

# FORENSIC & TOXICOLOGY SUMMARY

Done by Shahed Atiyat

## Drowning

- ❖ The dominant manner of death is accidental.
- ❖ Aspiration of 1 to 3 mL/kg of liquid compromises the function of pulmonary surfactant and leads to respiratory compromise and hypoxemia.

### ❖ Classification:

- Typical:
  1. **Fresh water drowning** (fatal period is 4-5 min)
  2. **Salt water drowning** (fatal period is 8-12 min)

- Atypical:

#### 1. Dry drowning:

- Water does not enter the lungs due to **laryngospasm** (blocks air entry).
- Cardiac arrest induced by small amounts of water entering the larynx.
- Negative autopsy findings & dry lungs.

#### 2. Immersion syndrome/cold water drowning:

- Vasovagal reflex that leads to cardiac arrest due to sudden immersion in cold water (less than body temperature by 5 degree).
- The resultant **loss of consciousness leads to secondary drowning**.
- Common among middle-aged alcoholic men.

#### 3. Near drowning:

- The patient died beyond 24h due to **complication** (ARDI, DIC, hypoxemia induced encephalopathy).

#### 4. Shallow water drowning:

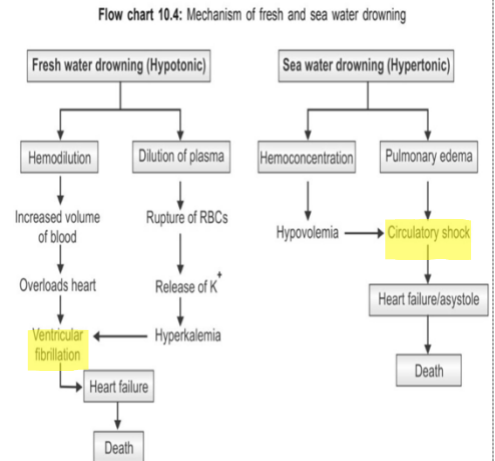
- Submersion of the **unconscious** (alcoholics, drugged, epileptic) in shallow water.

### ❖ Phases of drowning:

1. Breath holding >> CO<sub>2</sub> accumulation >> breath center activation.
2. Water swallowing >> space of air remaining in the lungs replaced by water.
3. Profound unconsciousness >> gasping >> respiratory standstill >> heart failure >> irreversible changes in the brain >> death.

### ❖ Causes of death:

1. **Asphyxia (the most common cause).**
2. Cardiac arrest (Sea water drowning & immersion syndrome).
3. Ventricular fibrillation (Fresh water drowning).
4. Laryngospasm (Dry drowning)
5. Vagal inhibition.
6. Concussion and head injury.
7. Apoplexy (SAH)



❖ **Postmortem findings (external):**

1. Face: Pale, cyanosed, bloated.
2. Eyes: Half closed half open.
3. Tongue: Swollen, may be protruded.
4. Froth: Fine white and odorless, mixture of air, water & mucus due to forcible respiration during drowning.
5. PM staining: Light pink color.
6. **Rigor mortis: Appear early.**
7. **Cadaveric spasm:** With mud, sand, aquatic vegetation, grass, gravel (vital proof of antemortem drowning).
8. Injuries.
9. Goosebumps: Skin appears granular and puckered, with hair standing on the end; due to spasm of erector pili muscles.
10. Washerwomen hand: Wrinkling, thickening of the skin & white in color.



**Goosebumps**



**Washerwomen hand**



**Froth**



**Degloving  
(2 weeks)**

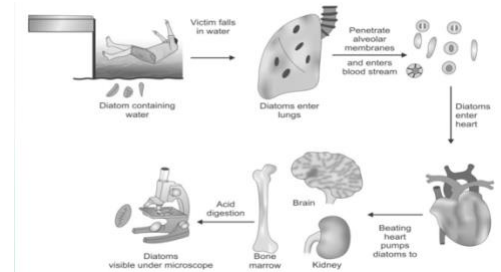


**Cadaveric spasm**

❖ **Postmortem findings (internal):**

1. lungs are voluminous, distended and show ballooning.
2. Rib imprints may be present on the surface of lungs
3. Paltauf's hemorrhage: mottled areas of red and gray distended alveoli (reflects intra-alveolar hemorrhages).

4. Heart and blood vessels: Like in other forms of asphyxia, left side of heart will be usually empty; the right heart will be full with the venous system engorged with dark blood.
5. Gettler test: Normally, the **chloride** content of the right and left side of heart is nearly same. If difference is 25 % or more, it is suggestive of antemortem drowning.
6. Stomach filled with water in 70%.
7. Hemorrhage in the middle ear and mastoid air cells.
8. The presence of **diatoms** in the lung substance, bloodstream, brain, liver, kidneys, bone marrow of femur (best site for analysis) or humerus or in the skeletal muscle has been claimed to be suggestive proof of antemortem drowning.



**Differentiation 10.4:** Antemortem drowning and postmortem submersion

S.No.	Feature	Antemortem drowning	Postmortem submersion
1.	Froth over mouth and nostrils	Fine, lathery froth, appears spontaneously	Absent, even if present, it is coarse, not spontaneous
2.	Cadaveric spasm in hands	Aquatic vegetations, mud may be present	Not observed
3.	Trachea and bronchioles	Presence of algae, mud along with frothy mucus	Absent
4.	Lungs	Ballooned up, bulky, edematous, bear indentations of ribs	Collapsed, decomposed
5.	Mud and algae in stomach and small intestine	May be present	Absent
6.	Diatom and Gettler tests	Positive	Negative
7.	Injuries	If present, need to be consistent with drowning	Injuries inconsistent with drowning
8.	Other suggestive signs	Water in middle ear, retracted genitals, cutis anserina, washerwoman's hands, wet clothing, mud and sand	Water is never present in middle ear; others are not valuable and corroborative findings

Done by Shahed Atiyat