Drowning

Aliases

Near-drowning, non-fatal drowning, fatal drowning, submersion, immersion

Patient Care Goals

1. Rapid assessment and management of life-threatening injuries
2. Rescue from the water-based environment
3. Transport all patients suffering from drowning for hospital evaluation

Patient Presentation

Inclusion Criteria

Patients suffering from drowning or drowning events independent of presence or absence of symptoms

Exclusion Criteria

Patients without history of drowning

Patient Management

- Uncertainty exists regarding survival in cold water drowning, however, recent literature suggests the following:
    - If water temperature is less than 43°F (6°C) and the patient is submerged with evidence of cardiac arrest:
        - Survival is possible for submersion time less than 90 minutes and resuscitative efforts should be initiated.
        - Survival is not likely for submersion time greater than 90 minutes and providers may consider not initiating resuscitation or termination of resuscitation on scene.
    - If water temperature is greater than 43°F (6°C) and the patient is submerged with evidence of cardiac arrest:
        - Survival is possible for submersion time less than 30 minutes and resuscitative efforts should be initiated.
        - Survival is not likely for submersion time greater than 30 minutes and providers may consider not initiating resuscitation or termination of resuscitation on scene.

Assessment

1. Follow Universal Care guideline.
2. Obtain patient history: It should include circumstances leading to the submersion, details of mechanism of injury, time under water, and water temperature (if available).
    1. **Note:** Consider possible c-spine injury when taking history, mechanism of injury, and conducting exam. If evaluation suggests injury to the cervical spine, manage c-spine**.**
3. Conduct primary survey: It should include aggressive airway management and restoration of adequate oxygenation and ventilation. Unlike the CAB strategy used in standard cardiac arrest, patients suffering cardiac arrest from drowning require an ABC approach with prompt airway management and supplemental breathing.
4. Assess for other associated injury such as injury to the head or dive-related emergency.

Treatment and Interventions

1. Ensure scene safety for patient and rescuers. Remove patient from water as soon as possible by rescuers who are properly trained and equipped.
    a. Practice the safest water rescue technique possible, given circumstances on scene.
    b. Evacuate to land or a water craft as soon as possible.
    c. If there is a delay to accessing shore or a rescue boat, initiate in-water basic life support consisting of ventilation only.

2. Manage airway per the Airway Management guideline.
3. Follow Cardiac Arrest guideline as indicated with consideration of ABC strategy for drowning victims in cardiac arrest.
    a. Initiate 5 rescue breaths followed by 30 chest compressions.
    b. After the initial 5 breaths, use a 2 breaths to 30 compression ratio.
4. If mechanism or history suggest cervical spine injury, manage c-spine per the Spinal Care guideline.
5. Monitor vital signs including oxygen saturations**.**
6. Administer oxygen as appropriate for dyspnea or distress with a target of achieving greater than 93% saturation for most acutely ill patients.
7. Consider positive pressure ventilation in patients with signs or symptoms of respiratory difficulty.
8. Consider hypothermia, treat per Hypothermia/Cold Exposure guideline.
9. If the victim was involved in underwater diving and uncertainty exists regarding the most appropriate therapy, consider contacting on-line medical control and discussing need for hyperbaric treatment. Include discussion regarding:
    a. Submersion time.
    b. Greatest depth achieved.
    c. Ascent rate.
    d. Gas mix.
10. Establish IV access ***[AEMT].***
11. Consider isotonic IV/IO fluid bolus 20 ml/kg ***[AEMT]***.
12. Perform advanced airway management as indicated. Consider non-invasive positive pressure ventilation ***[EMT]*** in awake patients with respiratory distress.
    a. Consider NG/OG placement [PARA] for gastric decompression of ingested water
13. Apply ECG cardiac monitor**.**

Patient Safety Considerations

1. Avoidance of hyperoxygenation of the drowning victim
2. Consideration of rescuer safety

Notes and Educational Pearls Key Considerations

- The World Health Organization definition of drowning is "the process of experiencing respiratory impairment from submersion or immersion in liquid."
    - Drowning is further defined in the following categories:
    - Non-fatal drowning: patients rescued from drowning
    - Fatal drowning: any death, acutely or subacutely, resultant from drowning
    - Submersion refers to situations in which the patient's airway is underwater.
    - Immersion refers to situations in which the patient's body is in water but the patient's airway remains out of the water.
- **Pediatric Considerations:**
    - Drowning is a common cause of death in children.
    - Risk factors for drowning include male gender, age less than 14 yo, alcohol use, lack of supervision, and risky behavior.
- Rescue efforts should be coordinated between all responding agencies to ensure patient is rapidly accessed and removed from the water.
- Initiation of in-water ventilations may increase survival. In-water chest compressions are futile.
- The European Resuscitation Council recommends 5 initial breaths be provided to the drowning victim.
- The initial ventilations may be more difficult to achieve as water in the airways may impede alveolar expansion.
- After the initial 5 breaths and 30 compressions, the standard ratio of 2 breaths to 30 compressions may be resumed.
- Active efforts to expel water from the airway (by abdominal thrusts or other means) should be avoided as they delay resuscitative efforts and increase the potential for vomiting and aspiration.

- Long-standing teaching has suggested that rescuers should always assume c-spine injury in victims of drowning.
- The 2010 American Heart Association update on special circumstances in cardiac arrest notes that routine c-spine precautions in all victims of drowning is likely unnecessary unless the mechanism or injury, history, or physical exam suggests a cervical spine injury.
- Mechanisms of injury highly suggestive of cervical spine injury include diving, water skiing, surfing or watercraft accidents.
- Patients may develop subacute respiratory difficulty after drowning and therefore all victims of drowning should be transported for observation.

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

- 9914093—Injury-Drowning/Near Drowning
- 9914091—Injury-Diving Emergencies

Key Documentation Elements

- Mechanism of injury or history suggesting cervical spine injury
- Submersion time
- Water temperature
- Activities leading to drowning
- (Optional) Standardized data collection metrics such as the Utstein drowning data reporting elements

Performance Measures

- Recognition and appropriate care of pulmonary or respiratory complaints
- Management of cervical spine when appropriate
- Adherence to Cardiac Arrest guideline

References

1. Harris M. ABC of resuscitation, near drowning. *BMJ.* 2003;327(7427):1336-8.
2. Idris AH, Berg RA, Bierens J, et al. Recommended guidelines for uniform reporting of data from drowning: The "Utstein Style." *Circulation.* 2003;108(20):2565-74.
3. Layon J, Modell JH. Drowning, update 2009. *Anesthesiology.* 2009;110(6):1390-401.
4. Olshaker J. Submersion. *Emerg Med Clin N Am.* 2004;22(2):357-67.
5. Szpilman D, Bierens JJ, Handley AJ, Orlowski JP. Drowning. *N Engl J Med.* 2012;366(22):2102- 10.
6. Vanden Hoek T, Morrison LJ, Shuster M, et al. Part 12: Cardiac arrest in special situations. 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation.* 2010;122(18 Suppl 3):S829-61.