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1. Medicolegal Autopsy—Philosophy

The medicolegal autopsy is a special type of scientific examination carried out under the laws of the state for the protection of its citizens and to assist the identification and prosecution of the guilty. As such, it requires state permission and must meet with certain essential requirements. In India, such permission is given by the police officer under section 174, or magistrate under 176 of CrPC.

The *objects of a medicolegal autopsy* are: (1) To establish the identity of the person, (2) to determine the cause of death, whether natural or unnatural; if unnatural whether suicide, homicide, or accident; and if homicide, whether any trace of evidence has been left by the accused on the victim, (3) to determine the time since death, (4) in case of newly born infants, to determine the question of live-birth and viability of the child, and (5) in case of mutilated or skeletal remains, to determine if they are human; and if human, the probable cause of death, (6) to help the society to plan strategy to prevent current prevalence of crime and its pattern, (7) to retrieve best possible biological, trace and other relevant information for further examination and evaluation.

The *essential requirements* of a medicolegal autopsy are: (a) It should be performed by a registered medical practitioner preferably senior one with experience, or with special training or experience in forensic medicine; (b) the examination should be meticulous and complete; and one should routinely record all positive findings and important negative ones, e.g. absence of skull fracture in a case of head injury, or absence of defence injuries in case of struggle; (c) all information must be preserved by written records, sketches, relevant photographs and radiographs when possible; (d) evidentiary material, when recovered, should be properly preserved; and (e) from the data so obtained, the doctor should provide a factual and objective medical report for the law enforcement agencies keeping in mind that he may have to explain his findings and opinions in a court of law, under a cross examination.

ILLUSTRATIVE CASES

a. A certain medicolegal autopsy was performed by a general pathologist. A stab wound of the abdomen which was the cause of death was casually described in three lines while two pages were devoted to an incidental finding an ovarian cyst. This case emphasizes the importance of special training or experience in forensic medicine (forensic pathology)

for medicolegal work. There is difference between clinical autopsy and medicolegal autopsy as orientation differs.

b. In a case of strangulation, the failure of a forensic pathologist to record a club-foot was used as a weapon by the defence to discredit his whole evidence. This case emphasizes the importance of recording all positive findings and peculiarities in the body.

A doctor was asked to perform an autopsy on the body of a man for whose death, two persons were held in custody for murder. He stated that he found certain marks on the head and upper part of the body and attributed death to failure of heart's action due to shock. At re-examination of the case by another doctor, it was found that the first doctor had over-looked a dislocation of first and second cervical vertebrae with fracture of the odontoid process and rupture of the lateral ligaments.

A chain-smoker who was under treatment for an extensive myocardial infarct died of ruptured heart. The cigarette he was smoking dropped on the bed causing fire and consequent postmortem burns on his body. A doctor who was asked to perform the postmortem gave "burning" as a cause of death from external examination alone. Suspicion was aroused due to the presence of postmortem burns on the body. At re-examination, ruptured heart was found, and the whole episode could be reconstructed in proper perspective.

The above two cases emphasize the importance of a complete autopsy and careful examination.

c. In an assault on right side of the chest of an old man, the medical officer was of the opinion that a fractured rib penetrated the diaphragm and ruptured the liver. The autopsy report mentioned fractured rib and rupture of the liver. However, there was no record of any injury to the diaphragm with the result that the interpretation of the fractured rib rupturing the liver was not accepted by the court. This case emphasizes the importance of preserving all information by written records. The findings which are not recorded become speculative which may be correct or may be incorrect, ultimately affect the credibility of medical witness.

d. A victim of hanging was brought down by cutting the rope. The neck was then freed by untying the knot. An unnecessary confusion was created by relatives about the manner of death. In another case

of death by injection of a poisonous substance, the injection track was preserved but similar material from opposite area was not preserved as control. In both these cases, the evidentiary material did not serve any purpose. These cases emphasize the importance of properly preserving evidentiary material and now with the help of digital photography, original condition of the body should always be photographed as it resolves many issues and prevent miscarriage of justice.

- e. In a traffic accident, a solitary occupant of an automobile was killed. The actual cause of death was shock and hemorrhage due to multiple fractures and internal injuries. However, in the death certificate

under the column—other significant conditions the medical officer had listed “polycystic right kidney”. This was just an incidental finding and obviously not the cause of death nor a contributory factor. His lack of objectiveness in listing it on the death certificate not only caused him considerable embarrassment in court but also was severely criticized by the judge. This case emphasizes the importance of an objective medical report for law enforcement agencies. In death certificates language should be clear. Any ambiguous, double meaning, misspelled and inappropriate mentioning should be avoided. A finding which is not relevant to the present cause of death in any way should be avoided.



2. Medicolegal Autopsy—A Procedural Outline

A carelessly performed autopsy is legally useless, professionally, it is a liability and disgraceful. Mistakes, particularly omissions, may be very hard or impossible to correct later, and can prove fatal to the case in the court of law. It is therefore very essential to proceed step-by-step and record all positive and important negative findings.

Medicolegal autopsy is a special type of scientific examination performed primarily to meet with certain requirements of law. Accordingly, it must be carried out personally by the medical officer so that he can provide a factual and objective medical reports for the law enforcement agencies. It must be remembered that the mortuary technician (known as postmortem attendant) can assist the medical officer during autopsy in shifting, opening, bone cutting, stitching but is neither qualified nor competent to perform specific organ and system examination under any circumstances, even under supervision of a medical officer. The technician can definitely assist the medical officer in several ways, e.g. to weigh the body before dissection; measure its length (height) on autopsy table; make preliminary incisions; weigh the organs before cutting; and at completion of autopsy, to suture and wash the body before it is handed over to the police.

While every medical officer will develop his own style in due course, the following general scheme is recommended for a beginner. It may be modified depending on the facilities available. It is always beneficial to have orientation course before starting medicolegal postmortem work. The various modifica-

tions necessary under different situations are considered under appropriate topics. This account is merely an outline of the points which must receive attention. These points are amplified in subsequent chapters. Not all points require equal attention at all times. A check list of important points may be made.

GENERAL SCHEME

For convenience, the procedure is described under the following heads: (1) Preliminaries, (2) external examination, (3) skull and brain, (4) spine and spinal cord, (5) neck and thorax, (6) abdomen, (7) skeleton, (8) disposal, (9) preserve, pack, and label, and (10) opinion.

Preliminaries

- a. **Scene of death:** Visit the scene if possible. It should be writing and a brief report should be apart of part. The locality may provide some clue, e.g. gambling den (homicide), railway track (accident), one's home (suicide). Note the position of the body, its relationship to surrounding objects, presence of articles such as drugs and alcohol bottles, glasses, presence and position of weapons, blood stains and marks of struggle if any. A great deal of information can be obtained by simple observation at the scene with no elaborate equipment than a notebook, a pencil, a measuring tape, and a camera. In absence of camera or photographic facilities, a sketch of the scene provides a permanent record. Nowadays, instant digital photographs facilitate the work and reduce the need for a sketch for every detail. The

digital photographs are equally good for medico-legal purposes as metafile of picture gives all details about its history and modification. These are very economical as usual memory card of 4 GB can store thousands of pictures practically at no cost. Look again at the scene after the body is removed. A clue concealed by the body may be found. One example of scene examination is illustrated in Fig. 2.1. One person in his forties was enjoying sex with a co-worker's wife at construction. This was not liked by the worker so he murdered him on the spot after catching them red-handed. The presence of women was indicated by lipstick, slippers, scarf and saliva on cigarette butts (Figs 2.2. to 2.5).

- b. **Wrappings and doming:** In all suspicious or homicidal deaths where the body is wrapped in a plastic sheet, or hands and head covered with plastic or paper bags, examine these wrappings for any loose material that may be found and preserve it for further examination by the forensic science laboratory (FSL). As for example, in a hit and run accident, a paint chip detached from the clothing may still be retained by the plastic sheet. It could be a vital clue to identify the vehicle. Plastic or paper bags on the hands protect them from contamination (e.g. from head wounds of the deceased) and loss of trace evidence (e.g. finger-nail scrapings, powder marks, hairs, fibres, etc.). Paper bags are preferred over hands as moisture problem is not there.

Examine the clothing for marks of violence and poisoning. Correlate defects in clothes with bodily injuries. Air dry if wet and save them for further examination by the FSL if they are likely to have any bearing on the investigation of a case.

- c. **Identification of the body:** From identification marks, tag on the leg, etc. Identification should never



Fig. 2.1: One isolated room at construction site where one male was murdered and was lying naked.



Fig. 2.2: Person was lying naked with tied limbs with plastic cord. He was gagged and head was smashed with brick. In vicinity one condom, cigarette butts, ladies slippers were lying.

be omitted in criminal cases. It forms an important link in the chain of evidence.

- d. **Temperature:** Record the rectal temperature, the environmental temperature, and the time. Repeat



Fig. 2.3: Blood-stained brick, cigarette, gagged with bed-sheet.



Fig. 2.4: One pair of slippers, female clothing scarf (*Dupatta*).



Fig. 2.5: Lipstick (11), cigarette butts (5), condom cover (10) present near the body of deceased.

these observations at frequent regular intervals when possible.

External Examination (Figs 2.6 and 2.7)

- a. **Weight:** The body is weighed before being put on the autopsy table. Weight is important, especially in cases of poisoning, to determine if the amount of poison detected could have caused a fatal outcome.
- b. **Length:** This is important especially in cases of assault where the relative size of the assailant and victim would matter, and also in traffic accidents when the height of the pedestrian often determines the impact and nature of injuries.
- c. **Approximate age:** From general appearance, teeth, ossification of bones, closure of skull sutures, lipping of lumbar vertebrae and joints of extremities, osteophytic outgrowths on the intervertebral discs, ossification of laryngeal and costal cartilages, etc.
- d. **General description** of head, face, eyes, neck, mouth, cervical spine, thorax, abdomen, genitals, and extremities in a logical sequence. The presence of cord like thrombosed veins and scars suggest the possibility of drug abuse. Petechial hemorrhages on the skin in the absence of asphyxia should arouse suspicion of fat embolism or infusion induced phlebitis. Presence of edema may indicate cardiac, hepatic, or renal disease either as cause of death or

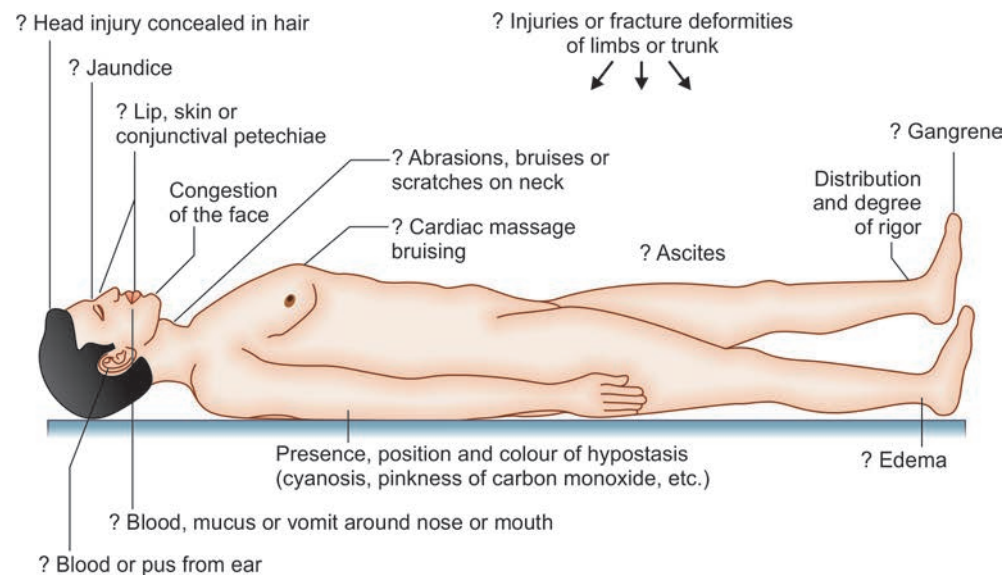


Fig. 2.6: Features that should be routinely noted on external examination of a body, at the time of postmortem.

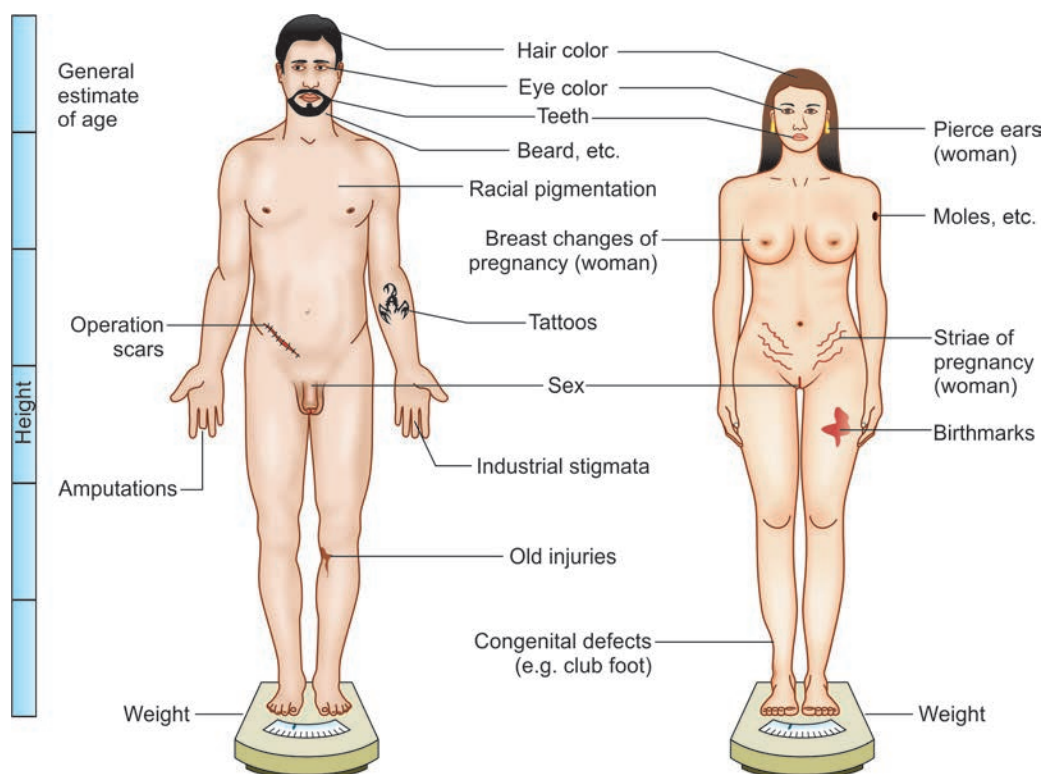


Fig. 2.7: Exteranal features useful for establishing identity.

contributory factor. Presence of surgical scars may indicate operations previously undergone.

- e. **Examination of back:** Patterned injuries may be found in cases when the body is pinned on the back. Bruises at this site may be mistaken for postmortem lividity. Deep bruises at sacral and iliac prominences, the spine and shoulder blades may be invisible through the thick skin at the back. Cut through the skin deep into the muscles if necessary. Spinal deformity, decubitus ulcers and sacral edema are commonly missed.
- f. **Description of all injuries:** Number, size (include scale), shape, pattern and location in relation to anatomic landmark. Scalp hair may be shaved to note the characteristics of scalp injuries. Obscure or indistinct external injuries, e.g. abrasions and asphyxial petechiae behind the loose skin of the ear may become apparent at completion of autopsy after blood has drained and tissues begun to dry. Identify and label any foreign object removed and specify its relationship to a given injury. Where there is any doubt as to whether an injury was inflicted before or after death, the tissue should be removed for histological, immunological, and/or histochemical examination.

The core of a medicolegal postmortem report is really the evidence as regards cause of death, mainly

violence and poisoning. Therefore, all the injuries should be numbered and summarized at the end in one coherent paragraph to provide an overview of the entire injury pattern. Any evidence of poisoning should be similarly recorded. Any disease, if present, should be described in a separate paragraph, along with its role in causation of death, if any.

- g. **Record** postmortem injuries and artifacts, also take photographs and tissue for histopathology, if it is relevant to the case.
- h. **Wash** the body, and carefully examine it again from head to foot, and back and front. This defines some lesions obscured by blood stains, mud, or hair. Please ensure all biological, trace evidences, stains have been properly retrieved from the body before washing.
- i. **Rigor mortis:** Flex the joints to determine if rigor mortis is present, and if so, its extent. See if the flexed limbs are consistent with the position of the body.
- j. **Postmortem lividity:** Note the incidence, extent, color, and degree of fixation. Turn the body semi-proneposition to see areas of contact flattening which would give an idea of the position of the body at the time of death, and if it has been altered, as may happen in a case of murder. Differentiate patches of postmortem lividity on back (dependent parts) from bruise by making an incision, if necessary, to verify

the presence of extravasated blood (bruise). Extravasated blood is not washed away easily but postmortem blood will be washed away. A simple method of quick examination is shown in Figures 2.6 and 2.7.

- k. **Putrefaction:** Note if putrefaction is present, and if so, its character and extent. Samples of insect eggs, maggots or pupa should be retained for laboratory examination, preferably by an entomologist if available otherwise common knowledge by forensic experts is sufficient to comment about their approximate duration. A comparative chart of all possible insects in the area should be available with forensic department. A country where all kind of weathers are seen, zonal charts can be made available for comparisons. They provide data for time since death. Specimens of maggots for laboratory examination should be dropped alive into boiling absolute alcohol which kills them immediately in the extended state. These are then transmitted to the laboratory in a spirit-proof container charged with 70% alcohol for preservation; on tissue piece for development; in saline or saturated solution for chemical analysis.
- l. **A certain minimum number of photographs is essential in medicolegal autopsies:** (1) Of the scene (from different angles) for a permanent record, (2) to identify the body, (3) to document injuries and their location (include scale), (4) to correlate external and internal injuries, and (5) to demonstrate any pathologic process. In absence of photographs, make diagrammatic sketches of the scene and record the observations on body diagrams.
- m. **Radiological examination** in suspected cases of fracture, poly trauma, embolism, strangulation, firearm injuries, drug trafficking through body packing, drowning for lung appearance, and to document radio-opaque foreign bodies, foreign bodies and sometimes for identification, total body X-ray in children abuse.

Skull and Brain

- a. The body lies flat on its back with a wooden block under the shoulders and the head resting firmly on a head rest. Make a routine incision of scalp from mastoid to mastoid over the vertex taking care not cut large mass of hair. This is done by inserting the scalpel at the right mastoid with the cutting edge facing the dissector and cutting the full thickness of the scalp from beneath outwards over a coronal line curving over the vertex to the opposite mastoid. Reflect the scalp flaps. Note any injury, petechial hemorrhages, or edema. Note any depressed fracture, and if present, record its dimensions and contour.
- b. Incise the temporalis muscle about its middle on each side. Saw and remove the skull cap, the line of severance following a point just above the superciliary ridges in front and through the occiput behind, and preferably making an angle of 120° between the anterior and posterior cuts. This ensures that the skull cap will not shift when the temporalis muscle is stitched into place on reconstruction of the body. The removal of skull cap is facilitated by gently inserting and twisting the chisel at various places through the cut. Care should, however, be taken not to produce any postmortem fractures or extend the existing ones, and to avoid any damage to the meninges and brain during the procedure.
- c. Examine the dura from outside for extradural hemorrhage, and superior sagittal sinus for antemortem thrombus. Determine the weight and volume of extradural hemorrhage, if present. An antemortem thrombus in the superior sagittal sinus can lead to back pressure in the bridging veins crossing the subdural space resulting in subdural hemorrhage.
- d. Cut the dura along the line of severed skull cap and pull it gently from front to back while cutting falx cerebri, and examine for subdural and subarachnoid hemorrhage. Determine the weight and volume of subdural hemorrhage and assess its effect on the brain-flattening, asymmetry, etc.
- e. Insert four fingers of the left hand between the frontal lobes and the skull. Draw them backward and cut with the right hand the nerves and vessels as they emerge from the skull. Obtain CSF sample by aspiration with Pasteur pipette from the base. Cut the tentorium along the posterior border of the petrous bone. Cut the cervical cord, first cervical nerves and vertebral arteries as far below as possible. Support the brain throughout with left hand. Remove the brain along with the cerebellum. Weigh and transfer to a clean dish for examining.
- f. Examine the remaining venous sinuses and the cranial cavity for antemortem thrombi.
- g. Remove the pituitary by chiseling the posterior clinoid processes and incising the diaphragm of the sella turcica around its periphery. Incising the diaphragm alone is sufficient in many cases. Do not squeeze the gland with forceps while removing. Examine after fixation in 10% formalin saline.
- h. Pull out the dura and examine the base of the skull and the rest of the cranial cavity for any fracture.

- i. Remove a wedge-shaped portion of the petrous temporal bone and examine the mastoid for any collection of pus, hemorrhage, or fluid in the middle ear. A significant number of drowning victims show hemorrhage in the temporal bones. Examine orbits and other air sinuses, if necessary.
- j. Inspect the skull cap for fracture by holding it against light or tapping it on the table.
- k. Examine the brain for swelling, shrinkage, or herniation; upper and lateral surfaces of the brain for asymmetry or flattening of the convolutions; circle of Willis for any aneurysm; and smaller cerebral arteries for embolism.
- l. Separate the cerebellum at the pons transversely just below the cerebral peduncles.
- m. Cut the brain in serial coronal sections about 1 cm apart or cut obliquely at the intracerebral fissure exposing basal ganglia, lateral ventricles and white matter, and examine for thickness of gray matter, hemorrhage or other abnormality. Shrinkage of cerebral cortex (gray matter) is common in chronic alcoholics. Cerebral fat emboli which have completely obstructed the small vessels of the brain may be visible to the naked eye as punctate hemorrhages in the white matter. Petechial hemorrhages in the white matter are commonly found in death from anaphylactic shock. In head injury, edema is seen in the white matter around or deep to contusions, lacerations, or ischemic lesions. If there are wounds of the brain, successive sections parallel to the wounded surface should be made till the whole depth of the wound is revealed.
- n. Cut the cerebellum through the vermis to expose the fourth ventricle. Make an oblique cut through each hemisphere to expose the dentate nucleus. Examine for any disease, injury, or hemorrhage.

Spine and Spinal Cord

- a. Turn the body over the face with a block beneath the thorax. Make a routine midline incision from the base of the skull to the sacrum. Scrape the paraspinal muscles and fasciae from the spinous processes and the laminae. Perform a laminectomy by sawing through the entire length of spine on each side of the spinous processes. Do not sever the laminae of the first cervical vertebra or else the head will move too freely on the spine. Remove the spinous processes and attached laminae en masse.
- b. Examine the dura for any pathological condition, such as inflammation, hemorrhage, suppuration or tumor. Slit it in midline. Cut the spinal nerves from below upwards as they pass through the spinal

foramina. Separate the cord at the foramen magnum, carefully lift it from vertebral column, and place it on table.

- c. Cut the cord transversely at several places and examine for any pathological condition such as softening, hemorrhage or inflammation.
- d. Examine the vertebral column with special reference to fracture of the odontoid process and cervical vertebrae. Hemorrhage under the prevertebral fascia should be taken as an indication of whiplash injury or fracture of cervical vertebrae which should be specially looked for.

Neck and Thorax

The procedure involves: (a) Routine midline incision and general examination of the abdominal cavity, (b) general examination of thoracic walls and cavity, (c) removal of structures of neck and thorax en masse (d) inspection of mouth cavity, (e) dissection of the heart, (f) examination of the remaining viscera—tongue, hyoid, esophagus, larynx, trachea, bronchi, lungs, and thyroid, and (g) examination of eviscerated thoracic cavity,

- a. **Make a routine midline incision** from just above the thyroid cartilage to the pubic symphysis avoiding the umbilicus and any injuries in the line of incision. The skin over the thorax along with the muscle mass is reflected up to the anterior axillary line. The skin over the abdomen is reflected up to the flanks. The cut over the abdomen is extended deeper into the underlying muscles/fascia till peritoneum is reached. The peritoneum is lifted by an artery forceps and a small nick made by scissors taking care not to

Methods of opening body by different types of incisions: *The body is opened either by 'I' shaped, 'Y' shaped or 'T' shaped incisions which are depicted in Figures 2.8 to 2.14.*



Fig. 2.8: The body is positioned for routine midline incision, with neck extended.



Fig. 2.9: Routine 'I' shaped incision extending from chin to pubic symphysis. The routine midline incision commences from below the thyroid cartilage. A position higher than this would show the incision in dressed body. The incision extends to the pubic symphysis on the left side of the umbilicus and avoids any injuries in the line of incision.

Method of 'shovel-shaped' incision in females to keep breast and neck portion intact (Figs 2.10 and 2.11)



Fig. 2.10: Shovel-shaped incision. Instead of routine midline incision, a **thoracoabdominal** incision passing under the breasts and sparing the neck can be made, as shown in this photograph. The two limbs of this incision commence on either side of the chest from anterior axillary fold, curve under the breast to meet at xiphisternum, and then continue as a single verticle cut down to pubic symphysis.



Fig. 2.11: The flap of the chest skin is reflected onto the face.



Fig. 2.12: The abdominal cavity is exposed in the usual manner.



Fig. 2.13: The rib cartilages are cut obliquely with an electric saw taking the usual precautions.



Fig. 2.14: U-shaped incision of neck to expose neck structures better.

injure any abdominal viscera. The left index and middle fingers with the palmar surfaces up are passed through the nick. The fingers are separated in the form of a V, the abdominal wall lifted, and the peritoneal incision extended both upwards and down-

wards without injuring any underlying structures. In asphyxial deaths due to compression of neck where a detailed study of neck organs is required, special technique for neck dissection should be followed. Flap wise neck dissection in bloodless field is recommended after opening head.

General examination of the abdominal cavity: To provide maximal exposure of the abdominal cavity after the routine incision, cut the abdominal muscles along the subcostal margin and divide the recti on each side of the lower abdomen. Note the thickness of the wall of the abdominal cavity, any bruising of the muscles, the appearance of the peritoneum with regard to adhesions, congestion, inflammation or exudation, the amount of fat in the mesentery, the height of diaphragm in relation to ribs, and relationship of organs to one another. If any injury is evident, trace its course. Measure any fluid if present, and examine it for any foreign body. Normally, the peritoneal cavity does not contain any fluid. Such preliminary examination is most important at this stage or else it will be impossible for the medial officer to determine at a later stage if blood or any fluid has trickled down from the thorax into the abdomen or was already present (Fig. 2.12).

- b. **General examination of thoracic walls and cavity:** After the routine midline incision, reflect the skin and muscle mass from the thoracic cage laterally, and examine them for any injury, extravasation, or surgical emphysema. The presence of surgical emphysema indicates that the victim was alive for some time after the injury. Note the comparative size of pectoralis minor. It is often larger on the side of the dominant hand and serves to confirm right or left handedness of the individual. Examine the breasts in females for any nodules or lumps, and ribs and sternum for fracture. Cardiopulmonary resuscitation may be responsible for fractures of ribs and sternum. Fractured ribs give a flattened contour or asymmetrical appearance to the thorax (Figs 2.11 and 2.13).

It is most convenient to test for the presence of pneumothorax now. Pneumothorax is suspected by bulging of the chest wall and confirmed by inserting a 16 gauge needle attached to a 25 ml syringe filled with water through an intercostal space into the pleural cavity when air bubbles will appear in the syringe if air is under pressure. Alternatively, an X-ray can help. PMCT is also useful to detect pneumothorax.

Cut the rib cartilages on either side from second to tenth obliquely to avoid cutting the lungs and

disarticulate the sternoclavicular joint carefully avoiding injury to the vessels below; cut the diaphragm from the sternum and lower ribs; and remove the wedge shaped piece formed by the sternum and cartilages. It is advisable to place a hemostat on the internal mammary arteries and veins on each side as they turn from the sternum to enter the superior mediastinum. This will prevent leakage of blood into the pleural cavities before they have been examined.

Use caution while opening the chest so as to preserve evidence of air embolism: do not pull the sternum and ribs at the time of resection to avoid negative pressure resulting in aspiration of air into the vessels. Air embolism is usually obvious by distension of the right side of the heart and peripheral veins. When air embolism is suspected, special technique for dissection of the heart should be followed.

Examine the thoracic contents *in situ*. Examine *thymus* if present or record its absence especially in cases of sudden death. The presence of an enlarged thymus is associated with a condition of such lowered resistance and hypersusceptibility that it predisposes the patient to sudden death from trivial causes.

Inspect the *pleural cavities* by lifting lower lobes of both lungs. Normally, the pleural cavities do not contain any appreciable quantity of fluid. Record the quantity of blood or any other fluid if present. Examine the fluid for any foreign body. If pleural adhesions are present, break them gently or strip the pleura from the chest wall and the diaphragm so that the lungs are attached at the hilum only.

Open the *pericardial sac* by an anterior midline cut with a pair of scissors. Inspect the coronary vessels for segmentation and palpate the right side of the heart for crepitation as evidence of air embolism. Over distension of the right side of the heart is suggestive of air embolism. Hold the heart at its apex and lift it up. Inspect the pericardial sac for its contents and any abnormality. Normally, the pericardial cavity contains some fluid, about 30–50 ml. If hemorrhage is present, determine its origin (ruptured left ventricle or aorta). Cut the pericardium over the diaphragm.

- c. **Removal of structures of neck and thorax en masse:** Reflect the skin and under tissue on each side of the neck outwards. Cut through the floor of the mouth close to the inner side of the mandible to separate the tongue from its attachment. Turn the knife inwards at the angle of the jaw to avoid cutting the carotid arteries. Open the mouth, press the tongue

downwards with the fingers, and pull it through the mandibular arch. Place the point of the knife on the hard palate and move it backwards till it penetrates the soft palate. Cut the soft palate and uvula. Continue dissection posteriorly as high and as far back as possible to the base of the skull and separate the posterior pharyngeal wall and the esophagus from the underlying tissues. The structures of the neck in continuity with those of the thorax should now be removed. Using gentle downward pressure on the tongue and a few touches of the knife, gently detach the whole viscera of the neck, viz hyoid, epiglottis, thyroid, larynx, trachea and upper part of the esophagus to the level of subclavian arteries. This dissection gives a perfect view of the fauces and larynx enabling any pathological condition to be readily recognized. Take care not to grasp larynx in hand as it may fracture the hyoid or superior cornua of thyroid cartilages. At this stage, it is useful to look into the larynx for presence of any obstructive foreign body, food, vomited material or edema.

In the event the body is to be embalmed which is not done in this country, dissect the ascending aorta and arch of the aorta with blunt ended scissors and free the right innominate, left common carotid, and left subclavian artery. These are then ligated leaving one end of the ligature at least about 40 cm long to facilitate the embalmer to locate these vessels through the sutured skin. In the routine course when the body is not to be embalmed, cut these vessels at the root of the neck. Pull the trachea and esophagus downwards, and raise the mass of thoracic viscera out of the cavity. It would be necessary to cut the aorta and inferior vena cava at the level of the diaphragm and also sever the esophagus (5 cm from the cardiac end) between a double ligature to prevent spillage of stomach contents. The tongue, hyoid, epiglottis, thyroid, larynx, trachea, esophagus, heart and lungs are thus removed for detailed examination, preferably on another table.

- d. **Inspect the mouth cavity:** Before the neck and thoracic organs are examined, it is worthwhile having a look at the cavity of the mouth. Inspect it for injuries on the inside of the lips, cheeks, and bruising and hyperplasia of gums, especially important in cases of strangulation, suffocation, and epilepsy. In unidentified bodies, have the teeth charted, preferably with the help of a forensic odontologist.
- e. **Dissection of heart:** The heart is held at the apex, lifted upwards, and separated from other thoracic organs by cutting the vessels entering and leaving it

(inferior and superior vena cava, pulmonary vessels, and ascending aorta) as far away as possible from the base of the heart.

Before cutting the pulmonary artery it should be palpated for any evidence of thrombi that are the cause of pulmonary embolism. These thrombi can be pulled out by making a longitudinal incision in the pulmonary artery and probing the artery with a pair of forceps. A thrombus from the leg vein may be coiled upon itself and when uncoiled will be of the same size as the lumen of the femoral vein. In all cases of pulmonary embolism, the legs must be examined for the presence of thrombi either by milking the femoral vein upwards, or by making transverse cuts through the popliteal and midcalf regions, the cut ends of the veins being examined for thrombus or by making vertical incisions along the course of the veins in the calf, back of the knee, and inner side of the thigh. Sometimes, the pulmonary artery and its branches contain clots which form in stagnant blood after death and fit these vessels as a perfect cast. It is essential, to be able to differentiate these postmortem clots from antemortem thrombi. An antemortem thrombus is firmly adherent to the lining endothelium and has a transversely ridged surface because it is formed in layers in flowing blood. A postmortem clot is weakly adherent to the lining endothelium and generally forms after the blood cells settle out, with the result that it appears either yellow (chicken fat) or soft and red (currant jelly).

The isolated heart is then studied as regards its size and weight (after sectioning). It is cut along the direction of blood flow—right atrium, right ventricle, pulmonary arteries, left atrium, left ventricle, and aorta. The right atrium is cut between the openings of the superior and inferior vena cava. One blade of the scissors is passed through the already cut inferior vena cava and the right atrium is cut till the blade emerges out of the superior vena cava. An additional cut opens the right auricle. Look at the tricuspid opening. It should normally admit three fingers. The knife is then directed through the tricuspid valve to cut the right ventricle along its lateral border up to its apex. The incision is then carried along 1 cm lateral to the ventricular septum, passes through the pulmonary valve at the junction of anterior cusps, and enters the pulmonary trunk and pulmonary arteries. The left atrium is opened by cutting between the opening of the pulmonary veins. An additional cut opens the left auricle. Look at the mitral opening. It should normally admit two fingers. The knife is

then directed through the mitral valve to cut the left ventricle along its lateral border up to its apex. The incision is then carried along 1 cm lateral to the ventricular septum, passes through the aortic valve ring in the region of the commissure between anterior and left posterior valve cusps, and enters the aorta.

Examine the auricular appendages for the presence of thrombi. Describe the state of the myocardium, the size of the chambers, state of endocardium (subendocardial hemorrhage in the left ventricle in shock, and poisoning by arsenic, oleander, etc.), valvular lesions, and condition of the aorta as regards any aneurysm, atherosclerosis, or syphilitic aortitis (tree bark appearance). The state of the aorta is carefully investigated particularly round the orifices of the coronary arteries. The heart can also be studied after fixation by cutting it in a series of rings not more than 5 mm thickness. This provides a good opportunity for the overall study of the state of valves, endocardium, myocardium and coronary arteries.

Examine the *coronary arteries* (particularly the left coronary artery) by making serial incisions down the course of vessels about 2–3 mm apart, to demonstrate any narrowing or antemortem thrombus, the common site being about 1 cm away from the origin of the left coronary artery. It is difficult to gauge their caliber when opened longitudinally and this tends to break up and dislodge a clot when present. However, a longitudinal cut with fine scissors provides a better measure of the extent of atherosclerotic disease and should be resorted to when this information is required. The remaining of the thoracic aorta with its branches is opened and examined now or after dissection of the tongue.

- f. **Examine the remaining viscera:** Inspect the tip and sides of tongue for bite marks or bruises. A small hemorrhage is seen under the intact mucosa in case of bite mark. In an epileptic, a bite mark on the tongue may be the only evidence of death during an epileptic attack. Hyperplasia of the gums, if present, is helpful, as evidence of antiepileptic treatment with dilantin sodium. Serial sections will reveal bruising. Bruising (hemorrhage) at the base of the tongue may sometimes be the only evidence of throttling.

Examine the *hyoid* for any fracture. A fracture may be reported when not present due to mistaking normal joints for fracture and not specifically looking for ecchymosis in suspected area of fracture. If the evidence of ecchymosis is doubtful, the tissue should be submitted for histologic study. Decomposition may result in separation of joints of this bone giving

an erroneous impression of fracture. When hyoid fracture is suspected, it is advisable to take an X-ray before the part is dissected.

Slit open the esophagus, larynx, trachea, and bronchi from the posterior surface. Examine them for blood, edema, foreign body, soot, mud or sand (drowning), and vomited matter.

Cut the *lungs* laterally through the hilum, first the left, then the right. Examine the cut surfaces of the lungs, cross-sections of the bronchi, their ramifications, and blood vessels for consolidation, edema, emphysema, atelectasis, congestion, petechiae, emboli, thrombus, etc. The diagnosis of pulmonary fat emboli can be confirmed by microscopic examination of the frozen section of the lung stained for fat. In criminal abortion when soapy fluids have been injected, it is also possible to demonstrate soap in the lungs. Open the hilar lymph nodes along their longest diameter.

Examine the *thyroid* gland for its size and nodularity. Section both the lobes in their longest diameter.

- g. **Examine the thoracic cavity:** Inspect the thoracic cavity after removal of viscera for evidence of any fracture, disease, deformity, or injury.

Abdomen

At the time of routine incision, the peritoneum and abdominal contents as a whole have already been examined and the course of any injury traced. Now, the organs should be examined individually, as described below. At this stage, the diaphragm is severed from the inner aspect of the rib cage to facilitate dissection. A cut between the crura and esophagus will allow the lower end of the esophagus to slide easily through the diaphragmatic hiatus while removing the stomach.

- a. **Spleen:** Incise the splenorenal ligament (this is generally not necessary) and the hilar vessels. Grasp the diaphragmatic surface of the spleen and take it off from the tail of the pancreas. Weigh, measure, and examine for adhesions, and rupture. Section in long axis through the hilum. Look for accessory spleens.
- b. Separate the small intestine from mesentery by using a long autopsy knife like a saw. Mobilize the cecum and colon by cutting their attachments. Milk the rectal contents upwards. Cut the thus freed *bowels* between double ligatures from jejunum to sigmoid in the female and rectum in the male and keep aside preferably in a sink for subsequent examination.
- c. **Stomach:** When the esophagus was cut while removing thoracic viscera en masse, a ligature was

already tied at the lower end of esophagus. This ligature near the cardiac end of the stomach includes lower 5 cm of the esophagus. Tie a double ligature at the pyloric end and divide the stomach between these ligatures. Place the stomach in a clean enamel tray. Cut along the greater curvature. Examine the mucous membrane, contents, state of digestion of food, and presence of foreign or suspicious matter. When poisoning is suspected, a detailed study of stomach and its contents is required.

- d. **Liver:** Examine the portal vein and hepatic artery for any abnormality. Cut hepatic ligaments. Remove the liver along with the duodenum and pancreas if bile ducts are to be examined. Cut open the second part of the duodenum. Squeeze the gallbladder and note if bile enters the duodenum. Palpate and open the gallbladder and examine for calculi. Examine bile ducts for calculi and stricture. Separate the whole liver. Weigh and measure. Section the liver at intervals of about 1 cm. Describe any injury or pathological process.
- e. **Pancreas:** The pancreas is usually removed along with the duodenum. A partial cut is made across the tail of the pancreas to expose the pancreatic duct in the middle of the cut surface. The whole course of the duct is carefully dissected, the duct opened with fine scissors, and traced to its entrance into the duodenum. The pancreas is also examined for fat necrosis by a series of cuts at right angles to its axis. Examination of pancreas is important in cases of sudden death.
- f. **Abdominal aorta:** Examine for aneurysm. Cut the aorta along the anterior midline and examine it for atherosclerosis. Open the renal arteries along their length and examine for patency, calibre, thrombi, emboli, or atherosclerosis.
- g. **Suprarenals:** They are identified by their relationship to the upper pole of each kidney before it is cut. They are weighed and then transversely sliced. The cut section shows bright yellow cortex and inner grey medulla in a normal gland. Any hemorrhage should be noted. Examination of suprarenal is specially important in cases of sudden death.
- h. **Kidneys:** The kidneys are removed, after the removal of suprarenals, first left and then right, by incising peritoneal fat just outside their lateral margins. They are measured and weighed. The kidney is held firmly between thumb and fingers or between layers of gauze to prevent it from slipping. It is then cut longitudinally through the convex border to the hilum and opened like two halves of a book. The capsule is stripped from the cut halves by a toothed forceps. The cut surface is examined for any pathological process such as nephritis and degenerative changes. The renal pelvis is examined for calculi and evidence of inflammation. If necessary, a block is taken from the kidney in such a way as to include the mucosa of the pelvis. The ureters are freed all the way down to their entry to the urinary bladder and then slit opened by fine scissors.
- i. **Urinary bladder:** The urinary bladder is drawn backwards from the symphysis pubis. At this point it can be incised on its anterior wall and the urine removed and preserved. The bladder should be examined for congestion, hemorrhage, and inflammation or ulceration of its mucous membrane.
- j. **Prostate:** When the urinary bladder is drawn backwards from the symphysis pubis, the prostate is palpated and the urethra divided distal to the prostate. The prostate is then examined for enlargement or malignancy in those cases where there has been a history suggestive of such disorder of the organ. Vertical sections are made through the lateral and median lobes.
- k. **Testes:** The deep aspects of the inguinal canal from beneath the reflected skin are cut. Spermatic cords are identified at the inguinal ring. The testes are removed from the scrotum by separating them from the inside of the scrotal sac by gentle blunt dissection with scissors. The testes and epididymis are cut longitudinally and examined for evidence of any disease, or injury especially ecchymosis. Deaths due to squeezing of testes are alleged.
- l. **Female genitalia:** The ovaries and fallopian tubes are freed from the pelvis, uterus cut at its lower third, and the whole mass removed from the pelvis. Each organ, e.g. ovary, fallopian tubes and uterus is separated. The uterus is then examined for its size, shape, weight and any abnormality. It is cut longitudinally to expose the endometrium, the thickness of the uterine walls and the contents, if any—fluid, foreign body, or fetus. If the uterus contains a fetus, its intrauterine age is assessed. The ovaries are cut longitudinally and examined for corpora lutea. The fallopian tubes are cut across at intervals to examine patency. The vagina is examined for marks of injury, presence of foreign body, condition of the mucous membrane, presence of rugae, and the condition and type of hymen. Any fluid, if present, in the vaginal canal may be aspirated if necessary for determination of acid phosphatase or creatine phosphokinase, blood group substance, and examination for spermatozoa. The condition of the

cervix and any marks of instrumental injury should be noted.

If any foreign body is found in the genital tract it should be preserved along with such portion or whole of the genital tract as deemed necessary.

In cases of abortion deaths, the entire genital block is removed in one piece and then examined. After widely abducting the legs, an incision is made outside the labia majora extending up to the symphysis pubis above and including the anus below. Another incision is made round the level of the pelvic brim and continued downwards to the pelvic outlet till it reaches the vaginal incision. The entire genital tract together with the bladder and rectum can now be removed.

- m. **Intestines:** These have already been separated and kept aside in a sink. Open the small intestine with the enterotome along the line of mesenteric attachment. Examine the contents and mucous membrane. Examine the appendix for any pathological condition. Cut the large intestine with the enterotome along the anterior tenia. Examine for congestion, ulceration or any other abnormality of its mucous membrane and contents.

A *quick method* to examine the intestines is to irrigate them in a sink with tap water through one end, to allow the contents to pass through a sieve at the other end to retain worms, worm segments and other material that cannot pass, and then to open with an enterotome to examine the mucous membrane.

The possibility of traumatic perforation of the intestine should be borne in mind in cases with history of violence. In all such cases, it is essential to exclude disease or ulceration of the intestine.

- n. Inspect the abdominal cavity after the viscera have been removed. A strip of vertebral body and disc substance can now be removed from the anterior surface of all vertebrae for examination of bone marrow in case of any blood disorder.

Skeleton

Make a detailed inspection of skeleton for any deformity, injuries or fractures—vertebrae, ribs, pelvis, long bones, etc. especially in cases of violence and vehicular accidents.

- a. **Vertebrae:** Dissect the soft tissues and muscles from the surface in order to examine the vertebral bodies for fracture, dislocation, compression or hemorrhage at site. Hemorrhage under the prevertebral fascia should be taken as an indication of whiplash injury or fracture of cervical vertebrae which should be specially looked for. It is easy to overlook fracture

of the odontoid process of the axis. When such an injury is suspected, it is best to remove the whole of cervical vertebrae as a block from the base of the skull to the upper thoracic inlet, the soft tissues being dissected away. This facilitates both X-ray and visual examination.

A radiograph may show small projectiles which may have entered the vertebrae by splitting the fibers without any external evidence.

- b. **Ribs:** While bruising of intercostal muscles may indicate rib fracture, the ribs can be examined for fracture by stripping the pleurae from inside and even cutting the intercostal muscles.
- c. **Pelvis:** The presence of blood in soft tissues of the pelvis suggests pelvic fracture and demands careful search for the same.
- d. **Long bones:** In case of bumper fractures, the distance from heel to the fracture site should be measured.

If *bone marrow* is required, it can be obtained from the sternum, vertebral body, or upper end of femoral shaft where a rectangle of cortex is cut and the marrow scooped out.

Disposal

Suture and wash the body and hand it over to the police, under a receipt, for further disposal. The Medical Officer should see that the dead body is presentable and its appearance such that it does not hurt the sentiments of the relations when they receive the body from the police.

Preserve, Pack, and Label

- a. Specimens for toxicological analysis histological examination where necessary.
- b. Blood from leg (femoral vein) or arm (subclavian vein) for grouping and alcohol estimation.

Opinion

The law courts require scientific data as well as opinion. In a number of cases, it is possible to complete the autopsy with gross examination and dissection without microscopic studies or special laboratory examination. The medical officer must give a definite opinion as regards the cause and manner of death and probable time since death based upon his findings. Evidence is generally necessary to support the findings. *Photographs, diagrams, weights, and measurements provide an objective record.* In cases where microscopic studies or special laboratory examination are necessary, the opinion as regards the cause of death is reserved, and furnished when the results of such examinations are known.

- a. **Cause of death:** Disease, or condition that brought about cessation of life.
- b. **Manner of death:** (1) Natural (2) suicide (3) homicide (4) accident (5) undetermined.

Illustrative examples of cause and manner of death: (1) Cause of death: Ischemic heart disease; manner of death: Natural, (2) Cause of death: Incised wound of the wrist, self-inflicted (hesitation cuts); manner of death: Suicide, (3) Cause of death: Asphyxia by throttling;

manner of death: Homicide, (4) Cause of death: Shock and hemorrhage due to multiple fractures, run over by truck; manner of death: Accident, (5) Cause of death: Indeterminate—no disease, no injury, no poisoning; manner of death: Undetermined.

- c. **Time since death:** From rectal and environmental temperature, rigor mortis, postmortem lividity, putrefaction, stomach emptying, state of digestion of food, etc.



3. Medicolegal Autopsy—Preliminaries

The following preliminaries should receive attention in carrying out a medicolegal autopsy: (1) Permission or authorization, (2) identification, (3) visit to scene of crime, (4) history of the case, (5) examination without delay in the mortuary or at site, (6) verification of injuries noted at the inquest, (7) preservation of viscera and other tissues, (8) notes, (9) list of articles, and (10) preserving chain of evidence.

1. **Permission or authorization:** In India, authorization for a medicolegal autopsy is given by a police officer, or magistrate. Without such a permission a medicolegal autopsy cannot be performed. Whenever a dead body is sent for autopsy, it is always accompanied by a dead body challan, and an inquest report or panchnama. A specimen of dead body challan and an inquest report is given in the appendix.

A *dead body challan* is a requisition submitted by the investigating police officer to the medical officer while handing over the body for performing an autopsy. It contains the name, age, sex and religion of the deceased as well as the suspected cause of death and the purpose for which the body is sent for postmortem examination. It also gives the place and distance from whence the body has come, the name of the persons accompanying the body for protection and identification, the identification marks, the time of despatch from village/original site, and the details of articles and the clothing accompanying the body. The medical officer should fill in the columns indicating the time of arrival of the body in the mortuary and the time of postmortem examination.

An *inquest report* or panchnama is a report in which the available history of the case and the

circumstances under which the body was found or recovered are recorded. There is also the recorded opinion of the witnesses and the police officer regarding the injuries, manner of their causation, the cause of death, and indication of suspected foul play, if any. The information provided is usually not complete but the medical officer should carefully peruse it so as to enable him to examine particularly the organ or that part of the body most suspected for evidence of death. This is especially helpful in the case of a decomposed body.

In case of death from injuries, either homicidal, suicidal, or accidental, copy of the *accident register* filled in by the medical officer from the hospital where the deceased was first taken for treatment and also the *case-sheet* from the hospital where the deceased was an inpatient are also forwarded along with the requisition for reference. In cases of traffic accidents, the *plan of accident* is also provided. *Contrary to popular belief, in all accidental deaths, ideally an autopsy is required to rule out any foul play.* As for example, a person who is under the influence of alcohol may be pushed down from a terrace and the subsequent death misreported as an accidental death.

2. **Identification:** The body of the deceased should be identified by the police constable who brought it in order to avoid performing autopsy on a wrong body (Fig. 3.1). This could have serious consequences if in the mean while the body that should have been autopsied is cremated. It should also be identified if necessary by the relatives in the presence of the medical officer who should make a note of the names and addresses of such persons. *In all*



Fig. 3.1: Identification tag in toe, person to be identified by police and relatives before autopsy.



Fig. 3.2: Body put on platform to take whole body weight. The body is **weighed** and then put on the autopsy table.

medicolegal postmortems, and especially in case of bodies whose identity is not known, it is necessary to note all particulars which help to establish the identity with reference to race, religion, sex, age, social status, length, weight, dental formula, congenital features, acquired peculiarities, etc. as in Fig. 3.2. **The body is identified** by the police constable who brought it and, if necessary, by the relatives, in the presence of the medical officer. Identification marks, **tag on the leg**, and the **body data** (age, sex, etc.) are helpful for this purpose. In suspected homicide, the wrappings and clothings are examined for marks of violence, poisoning, and trace evidence. They should be preserved for examination by the forensic science laboratory (FSL). The **length** is measured by a tape lying by the side of the body. If necessary, the rectal and environmental temperature are recorded along with the time and then the rectal temperature recorded at regular frequent intervals. The **external examination** is then made systematically from

head to toes, front and back, before and after washing the body. All injuries are numbered and fully described. The various injuries, stains, and pathologic processes are photographed, or sketched on body diagrams. Trace evidence, if any, is preserved for laboratory examination. In case of unknown bodies, the police usually take a photograph before forwarding the body for autopsy. And, they may request the doctor for the preservation of material for finger prints for subsequent examination by the finger print expert. For this purpose, the doctor should dissect the entire thickness of skin from the terminal phalanx of each finger and keep it in 10% formalin in separately labeled small bottles or phials. As this procedure has sometimes been objected to on grounds of mutilation, it is desirable, when possible, to take finger print impression, both plain and rolled, straightaway. Identification should never be omitted in criminal cases. It forms an important link in the chain of evidence.

3. **Visit to the scene of crime:** If a visit to the scene of crime is possible, it is well worth undertaking in certain cases such as murder, poisoning, traffic accidents, sexual offences especially rape, and firearm injuries (Figs 3.3 to 3.5). In one scene (Fig. 3.3) of hanging deceased, he had used the sleeve of his shirt and waist thread as ligature. The shelf attached to the wall, as seen in the photograph, was used by him to climb and then jump off. As is seen here, the suicide usually selects a quiet place where he is unlikely to be disturbed. He uses readily available material to end his life. There are no signs of struggle or disturbance at the scene. A farewell note may be there. The locality itself may provide some clue. As for example, a body with a cut throat lying in a house of ill-fame or a gambling den indicates, perhaps, murder. One with similar injuries in his own home is likely to be suicide. A body with multiple injuries lying on or near a railway track suggests accident. The examination should be unhurried and the possibilities thought of at the scene.

The position of the body when found, its relationship to surrounding objects, presence of articles such as drugs and alcohol bottles, presence and position of weapons, bloodstains, and marks of struggle should be noted, and any evidentiary material such as fly button, cigarette ends, and pencil dropped from pocket should not be missed. An uninjured body lying in bed in an attitude of sleep is probably that of a person dead due to



Fig. 3.3: Scene of hanging. **Crime scene—suicide.** A male aged 24 years was found hanging in the room from a wooden peg.

natural causes or narcotic poisoning. An injured body lying in bed with disarranged clothing is likely to be that of a murdered person.

Should the medical officer be fortunate enough to be called in before anything is touched, he should have several photographs from different angles, with scale in position, taken of the body and its surroundings and write a precise description before he moves anything. If this is done as a routine, it would save much subsequent trouble. The photograph would document the *lie* of the body, state of clothing, materials grasped in hands or fluids trickling from the mouth, blood stains, and exact position of weapons. In absence of photographic facilities, a sketch of the scene would provide a permanent record. One more look at the scene after the body is removed is worthwhile; a clue concealed by the body may be found.

Loss of much useful information results on account of the frequent impossibility of arranging for medical inspection of the scene of crime and failure to do so when it is possible. There is nothing like a fresh undisturbed scene and untouched body with



Fig. 3.4: **Crime scene—suicide.** A man shot himself with a heavy (hunting) gun. The arrows indicate pieces of his brain. The bullet is encircled with a ring. A farewell note was found in the room. There are no signs of struggle or disturbance at the scene.



Fig. 3.5: **Crime scene—suicide and homicide.** There is a lot of disturbance at the scene with a chair upside down, glass broken, blood on the floor, etc. The man first stabbed his wife and, thereafter, killed himself with the same knife.

the knife still stuck in the chest or back, strangling cord round the neck, or an "empty" by the side of a firearm victim for real evidence. A visit to the scene even after autopsy is worthwhile.

A woman was found dead with bullet injury on the left temple. The husband was charged with murder and he denied having been present at the scene at that time.

Examination at the scene revealed that the incident occurred in the bedroom. The bed was near one wall and the body was lying on its side with one arm bent beneath it and the other outstretched. There was blood on the floor, and nowhere else



Fig. 3.6: Crime scene—victim of homicide. There is a lot of blood on the left chest and on the floor. Glass fragments are seen near the right arm.

(Fig. 3.6); there were no signs of struggle nor any indication that she might have staggered some distance. The bullet had lodged in the opposite wall 2.45 meters from the floor. The victim was 1.62 meters tall.

Her foot prints so near the wall indicated that there was no room for anyone else to stand between her left side and the wall. The wall had no windows from which the bullet could have come. In fact, the only way she could have been shot from the left was if she had done it herself. To do so, she had used her left hand. It is natural to tilt the head in self-shooting at the temple with the result that though the bullet passed horizontally through the head, yet it ended so high up on the opposite wall. On enquiry, it was found that she was left handed: It was a case of suicide. The husband was found 'not guilty'.

Some *disadvantages* in not visiting the scene of crime are: (a) In the process of removal of the body from the scene to the mortuary, fresh abrasions may be produced, (b) Clothing will be disarranged, blood stains may form on parts of the garments originally free from them, and fresh tears in the clothes may result from rough handling; (c) Existing rigor mortis may be broken down at least partially. All these may mislead the medical officer. The body in its new position may show inappropriate rigidity and lividity and add to the confusion.

In all suspicious or homicidal deaths, it is desirable that the body be wrapped in a plastic sheet and the head and hands covered with plastic or paper bags. The plastic sheet would retain any loose material for examination by forensic science laboratory (FSL). As for example, in a hit and run accident, a paint chip detached from the clothing may be retained by the plastic sheet and provide valuable evidence to identify the vehicle. The plastic or paper bags would prevent contamination of the hands (e.g. from head wounds of the

deceased) and loss of trace evidence (e.g. fingernail scrapings, powder marks, hairs, fibers, etc.).

4. **History of the case:** Before commencing the postmortem examination, the medical officer should obtain all available details of the case so that attention may be directed to salient points. *The opinion of even the most eminent medical officer may be of little value if he is ill-informed of the clinical facts.*

Helpert, in his autopsy on Carmela's body, exhumed 3 and a half months after death, on a complaint of death by injection of succinylcholine, records that he might well have missed the needle mark if this information was not at hand. After washing the body, on examination of buttocks, a tiny pink spot was noted. The needle track was excised with a similar control sample from the opposite thigh. Analysis of the tissues of the track showed two substances, choline and succinic acid, in a quantity far greater than those that could be expected from a legitimate dose. The control sample gave negative result.

A 37-year-old male was assaulted by a 2 inches long screw driver which poked him in the left eyelid. There was no immediate disability and no indication to suspect then that the weapon had penetrated beyond the skin. His wound was cleaned, a surgical patch was placed over his eye, and he was instructed to return to the eye clinic 2 days later. Meanwhile, he was found unconscious at home and admitted to the hospital, where despite adequate treatment including X-rays of the head, he died 8 days after admission, the diagnosis remaining obscure. At autopsy, the brain revealed acute purulent meningitis and a large hemorrhage in the left temporal lobe. Though cerebral hemorrhages are rarely complicated by meningitis, and while the death was about to be certified as a natural one, a curious relation expressed surprise at the findings and blurted out that the deceased had been stabbed in the eye with a screw driver. On examination of the eyelid, a tiny scar concealed by the skin fold was found. However, the sequence of events could be easily reconstructed, with the new information that was now available. The screw driver had penetrated the orbit above the eyeball, the track continued through the superior orbital fissure into the brain, and the dirty weapon had infected the meninges. Secondary hemorrhage had developed in the temporal lobe of the brain.

In a case of sudden death of a woman, the only finding at postmortem examination was an enlarged ruptured spleen, thought to be a spontaneous rupture. However, on inquiry, a history of 'kick on the abdomen' was available, and a re-examination of the abdominal skin revealed faint abrasions in the region of the kick.

5. **Examination:** The autopsy should be performed according to circumstances either in the mortuary or at site without undue delay after receiving the requisition. In routine cases, the autopsy is performed in the mortuary. In exhumation cases and in mass disasters, it can be performed at site with improvised table and fencing. In those cases where the medical officer visits the scene of

crime, he may make preliminary examination at site and detailed examination of organs in the mortuary. The medicolegal autopsy is performed on all the days of the week inclusive of public holidays because there should be no delay in the process of crime investigation. The examination, as far as possible, should be done in day light. In artificial light, jaundice, characteristic postmortem stains in certain cases of poisoning, and the color changes in bruises are difficult to appreciate unless adequate quality and quantity of artificial light are available. Nowadays, as per new guidelines, autopsy can be conducted in night also. This is to encourage organ donations in brain dead patients. Therefore, generally, postmortems are not conducted after dusk, but the body kept in cold storage till next day. In mofussil places where cold storage facilities are not available, even if the body is brought by the police at any time of the night, it is imperative for the medical officer to do the external examination immediately with special reference to body temperature, postmortem lividity, rigor mortis, external injuries, etc. so as to obviate the effects from postmortem changes when the autopsy is done the next day.

However, obvious the cause of death may appear, the examination should be as thorough and complete as circumstances may permit because (a) the obvious cause of death may not be the real cause, and (b) coincident diseases may be missed. When a medicolegal autopsy is being performed, it is advisable that no unauthorized person is allowed to be present. Those officially not concerned with the investigation of the case should not be allowed.

Doctor Palmer was allowed to witness a medicolegal autopsy being performed on one of his victims, a case of strychnine poisoning. When the stomach contents were being removed for preservation and chemical analysis, he attempted to spill out the contents by turning down the container, with a view to destroy this evidence. He was immediately expelled from the mortuary.

6. **Verification of injuries noted at the inquest:** The injuries noted and recorded by the investigating police officer in the inquest report should be verified while conducting the autopsy. Injuries may have been recorded when, in fact, they are not present, due to postmortem changes and postmortem injuries being misinterpreted as antemortem injuries. As for example, postmortem lividity may be mistaken for bruises, putrefactive blisters under the skin for burns, postmortem

antbite marks for antemortem abrasions, and post-mortem injuries by rodents and animals for antemortem violence. Likewise, postmortem abrasions on chest from unsuccessful artificial respiration may lead to serious misinterpretation.

A case of accidental cocaine poisoning was suspected to be that of murder, when first seen, on account of presence of abrasions on the throat which were misinterpreted. The abrasions were, however, of postmortem origin, being the work of ants.

If the doctor fails to find the injuries recorded by the police, he should always state categorically that such and such injuries noted by the police are either not present, or are misinterpretations, or merely postmortem changes and not injuries. This will obviate any subsequent charge that the injuries noted at the inquest have been missed by the doctor. In the event of major discrepancy in the description of injuries as given by the police and as observed by the medical officer it is advisable for a second panchnama (inquest) to be held preferably by a magistrate.

7. **Preservation of viscera and other tissues:** Normally, the viscera are preserved and submitted for chemical analysis under the following circumstances: (1) When the investigating officer requests for such an examination; (2) when the medical officer suspects the presence of poison by smell or some other evidence while conducting any autopsy; (3) to exclude poisoning, in instances where the cause of death could not be arrived at on postmortem examination and there is no natural disease or injury to account for it; and (4) in decomposed bodies. Any tissue which is likely to provide material evidence should also be properly preserved for histopathological examination.
8. **Notes:** In absence of photographic facilities, a diagrammatic representation of all important injuries is necessary. As the autopsy is in progress, details of the examination should be taken down verbatim by an assistant. There is generally too much detail to memorize safely. A reference to the check list, if one is made, would ensure that no important point is missed. While one is working with both hands, a small pocket tape recorder may be found very valuable for the purpose of recording notes. The notes form the basis of the doctor's written report and can be used for reference when giving evidence. Nothing should be erased from the notes and all alterations should be initialed.

The core of a medicolegal postmortem report is really the evidence as regards cause of death, mainly violence and poisoning. Many medicolegal autopsies are performed because of suspected injuries caused by accident, homicide, attempted suicide, or suspected poisoning. It is, therefore, essential that all the injuries be numbered and summarized at the end in one coherent paragraph to provide an overview of the entire injury pattern. Any evidence of poisoning is similarly recorded. Any disease, if present, should be described in a separate paragraph, along with its role, if any, in causation of death.

9. **List of articles:** A list should be made of all articles removed from the body, e.g. clothes, jewellery,

bullets, etc. They should be labeled, mentioned in the report and handed over to the police constable after obtaining a receipt. The list should include not only what is recovered from the body but also state things that are not present such as no ring on the finger, no wallet in the pocket, etc.

10. **Chain of evidence:** It is absolutely essential to preserve the chain of evidence by identifying the body and maintaining absolute control of specimens removed at autopsy. The defense attorney has a right to ask how a specimen was taken, identified, preserved, and despatched to the appropriate laboratory in order to be certain that no mistake in report has occurred.



4. Medicolegal Autopsy—External Examination

The external examination should be very thorough. Time and patience in extracting information from both the scene and body are usually amply rewarded. Familiarity with the external appearances will enable the medical officer to plan his internal examination. Some of the external appearances and what they indicate are mentioned below. Those observations likely to be of significance in relation to the objects of a medicolegal autopsy are specially looked for and these include: (1) Data for identification; (2) detailed examination of wrappings, clothing and whole body for any information pointing directly or indirectly to the cause of death; (3) photographs and radiographs of evidential value; and (4) data indicative of time since death.

1. **Identification:** A brief general description of the body should be given as regards weight, height, sex, age, color, race, hair in various parts of the body with their length and color, color of the iris, bony framework, deformities, operational and other scars, tattoo marks, moles, lymph node enlargements, etc. for purpose of identification. The general condition of the body whether stout, emaciated or decomposed should be mentioned.

Apart from identification, these data provide other important information also. As for example, weight is important in cases of poisoning to determine if the amount of poison detected could have caused a fatal outcome. Weight is taken before the body is placed on the autopsy table. Height is important in cases of assault where the relative size of the assailant

and victim would matter. It is also important in case of vehicular injuries where the height of the pedestrian often determines the site and nature of injuries. Height is determined by a tape lying by the side of the body on the autopsy table. Tattoos are important to reflect personality, association beliefs beside identification as shown in Figs 4.1 to 4.6. Other methods of identification are shown through Figs 4.7 to 4.17. Absolute identification of person is done by DNA profiling in burnt, decomposed and old remains.



Fig. 4.1: Tattoos in forensic identification: Number of skulls over fingers reflecting mental make up of a person.



Fig. 4.2: Crocodile.



Fig. 4.5: Pashupatinath tattoo in a Nepali Hindu female.



Fig. 4.3: Tattoo mark showing blood shed and grabbing preys.



Fig. 4.6: Lord Budha.



Fig. 4.4: Om mark in a Hindu person.



Fig. 4.7: Photograph used in identification.



Fig. 4.8: Decapitated dead of same person as in Fig. 4.7.



Fig. 4.11: Overriding and unerupted teeth.



Fig. 4.9: Same person as in Figs 4.7 and 4.8 after decomposition.



Fig. 4.12



Fig. 4.10: Deformities as identification tool.



Figs 4.12 and 4.13: Non-circumcised penis.

2. **Examination of wrappings, clothing, and body:** In all suspicious or homicidal deaths where the body is wrapped in a plastic sheet or hands and head covered with plastic or paper bags, these *wrappings* should be examined for any loose material contained in them. As for example, in a hit and run accident, a paint chip detached from the clothing may still be retained by the plastic sheet. It could be a vital clue for the identity of the vehicle. Plastic or paper bags on the hands protect them from contamination (e.g. from head wounds of the deceased) and loss of trace evidence, e.g. fingernail scrapings, powder marks, hairs fibers, etc. The fingernail scrapings are collected by running a match stick carefully under the fingernail and preserving the material in separate labeled envelopes, one for each finger. The *clothing* should be examined *in situ*, listed, and described as regards its nature and condition noting any tears, loss of buttons, or disarrangement,

indicating a struggle. Cuts, holes, burns or blackening from firearm injuries should be described and any correlation with bodily injury specially looked for. The odor if any should not escape attention. Stains on clothes due to mud, grease, semen, poison, vitriolage, vomit, fecal matter or blood should be noted.

The importance of examining clothing and its correlation with bodily injury is exemplified by a case in which a medical officer could not find a bullet in a case of shooting where a local firearm was used. He described a fractured rib in the right hypochondrium with protruding ruptured liver as an entry wound. He could not find the exit wound. On re-examination of the case by another medical officer, he found a small hole in the shirt corresponding in position to the umbilicus which was found a little torn. With this information it was easy to understand the sequence of events: Bullet, after entry through the umbilicus had struck the spine, ricocheted along a rib, and exited rupturing the liver and fracturing the rib.



Fig. 4.14: Finger prints.



Fig. 4.16: X-ray of hand and elbow for age.



Fig. 4.15: Dentition for identification and age.



Fig. 4.17: DNA profiling (by PCR machine).

The clothing should be removed intact, each article separately, by unbuttoning or unzipping, without tearing so as to avoid confusion of signs of struggle. If it is necessary to cut it, a note should be made of the sites of cutting which should avoid any stained or torn area. If the clothing is wet or bloody it should be air dried and then preserved with proper identification for subsequent examination by the forensic science laboratory (FSL) if they are likely to have any bearing on the investigation of a case. The nature and position of stains provide important information. Mud stains suggest struggle. Grease stains suggest motor vehicle, machinery, or railway accident. Seminal stains on the body of a murdered woman suggest rape. Vomit stains suggest poisoning. Faecal stains suggest death from asphyxia or poisoning. Blood stains may suggest the position of the body at the time of and immediately after infliction of fatal injuries. It is therefore necessary to note the site and size of wounds and the distribution of blood stains. As for example, in a case of cut throat, if the clothing over the back is soaked with blood, it suggests that the victim was lying on his back and remained in that position after the fatal injury. If the clothing of the upper and lower part is heavily blood stained in the same case, it would mean that the deceased did not fall nor lose consciousness immediately after the injury.

Cases of vitriolage are still encountered. In any such death, the effect of vitriolage on clothes, skin, eyes, face, etc. should be specifically described.

The *whole* surface of the *body* should then be carefully examined before and after washing from head to foot, back and front, and the details noted. Stains, vomitus and crystalline deposits on skin are collected by swabbing or scraping before the body is washed. Washing defines some lesions obscured by blood stains, mud, or hair. While examining the back care should be taken not to miss patterned injury on the back due to pinning of the body, spinal deformity, decubitus ulcers, sacral edema, and postmortem lividity. Bruises on the back may be mistaken for postmortem lividity. Deep bruises at sacral and iliac prominences, the spine and shoulder blades may be invisible through the thick skin at the back. The skin should be incised at these points if deep injury to the back is suspected.

The presence of signs of *disease* such as edema of the legs, dropsy, icterus, or eruptions of fever should be recorded. Some of these cases die suddenly from their diseased heart, kidney, liver, lungs, etc. sometimes in early stage of their disease. The

suddenness of their natural death may give rise to unwarranted suspicion of foul play.

The condition of *natural orifices*, viz, nose, mouth, ears, urethra, vagina, and anus should be carefully observed and any change from the normal noted. Any smell of alcohol, acetone, paraldehyde, carbolic acid, or insecticides should not escape attention nor the presence of any foreign body including maggots. Blood and cerebrospinal fluid exude from the nose in fracture of the anterior cranial fossa and from the ear in middle cranial fossa. Samples of discharges should be taken on swabs, or smears prepared on slides.

In females, during the childbearing period, any external evidence indicating pregnancy or lactation is specially looked for, and these include pigmentation of the skin, changes in the breasts, presence of striae gravidarum, and enlargement of the abdomen.

Scalp injuries may be covered by hair and may be missed. Scalp hair should be shaved if necessary. A glance at the face would reveal important information. At death, the *face* generally appears expressionless. A tense expression on the face is suggestive of cerebral irritation due to disease (tetanus, hydrophobia), poisoning (strychnine), or injury to the brain. An expression of extreme exhaustion with sunken eyes indicates dehydration. A cyanosed face with protruding eyes and suffused conjunctivae denotes asphyxial death. A blanched face with poorly developed postmortem lividity suggests internal hemorrhage which may be due to internal bleeding from wounds or rupture of abdominal viscus from vehicular injury. The eyes should be carefully examined (Fig. 4.18), both upper and lower lids, and conjunctivae for petechiae of black eye; the inner canthus of the eye for punctures; the cornea and lens for opacities; the pupil and iris for irregularities; and periorbital tissues for extravasation of blood, suggestive of fracture of anterior cranial fossa. In all cases of vehicular accidents, conditions such as corneal opacities, cataract, blindness, absence of eyes and artificial eyes assume great importance. They may have contributed materially to the accident. In other cases, especially when the crime has occurred at night, this observation forms an important point to verify the correctness of dying declarations made by individuals suffering from such disorders.

In the *mouth*, dribble marks, and the state of the lips, cheeks, gums, teeth, and tongue should be noted especially in cases of hanging, strangulation, suffocation and epilepsy. Bruising and laceration of



Fig. 4.18: Eyes are carefully examined—conjunctivae for petechiae or hemorrhage; the inner canthus of eye for punctures; the cornea and lens for opacities; the pupil and iris for irregularities; and periorbital tissues for extravasation of blood.

inner side of lips, cheeks, and gums tend to be missed. In unidentified bodies, the teeth should be charted preferably with the help of a dentist. Sometimes, a bite mark on the tongue may be the only evidence of sudden death during an epileptic attack. Hyperplasia of the gums (due to dilantin therapy) when present is helpful in such cases. The position of the tongue in relation to teeth is important. It may be protruded in hanging and forced into the back of pharynx in gagging resulting in asphyxia. This information may be lost when the organs are removed. The palate should be inspected for a firearm wound which may explain a severe head injury.

The front, sides (especially the karate areas) and back of the *neck* should be examined for fingernail abrasions, bruises, petechiae, ligature mark or any other abnormality. If any injuries are found they are carefully described with sketches and photographs. X-rays may be helpful to document internal injuries. The circumference of the neck is recorded in all cases of strangulation. If a ligature is present on the neck, it should be photographed prior to removal, and then cut away from the knot so that it can be easily reconstructed. Binding the cut ends with thread prevents their fraying and opening out. The nature and position of the knot may be of value as evidence. A left handed person would tie a knot differently than a right handed person. The ligature mark if present externally is studied as regards its position, width, character, and extent of injuries.

The *thorax* both front and back should be examined for surgical emphysema, fractured ribs, pneumothorax, or any other deformity and the

axillary regions for enlarged lymph nodes. The presence of surgical emphysema over the chest indicates that the person was alive for some times after injury to the lungs, and death was not immediate. Fractured ribs give a flattened contour to the thorax.

The *abdomen* may show signs of injury; discoloration due to decomposition; or distention from heart failure, liver cirrhosis, or generalized dropsical condition; or evidence of hernia in the inguinal regions. Extreme emaciation and sunken a women denote starvation.

In alleged sexual offences pubic hair should be examined for matting from seminal fluid or blood and for foreign hair. If the hair are matted together, a portion must be cut off and kept for examination. The pubic hair should be combed to collect non-matching male pubic hair and a comparison sample of plucked hair preserved for laboratory examination. The *vagina* should be examined for signs of violation. In the male, the *penis* should be examined for any injury especially to the frenum or for venereal disease. *Testicles* should be examined after incising the under surface of the scrotum from behind for evidence of ecchymosis as indicative of violence. Sometimes, death due to squeezing of testes is alleged. *Anus* should be examined for evidence suggestive of sodomy, and the anal skin for excoriations common in irritant poisoning, e.g. arsenic.

The *limbs* should be examined for fractures and age dislocation by suitable movements, measurements, and by palpation, and for any condition that would suggest that the deceased was right handed or left handed. The limb that is commonly used shows hardened epithelium, corns and scars on the skin, and comparatively more muscularity. In cases of assault, the arms and hands may show characteristic defence injuries. The hands should be examined for any article such as hair, clothing, weapon, grass or weeds grasped by them in cadaveric spasm. The finger nails should be examined for tags of epithelium, cyanosis and splinter hemorrhages. Electrical discharge marks on hands of workmen are commonly missed. Leg fractures are common in traffic accidents. The distance from the heel to the fracture should be measured in such cases. It could be less than the distance between the ground and bumper in case of bumper fractures if brakes are applied to the vehicle in time.

In cases of suspected poisoning, search should be made for *marks of hypodermic injection* in the arms, thighs or buttocks. When such a mark is found, a

portion of the skin, at least 2.5 cm square, subcutaneous tissues, and muscle containing the whole needle track is excised. Similar material from opposite area is necessary as control. The presence of thrombosed veins, ulcers, abscesses and scars from previous septic lesions especially in a young person should suggest the possibility of drug abuse (dependence). The presence of edema and varicose veins suggest the possibility of thrombosis and pulmonary embolism. Petechial hemorrhages on the skin of the body in the absence of asphyxia should arouse suspicion of fat embolism.

All external *injuries* such as abrasions, bruises, wounds, burns, scalds, and scorching of hair should be recorded systematically with full descriptive details including sketch and measurements wherever possible. Deep or penetrating wounds should not be probed until the body is opened.

3. **Photographs and radiographs:** A certain minimum number of photographs with a scale in position is essential. At least, one photograph should be taken of the scene for a permanent record and another to

identify the body. Further photographs are necessary to document stains and injuries and to correlate external and internal injuries. Pathologic processes other than those of traumatic origin may also be photographed. In absence of photographic facilities sketches may be made on body diagrams. Instant photographs by digital cameras nowadays are good supplement for a sketch. A brief description of photographs or sketch is essential in the main report. A radiological examination is helpful: (a) In suspected cases of fracture, strangulation and firearm injuries, (b) to document radiopaque foreign bodies, (c) sometimes to identify the victim, and (d) where injuries are not readily apparent, e.g. in suspected battered baby case.

4. **Data for time since death:** Data pertinent to the determination of time since death should include: Rectal and environmental temperature; the presence and extent or absence of rigor mortis; the incidence, extent, color and degree of fixation of postmortem lividity; and the presence, character and extent of putrefaction, any evidence of entomology.



5. Medicolegal Autopsy—Internal Examination

The internal examination is conducted according to circumstances. Unintelligent adherence to a routine is not conducive to good work. No routine will serve equally well for all cases. The visit to scene of crime, inquest report, history of the case, or external examination may have given some indication about the cause of death or the body cavity chiefly affected. Three considerations are important: (1) Where to start, (2) what incisions to adopt for adequate exposure, and (3) what special precautions are necessary. A few minutes devoted to planning may make the difference between success and failure. All that is required is careful planning, complete autopsy, thorough examination, accurate description of abnormal findings, and objective interpretation.

The beginner would do well to jot down his plan in the form of a *check list*. A reference to it would ensure that no important point is missed.

Where to start: It is most convenient to start with the body cavity chiefly affected, e.g. in a case of head injury, one should start from the skull; in a case of fractured rib, from the thorax; in a case of abdominal stab injury, from the abdomen; in a case of abortion, from the vulva; and in a case of suspected air embolism from the

suspected site of entry. Air embolism can occur after operation on the neck, in criminal abortion when air and fluid are injected under pressure, and in forced blood pressure transfusion into the arm veins. Where there is no indication about the part or the organ affected, the examination of all the three body cavities can be made from above downwards.

Incisions: Incisions must be adapted to suit the requirements of the case. Any one of the following three methods may be followed to open the body: In the first method, a midline incision is made from just above the thyroid cartilage to the pubic symphysis avoiding the umbilicus and any injuries in the line of incision. This method is mainly followed as a routine on account of its simplicity and convenience. In the second method, two incisions are made. Each commences on one side of the chest from anterior axillary fold and curves under the breast to meet at xiphisternum; and from here it continues as a single vertical incision down to pubic symphysis. However, I prefer the incisions to curve above the breasts and then continue as a single vertical incision down to pubic symphysis to avoid the inconvenience due to bulkier breast mass. This method is desirable in those cases (especially females) where it

is customary to keep a dressed body for view for some time after death. In the third method, the two incisions commence on either side of the neck from the angle of the jaw to meet at manubrium sterni and then continue as a single incision down to pubic symphysis. This method is specially suited when a detailed study of neck organs is required.

Precautions: Certain special precautions are necessary in each case. As for example, (1) when injuries are situated in the line of the usual incisions necessary for postmortem examination, the incisions should be modified to examine the lesions in their entirety, (2) where an injury has received surgical attention, it is essential to have the surgeon indicate the surgical incisions, if the original injury has thereby been modified, and if so, how, and (3) in asphyxial deaths due to compression of neck where a detailed study of neck organs is required, a comparatively clean field is essential. It is therefore, necessary to avoid artifacts due to seepage of blood by dissecting the neck organs after brain and possibly thoracic viscera have been removed. The draining out of blood from the neck vessels then provides a comparatively cleaner field for the study of neck structures.

All the three major cavities of the body, viz. skull, thorax, and abdomen should be opened and examined as a routine. It is convenient to examine the neck structures along with thoracic organs. No autopsy is complete until all parts of the body have been examined and, wherever practicable, dissected in detail. The spinal cord need not be examined except in cases of: (1) Local injuries, (2) sudden death following trauma without apparent local injury, (3) deaths from convulsions, (4) battered babies, and (5) when such an examination is specially requested for by the investigating officer.

For the removal and examination of organs, three methods are available, viz. (1) removal of the organ one by one with occasional modifications when required. As for example, in this method, though thoracic aorta is removed separately from the abdominal aorta yet in case of dissecting aneurysm of the aorta, the method is modified to remove the whole aorta en masse the heart to get the best view of the extent and spread of the disease, or in case of suspected death from esophageal varices, the esophagus should be removed with stomach. This method is the one recommended for the beginner and is already described earlier with some modifications. (2) In the second method (Rockitansky method), the viscera of the thorax and abdomen along with or without those of the neck are removed en masse, after *in situ* dissection. A brief

version of this method is given at the end of this chapter. This method is helpful when the body is required quickly for disposal. It allows the dissector to carry out the autopsy taking his own time for dissection and examination. It also preserves relationship between the various organs. However, the beginner would find the organ mass too large and difficult to handle. (3) The third method "removal by systems" is a compromise between two. Naturally, it has certain advantages. As for example, in a case of instrumental abortion death, the complete block of female genitals which is removed can provide an integrated picture of injuries. Similarly, removal of brain and spinal cord as one unit can give proper evaluation of high cervical injuries. The relevant technique is described at appropriate places in the text.

The dissector, however, is free to adopt any method or modification that he considers best suited to the requirements and circumstances of the case bearing in mind the following:

1. Each organ, e.g. spleen, liver, kidney, lung, etc. should be dissected and described fully and systematically as follows: (a) External examination—weight, size (measurements), shape, surface (granular, smooth, rough), presence of adhesions, color (normal, abnormal). Consistency, presence of any abnormality (congenital or acquired), and relation *in situ* to the neighbouring structures. (b) internal examination—appearance of cut section, and microscopic appearance wherever indicated. All viscera except the heart should be weighed before they are sectioned. If any particular organ is missing, e.g. appendix, kidney, gallbladder or lung as a result of surgical removal, it should be specially mentioned and its correlation with operational scar on the skin looked for and appropriately described.
2. No organ should be separated from its connecting structures until the intervening tissue has been dissected and examined. As for example, the ostia of the renal arteries and veins, and the ureters should be examined before the kidneys are removed from the body; the mesentery, mesenteric arteries and veins should be explored before the intestine is separated from the mesentery.
3. Course and direction of wound tracks within the body and their relationship to specific organs should be noted before removal of the organs. It should, however, be remembered that antemortem and postmortem relationships of wounds and viscera may not always be the same and so also when the body is supine on the autopsy table.
4. The primary incision in each organ should be placed so as to expose the largest possible surface.

5. The structures that enter through the hilum should be opened in such a way as to visualize the ductal and vascular system.
6. Any organ or organs upon which the diagnosis of the cause of death has been based should be preserved till the conclusion of all legal proceedings.
7. All fluids recovered from the body cavities should be measured and no fluid discarded until after all known foreign objects or projectiles have been located.
8. A variety of clean containers should be kept to meet individual requirements such as solid material, fluid material, and foreign objects. They should be properly identified, labeled, and preserved, to maintain chain of evidence.
9. In most cases where internal examination fails to reveal sufficient injury or disease to account for cause of death, a second autopsy sometimes reveals gross omissions—coronary arteries have not been explored; smaller branches of pulmonary or cerebral arterial tree have not been examined. In India, instances of a “second” autopsy are rare because of the practice of cremation of the dead.
10. Before labeling the case as one of obscure poisoning or cause of death-undetermined, microscopy of the heart, brain, liver, kidney, and especially lungs in infants should be resorted to. Incidence of cardiomyopathies, collagen disorders, and hepatic or renal vascular or parenchymal reactions due to drugs or autoimmune processes is increasing nowadays. Tests for bacteriological infection or viral infection are also necessary. After all, the obscure autopsy is not quite common when a careful external and internal examination has been made, laboratory facilities utilized, and observations correctly recorded and interpreted.
11. Death from drug abuse should be suspected when teenagers and young adults die without serious injury or serious disease, and appropriate viscera should be preserved for chemical analysis.

Rokitansky's evisceration technique: This is a rapid method of evisceration and displays the aorta and branching renal arteries for dissection. The main steps

include: (1) Routine midline incision, (2) separation of thoracic organs from their attachments along with or without those of the neck, (3) separation of abdominal organs from the vertebral column, (4) separation of the pelvic organs, and (5) removal of the organ mass from the body for dissection and examination.

1. Make a routine midline incision and inspect the abdominal and thoracic cavities as already described.
2. Ligate, if the body is to be embalmed, the three major branches of the arch of the aorta and transect them below the ligatures which should be left with ends at least 40 cm long to facilitate the embalmer to locate these vessels. In the routine course when the body is not to be embalmed, cut these vessels at the root of the neck. Transect the trachea and esophagus just below the larynx or go cephalad and remove the tongue, larynx, pharynx, thyroid and parathyroid glands. Ligate, if the body is to be embalmed, all visible branches of the carotids to prevent leakage of embalming fluid. Using gentle downward pressure on the tongue and a few touches of the knife detach the whole viscera of the neck and thorax from the vertebral column.
3. Separate the diaphragm and peritoneum from the lateral and posterior abdominal walls. Dissect posteriorly behind the kidneys and adrenal glands upto vertebral column to separate the abdominal organs. Lift the thoracic organs to the left side of the body and rotate the abdominal organs to expose the right side of the vertebral column to separate the vena cava and aorta.
4. Insert the fingers into the extraperitoneal tissues behind the symphysis pubis. Separate the urinary bladder and prostate or vagina from the pelvic wall. Dissect posteriorly to separate the rectum. Milk the rectal contents upwards. With an amputation knife, cut the urethra and associated structures close to the pelvic outlet. The rectum is severed between a double ligature 2 cm above the anorectal junction. Reflect the pelvic organs upwards and outwards exposing the great iliac vessels which are then cut along the pelvic brim.
5. Lift the entire organ mass from the body, and place it on the dissection table with the posterior surface upwards, and examine.