Chapter 16: Immersion and drowning

A. Introduction

- ✓ Drowning can occur in only a few inches of water.
- ✓ Bodies retriever from water require the expertise of marine recovery units.
- ✓ **The pathologist** must attempt to address all of these potential explanations for death and determine if there is any pathological evidence capable of supporting a diagnosis of drowning.

❖ Examples of reasons for death in a body recovered from water:

- ✓ Died of **natural causes before** entering the water (eg. a myocardial infarction).
- ✓ Died of **natural causes while** in the water, having entered the water either voluntarily or accidentally (e.g. micturating into a canal and losing balance).
- ✓ Died from exposure and **hypothermia** in the water.
- ✓ Died of **injuries before** entering the water.
- ✓ Died of **injuries after** entering the water.
- ✓ Died from **submersion**, but not drowning
- ✓ Died from true drowning as a result of **aspiration** of water.

B. Evidence of immersion:

1. Wrinkled and and macerated hand and feet skin (washerwoman's fingers Figure 1).
2. wrinkled skin begins to separate as immersion time increases.
3. leading to skin peeling and 'degloving' of the skin of the hands and feet Figure 2
4. Loss of pigment layers may be apparent, causing colour change in skin
5. Bloating of the body due to gas formation in soft tissues (Gaseous decomposition and bloating often causes the body to 'float to the surface' leading to its discovery) after few days.

❖ Relevant factors that may influence the condition of a body:

- ✓ Whether the water is salt or fresh.
- ✓ Water source is tidal or non-tidal.
- ✓ The presence of possible predators.
- ✓ water temperature.
- ✓ Clothing worn on the body.
- ✓ Type of surface at the base of the water.

C. Post-mortem artefact and immersion

- ✓ Bodies moved by the flow of water may come into contact with underwater obstructions, all of which can injure the skin and deeper structures Figure 3
- ✓ Contact of a body with propeller blades classically leads to deep 'chop' wounds and/ or lacerations.
- ✓ Damage to the body by marine life (for example, fish, crustaceans, molluscs and larger animals Figure 4)

D. Pathological diagnosis of drowning

1. Pathophysiology of drowning

- ✓ Pathological diagnosis of drowning: Pulmonary surfactant insufficiency, pulmonary oedema, alveolitis, hypoxaemia and metabolic acidosis.
- ✓ As time in cold water continues, so does the likelihood of hypothermia leading to: wrong decisions and aspiration of water.
- ✓ **Drowning:** is a mixture of both mechanical presence of water within the respiratory system (causing a mechanical asphyxia) and fluid and electrolyte changes which vary according to the medium (sea water versus fresh water)
  - SEA water: is hypertonic results in fluid shifts into alveoli, plasma electrolyte hyperconcentration and hypovolaemia
  - FRESH water: is hypotonic. It causes electrolyte dilution and hypovolaemia, it also causes alveolar collapse/atelectasis.
- ✓ **Aspiration water** leads to *hypoxaemia* causing myocardial depression, reflex pulmonary vasoconstriction and altered pulmonary capillary permeability, contributing to pulmonary oedema.

There is an inverse relationship between survival and the volume of aspirated fluid (sea water being twice as 'lethal' as fresh water), but even small quantities (i.e. as little as 30 mL) cause arterial hypoxaemia.

2. Signs of drowning

Autopsy diagnosis of drowning is one that can cause considerable difficulty.

E. Alternative mechanisms of death in immersion

- ✓ **Dry drowning** if there is no autopsy signs of aspiration of water like because of trauma.
- ✓ **Diving response** Stimulation of trigeminal nerve receptors by immersing the face in water which is augmented by anxiety/fear
- ✓ a water temperature of less than 20°C and possibly alcohol, increasing the likelihood of the development of a fatal arrhythmia.
- ✓ Cardiac arrest has also been documented following entry of water into the nose.
- ✓ **The cold shock response** initiated by peripheral subcutaneous receptors, causes respiratory and and cardiovascular effects

Co-stimulation of both diving and cold shock responses may precipitate supraventricular arrhythmias.

Findings that may be associated with drowning Figure 5&6

F. The role of alcohol in drowning

Vasodilation from alcohol intake may hasten hypothermia.

G. Other investigations in bodies recovered from water:

- ✓ Post-mortem **blood chloride** and specific gravity analyses (to differentiate fresh and sea water drowning).
- ✓ Blood strontium analysis has been proposed as a marker of drowning, but this test has not found widespread acceptance.
- ✓ **Diatoms** which are microscopic organisms present in water (has been taken to imply that an individual found in the water). Figure 7

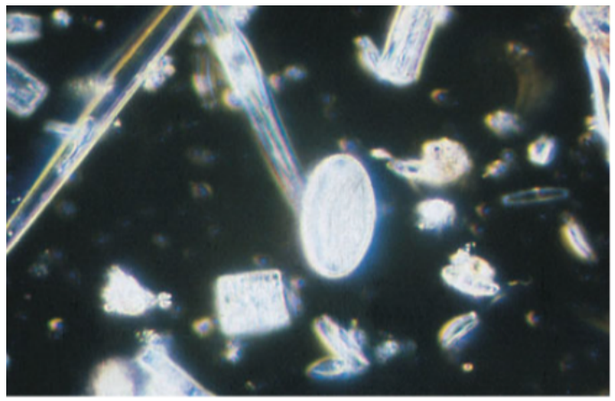


Figure7 Diatoms from lake water.

Figure 1 'Washer woman's hands'. Waterlogged skin after 1 week of immersion in a cold climate.

Figure 2 Peeling of the epidermis from the foot (degloving) following a few weeks of immersion.

Figure 3 Post-mortem injuries to the back of the hand in a body recovered from a shallow river. Such injuries are likely to have been caused by contact against the river bed.

Figure 4 Post-mortem injuries caused by marine creature predation. This body was recovered from the sea and the circular skin defects are likely to have been caused by crustaceans such as crabs.

Figure 5 Frothy fluid exuding from the mouth following drowning

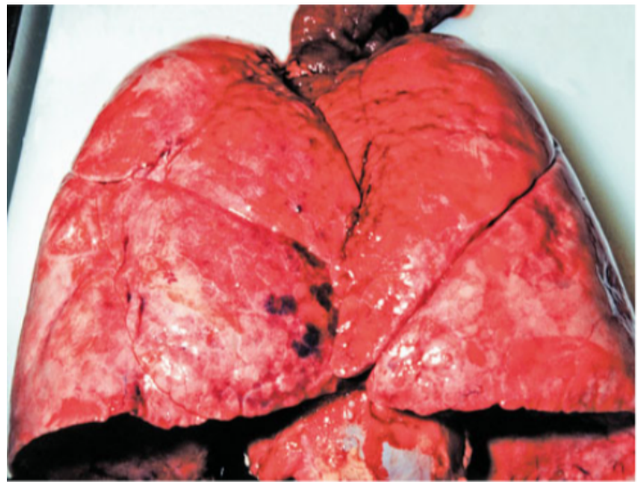
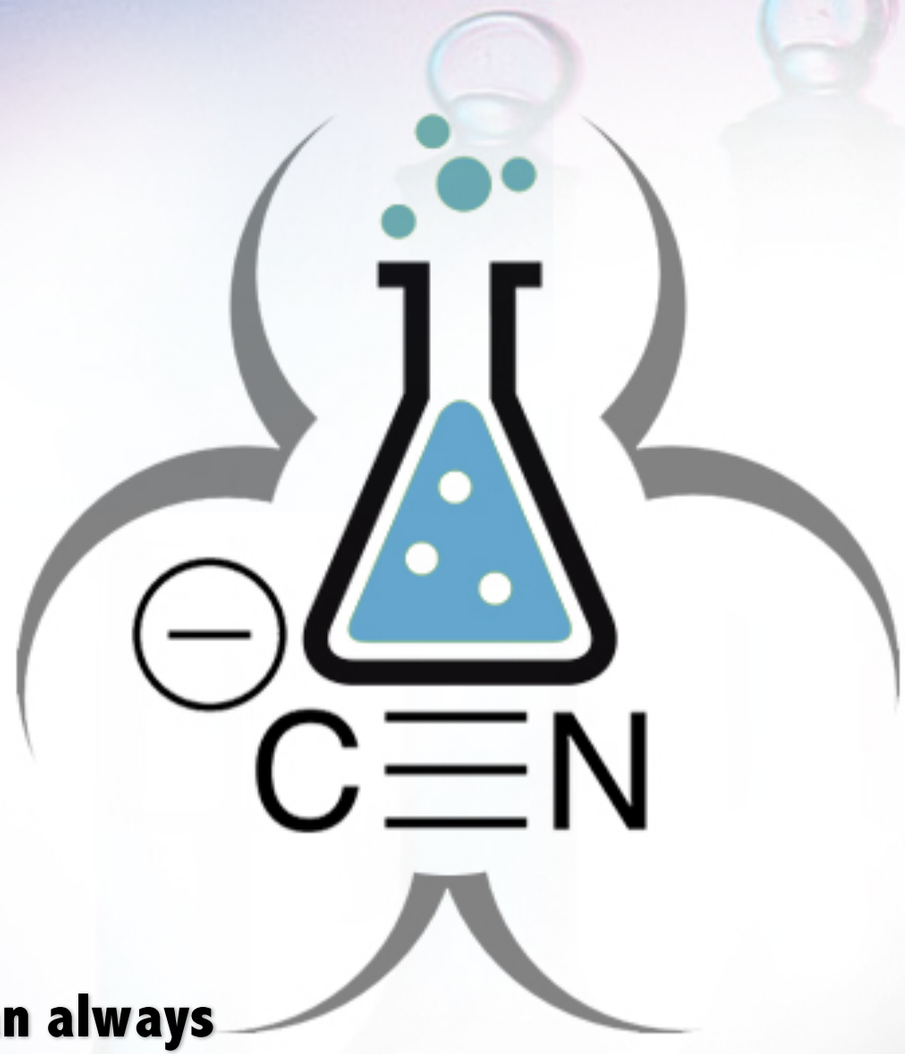


Figure 6 Emphysema aquosum following drowning. The lungs are hyperinflated, crossing the midline and obscuring the pericardial sac. There are subpleural haemorrhages in the right lung middle lobe (Paultauf's spots).



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