulations). A



Fig. (5-6) Primary scalp incision. Fig. (5-7) Common method of removing the skull cap.

note should be made of extradural or subdural haemorrhage, which should be measured, and also of intracranial tension. If they are solid, express in terms of grams of weight, or area covered over the superior portion of the brain. Describe variation in thickness if the material is semi-liquid and cannot be easily collected. The superior longitudinal sinus is opened along its length with a scalpel, and carefully examined for an antemortem thrombus. This is of medico-legal importance, as antemortem thrombus in this situation can lead to back-pressure in the bridging veins crossing the subdural space, and cause subdural haemorrhage.

The dura mater is grasped anteriorly with a forceps, and with a scissors or scalpel, the dura mater is divided from before backwards at the level of the skull division on both sides. The scalpel is now passed vertically downwards alongside the falx cerebri at its anterior end, and the knife turned medially to divide the falx. With the forceps, the dura and the falx are now pulled backwards, and the surface of the brain examined.

**DISSECTION OF HEAD IN INFANTS :** Rokitsansky's method is autopsy technique for infants. The scalp flaps are reflected as in adult. The skull can be opened as described by Baar (1946) (Fig. 5-10). With a knife, incision is made into the anterior fontanelle at its posterior margin, about 5 mm. from the midline. The point of the knife is pushed parallel to the inner aspect of the parietal bone for one to 2 mm. between dura and leptomeninges, and the incision is extended to the lateral angle. The opposite side and both anterior margins are cut similarly. One blade of scissors is passed under the original incision and the parietal bone is cut longitudinally about 5 mm. parallel to the sagittal suture, up to lambdoid suture. The coronal suture is cut in a similar way. The other side is cut similarly, and the two parietotemporal flaps are turned outward. Similarly, flaps of the two halves of the frontal squama are prepared and turned outward. Usually, a horizontal fronto-medial extension is required



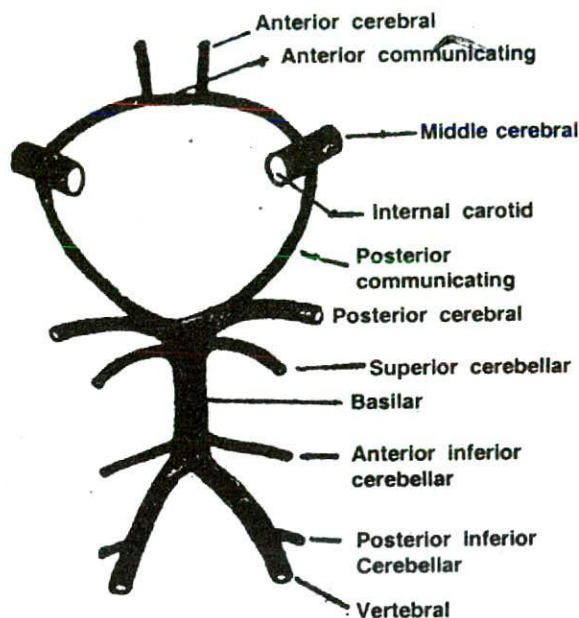


Fig. (5-8). Circle of Willis.

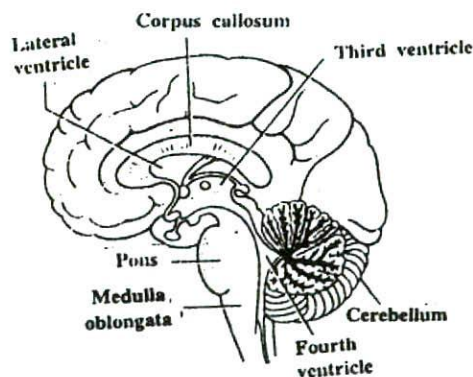


Fig. (5-9). Median section of the brain

with the help of a bone forceps, which leaves only short bridge for outward reflection of the flaps. This

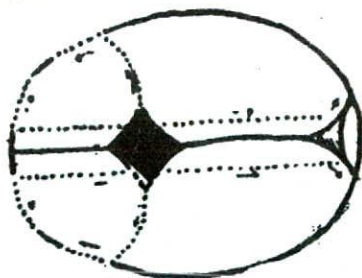


Fig. (5-10). Technique for opening the skull of a newborn infant.

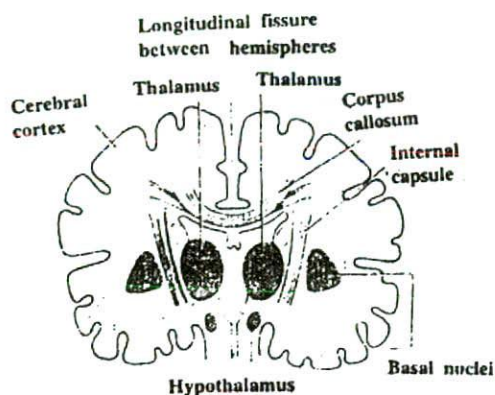


Fig. (5-11). Cross-section of the brain

leaves a medial strip about one cm. in width with the intact superior longitudinal sinus.

After reflecting the flaps, the vertex of the brain and the terminations of the pial veins into the superior longitudinal sinus are examined for haemorrhage. The hemispheres are gently pushed sideward and falx cerebri is examined. Haematoma may be found between the falx and the medial aspect of the hemispheres or between the two dural layers of the falx. The superior longitudinal sinus is opened and examined for thrombi. The falx is separated at its antero-inferior insertion, and the brain is removed as in the case of an adult. The tentorium is examined for tears and for haematoma between its layers. The dural sinuses are opened and the dura is detached from the base and sides of the skull with a pair of forceps, or a part of the dura is held with a towel and is pulled.

**BRAIN :** Cut the dura all along the line of cleavage of the skull and fold it back to midline. Free the falx cerebri from the cribriform plate and pull dura and falx backwards. The brain is removed by inserting the four fingers of left hand between frontal lobes and skull, and drawing frontal lobes backwards and cutting the vessels and nerves at the base. The tentorium is cut along the posterior border of the petrous bone. The brain is supported by the left hand. The knife is passed into occipital foramen and cervical cord, first cervical nerves and cerebral arteries cut as far below as possible. The right hand grasps the cerebellum and the brain is removed from the cranial vault. If any intracranial haemorrhage is present, the blood should be collected and measured. The child's brain attains mature size and weight at about five years of age.

The surface and base are examined for haemorrhage, injury or disease. The condition of the cerebral vessels, especially the vessels in the



circle of Willis is noted for the presence of arteriosclerosis, minute aneurysms, etc. (Fig. 5-8). In the fixed brain, cortical contusions and haemorrhages are much more distinct, but it becomes difficult to dissect out ruptured Berry aneurysms or small haemangiomas. Ruptured Berry aneurysms may be more easily dissected under a flow of running water, by a careful blunt dissection from the origin of the greater intracerebral vessels, around the circle of Willis, to the major branches of the circle. Berry aneurysms (size varies from few mm. to few cm.) are usually present at the junction of vessels especially at the junction of the posterior cerebral arteries, the posterior communicating vessels, the middle cerebral arteries and the anterior communicating arteries. Note for cerebral infarction which may occur due to a thrombus or atheroma or due to raised intracranial pressure causing obstruction to venous outflow. Haemorrhagic infarction appears as a pinkish-purple discolouration of the cortex with stippled haemorrhages.

**Fixation of Brain :** For complete examination of the brain, it is fixed in 10 percent formalin for one week. To facilitate penetration of formalin, the lateral fissures are opened with the fingers which tear open the pia-arachnoid, and a long sagittal cut is made through the corpus callosum to allow formalin to pass into the ventricles. To keep the organ in its natural form, the brain is suspended upside down, supported by a string passed under the basal vessels and attaching the ends of the thread to the two sides of the jar. Gauze should not be put beneath or around the brain, as it imprints an ugly pattern. The weight of the brain is increased by about 8% due to fixation in formalin.

The brain is placed in its normal anatomical position, and with a long knife the two halves of the brain are separated by a single incision which passes through corpus callosum, and through the midline of the midbrain, pons and medulla. If the incision passes through the median plane, it will pass through the cavity of the septum lucidum and expose the internal surfaces of its two laminae which form part of the medial walls of the lateral ventricles on each side. The incision passes through the third ventricle, the aqueduct of Sylvius and the fourth ventricle. The lateral ventricles are opened by dissection of the anterior, posterior and inferior horns, and the ependymal lining examined. Turn the cerebellum over and cut straight down through the

vermis to expose the fourth ventricle. To expose the dentate nucleus, cut obliquely through each hemisphere. Whole of the stem is sectioned transversely at intervals of a few millimetres, to demonstrate haemorrhages or other abnormalities. The cerebral hemispheres are placed base down on a board, and serial sections made in the coronal plane, beginning at the frontal pole passing backwards to the occiput, at intervals of about one cm. The slices should be moved aside in sequence and placed on the cutting board so that they can be identified consecutively later. Other method is to make a horizontal cut through the cerebrum, parallel to the cutting board at a level through the tips of the frontal lobes and temporal lobes to the occipital lobes. Inspect the choroid plexus and locate the interventricular foramen. The fornices and corpus callosum are cut and bent backwards. Examine the thalamus and caudate nucleus. The third ventricle will now be exposed. Pass a probe through the aqueduct of Sylvius. Now expose the fourth ventricle by cutting along the vermis in the midline with scalpel. This exposes the basal ganglia and lateral ventricles. Expose the third ventricles and trace the aqueduct.

The dura is stripped from the base of the skull with forceps to look for basal fractures. The bones of the skull must be tested for any signs of abnormal mobility. Subdural haemorrhage can be washed, whereas subarachnoid haemorrhage cannot be washed.

If the skull is crushed or broken into pieces, replacement and fixation of the bone fragments may be carried out by using an electric drill and copper wire, for personal identification and determination of type of violence.

In generalised oedema of the brain, flattening of the cerebral convolutions with obliteration of the sulci, and a herniation of the inner portions of the temporal poles through the tentorial hiatus, and of portions of the cerebellar lobe and cerebellar tonsils through the foramen magnum are found. In true "coning" the cerebellar tonsils will be discoloured or even necrotic. Gross changes are not present when oedema is present in minor degree. When it is of severe degree and widespread, the convolutions are flattened, lateral ventricles are reduced to mere slits, and the white matter appears glistening, smooth and shiny. The cerebral hemispheres are pressed hard against the dura. The



increased bulk of the hemispheres causes tentorial herniation and the uncus is pushed down the tentorial orifice. The brain may weigh up to 1750 g. Histologically, the white matter is vacuolated and in severe cases shows pools or lakes of pale staining fluid. In head injury, the oedema is seen in the white matter around or deep to contusions, lacerations or ischaemic lesions.

The **middle ear** can be examined by chiselling out wedge-shaped portion of petrous temporal bone. The mastoid is examined by nipping away the bone with a pair of bone forceps. The orbits can be examined by removing the orbital plates in the base of the skull. The sphenoid and frontal sinuses are opened from the inside of the skull by a chisel. The pituitary is removed by chiselling the posterior clinoid process and incising the diaphragm of the sella turcica around its periphery. Abscess formation in or septic condition, etc., about the jaws and teeth should be looked for.

**VERTEBRAL COLUMN:** The atlanto-occipital joint should be examined for any fracture-dislocation by moving the head on the spine. The cervical spine should also be examined. If there is excess mobility, look for haemorrhage on the anterior surface of the spinal ligaments and cut into the bodies of the vertebrae. The thoracic and lumbar spine should be examined by pushing the spine forwards with the hand under the body, which will show abnormal movement at the site of any fracture. The pelvis should be squeezed from side to side by pressure on each iliac crest. Mobility of the pelvis indicates fractures of the sacro-iliac joints or of the pelvic bones. The thorax should be examined for recent or old fractures of the ribs.

**SPINAL CORD :** It is not examined routinely, unless there is an indication of disease or injury. The body is placed prone on the table, face downwards. A wooden block is placed under the chest, and the head is bent downwards. This stretches cervical spine. An incision is made on the back in midline extending from the occipital protuberance to the lower end of sacrum and the muscles are dissected away from the top of the spinal column, noting their condition. The atlanto-occipital joint capsules are incised and articular surfaces examined. The atlas is disarticulated. The laminae are sawed close to the transverse processes through the entire length of spine on each side of the spinous process, by means of an adjustable double blade saw, and are separated with the chisel. It is easier to cut through the arches of the atlas and the axis with a pair of bone shears. The lumbar end of the freed spinous processes are grasped with bone forceps and

spinous processes lifted upwards in one piece. The dura is slit open along the midline with scissors and the presence of haemorrhage, inflammation, suppuration, infarction, degeneration, crushing or tumour is noted. The nerves are cut from below up as they pass through spinal foramina. The cord is separated at the foramen magnum. The cord is sectioned transversely and serially. The vertebral column is examined for fractures or dislocations. The empty spinal canal must be examined for disc protrusion, tumours, fractures, dislocations and vertebral collapse.

**EXTREMITIES :** The femoral vessels are examined by a longitudinal incision down the centre of the upper anterior half of the thigh, starting below the inguinal ligament. They should be examined in continuation with iliac vessels. For examination of popliteal and calf veins, a vertical midline incision is given over the back of the knee joint and leg and skin flaps are reflected. The tendon of Achilles is divided. The calf muscles are then separated from the bones from the heel upward. Transverse sections about two cm. apart are then made in the calf muscles. If thrombi are present, they protrude as firm, solid, tube-like masses. The major arteries of the calf pass between the tibia and fibula. For removal of the marrow from the femur, the incision for the femoral vessels can be employed. In the upper end of the shaft, a rectangle of cortex is cut out, using a rotary saw, and the marrow is scooped out.

All the organs and parts removed from the body should be returned to the dead body for the purpose of burial, except when they are required for further studies or to be produced as evidence in subsequent trial. If the organs are retained by the doctor for his department, he can be sued by any relative of the deceased.

**ENDOSCOPIC TECHNIQUE OF POSTMORTEM DIAGNOSIS:** The method requires the use of rigid Hopkins-endoscope of 4 mm and 8 mm diameters with 0°, 90°, and 130° view angles having a light source from fibreglass cable. The endoscope is fitted with zoom lens camera for photographic documentation.

Sinuses, fundus, external auditory meatus, larynx, etc. can be directly visualised. Bullet tracts in the body can be traced accurately. Hepatic, splenic and diaphragmatic injuries and intraperitoneal and thoracic haemorrhages can be visualised. Natural orifices can be clearly examined.

**Collection of Blood :** The cellular barrier of mucous and serous membranes breakdown after death, due to which substances in the stomach and intestine can migrate to the organs in the thorax and abdomen, causing false rise in the blood level.



Before autopsy, 10 to 20 ml. of blood can be drawn from the femoral vein by a syringe. The flow may be increased by massaging the leg to drive blood proximally. The jugular or subclavian vein can also be used. After removal of the viscera, blood can be collected by raising the arm, and holding a small container under the cut end of a subclavian vein. The arm can be elevated and massaged towards the shoulder, if the flow is slow. Similarly, blood can be collected from cutting the iliac veins at the brim of the pelvis, or from the jugular vein. Blood should never be collected from the pleural or the abdominal cavities, as it can be contaminated with gastric or intestinal contents, lymph, mucus, urine, pus, or serous fluid. Alcohol and barbiturates can diffuse passively after death from the stomach and intestines into adjacent organs or cavities leading to erroneous results.

For grouping, a piece of filter paper or clean cotton gauze can be used to soak up some blood and dried.

**C.S.F. :** It is collected by lumbar puncture or from the cisterna magna by inserting a long needle between the atlas and the occipital bone. Direct aspiration of CSF can be done from the lateral ventricles or third ventricle after removal of the brain.

**VITREOUS HUMOUR :** A fine hypodermic needle is inserted through the outer canthus into the posterior chamber of the eye, (centre of the globe), after pulling the eyelid aside followed by aspiration with a syringe. One to two ml. of fluid can be aspirated from each eye. Water can be re-introduced through the needle to restore the tension in the globe for cosmetic reasons.

**LUNGS:** In solvent abuse and death from gaseous or volatile substances, a lung is mobilised and the main bronchus tied off tightly with a ligature. The hilum is then divided and immediately the lung is put into a nylon bag, which is sealed. Plastic (polythene) bags are not suitable as they are permeable to volatile substances.

After completing the autopsy, the body cavities should be cleaned of blood, fluid, etc. The organs are replaced in the body, and any excess space is packed with cotton, cloth, etc. especially in the pelvis and the throat, where blood tends to leak. The dissected flaps are brought close together and well sutured by using thin twine and large curved needle. The skull should be filled with cotton or other absorbent material, and the skull cap fitted in place. The scalp is pulled back over the calvarium and the

scalp stitched with thin strong twine. The body should be washed with water, dried and covered with clothes. The body is handed over to the police constable accompanying it for disposal.

**S.297, I.P.C.:** Whoever offers any indignity to any human corpse shall be punished with imprisonment for a term which may extend to one year or with fine or with both.

**AUTOPSY OF A CASE OF AIDS AND INFECTIONS:** Highly infectious diseases transmitted by direct contact or contact with infected materials, clothing, discharges, vomit, etc. are cholera, rabies, tetanus, anthrax, poliomyelitis, mumps, septicaemia, typhoid, tuberculosis, hepatitis B & C, diphtheria, C.S.F. meningitis, smallpox, plague tick-borne encephalitis, equine encephalomyelitis, T-cell lymphotropic viruses I and II, and HIV. Patients with presenile dementia may have Creutzfeldt-Jakob disease (CJD) caused by virus, which is present in highest concentration in nervous and lymphoid tissues. It appears that the CJD agent can be acquired only by ingestion, inoculation or transplantation. Hepatitis B and C viruses are present in blood stream and concentrated in hepatic tissue.

Inoculation tuberculosis of skin (prosector's wart) is rarely seen in persons engaged in post-mortem examinations. There is a risk of transmission of HIV through needle prick injury during collection of blood and other body fluids, and mucosal splashes and skin contact with superficial injury during autopsy on a HIV infected dead body. HIV in high concentrations has been found to remain viable for three weeks and from liquid blood after two months. HIV and hepatitis viruses are not associated with air-borne transmission. HIV is present mostly in lymphoid tissue and brain, and also in colon and lungs.

After infection with HIV, blood becomes positive after 2 to 18 months. AIDS is usually communicated by sexual intercourse or from blood transfusion. According to guidelines laid by the Government of India, the status of HIV should not be disclosed to blood donor. The intention is to spare him of the agony of knowing the helplessness of his situation. If the blood drawn is positive, it should be discarded. Once blood sample is drawn, the register of patient-identities should be kept quite separate and samples identified only with a code number. If the donor wants to know the result of HIV test, he should be referred to an accessible HIV testing centre where supplemental tests with counselling will be offered to him.

The Centre for Disease Control (CDC), estimates



that 5.5% of all HIV positive persons are employed in the health care field. According to the guidelines issued by CDC, with the exception of health care workers and personal service workers who use instruments that pierce the skin, no testing or restriction is indicated for workers known to be infected with HIV but otherwise able to perform their jobs. A person testing positive for HIV cannot be removed from service, if he is physically fit to discharge his duties. If a person suffering from AIDS, knowingly marries or has sexual intercourse with a normal person and thereby transmits the infection to other person, he would be guilty of offences under S. 269 and 270, I.P.C.

It is better to leave some organs in situ in the cadaver rather than eviscerating en masse. Another method is to fix lungs and other organs whole after removal rather than slicing them before fixation.

**Universal Work Precautions:** (1) All infected bodies should be wrapped and tied in double layer tough plastic bag, with a red colour tag mentioning "Biologically Hazardous". The label should mention the name, age, sex, registration number, etc. (2) Workers who have exudative lesions or weeping dermatitis or external injury should not handle AIDS victims. (3) **Proper protective clothing**, full sleeves overalls instead of simple surgical gowns, water-proof plastic apron, head cap, face mask, goggles if eye glasses are not worn, double gloves (heavy autopsy gloves over surgical gloves), waterproof rubber gumboots of knee length with shoe covers. A plastic visor will protect eyes and mucosal surfaces from splash injury. (4) **Handling sharp instruments:** Avoid accidental pricks and cuts from needles, scalpels, etc. If a cut is made in the rubber gloves or needle injury occurs they should be removed immediately and replaced with new ones. Hands and other skin surfaces should be washed immediately and thoroughly if contaminated with blood or other body fluids. Infection of AIDS can be acquired by transdermal inoculation through cuts and needle punctures. About 0.5% of individuals will become seropositive. Transmission rates from contaminated needle punctures or close contact are 10 to 30 times higher for serum hepatitis than for AIDS. The incident should be reported to proper authority to get their blood check for HIV seropositivity. (5) **Handling specimens for laboratory examination:** They should be properly labelled and filled with 10% formalin solution and should be handled with gloved hands. (6) **Disposal of used instruments:** They should be dipped in 2%

glutaraldehyde (cidox) for half-an-hour, washed with soap and detergent and water, dried and then rinsed in methylated spirit and air dried. (7) All **soiled gauze and cotton**, etc. should be collected in a double plastic bag for incineration. (8) **Laundry material**, such as aprons, towels, etc. should be soaked in one percent bleach for half-an-hour, washed with detergent and hot water, and autoclaved. (9) **Clean-up procedure:** Wear new intact disposable gloves. Small spatters and spills of blood and other body fluids can be wiped up with disposable tissues or towels which are discarded in special bio-hazard bags and properly disposed. The autopsy table and floor should be cleaned with one percent bleach solution, followed by washing with soap and water. (10) **Disinfectants:** 1:10 dilution of common household bleach or a freshly prepared sodium hypochlorite solution are recommended. Liquid chemical germicides commonly used in health care facilities and laboratories are effective against HIV. (11) In case of accidental **injuries or cuts** with sharp instruments, contaminated with blood or body fluids or not, while working on a body, the wound should be immediately washed thoroughly under running water, bleeding encouraged and disinfected. (12) To minimise aerosol splatter, skull can be opened with an electrical oscillating saw attached to a vacuum dust exhaust and filter or with a band saw under a transparent anti-slash cover. After autopsy all body orifices should be packed and the body should be wrapped in double layer heavy plastic sheet bag and secured properly, so that there is no leakage. A tag should be attached for identification. (13) After completing autopsy, hands and face should be washed with soap and water and rinsed in 70% methylated spirit. (14) The body should be burnt or incinerated.

Universal precautions apply to blood, semen and vaginal secretions as well as to CSF, synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid and amniotic fluid. Universal precautions do not apply to faeces, nasal secretions, sputum, sweat, tears, urine and vomitus unless they contain visible blood. If the recommended guidelines are adhered to there is no risk to the staff conducting autopsies on AIDS patients.

**The Autopsy and Disposal of Radioactive Corpse:** If the amount of radioactivity is less than 5 millicuries, no extra precautions are necessary. If the body contains between 5 to 30 millicuries of radioactive material, the doctor must wear heavy rubber gloves,



plastic aprons, plastic shoe covers and spectacles to reduce contamination. Instruments with long handles should be used during the autopsy. Organs and fluids that are most radioactive should be removed first and placed in covered glass jars, labelled and examined for radioactivity from time to time. Fluid of the pleural and peritoneal cavity should be flushed copiously with running water and disposed off directly into the sewer. Contaminated wearing dress should be thoroughly cleaned with soap and water, and stored for suitable decay of the radioactive material before being sent to laundry. Instruments can be brought to a safe level by soaking them in water with soap or a detergent. Contamination of the floor of the autopsy room should be avoided. Spilled fluid should be cleaned with dry disposable water, held with forceps and put into a suitable vessel. If the radiation level is high, a team may be required to complete the autopsy. Special organs may be removed first, and detailed dissection done away from the body, or after a period of cold storage, or fixation to permit radioactive decay. If the body contains more than 300 millicuries of activity after autopsy, it should be embalmed in the hospital morgue. The presence of a cardiac pace-maker must be recorded, especially if it is one which might contain mercury or a radio-active substance, as explosions in crematoria from the heating of mercury batteries have proved hazardous.

#### NATIONAL HUMAN RIGHTS COMMISSION'S RECOMMENDATIONS ON AUTOPSY:

The following is the brief account of the procedure to be carried out. The doctors who have access to the scene of death should (1) Photograph the body. (2) Record body position. (3) Determine time of death. (4) Protect deceased's hands with paper bags. (5) Examine the scene for blood. (5) Obtain information from scene witnesses, friends or relatives, hospital records, etc. (6) Place the body in a body pouch. (7) Become familiar with the types of torture or violence (Refer "Torture" page 244).

**AUTOPSY:** (1) Record the names of all persons present during autopsy. (2) One doctor should be designated as principal prosector. (3) Photograph full frontal aspect and right and left profiles of the face. (4) Colour photographs should be comprehensive in scope and must confirm the presence of all demonstrable signs of injury or disease. (5) Radiograph the body. (6) Obtain dental X-rays. (7) Examine clothing and photograph. (8) Photograph 100% of body area. (9) Determine the time of death. (10) Photograph all injuries. (11) Photograph scars, keloids, moles, etc. (12) Identify and label any foreign object that is recovered. (13) The length of the back, the buttocks and extremities,

including wrists and ankles must be systematically incised to look for deep injuries. The shoulders, elbows, hips and knee joints must also be incised to look for ligamentous injury. (14) Conduct a thorough and complete autopsy. (15) Take colour photographs of all injuries and abnormalities, found during internal examination. (16) After completing autopsy, record which specimens have been saved. (17) Send viscera for chemical examination. (18) Preserve all foreign objects, all clothes and personal effects, finger nails and nail scrapings; foreign and pubic hair in cases of sexual assault. (19) At the end of the autopsy report should be a summary of the findings and the cause of death.

**PSYCHOLOGICAL AUTOPSY:** In some cases of suicide, police reports may be incomplete as sources of information. Description of scene of death, position of body, evidence at the scene, such as weapons, poison and notes, etc. are necessary. Interviewing family members, friends, teachers, doctors, employers, etc. who had dealt with the deceased are helpful to reconstruct the habits of the victim as regard to his background, habits, character, personality traits, general life style and method of death. The process is termed "psychological autopsy".

**LABORATORY PROCEDURES :** (1) **Histopathology :** Various internal organs are examined routinely. A typical portion of affected area as seen by gross examination should be removed along with a portion of normal borderline tissue. It should be cut into pieces one to two cm. in thickness for proper preservation. The specimens can be fixed in ten percent neutral formalin or 95% alcohol. The amount of preservative should be 6 to 10 times the volume of the tissue to be fixed.

(2) **Bacteriologic Examination :** All specimens must be collected under sterile conditions. Blood for culture must be obtained before organs are disturbed. After opening the pericardial sac, the anterior surface of the right ventricle is seared with heated knife, and 10 ml of blood aspirated using a sterile needle and syringe. The same technique may be used to remove material from other organs. The sample should be placed in sterile stoppered containers. The subarachnoid space is opened with a sterile scalpel and a specimen is taken from the space by sterile swabs from which smears and cultures may be made. The samples should be placed in sterile stoppered containers. For culture of splenic tissue, the surface of the organ (2x2cm) is seared with a hot spatula, and the area is punctured with a sterile instrument and pulp is scraped. In deaths



due to septicaemia, spleen is the best organ for culture, or blood is collected from a peripheral vein.

(3) **Smears** of brain cortex, spleen and liver may be stained for malarial parasites. Smears of bone marrow from ribs or sternum is stained and examined for blood dyscrasias. Smears from chancres and mucous patches are examined fresh by dark field method or stained.

(4) **Virological examination:** A piece of appropriate tissue is collected under sterile conditions and the sample frozen or preserved in 80% glycerol in buffered saline. The specimen should be placed in a sterile container and sealed tightly.

(5) **Blood, Urine, Vitreous and C.S.F.** are collected for biochemical examinations. Blood should be collected from the femoral vessels. Other sites, in descending order of preference are the subclavian vessels, root of aorta, pulmonary artery, superior vena cava and the heart. When blood samples are collected for volatile substances, small glass bottles should be used, which should be filled to the top to avoid loss of volatile substances into the head space and stored at 4°C. CSF is collected by lumbar or cisternal puncture. They are of value if collected within 4 to 6 hours after death, but not later than 12 hours.

(6) **Enzymes** : Small pieces of tissues are collected into a thermos flask containing liquid nitrogen.

(7) **Faeces** is examined for protozoa and helminths. Five to ten gm: without any preservative should be sent for bacteriologic examinations.

(8) **Urine:** It can be obtained by catheter or suprapubic puncture with syringe and long needle before autopsy, or by making an incision on the anterior surface of the bladder during autopsy.

(9) **Cyst fluid** is examined for echinococcus hooklets.

(10) **Bite marks:** Swab the bite site with a saline-moistened cotton swab, dry and place in a test tube and plug with cotton.

(11) **Vaginal and anal swabs.**

(12) **Urethral discharge.**

(13) **Rectal swabs:** For bacteriological examination swabs taken from the mucosa of rectum are suitable.

**PRESERVATION OF VISCERA IN CASES OF SUSPECTED POISONING:** Viscera should be preserved (1) If death is suspected to be due to poisoning either by the police or the doctor. (2)

Deceased was intoxicated or used to drugs. (3) Cause of death not found after autopsy. (4) Death due to burns. (5) Advanced decomposition. (6) Accidental death involving driver of a vehicle or machine operator. The following must be preserved in all fatal cases of suspected poisoning.

(1) **Stomach** and its contents. If the stomach is empty, the wall should be preserved.

(2) The upper part of **small intestine** (about 30 cm.length) and its contents.

(3) **Liver** 200 to 300 gm.

(4) **Kidney** half of each. as one kidney may be dysfunctional.

(5) **Blood** 30 ml. Minimum 10 ml.

(6) **Urine** 30 ml.

As most poisons are taken orally, the poison is most likely to be present in the stomach and intestinal contents and in their wall. After absorption all poisons pass through the liver, which is the major detoxicating organ and has the power of concentrating many poisons making them identifiable when the blood and urine concentrations may have declined to very low levels. The kidney being the organ of excretion contains large amounts of poison, which is excreted into the urine. Levels of drugs in the muscle more accurately reflect blood levels than the liver or kidney.

It is essential to prevent contamination of the solid viscera with the contents of the gastrointestinal tract, because an idea of the length of time since ingestion may be had from the relative amounts of poison in the stomach, intestines and the solid organs. If the poison is only found in the contents of the stomach, and none in the solid viscera and is not an irritant, doubts may occur about the actual proof of absorption. Therefore, it is important to keep the contents of the alimentary canal in separate bottles. Poison found in urine, unless added with evil intention is a proof of absorption and excretion. If the poison is also found in the food or medicine preserved, this would be very strong additional evidence. The stomach contents are of primary value for estimating the quantity ingested in acute overdoses, and qualitatively in identifying substances which have been recently ingested.

**Containers:** For preservation of viscera, the glass bottles used should be of one litre capacity, clean, wide-mouthed, white and fitted with glass stoppers. Rubber inserts should not be used under caps, because it can extract from the contents certain



poisons, such as chloroform and phenols. Glass containers should be cleaned with sulphuric acid-chromate solution, rinsed with distilled water and dried. Polythylene bags or containers can be used, but volatile poison may diffuse through plastic. When lungs or other tissues are to be preserved for analysis for volatile substances, nylon bags should be used, as they are not permeable to such substances. Blood should be collected in screw-capped bottle of about 30 ml.

**Preservatives :** (1) Saturated **sodium chloride** solution. It is not used in poisoning from corrosive acids except phenol, alkalis, corrosive sublimate, and aconite. (2) **Rectified spirit**, except in cases of suspected poisoning by (a) alcohol and kerosene, (b) chloroform, ether, (c) chloral hydrate, (d) formic acid, (e) formaldehyde, acetic acid, (f) phenol, (g) phosphorus, and (h) paraldehyde, because the organic acids and paraldehyde are soluble in alcohol and the phosphorescence of phosphorus is diminished by alcohol. (3) Ten. mg./ml of sodium or **potassium fluoride** (enzyme inhibitor) and 3 mg. potassium oxalate should be used for preserving blood. Fluoride should also be added to urine, CSF, and vitreous humour if alcohol estimation is required, and also to samples for analysis for cocaine, cyanide and CO. One ml of concentrated hydrochloric acid or 10 mg. of thymol or 100 mg. of sodium fluoride can be used for 10 ml urine as a preservative. Toluene is better. Preservative is not necessary if (1) viscera can be analysed within 24 hours, (2) if sample can be kept in a refrigerator or ice box, (3) bone, hair, nails, (4) lung for detecting inhaled poisons.

N.B. The viscera **should not be preserved in formaldehyde** because extraction of poison, especially non-volatile organic compounds becomes difficult.

**Instructions for Preservation and Despatch of Viscera:** (1) The stomach and its contents, and the small intestine and its contents are preserved in one bottle, and the liver and kidney in another bottle. The blood and urine are preserved separately. (2) The stomach and intestines are opened before they are preserved. The liver and kidney are cut into small pieces of 0.5 to 1 cm. thickness or they can be minced in a grinder or mixer, so that they are well-preserved. (3) The quantity of preservative should be equal to the viscera in bulk. (4) Only two-thirds of the capacity of the bottle should be filled with the viscera and preservative to avoid

bursting of bottle if gases of decomposition are formed. (5) The stoppers of bottles should be well-fitted, covered with a piece of cloth, and tied by tape or string and the ends sealed. The bottles should be sealed as soon as possible to prevent loss of volatile substances and possible contamination by external material. (6) The bottles should be labelled which should contain the name of the victim, age, sex, autopsy number, police station, crime number, the organs it contains, the date and place of autopsy, preservative used and signature. If the contents are infectious, a clearly visible warning should be put on the label. (7) A sample of the preservative used, i.e. 100 ml. of rectified spirit or 25 g. of sodium chloride is separately kept in a bottle and sent for analysis, to exclude the possibility of any poison being present as a contaminant. (8) The sealed bottles containing the viscera and preservative are put into a box which is locked and the lock is sealed using personal or departmental seal. (9) A copy of the inquest report, post-mortem report and the authorisation from the Magistrate are sent to the Forensic Science Laboratory along with the viscera. The viscera are not analysed unless there is an authorisation letter from the Magistrate or a police officer not below the rank of Deputy Superintendent, which is issued on an application by the investigating police officer. (10) The key of the box and a sample seal on a piece of paper, corresponding to the seal used on bottles and lock are kept in an envelope, which is sealed and sent with viscera box. (11) The viscera box is handed over to the police constable after taking a receipt, who delivers it personally in the office of the FSL, after obtaining a receipt for the same.

In certain cases of poisoning, the following articles are preserved. (1) **Heart:** strychnine, digitalis. (2) **Brain:** 100 gm. of cerebrum or cerebellum: alkaloids, organophosphorus compounds, opiates, CO, cyanide, strychnine, barbiturates and volatile organic poisons. (3) **Spinal cord** entire length: strychnine. (4) **C.S.F. :** alcohol. (5) **Bile :** It is best removed by puncturing the gall bladder *in situ*. Narcotic drugs, cocaine, methadone, glutathione, barbiturates and some tranquillisers. (6) **Vitreous humour :** alcohol, chloroform, etc. (7) **Lung :** one lung in gaseous poisons, hydrocyanic acid, alcohol, chloroform, etc. Use a nylon bag which should be heat-sealed. (8) **Skin :** In deaths where hypodermic injection marks, or areas where absorption of poison



through the skin may have occurred, an area of 10 cm. radius about the site, with as much underlying fat and muscle as possible, and the whole needle track is removed. Control specimens should be taken from the opposite side of the body. The usual substances injected are insulin, morphine, heroin, cocaine and other illicit drugs. (9) **Bone** : 10 cm. of the shaft of the femur is taken in cases of subacute or chronic poisoning by arsenic, antimony, thallium or radium. (10) **Hair** : An adequate sample (20 to 30) of head hair should be removed with a tweezer to remove the roots, and tied in locks. (11) **Nails** : All the nails should be removed entire by inserting the blade of a Spencer-Wells forceps under the nail-plate, grasping it and twisting. (12) **Uterus** : Uterus and appendages and upper part of vagina are preserved in cases of criminal abortion. Sticks and foreign bodies found in the genital tract are preserved separately. (13) **Muscle** : If the internal organs are badly putrefied, muscle tissue (3x3cm) especially of thigh is well preserved and can be analysed. (14) **Fat** : 10 g. from abdominal wall or perinephric region in cases of poisoning by pesticides and insecticides.

**N.B.:** If the contents are infectious, e.g., hepatitis B virus, HIV, tuberculosis, tetanus, anthrax, gas gangrene or contain radioactives, this must be communicated to the chemical examiner.

The viscera should be refrigerated at about 4°C. if not forwarded to the laboratory. They can be destroyed either after getting the permission from the Magistrate, or when the investigating police officer informs that the case has been closed.

Preservative is not necessary: (1) If viscera can be analysed within 24 hours. (2) If samples can be kept in a refrigerator or ice box. (3) Bone, hair, nails. (4) Lung for detecting inhaled poisons.

**CAUSE OF DEATH** : After completing the post-mortem examination, a complete but concise report should be written in duplicate using carbon papers. One copy is sent to the investigating officer and another copy is retained for future reference. Autopsy report should contain a list of specimens and samples retained for further examination. The report should be given on the same day, as the details cannot be accurately recorded from memory, if there is much delay. If laboratory tests have to be carried out, an interim report should be written and later after obtaining the reports, a supplementary report is written. It has been said with a considerable

measure of truth, that autopsy reveals the diseases and lesions that the person lived with, and not necessarily those which killed him. A definite opinion should be given whenever possible, but if the cause of death cannot be found out, it should be mentioned in the report. In such cases, viscera should be preserved and histological and bacteriological examinations carried out. While giving cause of death, the word 'probably' should be avoided. In suspected cases of poisoning, the opinion should be kept reserved until the Chemical Examiner's report is received. The conclusion that death was caused by poison depends on evaluation of clinical, autopsy, toxicologic and circumstantial evidence. If opinions are given to police before evaluation of data are complete, they should be clearly and unmistakably labelled as preliminary impressions, subject to change if and when the facts so warrant. When the findings are less clear cut, or are multiple, probability of various alternatives can be offered. It must be recognised that the determination of cause and manner of death are opinions, not facts. The opinion of one medico-legal officer can differ from another. If the cause of death is not found on autopsy, the opinion as to the cause of death should be given as "undetermined," and the manner of death as "unknown".

**Autopsy of Decomposed Bodies** : It is a fundamental rule of forensic pathology that all human remains should be examined, even when they are not likely to provide information. Even when the body shows advanced decomposition, a thorough examination may show a gross traumatic or pathological lesion. The skin though discoloured, may show the presence of a gross external injury, e.g., a bullet wound, lacerated wound or incised wound. Fractures are easily detected. Gross pathological lesions may be found, e.g., valvular lesions of the heart. Ante-mortem thrombi may persist.

**EFFACEMENT OR OBLITERATION OF IDENTITY** : The identity of a dead body may be destroyed by the following methods.

(1) Purposive removal of the identifying features, e.g. fingerprints, tattoo marks, scars, moles, teeth, hair, etc. and articles of clothing.

(2) Animals, e.g., rats, dogs, jackals and hyenas and birds, such as vultures may attack a dead body and mutilate it in a very short time, when the body is exposed in an open place.





Fig. (5-12) Reconstruction of dismembered human remains.

- (3) Burning or incineration.
- (4) Advanced putrefaction.
- (5) Dismemberment and burying or throwing different parts in different places.
- (6) Chemical destruction of the body in corrosive acids or alkalis.
- (7) Dismemberment by moving vehicles, like trains or by machinery.
- (8) Bomb explosions, which may disintegrate the body.

**EXAMINATION OF MUTILATED BODIES OR FRAGMENTS :** Mutilated bodies are those which are extensively disfigured, or in which a limb or a part is lost but the soft tissues, muscles and skin are attached to the bones. Sometimes, only a part of the body, such as head, trunk or a limb may be found.

(1) **Human or Animal :** This is easy if the head, trunk or limbs are available, but when pieces of muscle only are available without attached skin or viscera, it is very difficult. In such cases, definite opinion can be given by performing precipitin test or anti-globulin inhibition test using blood, or any other soft tissue, if the tissue is not severely decomposed.

(2) **One or more Bodies:** This is determined by fitting together all separate parts. If there is no disparity or reduplication, and if the colour of the skin is same in all parts, they belong to one body.

(3) **Sex :** It can be determined if the head or trunk is available, from the presence and distribution

or absence of hair, characters of the pelvis, skull, etc. It can also be determined from the recognition of prostatic or uterine tissue under a microscope which resist putrefaction, and are found even in advanced state of putrefaction.

(4) **Age :** Age can be determined from general development, skull, teeth and ossification of bones.

(5) **Stature :** It can be determined from the measurement of long bones.

(6) **Identity :** It can be determined from fingerprints, tattoo marks, scars, moles, hair, teeth, deformities, etc., articles of clothing and superimposition technique.

(7) **Manner of Separation of Parts :** This is determined by examining the margins of the parts, whether they had been cleanly cut, sawn, hacked, lacerated, disarticulated at the joints or gnawed through by animals.

(8) **Time since Death :** The probable time since death may be determined from the condition of parts.

(9) **Cause of Death :** The cause of death can be made out if there is evidence of fatal injury to some vital organ or large blood vessel, or marks of burning or deep cuts or fractures of bones, especially of the skull or the cervical vertebrae, hyoid bone or of several ribs.

(10) **Ante-mortem or Post-mortem :** This may be determined by examining the margins of parts for evidence of vital reaction.

## EXAMINATION OF BONES

**Forensic anthropology** is that branch of physical anthropology which for forensic purposes deals with the identification of skeletonised remains known to be or suspected of being human.

Sometimes, bones are found disposed of in jungle, in the open, in the ditches or rubbish dumps, etc., or may be found while digging foundations for buildings or skeleton may be exhumed. In case of mass disaster, where many persons die in the same area at the same time from fire, air crashes, etc., the help of the anthropologist is sought in identification, if the remains are skeletonised, badly burned or mostly destroyed.

**General Description :** Keep the bones in anatomic arrangement and draw a skeletal chart, indicating which bones are present. A complete list of all the bones sent for examination should be prepared, and photographs of all the bones are taken. The sand, dust or earth present on the bones is



removed with brushes and wooden picks and scrapers. Light applications of acetone help to remove tight dirt. Note the attachment of soft tissues to bones if any, and their stage of putrefaction. The skeletal remains should be first examined in the condition in which they were found with whatever soft tissues present. Note whether the bones are moist and humid or dry and their smell. The bones are then washed by brushing with lukewarm water, and are placed under shelter to dry slowly. If soft tissues are attached, the bones are boiled in water for five to six hours in the case of young bones, and for twelve hours or more in the case of adult bones, or they can be immersed in a dilute aqueous solution of trisodium phosphate and household detergent for several days. With this, the soft parts, including tendon attachments and the periosteum can be removed easily with an ordinary scrubbing brush. It is very difficult to disarticulate a dry skull through outside pressure. The disarticulation is usually done by filling the cranial cavity with a substance that swells when moistened and forces the bones apart through expansion. The specific gravity of a bone, which forms the densest part in the human body is two. Many of the procedures and techniques employed have already been discussed in the chapter on "Identity".

**(1) Are the remains actually bones?** Sometimes stones or even pieces of wood are mistaken by the public for bones. Anatomical shape and structure will help.

**(2) Human or Animal :** The knowledge of human as well as comparative anatomy is necessary to find out whether particular bones are human or not. It is easy when whole skeleton or entire bones are available. Difficulties arise when there is marked fragmentation, burnt bones and with smaller bones of some animals, such as digits, metacarpal and metatarsal bones. If the bone is fairly fresh, and some of the blood constituents are still present, the precipitin test is useful. Serological tests are not useful in case of bones not having extractable plasma proteins (5 to 15 years old bones), and burnt and cremated bones. Bones of the hand and wrist of bears may be confused with human hands. Microscopic structure is also useful, but bones of great apes cannot be distinguished from those of man. Non-human bones contain sheets of plexiform structures in cross-section. Human and animal bones can also be distinguished by chemical analysis

of bone-ash.

**(3) One or more Individuals :** This can be determined by reconstructing the skeleton. If there is no disproportion in the size of various bones, or reduplication, articulation is correct, and if the age, sex and race of all the bones is same, they belong to one individual.

If commingling (mixing) of bones from more than one skeleton is suspected, they can be separated by the use of a short wave ultraviolet lamp. When the surface of bones are exposed to ultraviolet radiation, they reflect a variety of colours. The radiated colour is derived from fluorescence of organic elements in the bones, inorganic substances on the surface of the bones, and to a lesser extent reflected light. The bones of different persons can be segregated by the difference in the colour emissions.

**(4) Sex :** Recognisable sex differences are not present before puberty. After puberty, the sex can be determined by examination of the pelvis, skull, manubrium-gliadriolus ratio, diameter of head of femur and humerus and measurements of femur, tibia, humerus and radius. In parous women, the dorsal border of pubic symphysis becomes irregular and/or undermined by depression or pits believed to be caused due to trauma during child-bearing. These are called scars of parturition.

**(5) Age at Death :** It can be determined from examination of teeth, ossific centres, amount of wear and tear in teeth, length of long bones, epiphyseal union, pubic symphysis, closure of skull sutures, cortical resorption, bony lipping, osteoporosis, calcification, osteoarthritic changes, etc. After the completion of bony union, age cannot be determined in an exact number of years. Foetal age can be determined by measuring the length of the ossified portions of the long bones. In case of broken bones, a rough estimate of the age can be made by measuring the external diameter of the long bones at midshaft. Ancient bones are light, brittle and often red-brown.

The general age can also be estimated by the resorption patterns in the cortex of the long bones. In infancy, most resorptive activity is found in the medullary third of the cortex. In childhood, it is scattered throughout the thickness of the cortex, and during adolescence is most marked just under the periosteal surface. In young adulthood, there is very little resorption. Beginning in the sixties in men and earlier in women, the medullary third of the cortex



undergoes increasing resorption, with thinning of the cortex from within. These changes in the cortical tissue are microscopic. Kerley has described for the quantifying four cortical elements for estimating age, i.e., osteons, osteon fragments, lamellar bone, and non-haversian canals. With the loss of cancellous tissue, the proximal end of the medullary cavity of humerus assumes a cone shape, the tip of which gradually ascends and reaches the surgical neck between 41 to 50 years, and the epiphyseal lines between 61 to 74 years. With advancing age, there is gradual fatty replacement of red bone marrow.

(6) **Race** : There are certain racial differences in the skeleton, chiefly in the skull and face measurements, teeth and lower extremities.

(7) **Stature** : When the skeleton is incomplete, or severely disintegrated, the stature may be calculated by applying mathematical formulae to the length of the long bones. Long bones must be measured by means of osteometric board; measurement by the use of tapes or calipers are not accurate. **Pearson's formulae (1899)** were used for a number of years. **Trotter and Gleser formulae (1958)** are more satisfactory. **Harrison and Dupertuid** and **Hadder** also published their tables. These formulae have been constructed using skeletons of Europeans and North Americans, and as such are not accurate for Indians. Moreover, there is considerable variation between the different ethnic and geographical groups in India. The principle of these formulae is to measure the length of long bone and multiply it with a given factor, and then adding a fixed factor. The formulae are different for dry bones and wet bones, for white persons and Negroes, and for males and females. **Steele (1970)** has devised a method for estimating stature from fragmented pieces of major long bones. Formulae for stature are not valid for children, giants or dwarfs.

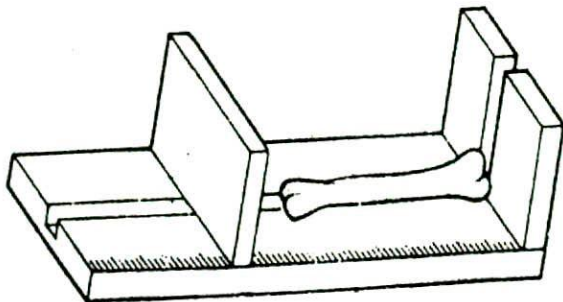


Fig. (5-13) Osteometric board.

**OSTEOMETRIC BOARD:** This has a rectangular base with a ruler fixed along one of its long sides. An upright is fixed at one end of the board, and a second one slides along the board. The bone is placed with one of its ends against the fixed upright and the movable upright is brought up to the other end of the bone. The distance between the uprights is then shown on the ruler. Hepburn osteometric board modified by Trevor is commonly used.

Weight-bearing long bones are used for applying these formulae. Femur and tibia give more accurate results than humerus or radius. The average stature obtained from a measurement of more than one long bone gives a more accurate result than when calculated for a single bone. Right side bones are normally measured in the dry state without cartilage. The results obtained are not quite accurate, and the error may be up to 2.5 cm. Measurements of femur, tibia, humerus and radius are useful. Long bone lengths are measured as follows: (1) Femur: head to medial condyle. (2) Tibia: lateral condyle to tip of medial malleolus. (3) Fibula: tip of head to tip of lateral malleolus. (4) Radius: Medial margin of head to tip of styloid process (5) Ulna: top of head to tip of styloid process. (6) Humerus: Trochlea to the head. A useful rule of thumb is that the humerus is 20%, the tibia 22%, the femur 27%, and the spine 35%, of the individual's height in life. In the absence of long bones, adult stature can be calculated from the articular length of the five metacarpals.

(8) **Identification** : Identity may be established from teeth, disease and deformities of the bone, old healed or healing fractures, orthopaedic surgical procedures, regional atrophy, spinal deformities, flat feet, supernumerary ribs, congenital defects, etc., and by superimposition technique using the skull. In the skull, all major dimensions are reduced by 1 to 2% by drying. In the vertebral column, total length is reduced by 2.7% by drying. If previous X-rays are available, it may be possible to make positive identification on the basis of contours and cancellous patterns of various bones and the profile of the pituitary fossa. Dental charts and dental radiographs are also useful. Other methods include X-ray comparison of trabecular patterns and neutron activation analysis to distinguish the relative mineral contents. Certain diseases and developmental problems can lead to asymmetry of human skeleton from side to side, such as poliomyelitis, Paget's



disease, neurofibromatosis. It may be possible to identify the ABO group of skeletal material.

**(9) Nature of Injury :** The ends of the long bones should be examined carefully to find out if they have been cut by sharp cutting instruments or hacked or sawn or gnawed through by animals. If the body disintegrates naturally, articular surfaces are smooth. Dog, fox and wolf cause splintering of bone. Rodents produce parallel "chisel marks" due to gnawing. Deer and sheep hold bones with back teeth which may be partially broken to give "fork-shaped" or "double-pronged" fragment. Crabs, fish and turtle may leave shallow marks. Bones discarded after dissection of the body will show some stain in the nutrient canals. In a skeleton, usually the inside of the skull is filled with earth. As the earth dries, it forms a hard ball which can cause fragmentation of skull in transit. Post-mortem conditions may cause fractures and fragmentation due to continued and repeated freezing and thawing and from the pressures of shifting soil weight.

Depending upon the degree of heat applied, the bone will be more or less destroyed. Heat makes the bones brittle, so that breakage may occur during collection. The shape of burnt bone is preserved, but it becomes powder when pressed between the fingers. In a burnt skull, the cracking often has a circular pattern with sharp edges, which look like cuts. Whether the bones have been burned with flesh covering them or in the dried state can be made out from their appearance. This is important to know whether the body was disposed off immediately after death, or after the decomposition of the soft parts. Unprotected bone when burnt undergoes charring, cracking (usually transverse), splintering and may be reduced to ashes, whereas bone embedded in thick, soft tissue shows the melted, guttered condition characteristic of fusion by heat. A bone burnt in the open is white, but when burnt in a closed fire, black or ash-grey.

**(10) Time since Death :** Determination of the time of death by the appearance of the skeletal remains, such as presence or absence of ligaments, cartilages, etc. is very difficult due to the various factors, such as burial or non-burial, the type of soil, climatic conditions, particularly temperature and humidity, accessibility of insects, carnivorous animals, etc. Due to bleaching by the sun, the bones appear pale ivory. The answer depends upon the circumstances under which the bones have been

found, e.g., burial and cold weather will diminish decomposition. After the soft tissues disappear, pieces of cartilage and ligaments remain attached to bone for 3 to 4 months. Traces of marrow and periosteum may remain in, or attached to the bones for several months. A fairly recent bone is slightly greasy to the touch and is heavy. Odour is a good indication of relatively recent death. After the bones have lost the covering tissue, and the odour of decomposition is lost, the bones still appear fresh. Repeated freezing and thawing of the bones when buried superficially may cause a bone to expand and crack within a few years. In older burials, the cancellous bone at the metaphyses and epiphyses may be eroded away by weathering. Ground-water seepage may leach the normal calcium phosphate out of bone in non-biological distributions, or may deposit excess calcium carbonate, depending on the nature of the ground water. In mineral-rich areas, leached areas are found in some parts of the skeleton and heavily mineralised bone in others. This can be detected by examining histological ground-section of long bones or by microradiographs of undecalcified ground-section of these bones. A fairly recent bone is slightly greasy to the touch, and is heavy due to the persistence of collagen and the normal apatite matrix. Bones tend to absorb iron salts, pigments and fine sand from the percolation of water and may become heavily impregnated, so that after many years they are dark in colour and weigh more than the original dry bone.

The date of a bone can be corroborated by following methods (Knight). (1) A recent bone will have about 4 to 5 g.% of nitrogen which gradually diminishes with decay. Between 50 to 100 years, the nitrogen content is more than 3.5 g. %, and if it is more than 2.5 g.%, the age will be less than 350 years. (2) A fresh bone shows about 15 aminoacids mostly derived from collagen. Glycine and alanine are predominant. A bone more than 100 years old will contain 7 aminoacids. Proline and hydroxyproline tend to disappear after 50 years. (3) A bone less than 100 years old fluoresces in ultraviolet light over most of its cut surface. There is progressive loss, and it is absent in 500 to 800 years. (4) Blood pigments persist up to 100 years since death in temperate zones. (5) Precipitin tests are negative after about 10 years. (6) There is no significant fall in the  $C^{14}$  content of bones during the first century after death. After prolonged burial, probably over 50 years, histological examination of ground-sections of bone may show globular pockets of resorption, which result from the acid balance of



the bacteria and their by-products. Ancient bones tend to be dry, brittle, chalky and the marrow cavity is dry, free of fat and often contains particles of earth or sand.

(11) Cause of Death : The cause of death cannot be made out unless there is evidence of fracture or injuries which usually cause death, e.g., fractures of skull bones, upper cervical vertebrae, hyoid bone, several ribs or marks of deep cuts in long bones or marks of burning. The bones should be examined for firearm injuries or any disease, e.g., caries or necrosis. The type of the weapon can be known from the type and depth of the cut in the bone. Metallic poisons, e.g., arsenic, antimony, lead or mercury can be detected even in burnt bones.

Case : (1) ALAVANDER MURDER CASE : Alavander, aged 42 years was murdered on 28th August, 1952, by Prabhakar Menon, with the help of his wife Devaki, who had confessed to the husband of having been seduced by Alavander. The next day, his headless trunk with arms and legs was found in the third class compartment of Indo-Ceylon Express at Manamadura station. Two days later, his head was found at Royapuram sea beach, Chennai. The identity was established from the fingerprints, circumcised penis, socks, waist thread, overriding canine teeth and pierced earlobes.

(2) THE ACID-BATH MURDER CASE : John George Haigh took Mrs. Olive Durand Deacon, a rich widow to Crawlye in his car, on 18-2-1949. There, he took her into a store shed, shot her through the back of the head, removed her Persian lamb coat and jewellery and put her fully clothed in a steel tank and filled it with strong sulphuric acid. After 3 days, he removed some fat and bones floating in sludge in the tank, and then pumped some more acid into the tank. On the next day, he poured off the contents of the tank on the ground opposite the door. A number of fragments of tissues, bones, intact upper and lower acrylic dentures and gallstones, were found in the acid sludge. A London dentist recognised the dentures as made for Mrs. Durand Deacon. Bloodstained lamb coat and jewellery were also identified. Haigh was arrested, charged with murder and convicted.

(3) PARKMAN-WEBSTER CASE : Dr. Parkman, who had loaned money to Professor Webster was lured into the chemistry laboratory of Dr. Webster on 2-11-1949, where he was killed with a knife. The body was mutilated, then destroyed in a furnace and by chemical agents. A week later, an entire trunk of a human body with left thigh and some artificial teeth were recovered from Webster's laboratory. The age, sex and stature tallied with those of Dr. Parkman. The dentist, Mr. Keep, who had attended Dr. Parkman, identified the blocks of mineral teeth recovered from

the furnace. He demonstrated that mandibular mineral blocks fitted the original plaster model which he had preserved. Webster was tried and convicted.

(4) THE RUXTON CASE : Two women, Mrs. Isabella Ruxton, wife of Dr. Ruxton, aged 35 years and Mary Rogerson, their maid, aged 20 years, disappeared from the house of Dr. Ruxton in Lancaster on 15-9-1935. A quantity of human remains (70 portions) were found in a ravine near Moffat, about 107 miles from Lancaster. The remains consisted chiefly of two heads, thorax, pelvis, segments of the upper and lower limbs, three breasts, portions of female external genitals, and the uterus and its appendages. The disarticulation had been carried out without damage suggesting the anatomical knowledge of the person. Both bodies had been mutilated to remove all evidence of identity and sex. All the remains were assembled and found to represent two female bodies, aged about 35 to 45 years and 18 to 22 years, respectively. Casts of the left feet of the two women fitted perfectly shoes belonging to Mrs. Ruxton and her maid. Superimposition of photographs of the skull on life-size photographs of the heads of two women were found to tally in every respect. The fingernails of the younger were scratched and her finger prints tallied with prints found on many articles in the house of Dr. Ruxton. The newspapers and certain garments found with the bodies were useful in identification. The parts assigned to Mrs. Ruxton showed signs of asphyxia and fracture of the hyoid bone, suggesting strangulation. In the body assigned to Mary Rogerson, there was a fracture on the top of skull. A number of human blood stains were found in the bathroom and on the stair carpets and pads, in the house of the accused. Fragments of human tissue were found in the drain traps and a suit of clothes of the accused was contaminated with blood. Dr. Ruxton was found guilty of murder and sentenced to death.

(5) NAGARAJU CASE: A doctor in the Indian Army, killed his wife and daughter by manual strangulation in a train during their journey from Delhi to Secunderabad. In a hotel bathroom at Secunderabad, he neatly dismembered his wife's body into portions convenient for transport, and dumped them at various places in a nearby tank, tied in pieces of a saree, house coat and hand bag, to cover up the crime. The left lower limb was carried by a stray dog to nearby residential quarters, which was the starting point of the police investigation. The search of the bank led to the recovery of upper and lower trunk portions in two pieces, right lower limb, left upper limb, the skull devoid of soft tissues and brain, and mandible. The intact body of female child 14 months old, fully clothed was also found along with the human remains. The disarticulation had been carried out



without damage, suggesting the anatomical knowledge of the culprit. All the remains were assembled and found to represent a female body aged between 20 to 25 years, 158 to 159 cm. in stature. Superimposition of the photographs of the skull on life-size photograph of the head of the woman were found to tally in every respect. The police investigation and the medical examination established the identity of the deceased and culprit. Faced with the evidence and to cheat the gallows, the culprit committed suicide.

**EXHUMATION** : Exhumation is the digging out of an already buried body from the grave. There is no time limit for exhumation in India. Autopsies are performed on exhumed bodies : (1) In criminal cases, such as homicide, suspected homicide disguised as suicide or other types of death, suspicious poisoning, death as a result of criminal abortion and criminal negligence. (2) In civil cases, such as accidental death claim, insurance, workmen's compensation claim, liability for professional negligence, survivorship and inheritance claims or disputed identity.

**Authorisation** : The body is exhumed only when, there is a written order from the Executive Magistrate.

**Procedure** : The body is exhumed under the supervision of a medical officer and Magistrate in the presence of a police officer. Wherever practicable, the Magistrate should inform the relatives of the deceased, and allow them to remain present at the enquiry (176(4)Cr.P.C.). The grave site should be positively identified with identifying features, such as location of burial plot, the headstone, and gravemarker. The distance of the grave from some of the permanent objects like trees, rocks, road or fence should be noted. It should be conducted in natural light. If the grave is in an open place with lot of spectators, the area should be screened off. The burial should be uncovered 10 to 15 cm. at a time, and notes should be made about the condition of the soil, water content and vegetable growth. After the dirt has been removed from above and around the corpse, it should be photographed in the position in which it was found. A drawing of the grave and body or skeleton should be made noting all the details, e.g., if the face is up, or to the right, arms are extended, or the lower limbs are flexed. If decomposition is not advanced, a plank or a plastic sheet should then be lowered to the level of the earth on which the body rests, the body gently shifted on to planks or sheet and then removed from the grave. If skeletonisation is advanced, then it

may become necessary to dig down beside and then beneath the body so that some firm material, such as a sheet of hardboard may gradually be inserted under the body, which can then be lifted and transported on it. If the body is skeletonised, after removing the remains, the soil must be sifted, in a finely-meshed screen to recover smaller objects, e.g., teeth, epiphyses, bullets, etc.

The condition of the burial clothes and the surface of the body should be noted. In cases of suspected mineral poisoning, samples of the earth (about half kg.) in actual contact with the body and also from above, below and from each side should be collected. Any fluid or debris in the coffin should also be collected. A portion of the coffin and burial clothes must be removed in order to exclude any possibility of contamination from external sources. The body should be identified by close relatives and friends. All personal effects, clothing, hair, nails, etc., should be picked up for examination.

**Autopsy** : Disinfectants should not be sprinkled on the body. If the body has been buried recently, the post-mortem examination is conducted in the usual manner. Various artifacts have to be interpreted correctly. In much putrefied bodies, an attempt should be made to establish the identity. All the viscera should be preserved for chemical analysis. If the body is reduced to skeleton, the bones should be examined.

**Second Autopsy** : Before performing the second autopsy, the doctor should obtain all the available documents relating to the case especially the first autopsy report, photographs of the scene of death, of the body taken during first autopsy, hospital records, police investigative reports, etc. and if possible the first autopsy pathologist should be called to correlate all the findings. Contusions become visible when the blood is drained from the tissues following the first autopsy. Decomposition causes merger of the contusions with blurring of their patterns. The interpretation of the findings of a second autopsy performed on a previously autopsied exhumed body is difficult due to the various artifacts of burial and exhumation, and serious alterations resulting from the first autopsy. The findings should be documented in great detail, whether the findings are confirmatory or contradictory from the result of first autopsy. It is possible that valuable results may be obtained. Even if no new information is obtained from the second autopsy, it will help in putting an end to rumours or suspicions.