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DROWNING AND HYPOTHERMIA

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I DROWNING

Drowning is most frequently the end result of accidents in water and is defined as "to suffocate by submersion – especially in water". It is a continuing process which may result in death (drowned) or recovery if rescue and resuscitation is adequate.

The process of drowning commences when the victim is no longer able to remain afloat and the face cannot be kept above water. There are many causes for this e.g. inadequate flotation equipment, fatigue, injury, hypothermia etc. When water enters the mouth there is copious swallowing. The desire to breathe lessens and in possibly 20% of subjects, especially those who are fit and less exhausted, a protective laryngeal spasm prevents the entry of water into the lungs. This is DRY drowning and respiratory paralysis and unconsciousness result from an uncomplicated anoxia. The patient suffers little and the loss of consciousness is often preceded by pleasant and colourful recall of previous events. There is no pain and the response to treatment is good and uncomplicated.

On the other hand in the remaining majority where water is inhaled this is accompanied by a searing sternal pain. This WET drowning is much more dangerous and complications are always a threat.

It makes little difference whether the inhaled water is salt or fresh and the gross blood changes described from animal experiments do not seem to occur in man.

In the normal lung the patency of the alveoli is ensured by the presence of a lipo-protein anti-surface tension agent lining the alveolar epithelium. When this is neutralised by inhalation of water there is a rapid in-balance of alveolar patency. Those which contract do not ventilate and the expanded ones empty the blood from their supporting vessels so limiting the opportunity for electrolyte transfer.

Unless treatment is prompt and effective the trauma of water within the lungs rapidly leads to pulmonary involvement with pulmonary oedema and consolidation. The clinical picture in this SECONDARY drowning is a progressive respiratory distress, pain, cough, haemoptysis and frequently death.

It is quite impossible to know in the early stages whether or not water has been inhaled, therefore even where resuscitation has lead to apparent recovery ALL cases must be admitted to hospital and retained for at least twenty-four hours.

TREATMENT

Respiratory paralysis must be treated at the earliest opportunity with exhaled air resuscitation. If this can be given in the water without delaying the return to shore it should be done. In some cases there will also be cardiac failure which demands closed chest cardiac massage. In practice quite rewarding results have been achieved with the technique on the beach. Resuscitation should be continued until there is either recovery, or until hospital is reached or medical opinion confirms death.

Oxygen should be given as early as possible. The ambu bag is adequate, cheaper, and more reliable than complicated mechanical apparatus. The preservation of a good airway is mandatory, an intratracheal tube being recommended.

On admission to hospital each case must be treated as an acute medical emergency until the possibility of water in the lungs is eliminated by x-ray and good clinical progress.

Secondary drowning involves loss of fluid and protein into the alveoli. This must be replaced by intravenous infusion of plasma or equivalent. Antibiotics are also indicated and some physicians use steroids. The temptation to withhold early treatment because delay in starting may have increased the possibility of gross cerebral damage should never be accepted. It is encouraging how well some apparently hopeless cases progress.

Care must also include psychological rehabilitation to restore confidence and return to aquatic activity.

PREVENTION

An appreciation and respect of the hazards of the sea and inland waters must be instilled at an early age. There must be continuous availability of life jackets, rescue equipment and beach patrols. Good training in resuscitation is a necessity for all who are involved in water sports.

II HYPOTHERMIA

It is quite certain that a very large number of deaths in water, particularly in Northern latitudes are due to cold and exposure. The sinking of the Titanic in 1912 is the classical example where 1500 souls were lost, all wearing life jackets in a calm but icy sea. Death was due to hypothermia.

Man loses heat in water by conduction twenty-five times as fast as in air. In fact a nude man would tolerate still air at 23°C (73°F) but would be at risk in water of 35°C (95°F). Clothing gives considerable protection and in the disaster situation at sea when abandoning ship it is just as important to put on warm clothing as a life jacket.

It is very difficult to lay down survival times for man in cold water because of the profound individual variations and the following mean times for lightly clothed men are only the crudest of guide lines –

0°C (32°F)	–	15 minutes
5°C (41°F)	–	30-40 minutes
15°C (59°F)	–	1½-4 hours
25°C (77°F)	–	3-60 hours
30°C (85°F)	–	5 hours to indefinite

When we remember that sea temperatures round these islands vary from 5°C – 15°C the risk is obvious particularly for the swimmers and small boat sailors.

Instances of hypothermia are frequent and have occurred in long distance swims in inland waters.

To avoid hypothermia it is necessary to maintain a core temperature of 37°C (98°F) for which the rectal temperature is a good guide.

When the core temperature drops below 36°C (95°F) shivering is apparent associated with an increase in heat output and oxygen consumption. There is peripheral vaso-construction. Shivering stops and the metabolic rate falls when the temperature reaches 33°C (91°F) and dizziness and nausea may occur. At 31°C (88°F) there is drowsiness and stiffness. The early signs are typical. If the patient leaves the water he will stagger, be disorientated and unresponsive to attention. By the time 29°C (84°F) is reached there is loss of voluntary movement and tendon reflexes, collapse, cardiac irregularities and unconsciousness. At 26°C (79°F) there would be ventricular fibrillation and death.

TREATMENT

Treatment discussed here is for the physically fit sportsman or survivor and is not appropriate for hypothermia in the old or very young.

If the patient is confused or unconscious when rescued he will die unless rewarming is applied quickly.

Mild cases need no more than the removal of wet clothes, wrapping in dry blankets, bags etc. and transfer to shelter e.g. a warm room. Gentle reheating is used. More severe cases must be rewarmed rapidly but this is a job for experts. A hot bath of 40-44°C (104-111°F) or radiant heat cradle may be used. Progress must be monitored by rectal temperature and heating stopped when this is raised to 33°C (91°F). The person supervising treatment must be prepared at any time to give closed chest cardiac massage and exhaled air resuscitation. Intravenous dextran may be needed and blood pressure and blood sugar may be checked.

Apparatus is available for the on-site administration of warm oxygen but this is still somewhat in the experimental stage.

Like most threats to life hypothermia is best anticipated and steps taken to avoid it by ensuring maintenance of heat balance by adequate clothing and artificial methods of heating the environment.