

Postmortem examination is also known as, *autopsy examination*. The word *autopsy* means *self-examination*. In the terminology *postmortem*, word *post* means *after* and *mortem* means *death*, thus *postmortem examination* means *examination after death*.

- Autopsies are of three types:
- i. Clinical or pathological autopsy,
 - ii. Medicolegal autopsy, and
 - iii. Anatomical autopsy.

1. CLINICALOR PATHOLOGICAL AUTOPSY

To deter-mine the disease causing death. A Pathologist performs it with consent of the relative of the deceased.



2. MEDICOLEGAL AUTOPSY

To solve **mysterious unnatural death**. Medicolegal expert does it preferably. However, due to lack of adequate qualified experts, all registered medical practitioners can also perform this with an authorization by State.



3. ANATOMICAL AUTOPSY

To study the normal structure of the human body mostly of an unclaimed dead body, handed over to anatomy department by governmental authority.



CONSENT FOR AUTOPSY



- **CLINICAL AUTOPSY** Obtain consent from the relatives.
- **MEDICOLEGAL AUTOPSY** No consent is required but legal permission or authorization (*requisition from police*) is a must.
- **ANATOMICAL AUTOPSY** No consent needed, but permission must be obtained from government authority and body is mostly an unclaimed dead body.

A medicolegal autopsy is thus a special type of autopsy or postmortem examination, ordered by the government/legal authorities in all **unnatural deaths**, such as ***homicide, suicide, accident***, etc. It is a challenging problem in Pakistan for reasons such as:

- Dearth of properly trained experts in the medical specialty.
- Weather condition in Pakistan sets up the putrefactive changes early, rendering all the trace evidence lost in a dead body at times.
- Scope and facilities for such investigation and examination are not satisfactory.

Objective

Objective of medicolegal autopsy is definite and they are basically to establish:

- Identity of the deceased
- Time since death
- Cause of death
- Live birth, period of viability, etc.

Identity of the deceased

This is simple and easy if the person dead is well known. However, the problem is difficult when the dead body recovered is not known to anyone .



Time since death

Probable estimation of time since death (postmortem interval) is done by the various changes occurring in a dead body after death



LEGAL FORMALITIES

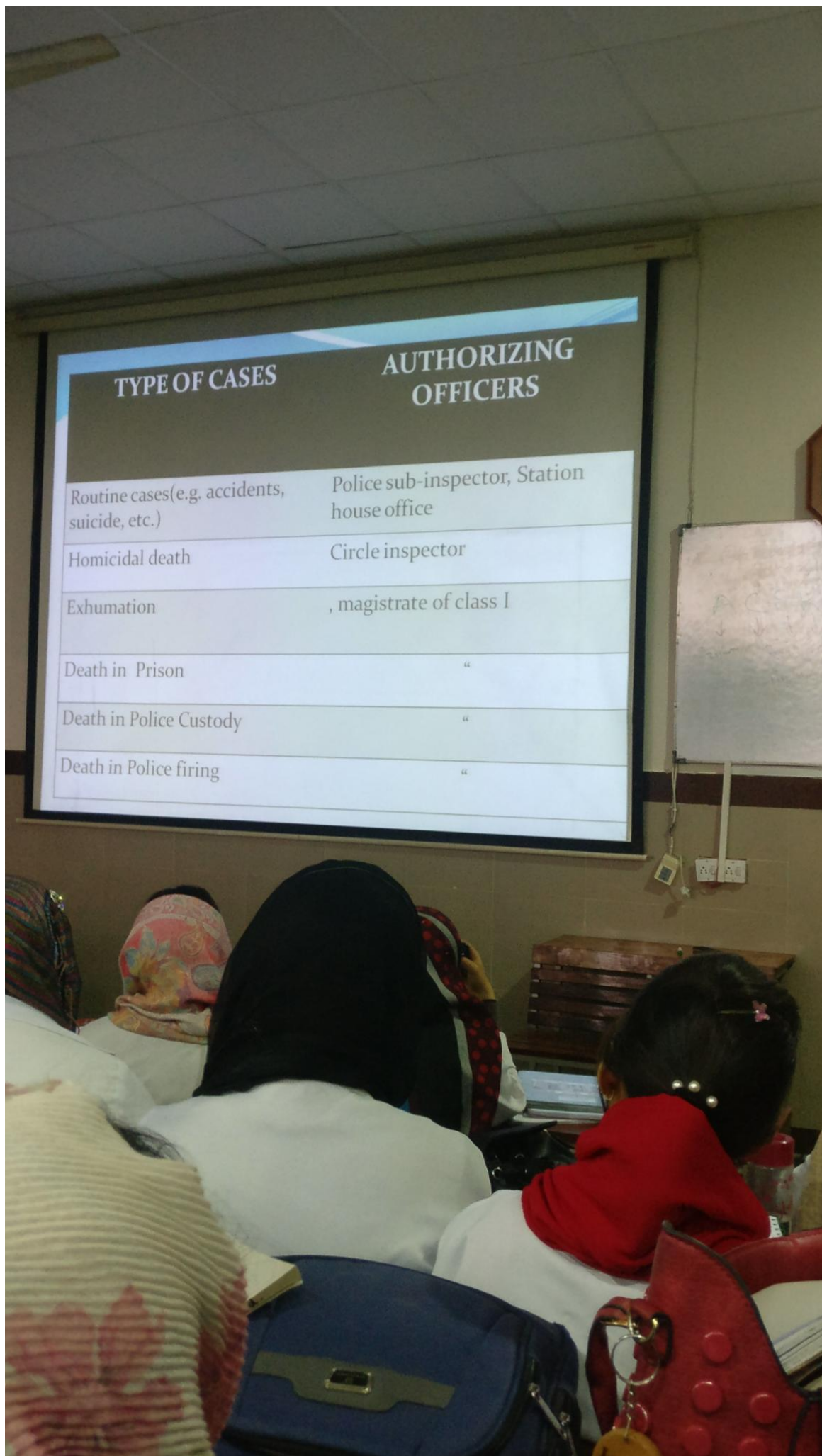
Legal formalities in taking up a case for medicolegal autopsy are:

- Authorization order
- Identification of the deceased
- Facts about the case
- Place of performing autopsy
- Qualifications.

AUTHORIZATION ORDER

Authorization order is usually in the form of requisition letter, which must be received by the doctor prior to autopsy and it depends on type of the case. However, never perform an autopsy examination without an authorization order.





TYPE OF CASES	AUTHORIZING OFFICERS
Routine cases(e.g. accidents, suicide, etc.)	Police sub-inspector, Station house office
Homicidal death	Circle inspector
Exhumation	, magistrate of class I
Death in Prison	"
Death in Police Custody	"
Death in Police firing	"

IDENTIFICATION OF THE DECEASED

A dead body is better identified prior to autopsy. If the deceased is a known person it is mandatory to get it identified. If the deceased is unknown, efforts are made in noticing the factors which could help in establishing the identity later.



FACTS ABOUT THE CASE

For better autopsy results always try to study all available facts about the case prior to autopsy and it includes:

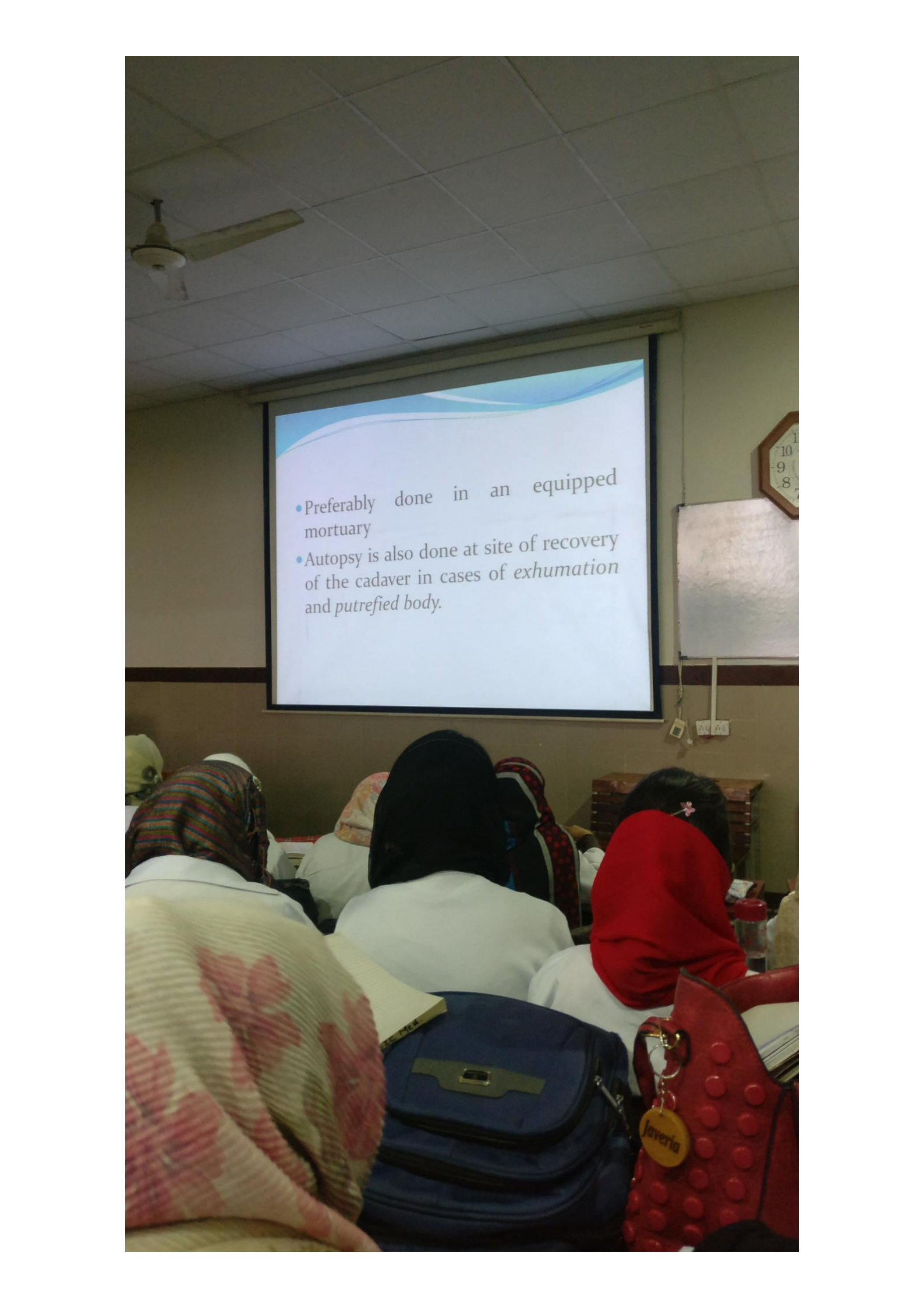
- Inquest report — issued by *police*
- Hospital records (if any) such as wound certificate, case file/sheet, etc.

Note: Confirm HIV and HBV status of the deceased whenever facilities available, as to take proper self-care and care of the other mortuary staff.



PLACE OF PERFORMING AUTOPSY



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- The image shows a classroom from the perspective of someone at the back. In the foreground, the backs of several students are visible. They are wearing various head coverings: a colorful striped headscarf, a black hijab, a red hijab, and a yellow and red patterned headscarf. A blue backpack is resting on a desk in front of the student with the black hijab, and a red backpack with a yellow tag that says 'Javeria' is in front of the student with the red hijab. In the background, a large projection screen displays a presentation slide. The slide has a blue and white wavy header and contains two bullet points. To the right of the screen, a whiteboard and a clock are visible on the wall. A ceiling fan is also visible in the upper left corner.
- Preferably done in an equipped mortuary
 - Autopsy is also done at site of recovery of the cadaver in cases of *exhumation* and *putrefied body*.

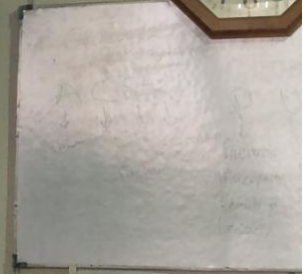
QUALIFICATIONS

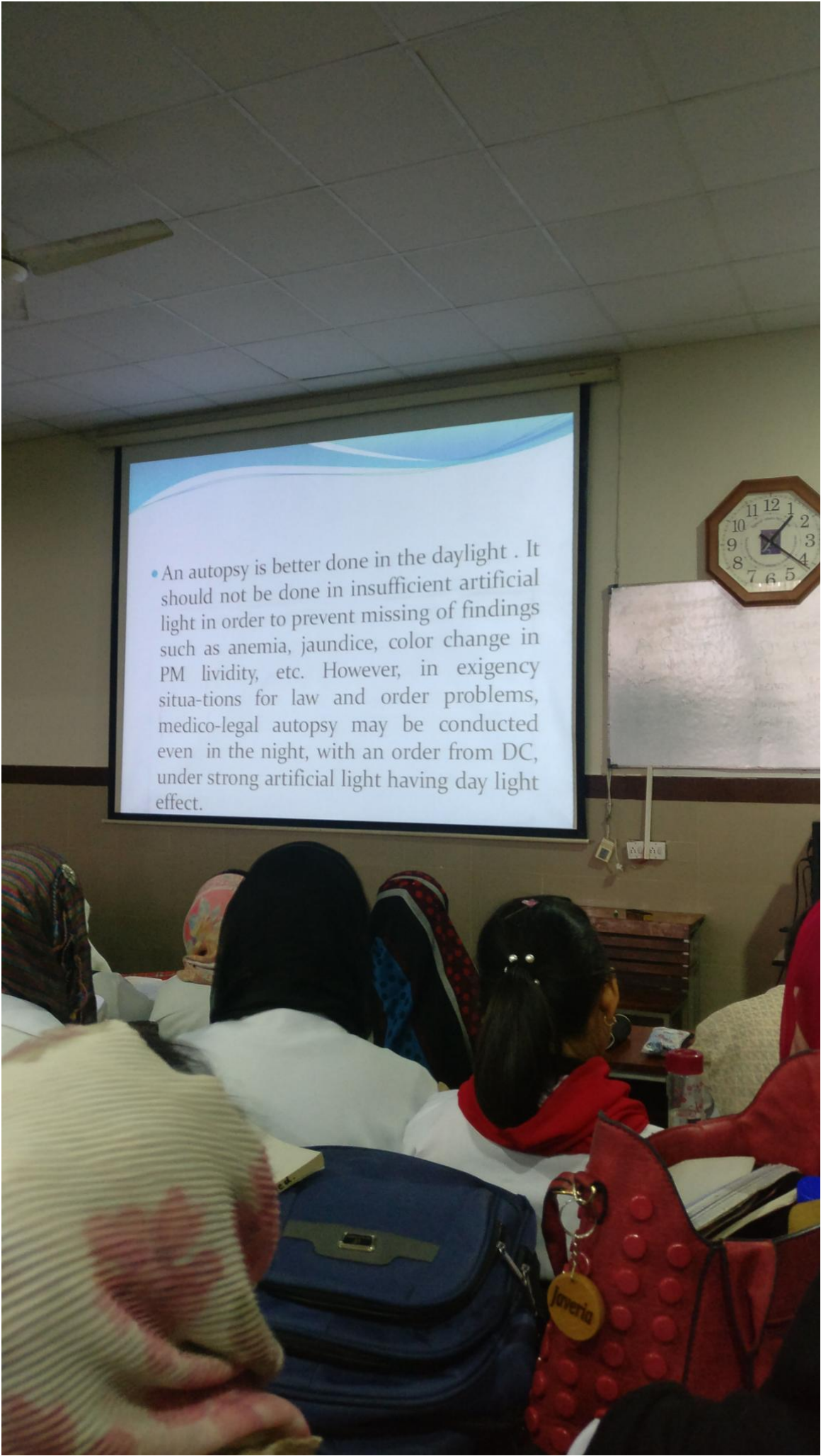
Minimum qualifications render a doctor qualified for this work is that he or she should have *MBBS* degree and that he or she must be a registered medical practitioner.

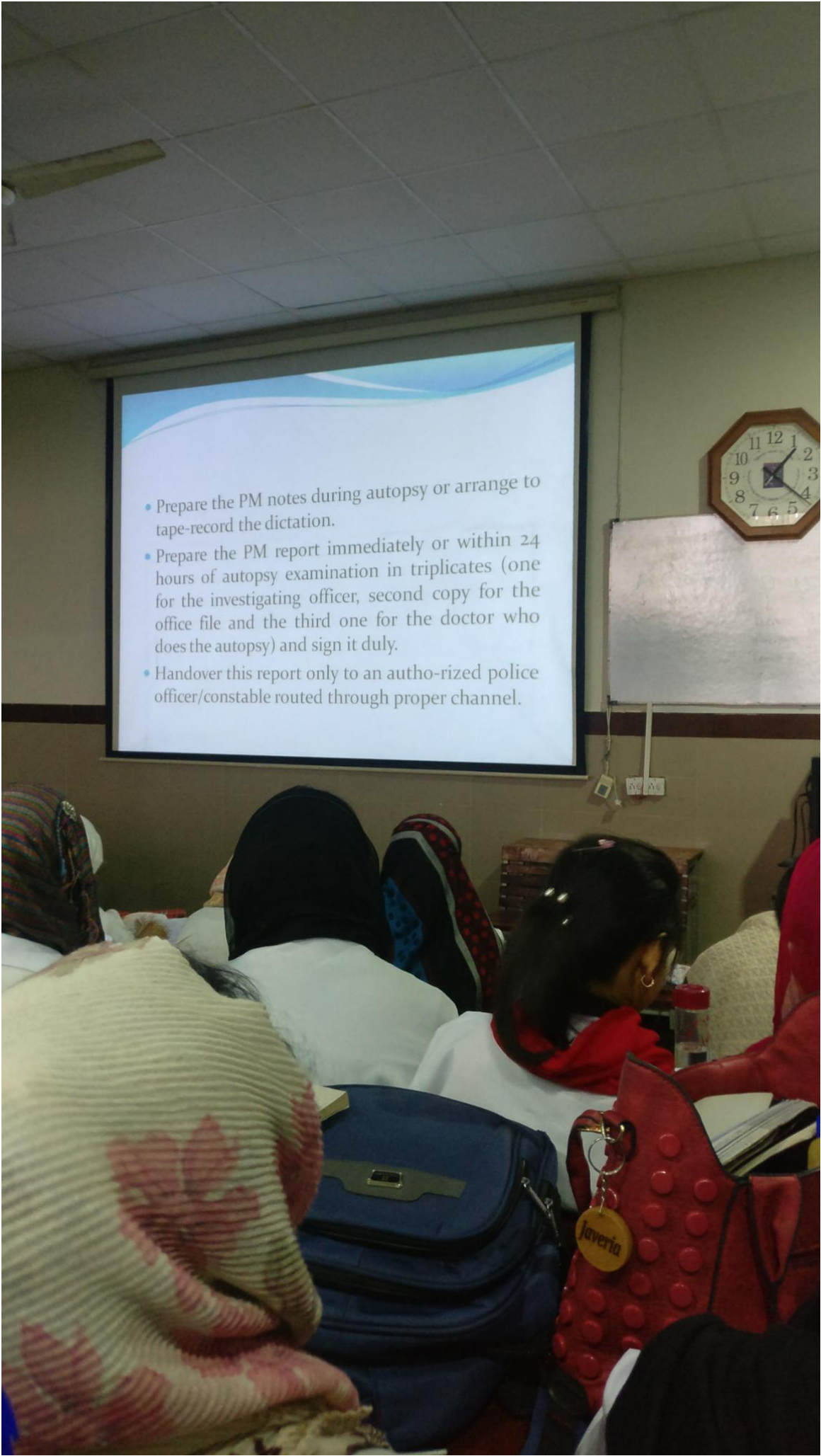


OTHER FORMALITIES

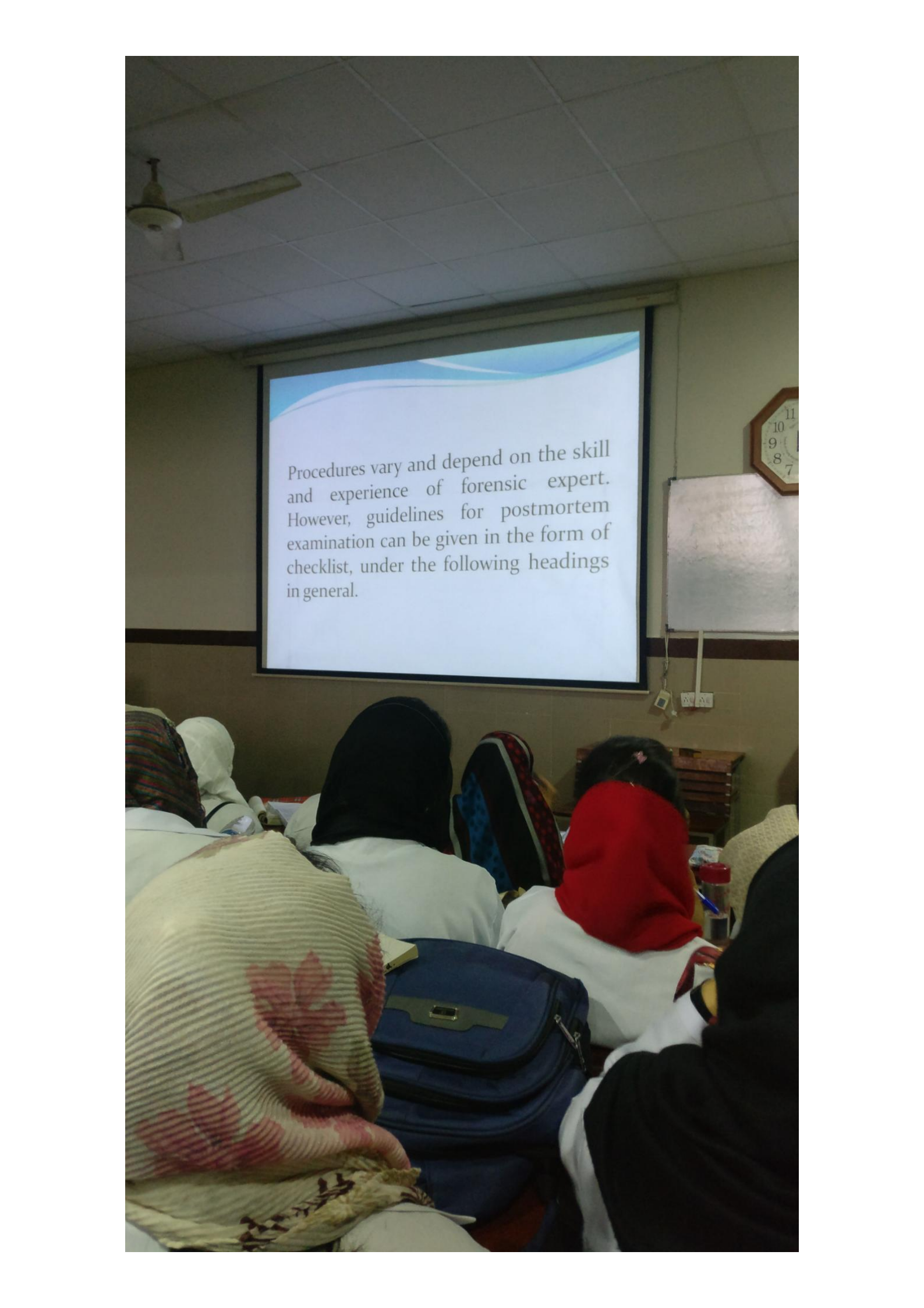
- Avoid unnecessary delay in performing autopsy
- Do not allow unauthorized person into the mortuary. If allowed record a statement from him or her giving reasons for his or her presence and signature for being present during the autopsy.



- 
- An autopsy is better done in the daylight . It should not be done in insufficient artificial light in order to prevent missing of findings such as anemia, jaundice, color change in PM lividity, etc. However, in exigency situa-tions for law and order problems, medico-legal autopsy may be conducted even in the night, with an order from DC, under strong artificial light having day light effect.

- 
- Prepare the PM notes during autopsy or arrange to tape-record the dictation.
 - Prepare the PM report immediately or within 24 hours of autopsy examination in triplicates (one for the investigating officer, second copy for the office file and the third one for the doctor who does the autopsy) and sign it duly.
 - Handover this report only to an autho-rized police officer/constable routed through proper channel.





Procedures vary and depend on the skill and experience of forensic expert. However, guidelines for postmortem examination can be given in the form of checklist, under the following headings in general.

External Examination

It is the most important part of the medico-legal autopsy procedure. This includes examination of:

- Clothes
- Stains of mud, blood, urine, stool, etc.
- Identity
- Body orifices
- Fingers nails
- Postmortem lividity
- Rigor mortis
- Decomposition changes



Internal Examination

This includes dissection and examination of the three major cavities and their contents,

- Dissection of skull/cranial cavity.
- Dissection of thoracic cavity.
- Dissection of abdominal cavity.

Usually the dissection of thoracic and abdominal cavities are done together.

However, no autopsy is completed until all parts of the body are dissected and examined in detail.



Note While undertaking a medicolegal autopsy following points may be remembered also:

- Depending on type of case, any of the body cavity can be opened first.
- Spinal cord is routinely not opened.
- Arrange for histopathological examination, chemical analysis, etc. as needed.

DISSECTING CRANIAL CAVITY

Dissecting cranial cavity includes following steps:

- Scalp incision
- Removing the skull cap
- Opening the duramater
- Removing the brain
- Dissection of brain and its parts.



During each of the steps enumerated above, proper examination of each of the following is done:

- Scalp — any injuries
- Skull — any fractures
- Membranes — hemorrhages, pus, etc.
- Brain — pressure manifestations, injuries, congenital anomalies, abscess, tumors, etc.

Note Keep a wooden block under the shoulder making the head rests firmly.



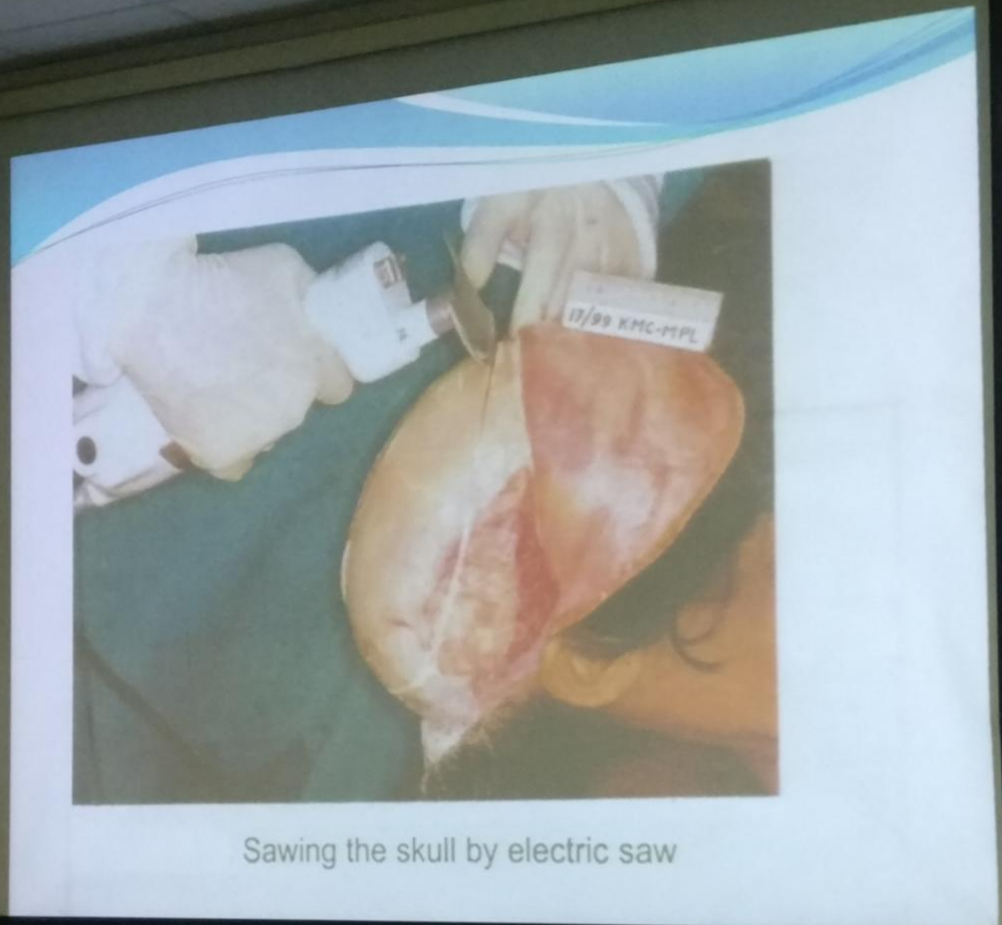
Incision of scalp along line of parting the
hairs in coronal plane





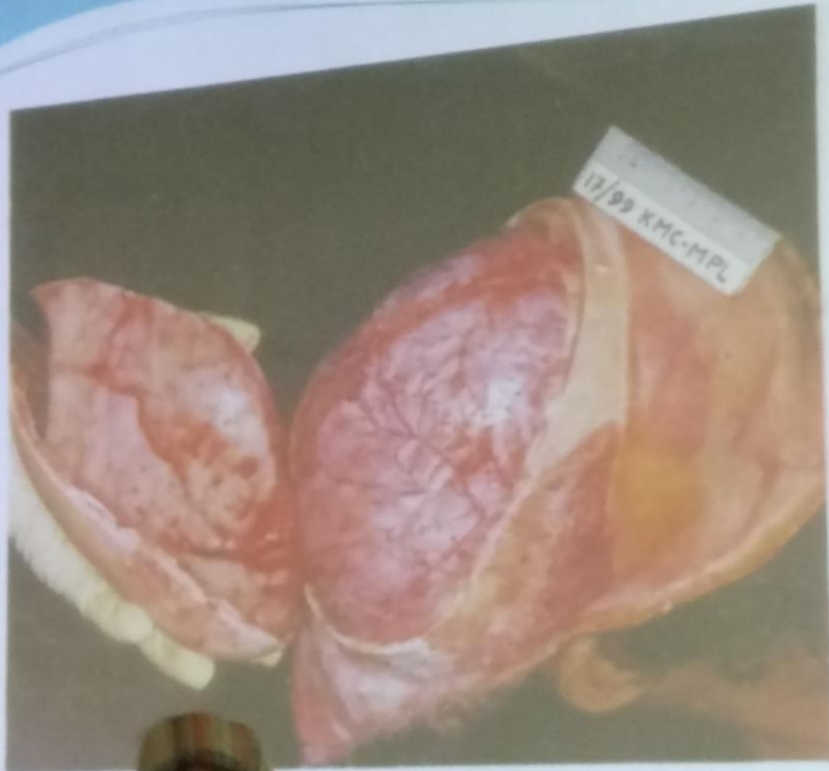
Reflection of scalp



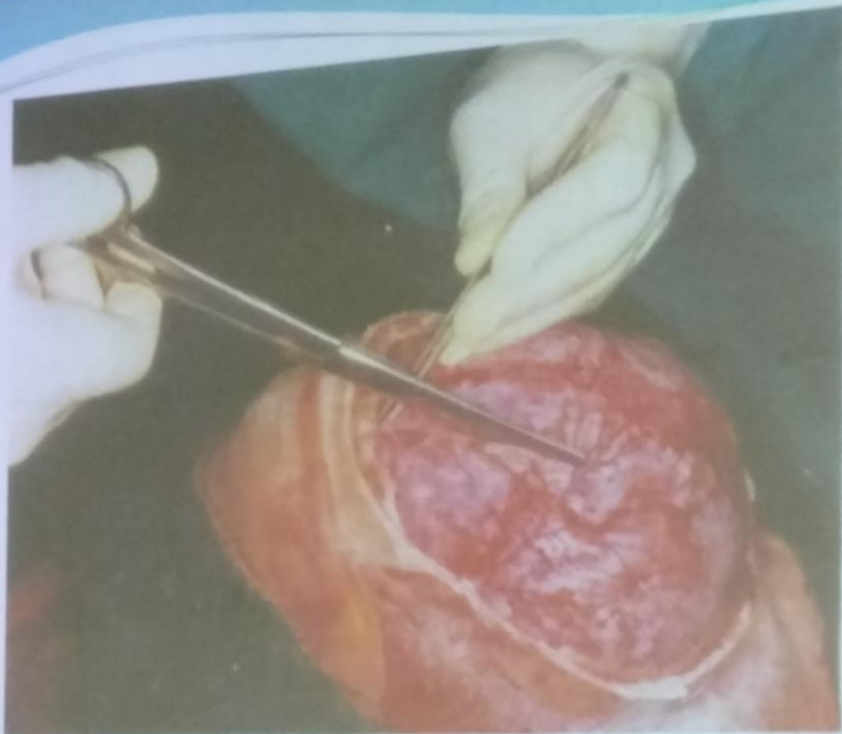


Sawing the skull by electric saw



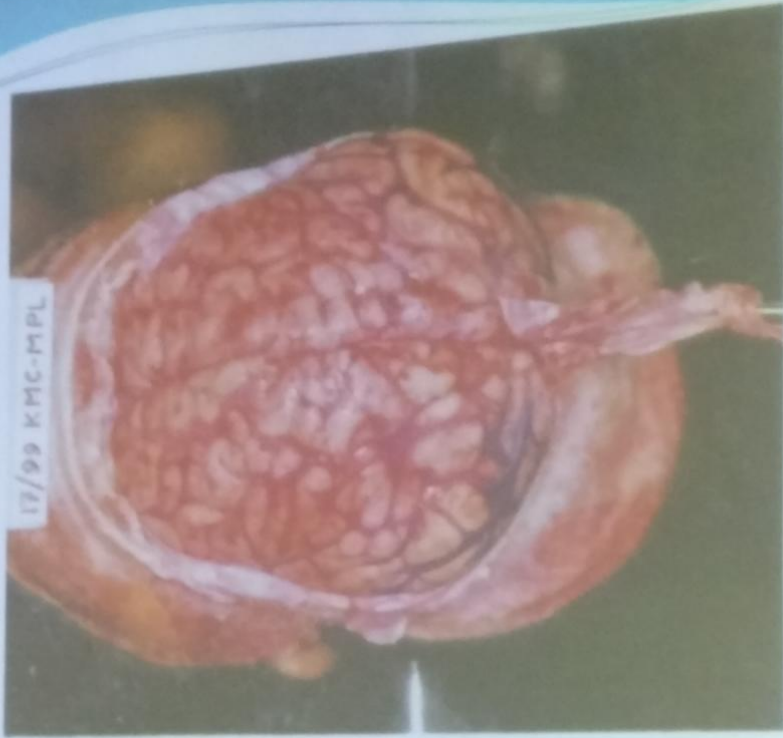


. Cranium opened, exposing duramater



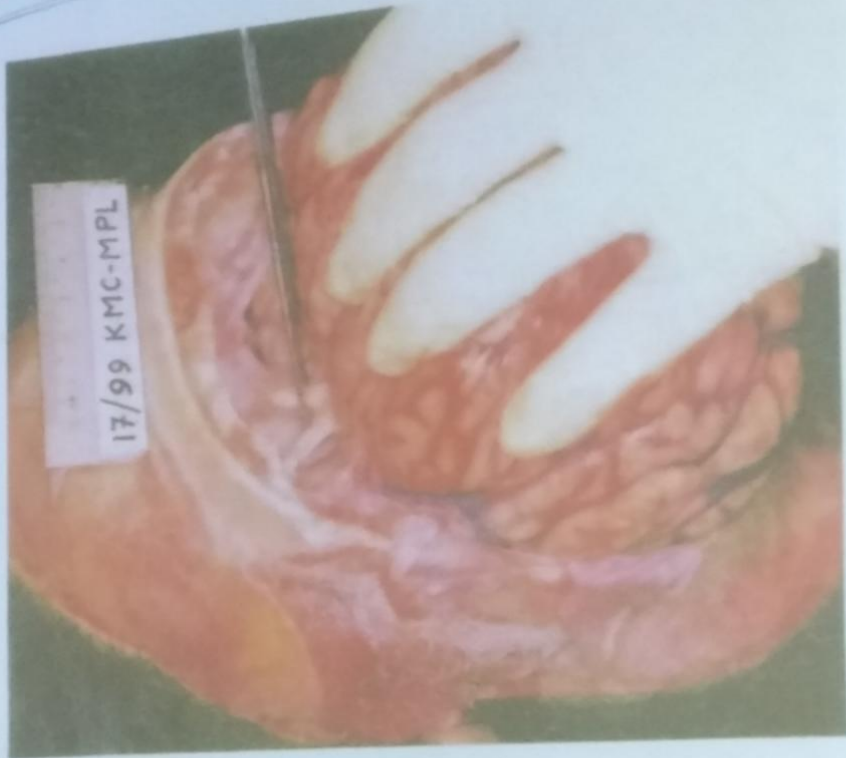
Opening the duramater





Brain exposed on reflecting
the 4 flaps of dura





Cutting optic nerves

Removing the Skull Cap

Comprise of following steps: incise the **temporalis muscle** and cut it along its **origin** and reflect down on both sides. Next, saw the skull bone a little above **superciliary ridges** in front and **occipital protuberance** behind.

Removing the brain

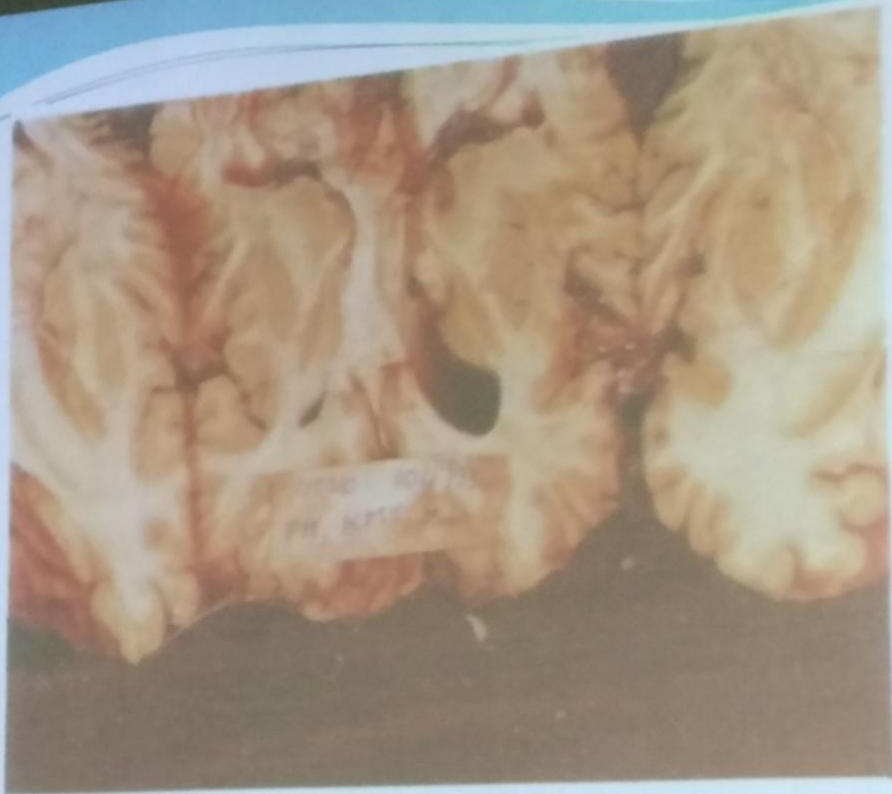
it comprises of following steps

- Insert four fingers of left hand between frontal lobes and skull.
- Draw the lobes backwards gently and cut optic nerve and then other nerves and vessels with right hand as they emerge out from the skull.
- Cut the tentorium cerebelli along superior border of petrous bone and along its attachments in posterior cranial fossa.



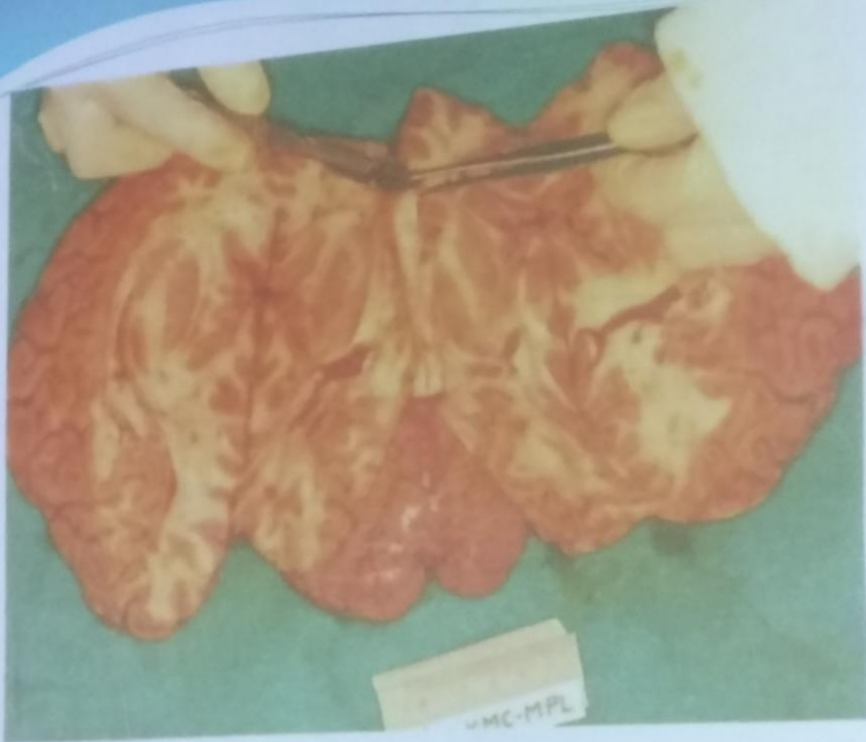
Removing the brain on cutting
spinal cord deep in foramen magnum



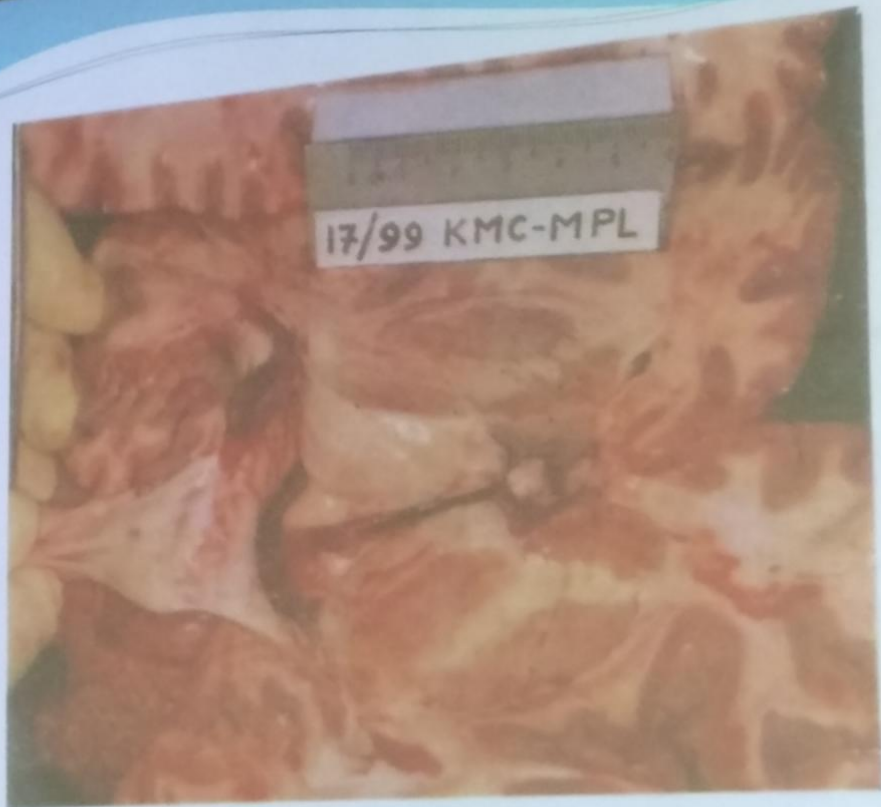


Sectioning the brain for exposing the lateral ventricle and basal ganglion





I : Cut section of brain exposing lateral ventricles and basal ganglion



Exposing third ventricle



Dissection of Brain

- The cerebral hemispheres are separated first by left hand
- Using a brain knife, placing it in the longitudinal sulcus, cerebral hemispheres of brain is sectioned on either side, just above the level of corpus callosum, exposing basal ganglion, the lateral ventricles the choroid plexus and inter-ventricular foramen, are examined
- Next cut the fornices and corpus callosum and reflect it backwards. Examine thalamus and caudate nucleus.

- Third ventricle is now exposed, pass a probe through aqueduct of Sylvius
- Expose now fourth ventricle by cutting along vermis in midline by a scalpel.
- The internal and external capsule and basal ganglia are now exposed and examined.
- Remove cerebellum and brain stem now by cutting through cerebral peduncles.
- Make sections through the pons, medulla and remaining cord

- Third ventricle is now exposed, pass a probe through aqueduct of Sylvius.
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- The internal and external capsule and basal ganglia are now exposed and examined.
- Remove cerebellum and brain stem now by cutting through cerebral peduncles.
- Make sections through the pons, medulla and remaining cord.
- Expose dentate nucleus by cutting the cerebellar hemispheres.

DISSECTION OF THORACIC AND ABDOMINAL CAVITIES

The procedure includes several steps and they are:

- Incisions
- Removing the abdominal and thoracic viscera
- Closing the body
- Handing over the body
- Preserving/dispatch of viscera to FSL or to other laboratories.

Incisions

Several types of incisions are described, but only three types of incision are in practice routinely and described.

- I-shaped incision
- Y-shaped incision
- Modified Y-shaped incision.

I-Shaped Incision

Extends from symphysis mentii to symphysis pubis taking curve towards left around umbilicus. It is used routinely in practice.

Advantages It is simple and convenient.



Y-Shaped Incision

Commence at angle of mandible above on either side and the incision from both sides brought forwards, downwards to meet at the suprasternal notch and then run downwards as in "I" shape incision to symphysis pubis. This is preferred when a detailed study of neck structures required, e.g. asphyxial death due to neck compression.

Advantages It has a better exposure and allows study of neck structures.



Modified y shaped

- In this method two incisions commence on either side of the chest from anterior axillary fold, curve under the breast to meet at xiphisternum, and continue as a single vertical incision down pubic symphysis

Removing the Abdominal and Thoracic Viscera

Opening Abdominal Cavity

1. The **rectus abdominis** muscle is incised first and then a small nick is made into the **peritoneum**
2. Next, introduce the index and middle fingers of left hand into the peritoneal cavity, lift the abdominal wall and extend the cut upwards up to **xiphisternum** and downwards up to **symphysis pubis** and open the abdominal cavity



3. As soon as the abdominal cavity is opened look for following:

- **Thickness of fat** in abdominal wall, in the omentum and around kidneys
- Presence of **fluid, pus or blood** in the peritoneal cavity
- Evidence of **perforation, obstruction, twisting**, etc. of gastro-intestinal tract
- Mobilize the large intestine by cutting along peritoneal attachments

Opening the Thoracic Cavity

- The skin, subcutaneous and soft tissues in the neck and chest are then reflected sideward (**Bruising of the thoracic wall, fracture of ribs**, etc. may be made note if present).
- Now cut along the costochondral junction, and reflect the chest plate.
- Introduce the hands into pleural cavities and look for **blood/fluid collection**.
- Disarticulate the sternoclavicular joints on either side, cut the cartilage of first rib and separate the chest plate and remove it.



Examination of thoracoabdominal viscera

- Each viscera is then removed and studied separately for its **weight, gross and cut section** findings carefully before further dissection

Stomach The stomach is first removed by cutting between ligatures at its cardiac and duodenal ends, and cut open along greater curvature studying the contents and changes of the wall. Smell the contents for any abnormal odor.



- ***Other viscera*** Remove the heart, lungs, liver, spleen, kidneys, etc. and note down all changes grossly and on sectioning.
- ***Uterus with appendages*** It must be removed and dissected separately noting the changes, especially for products of conception or signs of delivery, criminal abortion, etc.

Dissection of Heart

Heart is separated by holding it at its apex and cutting the aorta and pulmonary vessels as far away from base of the heart as possible. It is then **opened in the direction of blood flow**

Examination of Spinal Cord

Routinely not examined. However whenever needed it should be examined from the back. A midline incision is given in the back along entire length of neck and trunk, skin reflected out on either side laterally for about 2.5 cm. Vertebral column is then chiseled out along the medial margin of the transverse process of the vertebrae. An electric saw may also be used in cutting. Entire length of spinal cord can be then taken out without causing much postmortem trauma.

Closing the body After complete dissection study, put all the viscera into the trunk and the body is closed properly suturing along the incisions . Clean the body and dress it properly , handed over to police or deceased party.

Handing over the body to the police

Always handover the body to concerned police constable or officer who brought it for autopsy. Take a **written statement for receiving the autopsied body** from the police mentioning the actual date, time, etc. accurately.



Special procedures for specific cases

These vary according to types of cases, are enumerated below:

- Poisoning
- Mechanical asphyxia such as hanging, strangulation, drowning, etc.
- Burns
- Criminal abortion
- Road traffic accident
- Newborn infant/fetus —infanticide case
- Firearm injuries
- Exhumation
- Examination of skeletal remains



Poisoning case Take care to note following observation as found during the autopsy examination:

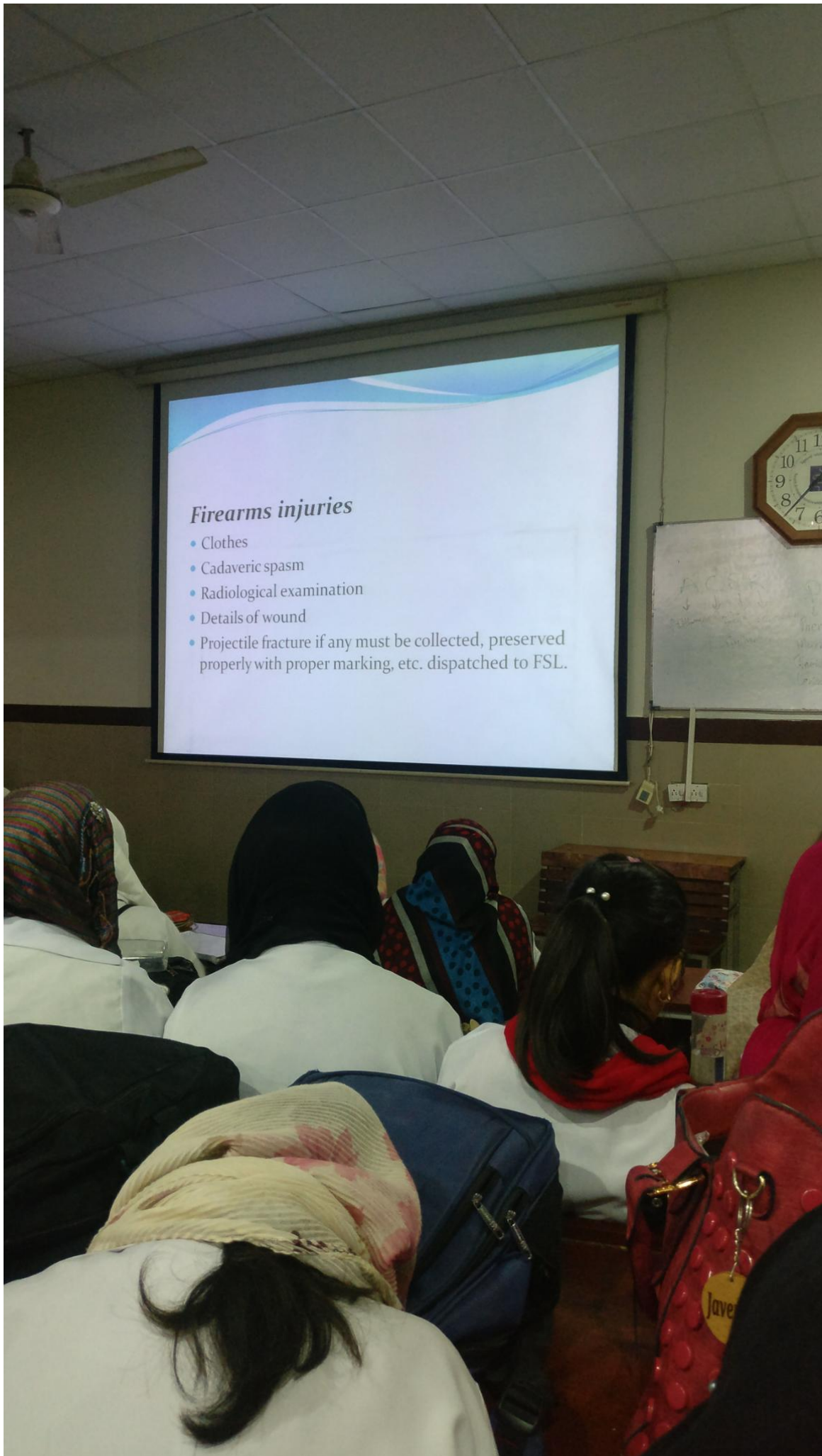
- Smell
- Color of PM stain
- Froth around mouth and nostrils
- Corrosions
- Any injuries, fang marks, etc.
- Gastrointestinal tract findings.

Hanging/strangulation cases Take care
to note following during the autopsy examination:

- Ligature material and mark
- Salivary dribbling marks
- Face findings (eyes, pupils, and tongue)
- Injuries to spinal vertebrae.
- *Bloodless dissection of neck* Here the cranial and thoracoabdominal cavities are dissected first, and neck and neck structures dissected last.

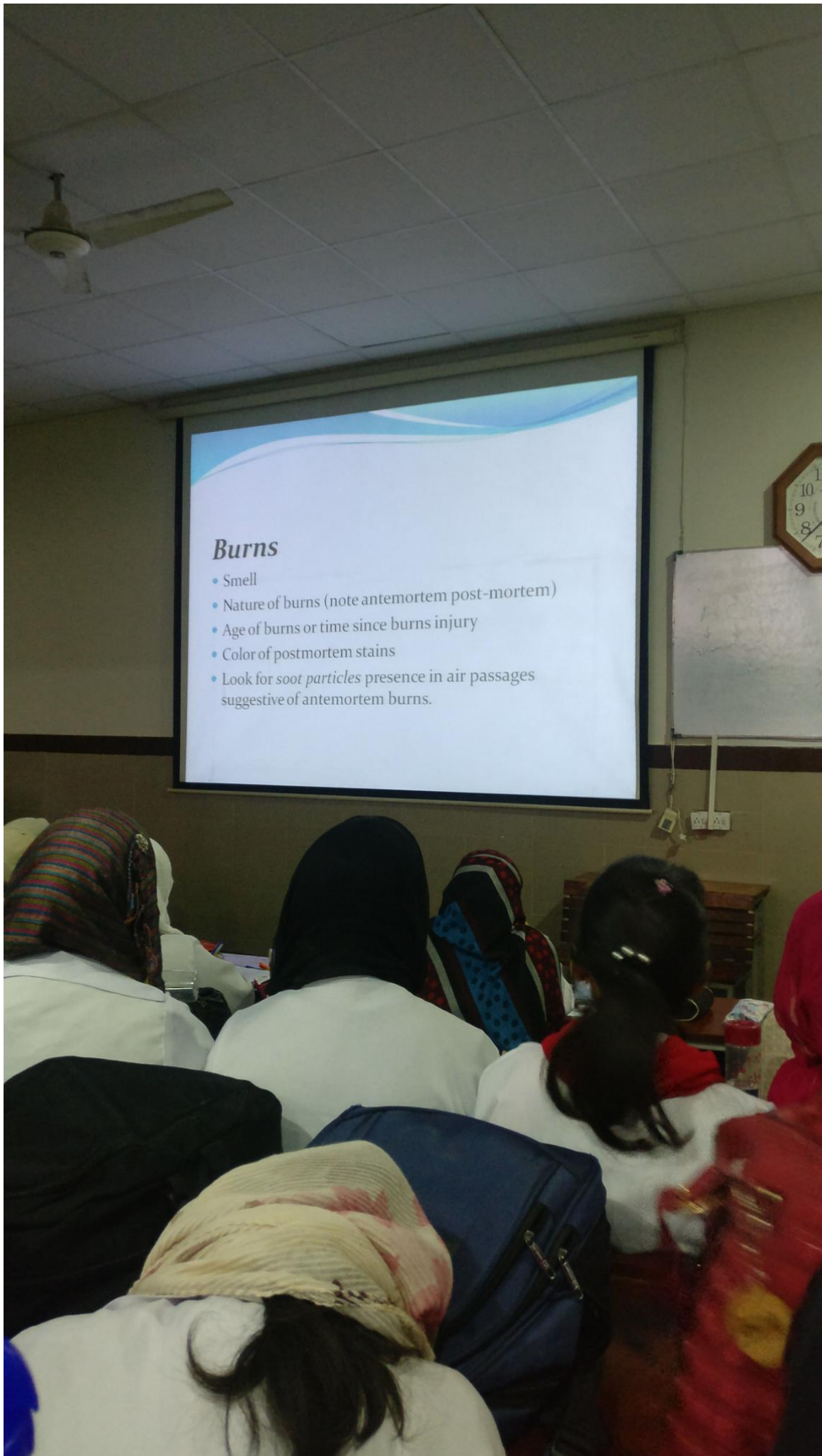
Firearms injuries

- Clothes
- Cadaveric spasm
- Radiological examination
- Details of wound
- Projectile fracture if any must be collected, preserved properly with proper marking, etc. dispatched to FSL.



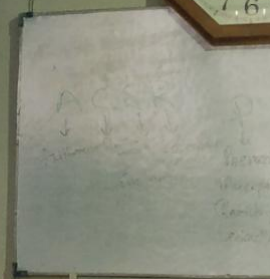
Burns

- Smell
- Nature of burns (note antemortem post-mortem)
- Age of burns or time since burns injury
- Color of postmortem stains
- Look for *soot particles* presence in air passages suggestive of antemortem burns.



Abortion

- Evidence of pregnancy and gestation period
- Criminal abortion — evidence
- Toxic substance — evidence
- Sepsis, emboli, complications, etc.



• *Road traffic accidents*

- All injuries must be described
- Any foreign particles — preserved
- Alcohol — stomach, blood, urine
- Eyes — vision impairment evidence.



FOETAL AUTOPSY



Objective

- What is the **intrauterine age** of the foetus?
- Is it **live born** or not?
- How long did it **survive after birth**?

An examination of the foetus may also be required in **criminal abortion**

- Material recovered is a human foetus.
- Ascertain the intrauterine age of the foetus.

External Examination

A thorough external examination is done noting following facts.

Clothes and wrappings —if any may be noted for purposes of establishing the identity.

Postmortem changes —describe in detail.

Signs of maceration —the skin of the macerated foetus is coppery red in color the body parts are flaccid and flat when placed on a table, the color is not that of putrefaction, the bones appear to be separated

Umbilical cord — tied or torn, or with signs of inflammation.

Placenta — attached or not, weight, infarcts, disease, etc.

Signs of maturity (*intrauterine age*) — the various factors which are helpful in this context are as follows.

- **Crown heel length** of mature new born child is about 48 to 52 cm and crown rump length is 28 to 32 cm
- **Weight** about 2.5 to 3.3kg
- **Midpoint of body** in relation to sternum and umbilicus.
- **Skin**—wrinkled or smooth , covered With *vernix caseosa*
- **head circumference** 30 to 35 cm
- **Nails** —appeared or not. If present-extent of growth.
- **Scalp hairs** —appeared or not.
- **Eyelashes and eyebrows** — appeared or not.
- **Eyelids** —adherent or open.
- **Testicles** — ascertain the position by incising the scrotum and inguinal canal if necessary.

Ossification centers: Special emphasis may be given to note for ossification status of certain bones only

Knee joint Open the joint by a **transverse incision on the front**. Reflect the soft tissues upwards and bring out **the lower end of the femur**. Make **thin transverse slices** with a cartilage knife starting from the periphery and look for the reddish ossification centre. centre appears at about 36 weeks. Make further slices. Make sure that the diaphyseal end is not mistaken for the epiphysis. **Section the upper end of the tibia similarly**



Ankle bones Make a longitudinal incision on the sole of the foot from the space between the third and fourth toes to the heel. Reflect the lateral flap exposing the outer border of the foot. Make slices in a sagittal plane to expose the centers of **the calcaneum, talus and cuboid**. Centers in calcaneum and talus appears towards the end of 5 and 7 month of intrauterine life. cuboid may show at or after birth

Sternum Later the sternal plate is removed and making a midline incision bisecting along long axis it may expose the centers.

Sacral segments The sacral centers could be examined after other organs are examined.

- Marks of violence on body —look for the mouth, neck, head, etc. in and around for trauma or foreign bodies.
- Cyanosis — look for this in the face, finger nails.
- Caput succedaneum—over head .

Internal Examination

Examination of Skull and brain

Reflect scalp as usual and cut through the membranous connections of the skull bones. Look for bruising of the scalp, fracture of skull bones, site and extent of caput, moulding, tears in membranes, hemorrhage in meninges, puncture in anterior fontanel, etc. Remove and examine the brain.

Examination of Thorax and Abdomen

- Make a midline incision from chin to pubis avoiding umbilicus. Open the abdomen first and ascertain level of diaphragm. Then reflect the chest muscles, remove the sternal plate exposing the viscera. Note position of heart and lungs *in situ*.

Examination the lungs

weight, color, consistency, edges,
presence of distended air cells under
pleura, crepitation and for conditions
like collapse or consolidation



HYDROSTATIC TEST (FLOATATION TEST)

Hydrostatic test is a test done to confirm whether the lungs tested are from a respired newborn or not.

Principle

If the newborn has respired after birth, the air that has entered the lungs shall remain within the lungs as residual air, which cannot be removed even after death, renders the lung lighter and makes it float in water giving positive result.

STOMACH BOWEL TEST

This test is done to determine whether the child was born alive or not.

Principle

Some air is swallowed during respiration in a live born child and detecting the presence of this air in these viscera constitutes the basis for this test.

Procedure

Procedure comprises of following steps.

Remove stomach and duodenum separately by cutting in ligatures.

Place them both in water. See whether they float or sink.

If they float, make a small cut while under water to see air-bubbles coming up.

Inference

- A floating viscera with giving out air-bubbles when opened under water is positive test and suggestive of live birth.
- A positive test proves live birth even in the absence of a positive hydrostatic lung test. This may happen, if there had been some **obstruction in the respiratory passages**.
- A negative test does not mean stillbirth since air does not necessarily enter stomach in adequate amounts during the breathing act.
- Putrefaction invalidates the result.

Other Findings Suggestive of Live Birth

- Open the stomach along the greater curvature and look for **mucus and milk**, which is suggestive of not only live birth, but also indicates that the infant had lived for some time.
- Examine the **large bowel for meconium** and **urinary bladder for urine** indicates that the child had lived for some time.

- The umbilical vessels are removed and examined histologically, which is of help in determining exactly how long the child, lived.
- The ossification centers: Certain parts of the fetal body is dissected and exposed last to confirm the presence or absence of ossification center in order to determine the age

AGE OF THE FOETUS

Determination of age of the foetus is very essential and crucial in cases such as:

- *Infanticide* A child which has completed 7 months of IU development is deemed *viable*, i.e. capable of being born alive. The possibility of live birth is ruled out if it is below the age of viability and a charge of infanticide cannot be sustained.
- *Criminal abortion* To know whether the mother was *quick with the child*. At about 14-18 weeks of pregnancy she feels the fetal movements from within. Abortion induced after this period brings *enhanced punishment*. The fetus is examined and its age fixed in such cases (Refer *Masses Rule* in chapter Identity).

WHETHER THE CHILD WAS BORN ALIVE OR NOT

A charge of infanticide can be sustained only, when it is proved that the child was born alive, and it was killed by criminal means of acts of commission or omission.



Deadborn Child

- Deadborn child is one, which had died in uterus long before labor started. It is diagnosed by the presence of maceration, i.e. a peculiar change that a dead fetus undergoes when it remains in the uterus without being expelled of live birth."

To ascertain whether the child is born alive or not, the following should receive consideration

Findings	5 months	6 months	7 months	8 months	9 months
Length	10 inches	12 inches	14 inches	16 inches	18—20 inches
Weight	<1 lb	1—2 lbs	3—5 lbs	4—5 lbs	2500 to 3000 gms
Midpoint	At xiphoid	----	Midway	----	At umbilicus
Skin	Wrinkled	Vernix	Fat	----	Plump with of vernix
Scalp hair	Light	Distinct	4 inches	----	Dark, an inch long
Eye brows	Nil	Appear	Distinct	----	----
Eye lashes	Nil	Appear	Distinct	----	----
Eyelids	Closed	Closed	Open	----	----
Nails	Appear	Distinct	Near finger tips	At finger tips	Project beyond finger tips
Testes	On psoas	----	At int. ring or scrotum	In ing canal	At ext. ring
Ossification	Calcaneum	Calcaneum sternum	----- Talus	5 th piece of sacrum	Lower end of Femur cuboid

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WHETHER THE CHILD WAS BORN ALIVE OR NOT

A charge of infanticide can be sustained only, when it is proved that the child was born alive, and it was killed by criminal means of acts of commission or omission.

Live born Child

- Live born child is one, which is partly or wholly born external to the mother and showed some signs of life. It is found out by the presence of certain well-defined changes that occur in the body after birth and known as "signs of live birth."

Deadborn Child

- Deadborn child is one, which had died in uterus long before labor started. It is diagnosed by the presence of maceration, i.e. a peculiar change that a dead fetus undergoes when it remains in the uterus without being expelled.

Stillborn Child

After being born the child never showed any sign of life. It might have died during delivery. It shows neither the signs of maceration nor positive signs of livebirth. A complete autopsy may give the cause of stillbirth.