

H12: Drowning

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Introduction

Drowning is a complicated clinical scenario for paramedics and EMRs/FRs. It may involve mild symptoms to situations requiring prolonged resuscitation. Complications of submersion incidents can include atelectasis, pulmonary edema, infection, hypothermia, and trauma. In British Columbia, there are over 50 drowning fatalities every year and an additional 40 near drowning cases requiring hospitalization. At least 20% of survivors experience permanent brain injury as a result of hypoxia, making early and appropriate out-of-hospital management important in promoting favourable outcomes.

Essentials

- **Caution:** Ensure paramedic and EMR/FR safety at all times around water. Wear lifejackets in accordance with High Risk Hazards policies and procedures.
- Cervical spine injury is uncommon in submersion incidents, but paramedics and EMRs/FRs should be alert to the possibility of damage based upon the mechanism of injury.
- All patients, including those with apparently minor injuries or symptoms, should be conveyed for observation due to the risk of developing secondary hypoxemia over subsequent hours.
- The early use of CPAP and/or PEEP can be beneficial for patients with hypoxemia and respiratory distress.
- Paramedics and EMRs/FRs must ensure adequate oxygenation, and prevent both heat loss and aspiration.

Additional Treatment Information

- Hypothermia should be managed in accordance with [→ I01: Hypothermia](#).
- Be suspicious for traumatic injuries based on the history of events leading up to submersion. Apply spinal motion restriction as appropriate.
- Manage cardiac arrest in accordance with resuscitation CPGs, with particular focus on oxygenation and airway management.
- Consider medical causes of cardiac arrest in patients where the mechanism of submersion does not appear to match the clinical presentation or severity of symptoms.
- There is no difference in the management of patients submerged in fresh water versus salt water.
- **Cardiac arrest considerations:**
 - Although survival is uncommon in victims who have undergone prolonged submersion requiring protracted resuscitation, successful resuscitation (with full neurological recovery) has occasionally occurred after prolonged *immersion* in icy water (and in some instances warm water). For this reason, scene resuscitation should be initiated and patients conveyed to the emergency department unless there are obvious signs of death.
 - Patients who have been *submerged* in water for a prolonged time should be evaluated for applicability of the [rapid discontinuation criteria](#).

Referral Information

- CliniCall should be involved for guidance in managing prolonged or special resuscitation situations (e.g., hypothermic submersion). See EMR interventions below.
- Contact CliniCall for assistance in managing patients refusing conveyance with minor symptoms and who are at risk for developing lung injury. See EMR interventions below.

General Information

- Water in the lungs results in alveolar collapse (atelectasis) which leads to a ventilation perfusion mismatch and

impaired gas exchange. Lung injury may take up to six hours to develop following a submersion incident.

- Monitor patients for non-specific symptoms such as productive cough, tachypnea, or mild crackles on auscultation. These can be warning signs of deterioration.
- It is important to differentiate 'immersion' from 'submersion': a submersion involves the whole body, including the airway, being submerged in water. Immersion does not necessarily imply submersion.
- Hypothermia can be present in both situations and it can be difficult to differentiate whether cardiac arrest is due to primary immersion (e.g., hypothermia) or submersion (hypoxemia).
- Swimming Induced Pulmonary Edema (SIPE) is a phenomenon seen in individuals undertaking strenuous surface swimming in cold water (e.g., triathletes or rescue personnel). Symptoms include dyspnea, hypoxemia and possible hemoptysis with a presentation similar to cardiogenic pulmonary edema. Treatment consists of oxygen administration, CPAP, and advanced airway management/mechanical ventilation as needed to correct hypoxemia.

Interventions

First Responder

- Apply spinal motion restriction as indicated based on the mechanism of injury
- Keep the patient at rest
- Position the patient sitting up
- Remove wet clothing and dry the patient
- If the patient is in cardiac or respiratory arrest, immediately commence resuscitation according to the appropriate guideline
 - [→ N02: Adult Cardiac Arrest](#)
 - [→ M06: Pediatric Cardiac Arrest](#)
- Supplemental oxygen as required
 - [→ A07: Oxygen Administration](#)

Emergency Medical Responder – All FR interventions, plus:

- **OniCall consultation required** in the setting of hypothermic cardiac arrest
 - Contact CliniCall early for guidance and treat in accordance with the hypothermic cardiac arrest guideline
- Obtain vital signs and treat hypothermia according to the hypothermia guideline
 - [→ I01: Hypothermia](#)
- Administer supplemental oxygen as indicated
 - [→ A07: Oxygen Administration](#)
- Perform basic airway management and initiate intermittent positive pressure ventilations (IPPV) if required to support failing respirations
 - [→ B01: Airway Management](#)
- Treat associated traumatic injuries according to the relevant practice guideline
- **OniCall consultation required** for assistance in managing patients refusing conveyance with minor symptoms and who are at risk for developing lung injury

Primary Care Paramedic – All FR and EMR interventions, plus:

- Consider Continuous Positive Airway Pressure (CPAP) for management of hypoxemia secondary to pulmonary edema/atelectasis
 - [→ PR09: Continuous Positive Airway Pressure](#)
- Consider placement of a supraglottic airway for ongoing resuscitation according to the resuscitation guideline
 - [→ PR08: Supraglottic Airways](#)
- If providing IPPV, consider application of a PEEP valve to assist with alveolar recruitment and oxygenation
 - [→ PR10: Positive End Expiratory Pressure](#)

Advanced Care Paramedic – All FR, EMR, and PCP interventions, plus:

- Consider advanced airway management to support ventilation/oxygenation/management of contaminated

airway

- → [PR18: Anesthesia Induction](#)
- If the patient is unconscious, consider placement of a gastric tube to decompress the stomach and facilitate airway management
 - → [PR14: Orogastic Tube Placement](#)

Critical Care Paramedic – All FR, EMR, PCP, and ACP interventions, plus:

- Consider mechanical ventilation to optimize oxygenation and ventilation
- Conduct point of care testing as indicated to guide mechanical ventilation strategy
- Consider invasive temperature monitoring in the setting of hypothermia

Evidence Based Practice

Drowning

Supportive

- [NiPPV](#)

Neutral

- [Prolonged Resuscitation](#)

Against

References

1. Alberta Health Services. AHS Medical Control Protocols. 2020. [\[Link\]](#)
2. BC Injury Research and Prevention Unit. Drowning. 2020. [\[Link\]](#)
3. Michelet P, et al. Acute respiratory failure after drowning: a retrospective multicenter survey. 2017. [\[Link\]](#)
4. Parenteau LM, et al. Joint trauma system clinical practice guideline: drowning management. 2017. [\[Link\]](#)
5. Quang C, et al. Is there a clinical difference between salt water and fresh water drowning? 2017. [\[Link\]](#)

