



## PAEDIATRIC ACUTE CARE GUIDELINE

### Immersion Injury

<b>Scope (Staff):</b>	All Emergency Department Clinicians
<b>Scope (Area):</b>	Emergency Department

This document should be read in conjunction with this DISCLAIMER  
<http://kidshealthwa.com/about/disclaimer/>

## Immersion Injury

Drowning is a major cause of death in children. However, most children who present to emergency following “near drowning” will require nothing more than observation.

### Background

- There is no clinical or therapeutically important difference between drowning in fresh or salt water
- Water quality may influence the nature of acute lung injury due to secondary infection
- Hypothermia is an important issue following submersion, especially in small children who have a large body surface area to weight ratio

### General

#### Pathophysiology

Aspiration of water results in pulmonary oedema and wash out of surfactant causing acute respiratory distress syndrome (ARDS) with the consequence of hypoxaemia. Hypovolaemia may also occur as a result of tissue hypoxia and capillary leak.

#### Indicators of Poor Prognosis

- Immersion time > 8 minutes
- Initial serum pH < 7.0
- Lack of initial effective CPR after rescue (delay longer than 10 minutes)
- Lack of response to early resuscitation efforts

- Comatose (GCS <5) on arrival in the ED

## Assessment

- ABCD approach

## History

Important history points:

- Immersion time
- Need for basic life support
- Mechanism of immersion – be aware of other injuries e.g. cervical spine or non accidental injury

## Investigations

### Early Investigations:

- Blood Gas
- Lactate
- Blood Glucose Level
- Electrolytes
- Chest X-Ray

## Management

- If the child is in cardiorespiratory arrest continue CPR and follow the [Advanced Life Support](#) algorithm
- Manage hypoxia and hypothermia
- Treat associated injuries – suspect cervical spine injuries if mechanism of immersion is unclear

### Initial management

**Airway + Cervical Spine**

<ul style="list-style-type: none"> <li>• Appropriate cervical spine precautions if history is suggestive of a fall or diving accident</li> <li>• Give 100% oxygen via face mask to all patients initially – hypoxemic child may be alert and talking</li> <li>• <b>Intubate and ventilate if:</b> <ul style="list-style-type: none"> <li>◦ Unable to maintain airway spontaneously</li> <li>◦ Inadequate respiration – Hypoxaemia despite being given increased inspired oxygen</li> <li>◦ GCS &lt; 9</li> <li>◦ Hypercapnia / severe respiratory distress</li> </ul> </li> <li>• Ventilate hypothermic patient initially at <math>\approx</math> 50% of usual volume (reduced CO<sub>2</sub> production in hypothermia – excessive ventilation risks respiratory alkalosis and arrhythmia)</li> <li>• Monitor end-tidal CO<sub>2</sub></li> <li>• Set initial PEEP = 5cm H<sub>2</sub>O</li> <li>• Nasogastric tube (NGT) if mechanical ventilation required – aspirate the stomach and leave NGT in-situ</li> </ul>
Breathing
<ul style="list-style-type: none"> <li>• Treat bronchospasm with nebulised salbutamol</li> <li>• Ventilate as required</li> </ul>
Circulation
<ul style="list-style-type: none"> <li>• <b>Cardiac compressions if:</b> <ul style="list-style-type: none"> <li>◦ Clinically pulseless</li> <li>◦ ECG shows asystole / VF</li> <li>◦ Bradycardic and shocked</li> </ul> </li> <li>• NOTE: “Pulseless” may be due to marked vasoconstriction and bradycardia in the hypothermic patient</li> <li>• <b>Hypotension:</b> <ul style="list-style-type: none"> <li>◦ This may be a result of fluid shifts, hypothermic/hypoxic myocardial dysfunction, rewarming vasodilation, possible cervical spine injury or other associated injury</li> <li>◦ <b>Management:</b> <ul style="list-style-type: none"> <li>■ Treat appropriately with fluid boluses (20mL/kg of 0.9% saline) +/- inotropic support</li> </ul> </li> </ul> </li> <li>• Minimal handling of hypothermic patient as increased risk of precipitating arrhythmias</li> <li>• Consider an indwelling urinary catheter to monitor urine output and fluid balance</li> </ul>
Disability
<ul style="list-style-type: none"> <li>• Prevent secondary brain injury – maintain oxygenation, cerebral perfusion and avoid hypercarbia</li> <li>• Treat any seizures appropriately. See ED Guideline: <a href="#">Status Epilepticus</a></li> <li>• Restrict fluid post resuscitation</li> </ul>
Exposure
<ul style="list-style-type: none"> <li>• Hypothermia (core temperature &lt; 35°C) <ul style="list-style-type: none"> <li>◦ Check core temperature using a rectal thermometer</li> <li>◦ Volume re-expansion is critical in the management of hypothermia – use saline rather than lactate containing fluids</li> <li>◦ Hypothermia is only neuro-protective if it occurs rapidly, prior to the onset of hypoxia (usually in water &lt; 10°C)</li> </ul> </li> <li>• <b>Effects of hypothermia:</b> <ul style="list-style-type: none"> <li>◦ Hypothermia substantially reduces effectiveness of defibrillation and resuscitation drugs. It is reasonable to attempt defibrillation, but if unsuccessful, continue cardiac compression until core temperature is &gt; 30°C, when defibrillation / drugs are more likely to be effective.</li> </ul> </li> <li>• Actively rewarm to 32°C then allow passive warming</li> <li>• Never diagnose death and thus stop resuscitation until the patient is rewarmed to at least 32°C, or cannot be rewarmed despite active measures</li> </ul>

## Further management

See ED Guideline: [Hypothermia](#)

## Admission criteria

- Children who are asymptomatic, or only suffered mild, transient symptoms on arrival following a brief submersion require a minimum of 8 hours of in-hospital observation (Emergency Observation Ward). Advise to see GP or return to ED if febrile or unwell after discharge.
- If submerged for more than one minute, a period of cyanosis or apnoea, or required any CPR – admit for observation for 24 hours or at least overnight in Emergency Observation Ward, even if they are well in the emergency department. In children who are asymptomatic initially (even with normal CXR), cases of fulminant pulmonary oedema up to 12 hours after submersion have been reported. If any symptomatic deterioration, oxygen requirement or respiratory distress, for ICU admission.
- Admit to ICU if:
  - required cardiopulmonary resuscitation
  - respiratory distress
  - supplemental oxygen requirement
  - abnormal blood gases on arrival
  - altered level of consciousness

## Tags




accident, ards, bronchospasm, core, diving, drown, drowning, fall, hypothermia, immersion, immersion injury, injuries, injury, intoxication, nai, near drowning, rewarm, rewarming, submerge, submersion, temperature, water

## References

PMH ED Guideline: Immersion Injury. Last Updated November 2014

This document can be made available in alternative formats on request for a person with a disability.

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