

Lecture 1:

- CHAPTER (3): THE MEDICAL ASPECTS OF DEATH.
- CHAPTER (4): IDENTIFICATION OF THE LIVING AND DEAD.
- APPENDIX (1): GUIDELINES FOR AN AUTOPSY AND EXUMATION

● Book

● notes

● Important

chapter (3): THE MEDICAL ASPECTS OF DEATH

Definition of death:

It is a process in which cellular metabolic processes in different tissues and organs cease to function at different rates.

- **It Has two separate aspects :**

1. **(Cellular death):** death of a single cell.
2. **(Somatic death):** the cessation of the integrated functioning of an individual.

1- Cellular death:

- Cellular death means the cessation of respiration and the normal metabolic activity in the body tissues and cells followed by autolysis and decay.

- **The differences in cellular metabolism determine when cells die:**

1. **Skin and bone** = die days after somatic death.
2. **White blood cells** = 12 hours after cardiac arrest.
3. **The cortical neurones** = 3-7 minutes.

2- Somatic death and resuscitation:

- The individual is irreversibly unconscious.
- The Academy of Medical Royal Colleges has published a code of practice for the diagnosis of death.

Criteria for the diagnosis and confirmation of death following:

Cardiorespiratory arrest:

- Irreversible onset of apnoea.
- **One of the following applies:**
 1. Not attempting (CPR) are fulfilled.
 2. CPR failed.
 3. Life-sustaining treatment has been withdrawn.
 4. Absence of a central pulse and heart sounds for 5min.
 5. Asystole on (ECG), absence of contractile activity or pulsatile flow.
 6. Absence of pupillary responses, corneal reflexes and any motor response to supra-orbital pressure.
- The time of death is recorded when these criteria have been fulfilled.

Irreversible cessation of brain-stem function:

- Absence of brain-stem reflexes.
- Brain-stem testing should be made by at least two medical practitioners, one of these must be a consultant.
- Ancillary investigations when there are extensive maxillofacial injuries.
- Irreversible brain damage resulting from damage of known aetiology or, no possibility of a reversible or treatable underlying cause.
- Causes of coma, depressant drugs, Hypothermia, reversible circulatory, metabolic and endocrine disturbances, and reversible causes of apnoea (neuromuscular blocking agents) have been excluded.

Vegetative state:

- Brain-stem functioning in the absence of cortical function.
- It may recover, or alternatively may enter a 'minimally conscious state' (MCS).
- If the VS **persists for 12 months** following traumatic brain injury or 6 months after another cause, the VS is judged to be '**permanent**'.
- In such circumstances, the withdrawal of hydration and assisted nutrition can be considered in the 'best interests' of the patient.

Tissue and organ transplantation:

- The laws relating to tissue and organ donation and transplantation are dependent upon the religious and ethical views of the country.
- Transplantation is expressly forbidden in Jehovah's Witnesses.

The organs and tissues to be transplanted may come from one of several sources, which are outlined below:

1- Homologous transplantation:	2- Live donation:	3- Cadaveric donation:	4- Xenografts:	5- Cloning:
<ul style="list-style-type: none">• Tissue is moved between sites on the same body. For example, skin grafts, bone chips.	<ul style="list-style-type: none">• In this process, tissue is taken from a living donor whose tissues have been matched to, or are compatible with, those of the recipient.• The most common example is, blood transfusion, marrow transplantation, kidneys or transplantation of a part of a single organ (such as the liver).	<ul style="list-style-type: none">• The best results are still obtained if the organs are obtained while circulation is present or immediately after cessation of the circulation.• The aim is to minimize the 'warm ischaemic time'.• Some organs (e.g. kidneys) are more resilient to anoxia than others and can survive up to 30 minutes after cessation of cardiac activity.• Opting in' system: the transplant team must ensure that the donor either gave active permission during life or at least did not object and that no close relative objects after death.• If an autopsy will be required by law for any reason, the permission must be obtained before harvesting of tissue or organs is undertaken.	<ul style="list-style-type: none">• It is Grafting of animal tissue into humans.• There is considerable difficulty with cross-matching the tissues and possibility of transfer of animal viruses to an immunocompromised human host.	<ul style="list-style-type: none">• A cheaper solution involves the cloning of animals for use as transplant donors.

Cause of death determination and certification:

- In general, if a doctor knows the cause of death, and that cause of death is 'natural', they may issue a 'death certificate'.
- The format for certifying the cause of death is now defined by (WHO).

The system divides the cause of death into two parts:

Part I:

- describes the condition(s) that led directly to death; divided into three subsections (a), (b) and (c).
- These are for disease processes: (a) being caused by or is a consequence of (b) and (b) in turn is caused by or is a consequence of (c), etc.
- **The disease lowest in the Part I list is the most important**, as it is the primary pathological condition in the leading to death. Also, it is used to compile mortality statistics.

Examples:

- 1- Ia Cardiac failure / Ib Hypertrophic cardiomyopathy.
- 2- Ia Coma / Ib Subarachnoid haemorrhage / Ic Ruptured congenital aneurysm.

Part II:

- is for other conditions, not related to those listed in Part I, that have also contributed to death.
- **Don't record the mode of death (e.g. coma, heart failure) in isolation, it should be qualified by indicating the underlying pathological abnormality.**
- In the UK 'Ia: Old age', sudden infant death syndrome (SIDS) is acceptable as causes of death.
- International classifications of disease are now well established as: International Statistical Classification of Diseases and Related Health Problems (ICD), which can be used for both clinical diagnoses and death certificates.
- In this classification, each condition is given a four-digit ICD code.

Medico-legal investigation of death:

- If a death is natural and a doctor can sign a death certificate, this allows the relatives to continue with the process of disposal of the body.
- If the death is not natural or if no doctor can complete a death certificate, some other method of investigating and certifying the death must be in place.
- The systems are arranged to identify and investigate deaths that are, or might be, **unnatural, overtly criminal, suspicious, traumatic or caused by poisoning**, or that might simply be deaths that are unexpected or unexplained.
- The types of deaths that cannot be certified by a doctor are examined by: **Coroners, procurators fiscal, medical examiners, magistrates, judges and even police officers.**
- Registrars of Deaths have a duty to inform the Coroner about any death that appears to be unnatural or where the rules about completion of the death certificate have not been complied with.
- The Coroner will attempt to find a family practitioner, if found, may be able to complete the death certificate if he is aware of natural disease and if the scene and circumstances of the death are not suspicious.
- If no family practitioner can be found, or if the practitioner is unwilling to issue a death certificate, the Coroner will require an autopsy.
- Autopsy examinations are not the final answer to every death, but without an internal examination it can be impossible to be certain about the cause and the mechanism of death.
- Deaths are usually referred to the Coroner by doctors, police and members of the public.

Autopsies can be performed for two reasons:

1- Clinical interest:

- after consent for the examination has been granted by, the relatives eg: for teaching medical students and research (in the past)

2- Medico-legal purposes:

- Autopsies can, in theory, be performed by any doctor, but ideally they should be performed by a properly trained pathologist.
- The first crucial part of any autopsy is **observation** and **documentation**.
- Many autopsies will require ancillary investigations, such as radiological, toxicological, biochemical and microscopic analyses.

The Minnesota protocol:

1. A model autopsy protocol produced by the United Nations within the context of the investigation of human rights abuses.
2. used for dealing with 'difficult or sensitive' or controversial cases.
3. covers all stages of the pathological death investigation process, from scene examination to ancillary tests.
4. done by well-trained forensic pathologists.

Exhumation:

A body which is removed from its grave for further examination.



Figure 3.6 Removal of the coffin lid following an exhumation. Liquid mud covers the upper body following leakage of the coffin lid.

chapter(4): IDENTIFICATION OF THE LIVING AND DEAD

- Loss of identity, either deliberate (e.g. because someone does not wish their identity to be known, or wishes to conceal the identity of another) or unintentional (e.g. in mass disasters, etc).
- Proper identification of a body is one of the key questions to be answered when a body is found and in the investigation of any death and forms the first part of a Coroner's inquest.
- Start with the visual identification.

Identification criteria:

1. **Primary identification criteria** are fingerprints, DNA, dental and unique medical characteristics.
 2. **Secondary criteria** include deformity, marks and scars, X-rays, personal effects and distinctive clothing.
- The detailed assessment of the dead for evidence of identity is a specialized task for a multi-professional team that includes the **forensic pathologist, forensic odontologist, anthropologist, radiologist, and other experts**.

DNA profiling:

- The chances of two unrelated individuals sharing the same sequence is one in a billion, or higher.
- Only uni-ovular twins have the same sequences.

Examination of dental structures:

- The **forensic odontologist** is of prime importance in mass disasters where trauma is likely to make visual identification impossible.
- The great advantage of dental identification is that the teeth are the **hardest and most resistant tissues** in the body and can survive total decomposition and even severe fire, short of actual cremation.
- Pre-existing dental records and charts and radiographic images can be **compared** with examination of teeth of the deceased.
- Where no previous records are available, examination of the mouth and the teeth can still give some general information on **age, sex, diet and ethnic origin**.



Figure 4.2 Retained dentition after fire.

Fingerprint:

Prints may often be obtained from desquamated skin or from the underlying epidermis after shedding of the stratum corneum following prolonged submersion.

Morphological characteristics:

- Established by matching the parameters that can be measured or seen on an individual with the **same parameters** that were known to apply to, or to be present on, a named individual.
- In both the living and dead, the height, weight and general physique need to be recorded and **compared**.
- Hair colour and length, including bleaching or dyeing, etc.

Tattoos and body piercings:

- The main use of tattoos and piercings in forensic medicine is in the identification of the bodies of **unknown persons**.
- Decomposing bodies should be examined carefully for tattoos, which may be rendered more visible when the superficial desquamated stratum corneum is removed. Also note the site and type of **body piercing**.

Identity of decomposed or skeletalized remains.

- Phalanges, carpal and tarsal bones can be extremely difficult to positively identify as human because some animals, such as the bear, have paw bones almost identical to the human hand.
- The skull and the pelvis offer the best information on sexing and the examination by an anthropologist or anatomist is vital.
- Age: will require a multi-professional approach.
- Race: is very much the field of trained anthropologists.

Body implants:

- May either relate to the cause of death or may simply be an incidental finding.
- Most body implants (e.g. pacemakers, joint replacement) bear a unique reference number which identify the maker.
- These and other unique medical data are often useful in establishing identity.
- Where pre-mortem clinical radiographs are available, the comparison of these with the post-mortem films may give a definite identity.
- If a skull X-ray is available, comparison of the frontal sinus patterns is incontrovertible as no two people have the same frontal sinus outline.

Mass disasters:

- A mass disaster requires appropriate collection of forensic samples.
- Fingerprints and DNA samples can be obtained from personal items.
- Body recovery teams will identify where the deceased are and then once identification evidence has been collected this will be presented to the Identification Commission who will decide if it meets the standards required to confirm identity.
- Multiple deaths are caused by some form of disaster the process of Disaster Victim Identification (DVI) should be established.

Age estimation in the living:

- Only few doctors have the knowledge or skills of assessing age or be aware of the limitations.
- The essential element of any age estimation procedure is to ensure that it complies with, and fulfils, all local and/or national legal and ethical requirements.
- **Underestimation** of age is unlikely to raise any issue in relation to an infringement of human rights (as younger persons tend to be treated better in law) but an **overestimation** of age can have adverse effects.

The 4 means of assessment that should be used now to estimate age in the living are:

1- Social and psychological evaluation.

2- External estimation of age.

3- Skeletal estimation of age (not visually but relies on technology to assist with informed consent).

4- Dental estimation of age.

- Evaluation must be undertaken by a qualified clinician.

- External estimation of age should use **Tanner staging Figure** to assess child maturity however, Pubertal and post-pubertal individuals require a radiographic investigation.











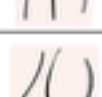




Stage	G = genitals (boys)		B = breasts (girls)		P = pubic hair (girls)	
1		Pre-adolescent		Pre-adolescent		No hair
2		Scrotum pink and texture change, slight enlargement of the penis		Breast bud		Few fine hairs
3		Longer penis larger testes		Larger, but no nipple contour separation		Darkens, coarsens, starts to curl
4		Penis increases in breadth, dark scrotum		Areola and paila from secondary mound. Menarche usually commences at this stage		Adult type, smaller area
5		Adult size		Mature (paila projects, areola follows breast contour)		Adult type

Figure 4.3 Tanner staging.

APPENDIX (1): GUIDELINES FOR AN AUTOPSY AND EXUMATION

Guidelines:

1. Where the death is definitely due to crime or if there is a possibility of crime, the doctor should attend the scene before body is moved (Notes on the scene and photographs are taken).
2. The identity of the body should be confirmed to the doctor.
3. If the remains are mummified, skeletalized, decomposed, burnt or disfigured to a point at which visual identification is impossible, other methods of establishing the identity should be used.
4. In a suspicious death, the body should be examined with the clothing in place so that defects caused by trauma that may have damaged the body (stab wounds, gunshot injuries, etc.) can be identified.
5. The body should be **photographed clothed and then unclothed** and then any injuries should be photographed in closer detail.
6. **X-rays** are advisable in victims of gunshot wounds and explosions and where there is a possibility of retained metal fragments, and are mandatory in all suspicious deaths in children.
7. The **surface of the body** should be examined for the presence of trace evidence (fibres, hair, blood, saliva, semen) performed by **police officers or by forensic scientists**, often with the assistance of the pathologist. Where samples are to be **removed from the body itself** as opposed to the surface of the body - fingernail clippings, head and pubic hair, anal and genital swabs - these should be taken by the **pathologist**.
8. Careful documentation of the **external features of injuries**, their position, size, shape and type **is the most important aspect of a forensic examination** and much greater value than the internal dissection of any wound tracks or of damaged internal organs.
9. The internal examination must fulfill **two requirements**: to identify and document **injuries** and to identify and document **natural disease**.
10. Samples of **blood** should be collected from a large limb vein, preferably the **femoral vein**, and **urine** should be collected, preferably using a clean syringe, through the **fundus of the bladder**.
11. Tissue samples should be retained in formalin for microscopic examination.

The autopsy:

1. An incision is made from the **larynx to the pubis**. The upper margin may be extended on each side of the neck to form a **'Y' incision**.
2. The skin on the front of the chest and abdomen is reflected laterally and the anterior abdominal wall is opened. The **intestines** are removed by cutting through the **third part of the duodenum**. Then dissecting the small and large bowel from the **mesentery**.
3. The ribs are sawn through in a line from the lateral costal margin to the inner clavicle and the front of the chest is removed.
4. The iliac vessels and the ureters can be bisected at the level of the pelvic rim.
5. The pelvic organs are examined in situ or they can be removed from the pelvis for examination.
6. The scalp is incised **coronally**.
7. Orders in organ dissection: tongue, carotid arteries, oesophagus, larynx, trachea, thyroid, lungs, great vessels, heart, stomach, intestines, adrenals, kidneys, spleen, pancreas, gall bladder and bile ducts, liver, bladder, uterus and ovaries or testes and finally the brain.



If you have any questions You can
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