Post-Mortem Changes

Done by: Muthana Qtashat
Importance

1) Sure signs of death

2) Estimating the post-mortem interval (PMI)

3) Doctor needs to know the normal progress of decomposition so that he does not misinterpret these normal changes for signs of an unnatural death
Cessation of circulation

The heart stops
Breathing stops
Immediate fall in BP
No Oxygen to the tissues
Anaerobic metabolism
loss of neuronal activity

All nervous activity stops

• reflexes are lost including corneal reflex
• the pupils stop reacting to light.
• The eyes lose their intraocular tension.
• The muscles rapidly become flaccid (primary flaccidity)

• focal twitching
• Pale skin and mucous membranes
• The hair follicles die at the same time as the rest of the skin

• Regurgitation of gastric contents

• voiding of urine
• Emission of semen
Rigor Mortis

• Rigor : stiffness
• Mortis : death

• Normal contraction VS Rigor Mortis
1. Myosin cross bridge attaches to the actin myofilament

2. Working stroke—the myosin head pivots and bends as it pulls on the actin filament, sliding it toward the M line

3. As new ATP attaches to the myosin head, the cross bridge detaches

4. As ATP is split into ADP and P_i, cocking of the myosin head occurs

ADP and P_i (inorganic phosphate) released
Timing

• Firstly in small muscle groups (around the eyes and mouth, the jaw and the fingers)
• From Head to the legs
• In the face 1-4 hs
• In the limbs 3-6 hs after death

• Strength of rigor increasing to a maximum by approximately 18 hours after death

• Will remain for up to approximately 50 hours after death
Factors favor Rapid onset

• Warm environment VS cold
• Low glycogen level
• Muscle activity (exercise, electrocution...)
Cadaveric Rigidity

• Aka; instantaneous rigidity/spasm
• stiffness of muscles that has its onset immediately at death
• Before the onset of normal rigor
• Unknown mechanism probably neurogenic, emotional stress immediately before death
• seen in cases of drowning victims when grass, weeds, roots or other materials are clutched, and provides proof of life at the time of entry into the water
# Rigor Mortis VS Cadaveric Rigidity

<table>
<thead>
<tr>
<th>Rigor Mortis</th>
<th>Cadaveric Rigidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delayed onset (1-4 hs)</td>
<td>Instantaneous onset</td>
</tr>
<tr>
<td>More duration (up to 50 hs)</td>
<td>Few hours</td>
</tr>
<tr>
<td>Moderate intensity</td>
<td>Very strong intensity</td>
</tr>
<tr>
<td>No ATP</td>
<td>Unknown mechanism</td>
</tr>
<tr>
<td>All muscles affected gradually</td>
<td>Emotional stress</td>
</tr>
<tr>
<td></td>
<td>The muscles that were in contraction at time of death</td>
</tr>
</tbody>
</table>
Cadaveric spasm in a drowning victim: had grass from the river bank firmly clutched in the hand

Victim of suicide: The cadaveric spasm has maintained the position of his arms after the shotgun has been removed
Hypostasis

• Aka: livor mortis / postmortem lividity / suggillation

• settling of the blood in the lower (dependent) portion of the body, causing a purplish red discoloration of the skin

• Appear 20m-3h after death

• Maximum lividity occurs within 6–12 hours
Hypostasis

• The color of hypostasis is variable and may extend from:
  • pink to dark pink to deep purple
  • in some congestive hypoxic states, to blue.

• in pressure areas such as the shoulder blades, buttock & calves → discoloration will be pale.

• Some indicators:
  • Cherry-pink: CO poisoning
  • Dark red: cyanide poisoning
  • Bronze: Clostridium perfringes infection.
Hypostasis

If the body remains vertical after death as in hanging cases, hypostasis will be most marked in the feet and to a lesser extent the hands.
Hypostasis

• Hypostasis is not always seen

• it may be absent in:
  - the young, the old
  - anemic
  - death from severe blood loss.

• It may be masked:
  - by dark skin colors
  - by jaundice
  - by some dermatological conditions.
Hypostasis

• once hypostasis is established, there is controversy about its ability to undergo subsequent gravitational shift if the body is moved into a different posture.

• **Primary hypostasis** may either:
  • Remain fixed
  • Move completely to the newly dependent zone
  • Be partly fixed and partly relocated
Sites of hypostasis

• Depends on the position of the body **before** death:
  • **Supine:**
    • shoulders, buttocks
    • heels pressing against surface give white color (pale).
  • **Vertical (hanging):**
    • distally in legs & feet.
  • **Drowning:**
    • chest, upper chest, and upper limbs.
  • **Face-down death:**
    • as in *epilepsy, drunken victims*
    • whitening around nose & lips.

• Hypostasis may also occur in **viscera:**
  • **Heart:** mistaken for MI
  • **Lungs:** mistaken for pneumonia
  • **Intestine:** mistaken for hemorrhagic infarction
## Hypostasis vs. Bruises (Ecchymosis)

<table>
<thead>
<tr>
<th>Hypostasis</th>
<th>Bruises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependant areas</td>
<td>Any where</td>
</tr>
<tr>
<td>Well defined edges</td>
<td>Ill defined edges</td>
</tr>
<tr>
<td>Blood is retained in intact capillaries</td>
<td>Blood escapes through ruptured capillaries</td>
</tr>
<tr>
<td>Superficial</td>
<td>Deep into skin</td>
</tr>
<tr>
<td>Same level on surface</td>
<td>Raised</td>
</tr>
<tr>
<td>Pale over pressure areas</td>
<td>Red</td>
</tr>
<tr>
<td>Incision: blood flows from the cut vessel (washable)</td>
<td>Incision: blood coagulates in tissue</td>
</tr>
<tr>
<td>No swelling</td>
<td>May be with swelling</td>
</tr>
</tbody>
</table>

With a bruise, blood will not flow from the cut.
Cooling of the body after death

• Aka: Algor Mortis
• Algor: coldness

• simple physical property of a warm object in a cooler environment

• 2°C during the first hour
• 1°C per hour until the body nears ambient temperature
To use body temperature as an indicator of the time of death, 3 forensic assumptions must be made:

1. the body temperature was 37°C at the time of death
2. that it is possible to take one, or perhaps a few, post-mortem body temperature readings and, using mathematical formulae, to generate a reliable estimate of the time taken by that body to cool to that measured temperature.
3. the body has lain in a thermally static environment
Factors affecting the rate of cooling of a body

- Mass of the body
- Surface area
- Body temperature at the time of death
- Site of reading of body temperature(s)
- Posture of the body – extended or curled into a fetal position
- Clothing – type of material, position on the body – or lack of it
- Obesity – fat is a good insulator
- Emaciation – lack of muscle bulk allows a body to cool faster
- Environmental temperature
- Winds, draughts, rain, humidity
Other post-mortem changes (decomposition)

Done by: Abeer Husein
Additional changes that happen as the post-mortem interval increases

Tissue breakdown, autolysis
1. Putrefaction
2. Adipocere
3. Mumification
4. Skeletelization
1. Putrefaction

- Start immediately after death at the cellular level
- Become visible by naked eye at about 3-4 days
- Its onset depend on several factors mainly: temperature and humidity
- Two phenomena for putrefaction:
  1. **Autolysis**: by digestive enzymes that released from the cells
  2. **Bacterial action**: most of them come from the bowel and *Clostridium welchii* predominates
Start as an area of green discoloration of the Rt iliac fossa of the ant. Abdominal wall

The gut bacteria find their way out the bowel lumen to the abdominal cavity and the blood vessels

As the bacteria spread through the blood vessels they decompose hemoglobin

When present in the superficial vessels results in linear branching patterns of variable discoloration of the skin called “marbling”
Over time there will be generalized skin discoloration
Formation of blisters containing red or brown fluid that can burst
Gas formation in soft tissues and body cavities
Body begins to swell
Eyes and tongue protrude
Blood-stained fluid leaks out of the mouth and nose
Prostate and uterus are relatively resistant to putrefaction
2. Adipocere

- is a chemical change in the body fat
  It occurs in subcutaneous fat of the cheeks, breast, buttocks and may occur in internal organs such as liver, kidney & heart.
- It needs months to occur, and occurs partially
- Moisture is necessary.
- The optimum conditions for the formation of adipocere:
  - wet, warm environment
  - bacterial activity (C. perfiringes).
- It is a grayish, greasy material
- may be dry, brittle, & have an odor similar to that of ammonia.
3. Mumification

- drying & shriveling of the tissues
- The optimum conditions are dry & warm climate.
- Once the changes are complete, the body will remain in that condition indefinitely.
- Also seen in newborn infants (sterile)
- No growth of micro organisms.
4. Skeletelization

- The speed of skeletelization depends on climate and microenvironment around the body.
- More quickly in a body on the surface than in one that is buried.
<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>2 years</td>
<td>Soft tissue is absent; Tendons, ligaments, hair and nails are identifiable</td>
</tr>
<tr>
<td>5 years</td>
<td>Bones will be bare</td>
</tr>
<tr>
<td>40-50 years</td>
<td>Bone becomes dry &amp; brittle</td>
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</tbody>
</table>
Estimating the time of death

1. Body temperature:
   the best and the most commonly used
   Rectally using long, low-reading thermometer

2. Rigor mortis

3. Hypostasis:
   complete after 6 hrs

4. Biochemical investigation of the CSF:
   requires the determination of the amino acid content & lactic acid & non-protein nitrogen content of the CSF.
5. Eye pressure:
   eye balls become softer, and less fluid pressure in the first 3 hrs

6. Gastric emptying:
   depend on type of meal and emotional status.

7. The entomology of dead:
   Studying insects & their maggots which infest the dead body for estimating the probable time of death.
   Different types of insects infest the dead body at different stages after death occurs.