



# MECHANICAL ASPHYXIA

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# Lecture items

- General concepts
- Classification of asphyxias and mechanical asphyxias
- Clinical course of mechanical asphyxia
- General asphyxial signs (asphyxial stigmata)
- Specific signs of hanging, strangulation by hand and ligature, positional asphyxia, thoraco-abdominal compression, obstruction of respiratory orifices and airways

# General concepts

**Asphyxia** comes from the Greek - a "missing, absence" and σφυγμός (sphygmos) "pulse": no pulse, absence (stopping) of the pulse.

**Asphyxia** is a pathological condition of the organism due to deprivation of oxygen and an excess increasing of the carbon dioxide.

Asphyxiation causes can be both:

diseases (**pathological asphyxia**) and external factors (**mechanical asphyxia**).

# Classification of asphyxia

## Intake asphyxia

**Violent**

**Pathological**

### Insufficient oxygen in the inspired air

Confined or thin air

### Obstacle on airways

Compression (hanging, strangulation)  
Obstruction (foreign bodies, drowning)

Tumors of the larynx, trachea, bronchi

### Impeding the gas exchange

Pulmonary agents (suffocative or other noxious gases)- Diphosgen, Phosgen

Pneumonia, lung disease

### Impeding the respiratory movements

Thoraco-abdominal compression  
Positional asphyxia  
Traumatic pneumothorax

Pathological pneumothorax

# Classification of asphyxia

## Transportation asphyxia

Violent	Pathological
<b>Hemoglobin blockage</b>	<b>Pathological states</b>
Carboxihemoglobin Methemoglobin	Stagnant (cardio-circulatory failure) Ischemic (coronary heart disease) Anemia (anemia, impaired hemoglobin) Intrauterine hypoxia

## Utilization asphyxia

Histotoxic hypoxia (disturbance in respiratory enzymatic systems)

# Classification of mechanical asphyxia based on the mechanism of causing

## Compression asphyxia

- Hanging
- Strangulation by ligature
- Strangulation by hand (s)
- Thoraco-abdominal compression

## Obstruction asphyxia

- Of respiratory orifices (nose, mouth) – suffocation
- Of airways
  - Blockage of airway by foreign bodies
  - Aspiration of liquids, blood, gastric content
  - Drowning

## Positional asphyxia

## Asphyxia due to confined air

# The clinical course of mechanical asphyxia

1. Preasphyxial stage (compensated)  $\approx$  1-2 min.
2. Asphyxial stage (decompensated)  $\approx$  5 min.
  - Inspiratory dyspnea
  - Expiratory dyspnea
  - Transient apnea or silent dyspnea
  - Terminal breath
  - Stable apnea or respiratory arrest
  - Cardiac arrest

# General asphyxial signs (asphyxial stigmata)

## External

- Petechiae on the skin and mucosa of the face, conjunctiva
- Cyanosis (purple discoloration of nailbeds and face, including lips and earlobes)
- Livor mortis are purple, faster, and wider
- Signs of involuntary urination, defecation and ejaculate

## Internal

- Fluidity of blood
- Congestion of internal organs, mainly pulmonary and cerebral congestion and edema
- Spleen anemia - **Sabinski**
- Dilation of right ventricle
- Petechiae on serosal surfaces (epicardium, visceral pleura) – **Tardieu**



# Hanging

It is a mechanical asphyxia due to constriction of the neck anatomical structures by a ligature, using the weight of the body, as a result of suspension.

## **The manner**

Suicide – as a rule

Homicide – rare

Accidental – very rare

# Hanging - classification

**Complete** - free suspension

**Incomplete** - a part of the body is supported



# Hanging - classification

Knot location:

**Typical**



**Atypical**



# Hanging – classification

depending on the ligature

## By material

**Hard** (wires, chains, crotch of the tree)

**Semi-hard** (ropes, belts, cables)

**Soft** (sheets, towels, clothes)

## Width across:

**Thin** (up to 0.3 cm)

**Thick** (up to 1cm)

**Late** (more than 1cm)

## Knot construction

**Open ligature** - no knot

**Fixed knot**

**Mobile knot**

**Number circulars around the neck:**

**Single**

**Double**

**Multiple**



# Hanging

## Mechanisms of death

1. Anoxic anoxia
2. Hemodynamic
3. Neuroreflector
4. Traumatic

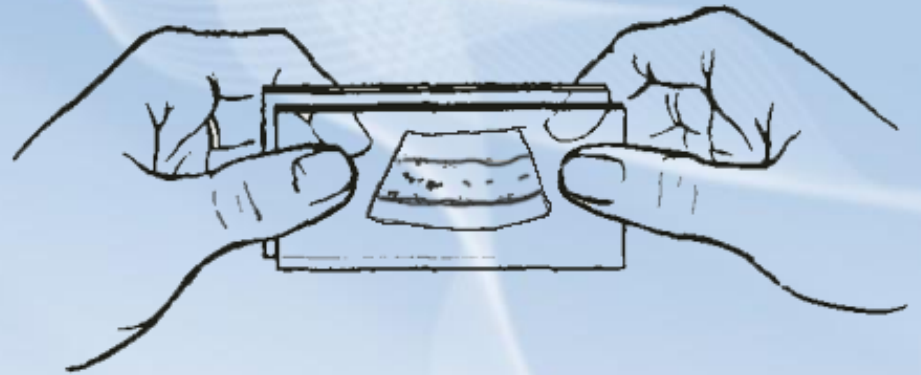
# Hanging

Morphological appearances

## External

Ligature mark (furrow)

- Incomplete
- Superior
- Oblique
- Irregular depth



**Bokarius test**



# Hanging

Morphological appearances

## Internal

Soft tissues hemorrhages

- Sternocleidomastoidian hemorrhages (Walker)
- Pericarotidian hemorrhages (Martin)

Transversal ruptures of the carotid arteries intima (Amusat)

Hyoid and larynx fractures

Lymph node hemorrhages

Trauma of the cervical spinal column

# Strangulation by ligature

a mechanical asphyxia due to constriction of the neck anatomical structures by a ligature, using an external force

Ligature mark (furrow)

Signs of self-defense

Soft tissues hemorrhages (excepted signs of elongation: Walker, Amusat)

sign	Strangulation	Hanging
Localized on the neck in	Middle part	Superior part
orientation	transversal	oblique
depth	uniform	deeper opposite to knot
continuity	continue	discontinue



# Strangulation by hand (s)

Morphological appearance:

External:

- Linear or semilunar abrasions
- Oval and round bruises
- Signs of self-defense

Internal:

- Massive soft tissues

hemorrhages

- Hyoid and larynx fractures



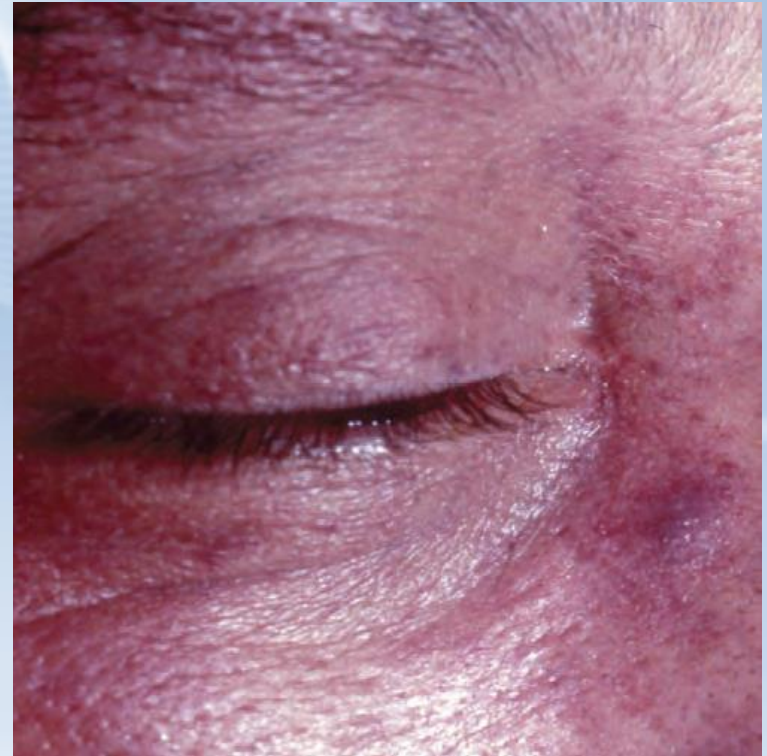
# Thoraco-abdominal compression

A constraint or blockage of respiratory movements

Mechanism of death:  
asphyxia or trauma

Morphological appearance:

- ecchymotic mask
- signs of trauma (external and internal)
- carmine pulmonary edema



# Suffocation

A mechanical asphyxia due to obstruction of the respiratory orifices (nose and mouth) by hand or soft objects (pillow, plastic bag, mammary gland)

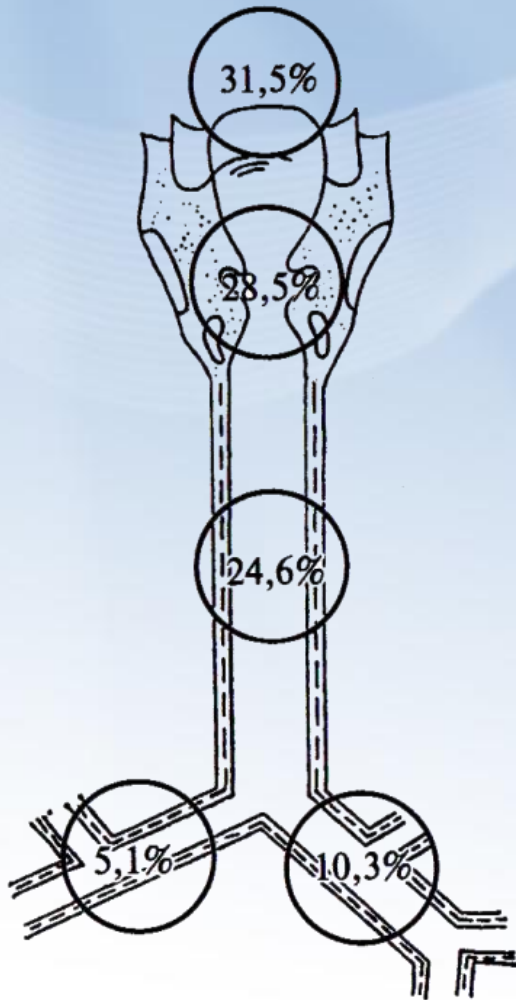
Mechanism of death: asphyxia

Morphological appearance:

- Bruises and abrasion round the nose and mouth
- Hemorrhages below lips mucosa and lacerations on it
- Signs of self-defense
- Particles from objects in mouth cavity and airways

# Blockage of airway by foreign bodies and aspiration

Mechanism of death: asphyxia





# Drowning

A mechanical asphyxia due to obstruction of airways by liquids.

## Forms of drowning

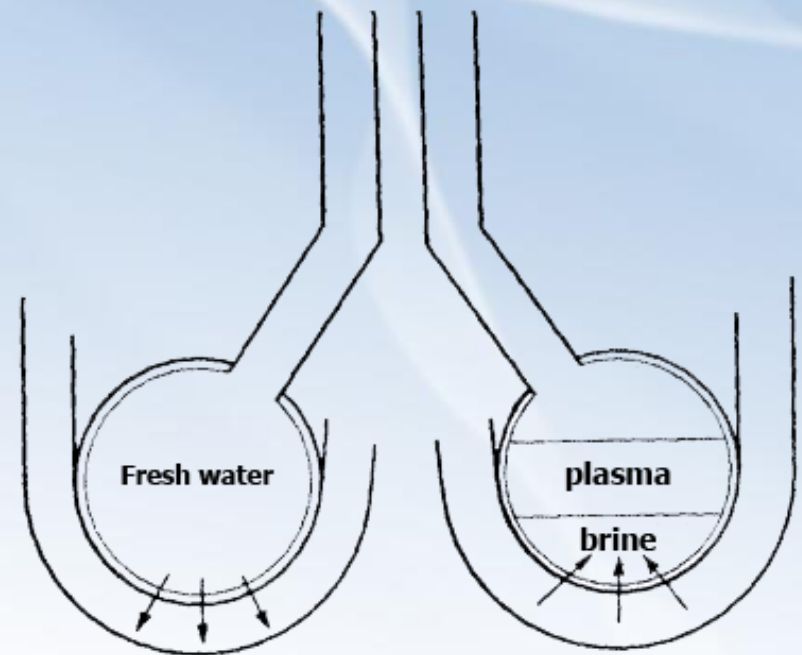
Aspiration

Spastic

Reflector

Mixt

## Mechanisms of death



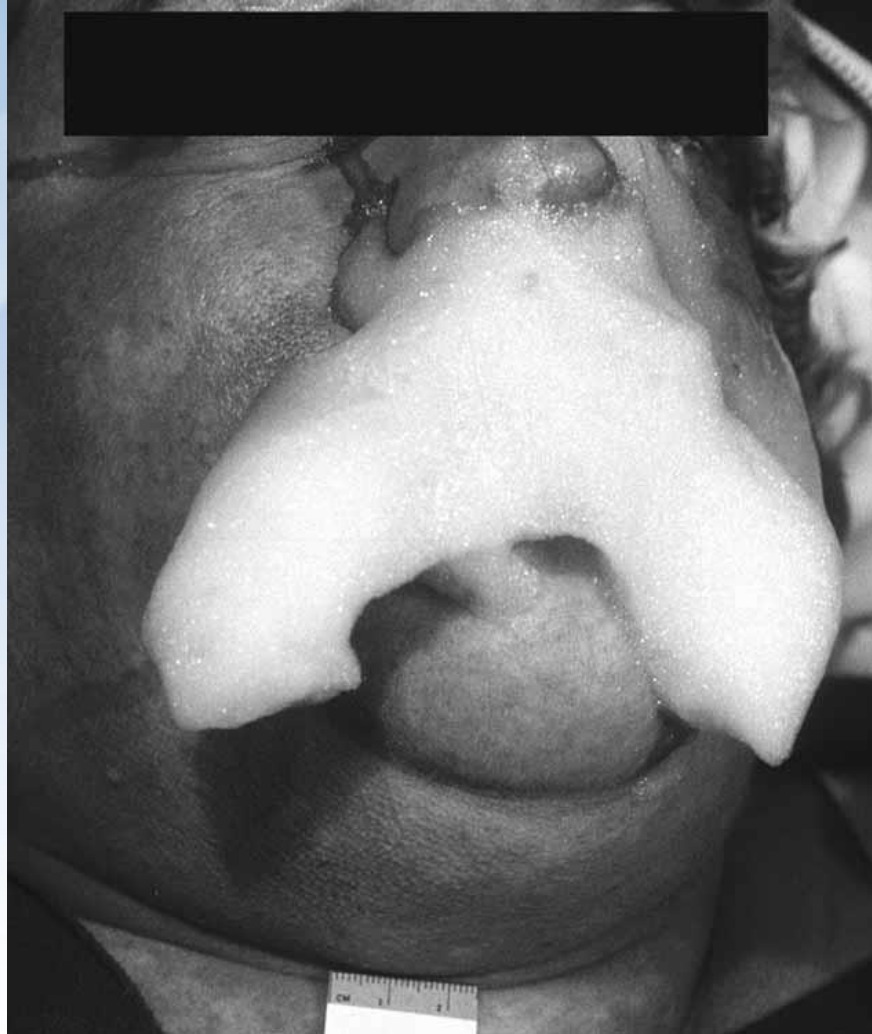
# Drowning

## Signs of drowning

- Foam (mushroom) at the mouth and nose (Krushewski)
- The increase in the circumference of the chest
- Smoothing over the supra- and subclavian fossae
- Foam inside the airways
- Pulmonary edema
- The fluid in the stomach and upper small intestine with silt, sand, algae (Fegerlund)
- Hemodilution in left half of the heart, blood is cherry-red color (Casper)
- Rasskazov-Lukomsky-Paltauf spots
- The submersion fluid in the sinus of sphenoid bone (Sveshnicov)
- Air embolism of the left heart (Isaev)
- Lymphohemia (Isaev)

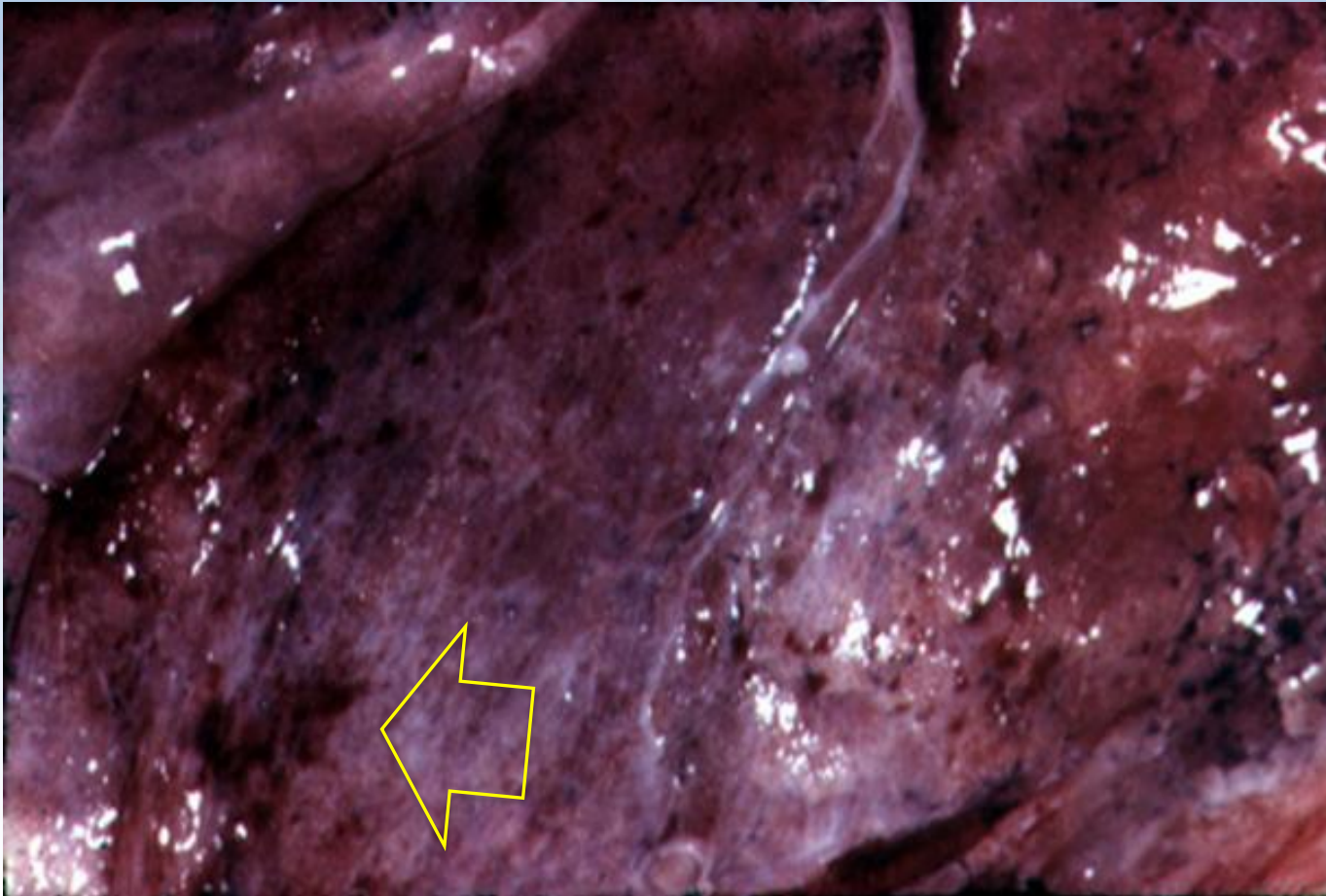
# Drowning

Foam (mushroom) at the mouth and nose  
(Kruszewski)



# Drowning

## Rasskazov-Lukomsky-Paltauf spots



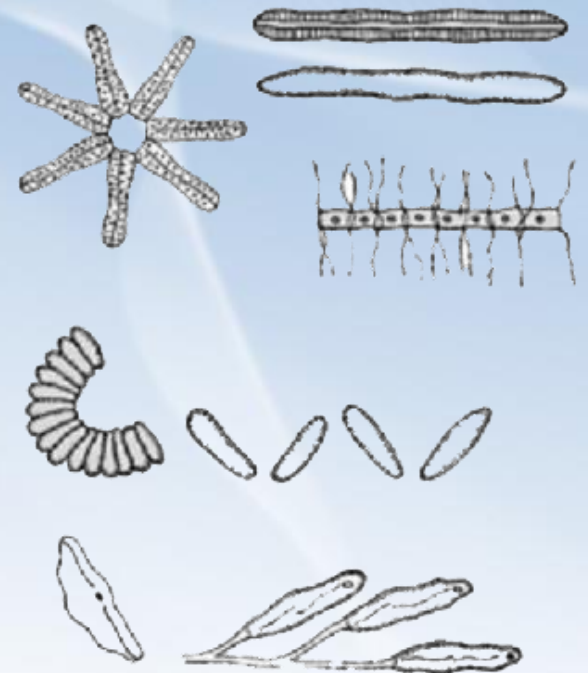
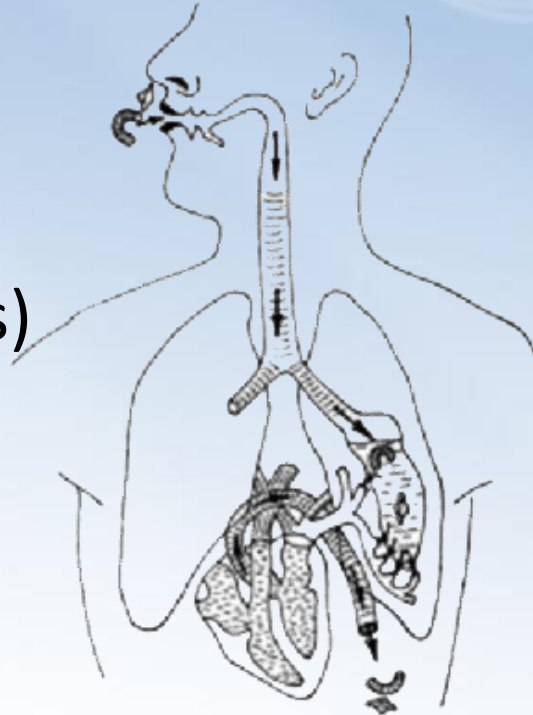


# Drowning

## Laboratory investigation

the organisms inhabiting the surface layer of a sea or lake, consisting of small drifting plants (phytoplankton) and animals (zooplankton), such as diatoms

plankton (diatoms)



# Drowning

## Signs of retention in water

- Gooseflesh
- Pale skin
- Nipples and scrotum shriveled
- Hair loss
- Maceration of the skin (wrinkled, pale, "the hand of the laundress," "glove of death")
- Rapid cooling the corpse
- Destruction the corpse by aquatic animals
- Putrefaction is faster (after recovered from water)
- Adipocere

# Drowning

## Gooseflesh and shriveled nipple



# Drowning

## Maceration of the skin

