

Postmortem changes



Forensic Team

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Recourses:

- Simpson's Forensic Medicine By Richard Shepherd -12th edition
- Doctor's slide
- Lecture notes
- 424 lecture notes

Introduction:

Thanatology:

- It is the scientific study of death that almost always involves deathbed visions.
- Such visions are regarded as showing that death is the transition, rather than extinction, of life.
- From a biological point of view, death is a process, not an event. this is because the different tissues and organs in a living body die at different rates.
- The cause of death is any Injury or disease that produces physiological derangement in the body that results in death.
- Manner of death explains how the cause of death came out.
- Mechanism of death is the physiological derangement produced by the cause of death e.g. arrhythmia

Importance of thanatology:

- 1- Time of death
- 2- Certification
- 3- Life support
- 4- Organ transplantation
- 5- Burial

Team Note:

Q: How to identify a dead person?

ABC: When checking the breath: check for the movement of the chest wall .. person might be asthmatic or a smoker so the movement of the wall will be difficult to check !

radial pulse, carotid Pulse, fixed dilated pupils , reflexes (knee jerk)

If you are in hospital you can do ECG and Auscultation

Death occurs in two stages:

- 1- **Somatic Death:** i.e. death of all the human body
- 2- **Molecular death:** Progressive disintegration of the body tissue

The immediate signs of death:

- 1- Pallor and loss elasticity of the skin
- 2- Ocular sings e.g. Retinal segmentation (most Important) .. Decreased intraocular pressure*.
- 3- Primary Flaccidity of muscles
- 4- Cessation of circulation (not the heart)
- 5- Cessation of respiration.

* you will see a dimness
Cornea .. If you see the
Cornea لامعة its a sign of a
recent death it is an early
sign to coz it occur within
20 minutes after death

Brain Death (mainly the brainstem):

- 1- Occurs after 5 minutes.
 - 2- Not a single entity; prognosis will depend on the cause
- A- Head Injuries (50 %)
 - B- Cerebral Hemorrhage (30 %)
 - C- Other tumor Thrombosis (20 %)

* in many countries brainstem death is considered legal death, even if the body is kept alive with artificial means. This opens up for organ donation (Transplantation) of heart, liver and lungs where the donor has to be dead

Postmortem (PM) Changes:

A-Cooling of the Body:

- Rectal temperature is more than mouth temperature by 1°C .
- The body after death will lose 1.5°C hourly at the first 6 hours (i.e. 9°C is lost in the first 6 hours), then it will lose 1°C every 6 hours later to reach the environmental temperature by 12-18 hours after death.

Factors that affect the PM cooling:

- Air current.
- Body weight.
- Surface area in relation with weight (children cool faster because they have larger surface area).
- Coverings of body.
- Atmospheric temperature.
- Season (more in winter).
- Night time.
- Body temperature at the moment of death.

Why the body cools? Loss of metabolism and the circulation that give us heat!

B- PM Hypostasis (PM Lividity or Suggillation) (الرسوب الدموي) :

- Gravitation of blood inside the capillaries and blood vessels (small veins) of the dependant part * الأجزاء المتكأ عليها *, giving skin its violent color Except Pressure areas.
- Starts at the moment of death, appears after 2 hours, and get completed after 8 hours.
- Appears in all bodies although it may be difficult to detect in dark skin people.

if someone died due to hemorrhage .. The hypostasis be unremarkable in color

late stage of heart failure .. Pumping action is very slow so the blood will accumulate and you may see hypostasis before being dead

Medico-legal importance:

- Know the position of the body after death if someone change the body position from the original place. Before 2 hours we can't detect the change in position.
- Sure sign of death 2-6 hours, i.e. know the time passed after death.
- May be mistaken with contusion.

	Hypostasis	Contusion
Blood in capillaries	Inside	Outside
Swelling	Absent	Present
Different color with time	No	Yes
Site	Dependant area	Any site
Cellular reaction	No	Yes (inflammatory response)
Washing (disappearance of color with pressure)	Yes	No

Important:

People die on their back side .. Blood hypostasis in the back except for the parts that's on pressure area (E.X : scapula .. bra ..etc)



Hypostasis in the sole of the foot is due hanging!



Hypostasis does not occur in pressure areas because of blockage of blood vessels

C- Rigor Mortis (RM) (التيبس بعد الوفاة):

- The initial flaccidity of the body after death is soon followed by stiffening or RM.
- Caused by exhaustion of ATP. ($ATP \rightarrow ADP$)
- The order of onset and passing of RM may be determined by the quantum and kind muscles involved; the smaller the muscle earlier the onset and passing of RM.
- Children have RM more than adults.
- It appears earlier in athletic because they have more ATP .
- Sever burn occurs without RM .
- Start at the moment of death, appears after 2 hours, completes after 12 hours, and disappear after additional 12 hours,i.e.24 hours .

Muscle of the eye is first to go! So that's why we close the eyes of the dead people

Medico-legal importance:

- Sure sign of death.
- Idea of time since death, i.e. primary flaccidity at 0-2 hours then RM at 2-24 hours then secondary flaccidity after 24 hours .
- Position of the body .
- Suggest the cause of death

It may be mistaken with other conditions of stiffness after death as:

- Cadaveric spasm (instantaneous rigors, instantaneous rigidity ,cataleptic rigidity).
- Heat stiffness.
- Cold stiffness.

1. Cadaveric spasm (التوتر الجثّي) :

- A muscular stiffness, which occurs at the moment of death.
- Associated with violent death in circumstances of intense emotion. For E.g. (scare, drowning)
- Occurs in a group of voluntary muscles only. Complete muscles cadaveric spasm is rare.
- Unknown mechanism (may be nervous).
- Considerable force is required to break a grip.
- Often described in battle situation.
- Record the last act of life.
- An object should be held on hand.



Cadaveric spasm in 43-year-old male with razor in right hand.

If you change the position of a dead person, he will not be fixed in his position there is a movement, so that's how you will differentiate between C.S and RM (you will see the movement)

2. Heat stiffness:

- Coagulation of muscle protein in case of burn, leading to stiffening of the body.
- No primary flaccidity in group of muscle acting.

	Rigor Mortis	Cadaveric spasm
Type of muscles	Voluntary and in voluntary	Only voluntary
Extension	All the body	Group of muscles in action(no primary flaccidity in this group)
Appearance	After 2 hours	At the moment
Type of death	All except severe burns	With severe nervous tension
Mechanisms	Chemical	`nervous?

3. Cold stiffness:

- Due to frozen of the body ,i.e. freezing of intra and extra (INTRA) cellular fluid and also the synovium.

D- Putrefaction:

- The last stage that takes place in the dead body.
- It is not like the PM changes.
- Occurs mainly due to fermentation and proteolysis enzymes of aerobic and anaerobic bacteria.
- Autolysis occurs before the action of microorganisms because proteolytic, glycolytic and lipolytic ferments of the body will act on body tissues, leading to auto digestion.

Occurrence of Putrefaction:

1. After 24 hours in summer and 36 hours in winter:

A greenish skin discoloration of the anterior abdominal wall starts opposite to the right iliac fossa due to the presence of cecum (where a larger number of microorganisms, stagnation of fluids, liberation of sulph hemoglobin) in this place.

2. Marbling phenomenon:

due to formation of gases inside the blood vessels causing there distention (arborization) under the skin and mucus membranes. It's more evident after 48 hours.



3. After 1 -3 days PM:

- Green discoloration all over, the face swollen, the feature is difficult to organize with distention of the abdomen and scrotum.
- Starts at the Right Iliac fossa

4. After one week PM:

- Putrefactive bullae under the skin, tongue protrusion and a foul coarse bloody froth at the mouth and nostrils.

5. Two weeks PM:

- Peeling of skin and the abdominal wall bursts. The viscera are liquefied to a dark doughy mass.
- Eggs of flies will become larvae (entomology of the dead).
- The body color is black and the hair and nails fall.

6. At 6 months PM:

- Bones attached with ligaments.

7. At one year after death:

- Dissolved ligament and loose bones.

8. After one year of death:

- The time is estimated by the weight of bones.

Factor affecting the rate of putrefaction:

- Age: less in child.
- Causes of death: death caused by poisoning delays putrefaction.
- High temperature and moisture accelerate putrefaction.
- Air.
- Manner of burial.
- Blood (no putrefaction without blood).
- Mutilated bodies.

Another conditions replacing Putrefaction:

A- Adipocere Formation (saponification) (التشمع):

- Adipocere is a yellow greasy rancid material.
- It is due the conversion of unsaturated fatty acids to saturated ones.
- The Process is called: wrongly saponification as it was though that soap is formed due to exchange of Na^+ and K^+ ions by Mg^{+2} and Ca^{+2} , Forming Ca^{+2} and Mg^{+2} soaps.
- Starts after 2 weeks and completes after 6 months

Medico-legal Importance:

- 1- Ante-mortem
- 2- Help in identification if dead under water
- 3- Prevent Purifications.
- 4- Estimate of the time of death.



B- Mummification (التحنيط الطبيعي):

- Brownish Pigmentation and dryness of the skin which due to high temperature, resulting in prevention of the bacterial growth.
- Starts after 2 weeks and stays for one year.

Medico legal Importance:

- 1- Helps in identification of those who were dead in the desert.



C- Embalming:

Used in cadaver Translocation.

Embalming is the act of injecting formaldehyde in the body's vessels to preserve the body (e.g. when the body needs to be transported overseas)

D- Maceration (التعطين):

- Aseptic autolytic changes occur in the body of the Fetus which had died in Utero and Remains in a sterile condition, characterized by brown red discoloration of the skin.
- Flaccidity of the body and undue mobility of the skull bones, with Rancid smell.

Entomology is the study of insects. In this context, it means the type of insects on/in the body that will determines the time of death

Estimation of PM changes Interval:

- From biological and histological changes: the lactic Acid and K⁺ content in the cerebrospinal fluid rise in the first 15 hours after death. Phosphate, chloride, and nitrogen contents of muscles and liver are also involved.
- From the rate of body cooling
- From the extent of Hypostasis
- From the distribution of RM
- From the extent of Putrefaction
- From adipocere formation and its extent
- From mummification and its extent of dryness and shrinkage of tissue.
- Entomology of the dead. Flies lay their eggs on the dead body and from the life cycle of such Fauna of the Cadaver, we can have an idea about the time passed since death.
- from gastric content, as the normal stomach empties in about 2-3 hours. Empty stomach suggest that nothing had been eating within hours before death.

This is imp. For organ donation that can occur between these two stages (molecular life)

Molecular life : period between somatic death and molecular death.

For further reading:

- <http://www-medlib.med.utah.edu/WebPath/webpath.html>
- <http://www.le.ac.uk/pathology/teach/va/titlpag1.html>
- <http://www.hbo.com/autopsy/interactive/>

Thanks