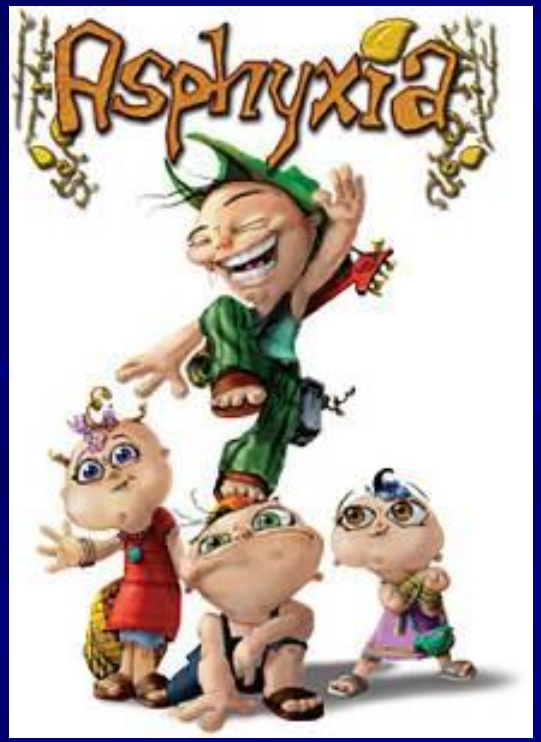
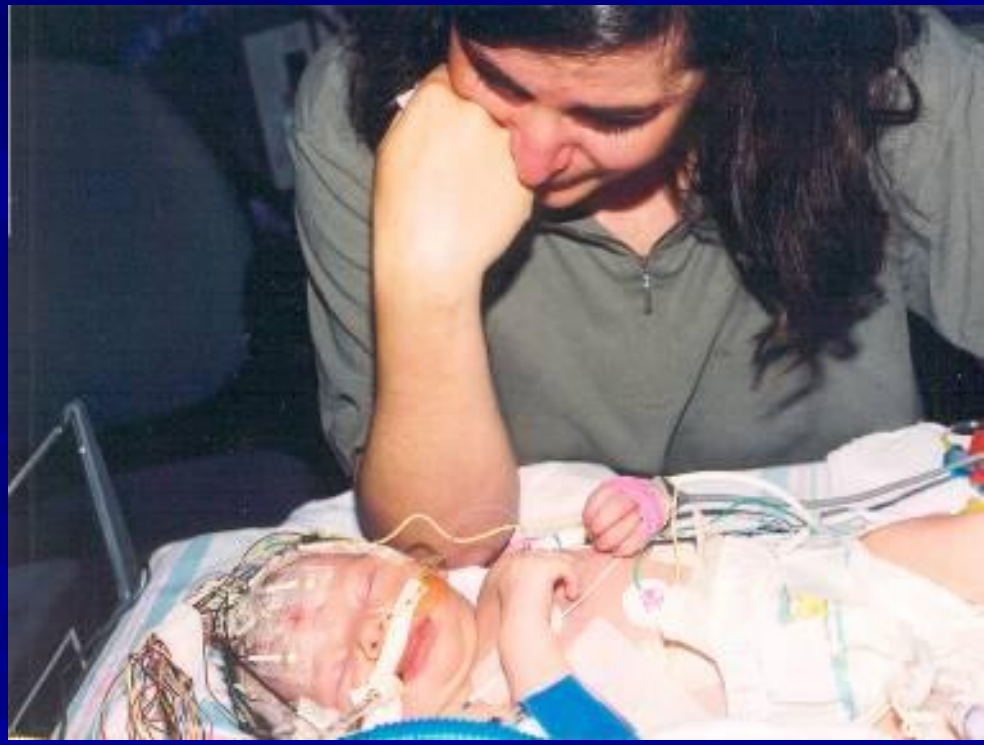
ZAPOROZHIAL STATE MEDICAL UNIVERSITY
THE DEPARTMENT OF PATHOLOGICAL ANATOMY and FORENSIC MEDICINE

ASPHYXIA





ASPHYXIA

ASPHYXIA - is a condition caused by interference with respiration or due to lack of oxygen in respired air, due to which the organs and tissues are deprived of oxygen (together with failure to eliminate CO_2), which may cause unconsciousness and death.

ASPHYXIA

Nervous tissues are affected first by deficiency of oxygen, and their functions are disturbed even by mild oxygen lack.

The neurons of the cerebral cortex will die in 3 to 7 minutes of complete oxygen deprivation, and the other nerve cells remain alive for a little longer time.

Subnormal oxygen in the blood supply to the brain causes rapid unconsciousness.

The rule of thumb is: breathing stops within 20 seconds of cardiac arrest, and heart stops within 20 minutes of stopping of breathing.

TYPES OF ASPHYXIA

Mechanical:

(a) hanging,
(b) strangulation,
(c) throttling,
(d) traumatic asphyxia,
(e) smothering,
(f) choking,
(g) drowning.

Pathological

Bronchitis, acute oedema of the glottis, laryngeal spasm, tumours and abscesses

Toxic

CO, CYANIDES, BARBITURATES, OPIUM, STRYCHNINE, GELSEMIUM

TYPES OF MECHANICAL ASPHYXIA:
hanging, strangulation, throttling

TYPES OF MECHANICAL ASPHYXIA:

smothering

TYPES OF MECHANICAL ASPHYXIA:
smothering, choking, traumatic asphyxia

MECHANISM OF ASPHYXIA

Pathology: Reduction in oxygen causes capillary dilation which is followed by stasis of blood in the dilated capillaries and in the venules, which produces capillaro-venous engorgement.

This blood stasis causes congestion of organs and venous return to the heart is diminished leading to anoxia, which causes capillary dilation and the vicious cycle goes on.

Petechial haemorrhages are caused due to raised venous pressure from impaired venous return and due to hypoxia of the vessel walls.

Post-mortem Appearances

External:

1. Postmortem lividity is well developed.
   The face is either pale in slow asphyxia, or distorted, congested, often cyanosed and purple, and sometimes swollen and oedematous.
   Ears and fingernails are bluish.
2. The tongue is protruded in most cases, and frothy and bloody mucus escapes from the mouth and nostrils.

Post-mortem Appearances

External:

3. The eyes are prominent, the conjunctivae are congested and the pupils are dilated.
4. Petechial haemorrhages, known as Tardieu spots are frequently seen in the conjunctivae.

Post-mortem Appearances

External:

5. Tracks of urine, excrement and sperm on body and clothes.

There may be blood on the clothing and relaxation of the bladder and bowels in people who hang themselves. It is also common for the decedent's feet to be touching the floor or ground.

Post-mortem Appearances

Internal:

1. The blood is fluid and dark, because of increased amount of CO2.
2. The large veins are full of blood.
3. The larynx and trachea are usually congested and contain a varying amount of slightly frothy mucus.
4. The lungs are dark and purple. The retained air compresses pulmonary capillaries and cause congestion.

Post-mortem Appearances

Internal:

5. If the backpressure persists, there is exudation of serous or sero-sanguineous fluid in the alveoli, producing oedema.

6. Some of the marginal portions of the lungs may show emphysematous change.

7. The abdominal viscera show marked venous congestion.

8. The brain is often congested.

Post-mortem Appearances

Internal:

9. The cranial sinuses are usually filled with dark blood.

10. Dilatation of heart chambers on right side and fluidity of blood in deaths due to asphyxia are absolute.

11. Tardieu spots are numerous where the capillaries are least firmly supported, as in subconjunctival tissues and under the pleural and pericardial membranes.

TYPES OF MECHANICAL ASPHYXIA

In this the air-passages are blocked mechanically:

1. Closure of the air-passages by external pressure on the neck, as in **hanging, strangulation, throttling** or manual **strangulation.**

2. Closure of the external respiratory orifices, as in **smothering,**
   -closure of the air-passages by the impaction of foreign bodies in the larynx or pharynx, as in **choking,**
   -prevention of entry of air due to the air-passages being filled with fluid, as in **drowning.**

3. External compression of the chest and abdominal walls interfering with respiratory movements, as in **traumatic asphyxia.**

HANGING

Hanging is that form of asphyxia, which is caused by suspension of the body by a ligature which encircles the neck, the constricting force being the weight of the body.

The whole weight of the body is not necessary, and only a comparatively slight force is enough to produce death.

HANGING

In "partial hanging" the bodies are partially suspended or are in a sitting, kneeling, lying down, prone or any other posture. The weight of the head acts as the constricting force.

In "typical hanging", the ligature runs from the midline above the thyroid cartilage symmetrically upwards on both sides of the neck to the occipital region.

Typical hanging

Partial hanging

VARIETY OF POSTURES AT HANGING

VARIETY OF POSTURES AT HANGING

VARIETY OF POSTURES AT HANGING

TYPES OF LIGATURE

Ligature: A suicide will use any article which is readily available for the purpose, like a rope, metallic chains and wires, leather strap, belt, bed sheet, scarf.

The doctor should note:

1) whether the mark on the neck corresponds with the material alleged to have been used in hanging,

2) if it is strong enough to bear the weight and the jerk of the body,

3) its texture and length to know whether it was sufficient to hang.

TYPES OF LIGATURE

HANGING

Causes of Death:

1) Asphyxia
2) Venous congestion
3) Combined asphyxia and venous congestion
4) Cerebral anaemia
5) Reflex vagal inhibition
6) Fracture or dislocation of the cervical vertebrae.

HANGING

Post-mortem Appearances:

The ligature mark in the neck is the most important and specific sign of death from hanging.

Ligature mark on the neck depends on:

1) Composition of ligature.
2) Width and multiplicity of ligature.
3) The weight of the body suspended and the degree of suspension.
4) The tightness of encircling ligature.

HANGING

Post-mortem Appearances:

Ligature mark on the neck depends on:

5) The length of time body has been suspended.

6) Position of the knot.

7) Slipping of ligature during suspension

Ligature Mark

The ligature produces a furrow or a groove in the tissues which is pale in colour, but it later becomes yellowish or yellow-brown and hard like parchment, due to the drying of the slightly abraded skin.

Ligature Mark

The course of the groove depends on whether a fixed or running noose has been used.

Ligature Mark

Metallic chains

Post-mortem Appearances at Hanging:

1) common postmortem signs of asphyxia.
2) ligature mark around the neck,
3) presence of abrasions, ecchymoses and redness about the ligature mark,
4) trickling of saliva from the mouth,

Post-mortem Appearances at Hanging:

5) ecchymoses of the larynx or epiglottis,

6) rupture of the intima of the carotid,

Post-mortem Appearances at Hanging:

7) the tongue swollen and often bruised, dark-coloured and protruded.

There is hemorrhage in the base of tongue

Hanging

The Circumstances of Death:

Scene of Crime: Note the posture of the body, any signs of violence or disorder of furniture, etc. and the condition of the clothing of the deceased.

Hanging

The Circumstances of Death:

Accidental Hanging.

It is seen is children during play while imitating judicial hanging, or in athletes who are in the habit of exhibiting hanging.

Some padding between ligature and neck suggests accident.

Workmen in falling from scaffolding may be hanged by becoming entangled in ropes.

Hanging

Suicidal Hanging:

Hanging is a common method of committing suicide.

In most cases, the body is found in a completely suspended position, with the ligature tied to a beam, nail, hook, window-casing, branch of a tree, etc.

The body must be in a position compatible with self-suspension.

Hanging

Homicidal Hanging: It is extremely rare.

It is difficult for a single assailant to carry it out unless the victim becomes unconscious by injury or by a drug, or is taken unawares, or is a child or a very weak person.

Homicide should be suspected:

1) Where there are signs of violence or disorder of furniture or other objects.

2) Where the clothing of the deceased is torn or disarranged.

3) Where there are injuries, either offensive or defensive. In all doubtful cases, circumstantial evidence is important.

STRANGULATION

Strangulation is that form of asphyxia, which is caused from constriction of the neck by a ligature without suspending the body.

There are two types:

1) strangulation by a ligature,

2) manual strangulation or throttling.

STRANGULATION

Rope with hammer

Rubber tube

STRANGULATION

STRANGULATION

Post-mortem Appearances:

External:

The Ligature Mark: It is usually a well-defined and slightly depressed mark at any level on the neck, but usually about the middle or below the thyroid cartilage.

The mark completely encircles the neck transversely, but is more prominent at the front and sides than at the back.

The skin of the front of the neck is more likely to be damaged by a ligature than the thicker, tougher skin at the back of the neck.

Sometimes, the ligature mark is seen only at the front.

STRANGULATION

Post-mortem Appearances:

External:

Signs of Asphyxia:

1. When constricting force is great, these signs are marked.

2. Intense congestion and deep cyanosis of the head and neck is seen.

3. The face may show bluish patches and is swollen, the eyes wide open, bulging and suffused, the pupils dilated, the tongue swollen and often bruised, dark-coloured and protruded.

4. Petechial haemorrhages are common into the skin of the eyelids, face, forehead, behind the ears and scalp.

STRANGULATION

Post-mortem Appearances:

External:

Signs of Asphyxia:

5. Blood-stained froth may escape from the mouth and nostrils and there may be bleeding from the nose and ears.

6. The hands are usually clenched.

7. The genital organs may be congested, and there may be discharge of urine, faeces and seminal fluid.

8. These external signs may be absent if death occurs quickly from vagal inhibition, due to pressure on carotid sheath.

STRANGULATION

Post-mortem Appearances:

Internal:

1. There may be superficial haemorrhages under the ligature mark, though this is often minimal.
2. There is severe congestion and haemorrhage into the tissues in and above the area compressed.
3. The adjacent muscles of the neck are usually lacerated.
4. Subcapsular and interstitial thyroid haemorrhages are common.
5. The mucous membrane of the pharynx, pyriform sinuses, epiglottis and larynx usually show areas of haemorrhagic infiltration.

STRANGULATION

Post-mortem Appearances:

Internal:

6. Fracture of the hyoid bone may occur.
7. Bruising of the root of the tongue and floor of the mouth may occur.
8. Haemorrhage may be seen under the mucosa of the larynx.
9. The larynx, trachea and bronchi are congested and contain frothy, often bloodstained mucus.

STRANGULATION

Post-mortem Appearances:

Internal:

10. The lungs are markedly congested.

11. Pulmonary oedema may be present.

12. The parenchymatous organs show intense venous congestion.

13. The brain is congested and shows petechial haemorrhages.

STRANGULATION

Medico-legal Questions:

1) Whether death was caused by strangulation?

2) Whether the strangulation was suicidal, homicidal or accidental?

Suicidal Strangulation: Suicide by strangulation is rare. Various methods of tightening the ligature are employed by the victims.

Sometimes, it is tightened like a tourniquet but the person can apply a single or double knot, before consciousness is lost.

Several turns of rope are tied round the neck with a knot which is usually single and in front or at the side or back of the neck.

STRANGULATION

Medico-legal Questions:

Homicidal Strangulation: Strangulation is a common form of murder.

Many of the victims are adult women, and frequently strangulation is then associated with sexual interference.

Usually there is a single turn of ligature round the neck, with one or more knots (granny or reef-knots) at the front or side of the neck.

When there are two or more firm knots, each on separate turns of the ligature, homicide is almost certain.

STRANGULATION

Medico-legal Questions:

Accidental Strangulation:

Children may get entangled in ropes during play, or the neck may be caught in window cords, etc.

Infants are sometimes strangled in their cots when the neck is caught inside bars, in restrainers, braces, etc.

Persons under the influence of alcohol, epileptics, and imbeciles may be strangled either by a tight scarf or collar and neck tie.

THROTTLING OR MANUAL STRANGULATION

Asphyxia produced by compression of the neck by human hands is called throttling.

THROTTLING OR MANUAL STRANGULATION

The hand position of the assailant on this model suggests one method of how people are strangled. Most people die from the pressure on the blood vessels and not from collapsing the larynx and trachea.

The victim may grasp the assailant's hands, leaving fingernail marks on his neck.

THROTTLING OR MANUAL STRANGULATION

Medico-legal Questions:

I. Whether death was caused by throttling?

The usual diagnostic signs of death due to manual strangulation are:

1) Cutaneous bruising and abrasions.

2) Extensive bruising with or without rupture of the neck muscles.

This man was manually strangled.
There are contusions on the lower part of the neck and fingernail marks (arrow) above the contusions.

THROTTLING OR MANUAL STRANGULATION

Medico-legal Questions:

I. Whether death was caused by throttling?

3) Congestion of the tissue at and above the level of compression.

4) Fracture of the larynx, thyroid cartilage, and hyoid bone.

5) Cricoid cartilage is almost exclusively fractured in throttling.

6) General signs of asphyxia.

THROTTLING OR MANUAL STRANGULATION

Medico-legal Questions:

2. Whether the throttling was suicidal, homicidal or accidental?

Suicidal Throttling:

Suicide by throttling is not possible because the compression of the windpipe produces rapid unconsciousness and the fingers are relaxed.

THROTTLING OR MANUAL STRANGULATION

Medico-legal Questions:

2. Whether the throttling was suicidal, homicidal or accidental?

Homicidal Throttling:

Throttling is a common mode of homicide, because the hand is immediately available.

In an adult, signs of struggle are usually present, but if the throat is forcibly grasped suddenly and firmly compressed, the victim cannot struggle.

Accidental Throttling:

A sudden application of one or both hands on other persons throat as a demonstration of affection, in joke, as a part of physiological experiment, etc., may cause death from cardiac inhibition.

SMOTHERING

This is a form of asphyxia which is caused by closing the external respiratory orifices either by the hand or by other means, or by blocking up the cavities of the nose and mouth by the introduction of a foreign substance, such as mud, paper, cloth, etc.

Types of smothering:

1. Suicide by Smothering
2. Accidental Smothering
3. Homicidal Smothering

Gag in mouth

SMOTHERING

This alcoholic fell asleep with his head on the pillow.

His nose and mouth were occluded by the pillow, and he suffocated. The autopsy was unremarkable except for signs of alcoholism.

The scene investigation was essential in determining the proper manner of death (accident)

SMOTHERING

Asphyxiation by occluding the airway with a bag.

Death due to occlusion of the airway. This man fell into a silo while shoveling corn.

SMOTHERING

Autopsy:

Obstruction by bed clothing a pillow, a cushion, etc., applied with skill, may not leave any external signs of violence, especially in the young and the old, except signs of asphyxia.

If the orifices are closed by the hand, there may be scratches, distinct nail-marks, or lacerations of the soft parts of the victim's face.

The lips, gums and tongue may show bruising or laceration. Slight bruising may be found in the mouth and nose.

SMOTHERING

Autopsy:

The asphyxial signs and symptoms are severe because death usually results due to slow asphyxia, and often the fatal period is 3-5 minutes.

Blood may ooze out from the mouth and nose.

The tongue may be protruded, and may have been bitten.

In some cases death is rapid due to reflex cardiac arrest, and asphyxial signs are absent.

SMOTHERING

Internal:

1. Bloodstained frothy fluid is present in air-passages.

2. Mucus may be found at the back of the mouth.

3. Slight acute emphysema and oedema of the lungs with scattered areas of atelectasis. petechiae and congestion are the major findings.

4. The internal organs are deeply congested and sometimes show small haemorrhages.

TRAUMATIC ASPHYXIA

Traumatic asphyxia results from respiratory arrest due to mechanical fixation of the chest so that the normal movements of the chest wall are prevented.

Fatal cases are only due to accident.

Usually there is a gross compression of the chest by a powerful force.

TRAUMATIC ASPHYXIA

The arrow points to the only mark on this man's body after he was discovered compressed between the cab of his truck and the ground after an accident.

He had petechiae, but there were no internal injuries.

TRAUMATIC ASPHYXIA

1. Multiple deaths are likely to occur when panic results from an outbreak of fire in a theater, or whenever large crowds gather in an enclosed place.

2. Some are crushed by the weight of the crowd, the chest being pressed violently, or may fall on the ground and crushed under feet.

3. Another common cause is crushing by falls of earth or stone, usually in a coal mine or during tunneling or in a building collapse.

TRAUMATIC ASPHYXIA

4. Sometimes, the victim is pressed to the ground by some heavy weight, as by a motor vehicle or other machinery.

5. Occasionally, it results from indirect compression when the body is subjected to force in such a manner that his thighs and the knees are driven against his chest, the so-called "jack-knife" position.

TRAUMATIC ASPHYXIA

Post-mortem Appearances:

1. An intense cyanosis, of deep purple-red colour of the head, neck and upper chest, above the level of compression is the prominent feature.

2. Numerous petechiae are found over scalp, face, neck, and shoulders (“ecchymosed mask”).

3. Pulmonary carmine-red oedema.

4. Fractures of the ribs, and various other bones may occur.

5. Internal organs are congested, and there may be subpleural petechial haemorrhages and epicardial ecchymoses.

DROWNING

- drowning is a type of asphyxia due to aspiration of fluid into air-passages, caused by submersion in water or other fluid. Complete submersion is not necessary, for submersion of the nose and mouth alone for a sufficient period can cause death from drowning.

Drowning is violent death, may be homicide, suicide and accidental.

DROWNING

Causes of Death:

1) **Asphyxia.** Inhalation of fluid causes obstruction to the air-passages. Circulatory and respiratory failure occur simultaneously, due to anoxia of both the myocardium and the respiratory centre.

2) **Ventricular fibrillation.** In fresh water drowning, arrhythmias of the heart beat, ventricular tachycardia and fibrillation cause death within three to five minutes.

3) **Laryngeal spasm** may result from inrush of water into the naso-pharynx or larynx.

DROWNING

Causes of Death:

4) **Vagal inhibition** is due to icy cold water, high emotion or excitement and unexpected immersion.

5) **Exhaustion.**

6) **Injuries:** Fracture of skull and fracture-dislocation of cervical vertebrae may occur due to the head striking forcibly against some solid object. Concussion may occur due to striking the head against some hard substance or the water itself while falling from a height.

Fatal Period:

Death usually occurs in 4-8 minutes of complete submersion.

DROWNING

Post-mortem Appearances:

1. **Foam in airways. Externally a fine white froth or foam is seen exuding from the mouth and nostrils (*Krushevsky's sign*).**

2. **Emphysema aquosum.**

3. **Subpleural petechiae (Rasskazov-Lucomsky-Paultauf's haemorrhages.**

4. **Water in stomach and intestine.**

5. **Diatoms in lungs, bone marrow, lien, liver.**

DROWNING

Post-mortem Appearances: **External:**

-Foam in airways.

SIGNS OF STAY OF DEAD BODY IN WATER

1. If the body is recently removed from water, the clothes are wet and may be soiled by mud, sand, or weeds.

2. The skin is wet, cold, clammy, and pale due to contraction of its blood vessels.

3. Cutis anserina or goose skin is produced by spasm of the erector pilae muscles and is due to exposure to cold water at the time of death.

4. Livores mortis has pink colour.

5. Rigor mortis appears early due to muscular exhaustion.

SIGNS OF STAY OF DEAD BODY IN WATER

6. Post-mortem maceration of the skin: The skin of the fingers, palms, and later the soles of the feet may be wrinkled, bleached, and sodden. It is due to osmotic action of water on thickened epidermis It is not a sign of death from drowning but may give some indication of the time that the body has been in water.