

# DROWNING & SUBMERSION INJURY

All submersion injuries should be termed “drowning. They involve otherwise healthy, young individuals (the leading cause of death by injury in children < 15 years).

Injuries & Disorders associated with Submersion Events
Spinal cord injuries (eg. diving into shallow water)
Hypothermia
Panicking
Syncope
Seizures
Others (eg. pre-existing dysrhythmias, ischaemic heart disease).

## PATHOPHYSIOLOGY.

- Speculation exists regarding the “protective” effects of the *diving reflex*.
  - Strongest effect < 6 months of age.
- Vertical immersion & vertical submersion activate both sympathetic & parasympathetic systems (overriding the dive reflex).

*Dry drowning* occurs in 10-20% of submersion injuries resulting from *laryngospasm*.

- Subsequent hypoxia leads to LOC.

*Wet drowning* (water aspirated into lungs).

- Dilution & washout of pulmonary surfactant.
- Diminished gas-transfer across alveoli.
- Progressive atelectasis & V/Q mismatch.

Freshwater aspiration can result in:  
haemodilution, haemolysis &  
hyponatraemia.

Saltwater aspiration leads to  
haemoconcentration,  
hypernatraemia & hyperkalaemia.

Scoring systems exist to predict outcomes, however they are rarely useful.

- Severity of presentation is most predictive.

## TREATMENT.

### Prehospital.

- Basic life-support / CPR / careful removal from water !!
- C-spine precautions
- High flow O<sub>2</sub> ± BVM
- Hypothermia prevention.

### ED Management.

- ABC.
- Seek & treat concomitant injuries.

Patients w/ GCS > 13 & SaO<sub>2</sub> ≥ 95% are at low-risk for complications.

- Should be observed for 4-6 hours.
- Clear, concise DC instructions.
  - Return w/ fever or respiratory symptoms.
- Any deterioration (including respiratory findings) mandates admission.

Patients w/ GCS <13.

- High flow O<sub>2</sub>
  - Intubation with progressive/refractory hypoxia.
- CXR + Bloods.
  - FBC, Na & K, haemolysis screen.
- Empiric ABx.

### Ongoing Management.

- Largely supportive.
- Significant illness will mandate ICU admission.
- Ventilation.
  - ↑PEEP (recruitment of lung units)
  - Lung protective strategy.

## DISPOSITION & FOLLOWUP.

Typically, survivors of arrest (following drowning) have terrible outcomes.

- Significant cerebral oedema ++.
- Therapeutic hypothermia, barbiturate coma & ICP monitoring do *NOT* alter outcome.

Icy-water submersions have reported to have better neurological recoveries.

Patients *not requiring* CPR (at scene or ED) should make a complete recovery in 48 hours.

- Those who do poorly have deteriorating CVS function in first 48 hours.