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.

1. 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.

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 lividitv. 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*

The clothing should be removed intact, each article separately, by unbuttoning or unzippering, 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 oedema, 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 oedema 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 child bearing 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

The body of a woman stabbed to death was found at daybreak one morning in a public park. She had last been seen about 9 pm the previous night in the company of a young man. A slipper which was proved to be the property of this man was found not far from the body. The man was charged with murder. He admitted having accompanied the woman to the park and the ownership of the slipper but stated that he had left the woman in the park and had gone home. Several witnesses testified to his having been at home from 11 pm onwards. The body when examined at 7 am was still quite warm to touch; rigor mortis was present in the jaw and neck, but the limbs were quite flaccid. Medical evidence was to the effect that the woman had not been dead more than about three hours. The murder could not, therefore, have been committed by the accused, who was then acquitted.

The factors which influence rigor mortis are: (1) Age and condition of the body, (2) mode of death and (3) surroundings.

The **medicolegal importance** of rigor mortis is as follows: (1) It helps to estimate the time since death. (2) It may give information about the position of the body at the time of death and if it has been altered after rigor sets in. The flexed limbs should be consistent with the posture of the body at the time it is found, if in a rigid state. As for example, if a person dies with the hands or legs supported against a brick wall and the position of the body is changed after rigor sets in, the hands or legs would remain raised in an unnatural position (without support).

PUTREFACTION

Putrefaction or **decomposition** is brought about by two processes, viz (1) autolysis and (2) bacterial action.

Autolysis: When tissues die, as in cardiac infarction, there is a rise in certain enzyme levels. Likewise, after death, enzymes are released from tissue cells. They soften and liquefy the tissues of the body. This process, known as autolysis, commences three or four hours after death and continues steadily for two to three days, sometimes longer, when body tissues are autolysed. Such autolysis is responsible for perforation of the stomach and appearance of hemorrhages and necrosis in the pancreas simulating acute pancreatitis. Microscopic examination, depending on presence or absence of inflammatory reaction, clinches the issue.

Bacterial action: Bacteria produce a large variety of enzymes and these breakdown the various tissues of the body. The micro-organisms responsible for putrefaction are *Cl. welchii*, streptococci, *E. coli*, and *B. proteus*. During life, these micro-organisms are found in large numbers mainly in the large intestine but within a short time after death, they enter the blood vessels and spread rapidly throughout the body. *Organs receiving the greatest blood supply, and those nearest the source of bacteria, naturally receive most bacteria and normally putrefy first.*

The **characteristic features** of putrefaction can be described under: (1) Colour changes, (2) development of foul smelling gases, (3) pressure effects of gases, (4) appearance of maggots, and (5) other sequelae.

The following account represents the sequence of *putrefactive changes in warm climates*.

Color Changes

The first external sign of putrefaction is usually the greenish discoloration of the skin over the cecum and the flanks, and internally on the under surface of the liver.

The *greenish discoloration* over the cecum and the flanks makes its appearance about 12 to 24 hours after death though it may appear as early as 6 hours in summer and may be delayed for more than 24 hours in winter. This discoloration spreads over the whole of abdomen, and external genitals. Patches also appear successively on the chest, neck, face, arms and legs. These patches coalesce and *the whole body is discolored within the next 24 hours*.

Shortly after the discoloration of skin has commenced, the veins converging on the root of the neck, over the shoulder, and running into the groins become visible as blue or purplish lines due to the pigments from decomposing blood passing through the vessel walls. The course of these veins is thus visible as a bluish network. This condition owing to its mosaic or arbore scent pattern is known as marbling. Incision shows the veins to be filled with gas bubbles and hemolysing blood. *Marbling commences after 24 hours and is seen prominently in 36–48 hours*.

Gases of Putrefaction

Side by side with the colour changes on the abdomen, the body begins to emit a foul nauseating odor owing to the gradual development of gases of decomposition such as hydrogen sulphide, ammonia, phosphoretted hydrogen, carbon dioxide and methane, These gases form below the skin, in hollow viscera, and eventually in solid viscera. *They cause false rigidity, exert considerable pressure, and produce effects that are of some medicolegal importance*.

In *12 to 18 hours* in summer, gases collect in the intestines and distend the abdomen. From *18 to 36 or 48 hours*, gas formation is abundant and gases collect in the tissues and hollow viscera and cause *false rigidity and pressure effects*.