MECHANICAL ASPHYXIA

Prelection by Vasile Șarpe
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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

<table>
<thead>
<tr>
<th>Violent</th>
<th>Pathological</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insufficient oxygen in the inspired air</strong></td>
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<tr>
<td>Confined or thin air</td>
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<tr>
<td><strong>Obstacle on airways</strong></td>
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<tr>
<td>Compression (hanging, strangulation)</td>
<td>Tumors of the larynx, trachea, bronchi</td>
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<tr>
<td>Obstruction (foreign bodies, drowning)</td>
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<tr>
<td><strong>Impeding the gas exchange</strong></td>
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<tr>
<td>Pulmonary agents (suffocative or other noxious gases)- Diphosgen, Phosgen</td>
<td>Pneumonia, lung disease</td>
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<tr>
<td><strong>Impeding the respiratory movements</strong></td>
<td></td>
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<tr>
<td>Thoraco-abdominal compression</td>
<td>Pathological pneumothorax</td>
</tr>
<tr>
<td>Positional asphyxia</td>
<td></td>
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<tr>
<td>Traumatic pneumothorax</td>
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</tbody>
</table>
## Classification of asphyxia

### Transportation asphyxia

<table>
<thead>
<tr>
<th>Violent</th>
<th>Pathological</th>
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<tbody>
<tr>
<td>Hemoglobin blockage</td>
<td>Pathological states</td>
</tr>
<tr>
<td>Carboxyhemoglobin</td>
<td>Stagnant (cardio-circulatory failure)</td>
</tr>
<tr>
<td>Methemoglobin</td>
<td>Ischemic (coronary heart disease)</td>
</tr>
<tr>
<td>Anemia (anemia, impaired hemoglobin)</td>
<td>Intrauterine hypoxia</td>
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</tbody>
</table>

### Utilization asphyxia

Histotoxic hypoxia (disturbance in respiratory enzymatic systems)

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Vasile Șarpe - medicina legală - USMF „N.Testemițanu”
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) ≈ 1-2 min.
2. Asphyxial stage (decompensated) ≈ 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 1 cm)
- **Late** (more than 1 cm)

Knot construction
- **Open ligature** - no knot
- **Fixed** knot
- **Mobile** knot

Number circulars around the neck:
- **Single**
- **Double**
- **Multiple**
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)

<table>
<thead>
<tr>
<th>sign</th>
<th>Strangulation</th>
<th>Hanging</th>
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<tbody>
<tr>
<td>Localized on the neck in</td>
<td>Middle part</td>
<td>Superior part</td>
</tr>
<tr>
<td>orientation</td>
<td>transversal</td>
<td>oblique</td>
</tr>
<tr>
<td>depth</td>
<td>uniform</td>
<td>deeper opposite to knot</td>
</tr>
<tr>
<td>continuity</td>
<td>continue</td>
<td>discontinue</td>
</tr>
</tbody>
</table>
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 (Krushewski)
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