

FORENSIC & TOXICOLOGY SUMMARY

Done by Shahed Atiyat

Death and postmortem changes

- ✓ **Cause** of death: Injury or disease (Stab wound, adenocarcinoma, ...).
- ✓ **Mechanism** of death: Physiologic derangement produced by the cause of death (Hemorrhage, acidosis, ...).
- ✓ **Manner** of death: How the cause of death came (Natural, accidental, homicide, suicide or undetermined).
- ✓ **Mode** of death: The abnormal physiologic state that pertained at the time of death (Coma, syncope, or asphyxia).
- ✓ Agonal period: The time between a lethal occurrence and death.

Postmortem changes (Immediate, early & late)

Immediate changes (Somatic death)

1. Irreversible cessation of the function of brain (earliest sign). Flat EEG
2. Irreversible cessation of respiration (>4 min). No breath sounds
3. Irreversible cessation of circulation (>3-5 min). Flat ECG

Early changes (Molecular death)

1. Facial pallor and loss of skin elasticity.
2. Primary relaxation and flaccidity of the muscles (the muscles still alive), **1 h after death**.
3. Contact flattening and pallor.
4. Changes in the eyes:
 - ❖ Loss of corneal and pupillary reflexes.
 - ❖ Pupils: Constricted (was dilated in immediate changes).
 - ❖ Tache noire.
 - ❖ Kevorkian sign
 - ❖ Loss of intraocular tension (from 10-22 mmHg to zero **within 4-8h**).
5. Algor mortis.
6. Livor mortis
7. Rigor mortis

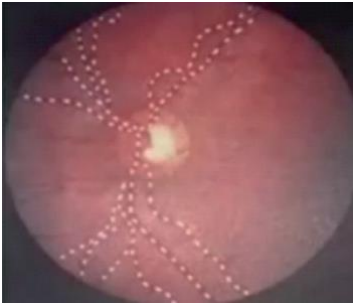


Tache noire

Sign of molecular death.

Yellow triangles in sclera > brown > black

Happen due to **drying** / desiccation and deposition of cellular debris, mucus and dust if eye opened for **3-4h** after death



Kevorkian sign

Sign of molecular death.

Retinal vessels appear segmented (cattle trucking or shunting).

Happens within second to minutes and persists for about an hour.

Algor mortis

- ❖ **Cooling** of the dead body.
- ❖ Cause: Cessation of the energy production and inactivity of the heat regulating center after somatic death.
- ❖ Factors: Age, clothing, environment temp., manner of death, body condition.
- ❖ The average rate of fall of body temperature is 1 C/h.
- ❖ **Rapid cooling delays the rigor mortis and decomposition.**

Livor mortis (PM staining)



Normal color is **bluish or purplish-red** discoloration.

Cause: Gravitational settling of the blood in the toneless vessels.

Site: Undersurface of skin in the superficial layer of the dermis.

Strat after 30 min to 1 h as small patches then increase in size after 3-4h, fully developed in 5-6 h. If the body is undisturbed, it will be fixed in 8-12h and persist until putrefaction.



Bright red Livor mortis

Indicates **cyanide** poisoning



Cherry red Livor mortis

This indicates **CO** poisoning



Pale and not well-developed Livor mortis

May be due to **anemia** or **hemorrhage**

*Note: the non stained areas called **contact pallor**.

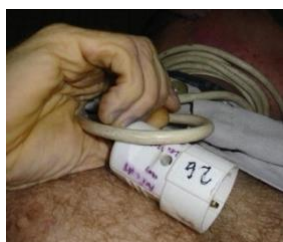
Difference between Livor Mortis (hypostasis) and bruises:

Hypostasis	Bruises
Dependent area	Any where
Well defined edges	Ill defined edges
Intact capillaries	Ruptured capillaries
Blanchable	Unblanchable
Superficial	Deep into the skin
Incision: blood flows from cut vessels (washable)	Incision: blood coagulate in the tissue
No swelling	May be with swelling
Same level on surface	Raised



Rigor mortis

- ❖ **Muscle stiffening** with some degree of shortening.
- ❖ **Onset: Starts 1-2 h after death (after primary relaxation), takes 9-12h to develop from head to foot, persists for 12h and takes 12h to pass off.**
- ❖ Develops **faster** in case of **electrocution** (faster ATP depletion).
- ❖ Causes: Persistent attachments of actin filaments to myosin due to the lack of ATP along with the loss of muscle softness and elasticity.
- ❖ Occur in voluntary and involuntary muscles (earlier in the involuntary).
- ❖ First appears in the heart muscle within an hour after death.
- ❖ Among voluntary muscles develops **sequentially** and follows a **descending** pattern.
- ❖ The rigidity disappears in the same order in which it has appeared.
- ❖ Stays for maximum duration in the muscles of the lower limbs.



Cadaveric spasm

The muscles were contracted immediately **before** death and continue to be so after death **without passing through primary relaxation**.

It's **antemortem** phenomenon reflects the last act of the body.

It occurs especially in cases of sudden death, excitement, fear, severe pain, exhaustion, cerebral hemorrhage, electrocution, injury to the nervous system, firearm wound of the head, or convulsant poisons.



Heat stiffening

The body is subjected to a heat exposure $> 65\text{ C}$.

There will be coagulation of the muscle protein, flexors affected more.



Cold stiffening

The body is exposed to freezing temperature for a reasonable period

There will be a freezing of body fluids and hardening of the subcutaneous fatty tissue

*Note: Secondary relaxation occurs after rigor mortis. It occurs with the onset of decomposition or putrefaction.

Late changes

1. Decomposition/putrefaction

- ❖ A process of breaking down of complex organic body tissue into simpler inorganic compounds or elements due to autolysis or action of saprophytic microorganisms.
- ❖ Clostridium Welchii is the main organism in putrefaction.
- ❖ External signs: 4 Ds (Discoloration, Distention, Degradation, Dissolution).
- ❖ Internal signs: Organ decomposition, uterus and prostate being the last organs to decompose.



Discoloration

The first external sign of decomposition, **starts 2 days after death.**

Greenish discoloration in the right iliac fossa; due to the reaction between H_2S and deoxygenated Hb



Marbling of skin

First appear in the shoulders, roots of limbs, thigh, sides of abdomen, chest and neck.

It marks the passage of bacteria; happens due to decomposition of Hb to sulphmethemoglobin in the inner wall of superficial vessels



Degradation

Loss of anatomic integrity of skin.

Skin slippage, loosening of skin of hand and feet (degloving) & loosening of hair and nails.

*Distention happens due to accumulation of various gases produced during decomposition.

*Dissolution occurs with progressive decomposition that leads to liquefaction and disappearance of tissue and organs and eventual skeletonization.

2. Adipocere (Saponification)



The **surest** sign of death.

In hot and moist environment, it may occur by the end of 1 week. In temperate countries, it starts in 3 weeks and completes in about 3 months.

Offensive sweet rancid smelling with whitish, crumbly and greasy material.

3. Mummification



Onset: 3-12 months after death.

The body loses weight and becomes thin, stiff and odorless.

Favoring factors: Hot environment, dry atmosphere, free air environment, poisoning.

	Somatic death	Molecular death
onset	Precedes molecular death	Succeeds somatic death (1-2 hours after stoppage of vital functions)
Tissues and cells of body	Alive and functioning	Dead and non-functioning with no metabolic activity
Response to external stimuli	Muscle responds to thermal, electrical or chemical stimulus	Does not respond
Confirmation	Flat ECG and EEG, and absent breath sounds	Rigor mortis, algor mortis, postmortem staining, putrefaction
Resemblance	Suspended animation, coma, hypothermia	Does not resemble any condition

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