I01: Hypothermia

John Merrett

Updated: June 02, 2021
Reviewed: March 01, 2021

Introduction

Hypothermia is defined as a drop in body core temperature below 35°C. Peripheral thermometers are of limited utility in hypothermia – they can be inaccurate and vary by as much as 2°C – but their readings can provide paramedics and EMRs with valuable data in respect to trends. Because core temperature probes (either rectal or esophageal) are generally unavailable in a out-of-hospital setting, recognition of the different stages of hypothermia is more important than an understanding of the exact boundaries.

General hypothermia management consists of removing the patient from the cold environment, ensuring the patient is dry, and to prevent further heat loss. Paramedics and EMRs/FRs should handle patients gently and attempt to keep them supine whenever possible.

Essentials

Although patient presentations can vary widely, the signs and symptoms of hypothermia can be divided into three categories:

- Mild hypothermia is defined as a core temperature between 32°C and 35°C. These patients have a normal mental status with shivering, tachypnea, tachycardia, initial hyperventiliation, ataxia, jumbled speech, impaired judgment, and "cold diuresis."
- Moderate hypothermia features a core temperature between 28°C and 32°C. Patients present with an altered mental status and are no longer shivering. Lower heart rates, and an attendant reduction in cardiac output are common. Atrial fibrillation, junctional bradycardias, or other dysrhythmias can develop. Respiratory rates decrease and hyporeflexia can occur as a result of central nervous system depression. The altered mental status may cause patients to remove clothing.
- Severe hypothermia features a core temperature between 24°C and 28°C. Unconsciousness, hypotension, and bradycardia are common. Pulmonary edema can develop, as can ventricular dysrhythmias or asystole.

Additional Treatment Information

WARNING: HYPOTHERMIA IS A SIGNIFICANT CONTRIBUTOR TO MORTALITY IN TRAUMA

In general, patients should be treated in a step-wise manner, beginning with less aggressive rewarming techniques. "Passive rewarming," through the use of blankets around the body and the head, coupled with "active rewarming" using heated IV solutions, offers an effective initial strategy for most patients who are perfusing effectively.

While environmental exposure may trigger an assessment for hypothermia, paramedics and EMRs/FRs are cautioned that other groups of patients may be at risk for developing hypothermia in atypical environments. Clinical problems that produce an altered level of consciousness can eventually result in hypothermia, including (but not limited to) behavioural or psychiatric problems, prolonged seizures, alcohol or drug intoxication, strokes and cerebrovascular accidents, and diabetic or other metabolic emergencies. Elderly or frail individuals who are "found down" in their homes are at significant risk for developing hypothermia. Paramedics and EMRs/FRs must perform comprehensive assessments, and treat identified conditions concurrently with the hypothermia.

Depending on the degree of thermogenesis from shivering, the rewarming rate for patients may be anywhere from 0.5°C to 2°C per hour. The addition of active rewarming measures, using insulated or wrapped heat packs applied to the torso (groin, sides of chest, back of neck, small of back, and axillae) will significantly improve comfort and may lessen thermal stress.

Do not attempt to rewarm frozen or frostbitten limbs.

Hypotension can result from decreased cardiac output. Fluid shifts into the extracellular space are common, producing dehydration. Vascular access is indicated in hypothermia with warmed saline (between 37°C and 42°C) as the fluid of choice, if available. In the out-of-hospital environment, it can be difficult to warm or measure the temperature of fluids; paramedics are cautioned that "room temperature" fluids will significantly worsen hypothermia.

General Information

Hypothermic patients have significantly reduced metabolic demands and have dramatic reductions in heart and respiratory rates. A range of 30 to 45 seconds should be taken to accurately assess spontaneous respiration and pulse rates. Afterdrop, a phenomenon where cold blood from the extremities returns to the core, can occur producing an additional drop in core temperature.

Electrocardiogram findings in hypothermia can include J or Osborn waves (positive deflections following the QRS complex), most prominently in V_2 through V_5. The height of the wave is roughly proportional to the degree of hypothermia, though these are non-specific and may be due to other clinical phenomena.

Interventions

First Responder

- At all times: handle patients gently
- Remove from cold environment, remove wet clothes, and prevent further heat loss
- Initiate passive rewarming with blankets
- Assess for concurrent injuries or conditions and treat as required
- Conduct ongoing assessment and gather collateral information, such as medications and identification documents
- Establish ingress and egress routes from the patient's location
- Communicate patient deterioration to follow-on responders
- In cardiac arrest:
  - Begin and maintain chest compressions.
  - Attach AED and analyze as indicated
  - Defibrillate up to 3 times as indicated; after 3 defibrillation deliveries, do not pause compressions to analyze rhythm or attempt additional defibrillations

Emergency Medical Responder – All FR interventions, plus:

- Obtain baseline vital signs, including temperature where possible
- Consider active rewarming measures (e.g., wrapped hot packs) for moderate hypothermia
- In cardiac arrest:
  - Begin and maintain chest compressions
  - Consider conveyance to a hospital capable of extracorporeal blood rewarming if within 90 minutes; these facilities are available in Vancouver, Victoria, and Kelowna
  - ClinCall consultation recommended if clinical pathway options are unclear and to discuss care planning options

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

- Establish vascular access
  - → D03: Vascular Access and Fluid Administration
  - If available, consider warmed saline (37°C-42°C) for hypotension (30 ml/kg, maximum 2 L)
- Obtain capillary blood glucose and treat as required
  - → E01: Hypoglycemia and Hyperglycemia

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

- Obtain and interpret 12-lead electrocardiogram
  - → PR16: 12-Lead ECG
- Consider transcutaneous pacing for persistent bradycardia if core temperature is between 32°C and 35°C
  - → PR19: Transcutaneous Pacing
- In cardiac arrest:

- May administer up to 3 doses of EPINEPHrine

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

- Vasopressors may be necessary to support blood pressure
- Rhabdomyolysis and multi-organ system failure can develop during rewarming process
- Consider Buddy warmer
- Consider conveyance to centre capable of extracorporeal blood rewarming (ECMO) in cases of severe hypothermia refractory to treatment
  - Review BC Accidental Hypothermia Treatment Guideline

Evidence Based Practice

Hypothermia

Supportive

- AER (Active External Rewarming)

Neutral

- Temperature Monitoring
- Warmed IV Fluids

Against

- Inhalation Rewarming

I02: Hyperthermia

Sara Kendall

Updated: May 12, 2023
Reviewed: May 12, 2023

Introduction

Hyperthermia is a life-threatening emergency that requires immediate and aggressive treatment to lower body temperature. Untreated, heat stroke leads to multiorgan failure and death, and the single greatest contributor to patient morbidity and mortality is the duration of the elevated core body temperature.

First responders, emergency medical responders, and paramedics can expect an increase in frequency and intensity of extreme heat events as climate destruction worsens these phenomena.

This guideline provides clinicians with the knowledge necessary to quickly recognize environmental heat injury, identify environmental and population-based risk factors, and to perform critical rapid cooling techniques.

Essentials

- Rapid recognition of environmental factors and patient risk factors for heat illness is key to management. Be aware of the diversity of the clinical manifestations of heat illness.
- Cooling should be initiated on scene wherever possible, and continued throughout patient transport.
- Recognize and treat concurrent dehydration if present.

Warning:

Hyperthermia as a result of increased environmental temperature is not equivalent to hyperthermia produced because of fever or medication use. Use clinical observation to differentiate the primary cause of heat, and treat environmental heat exhaustion/heat stroke according to this protocol.

- **DO NOT treat environmental heat exhaustion/heat stroke with anti-pyretics.** There is no role for antipyretic agents such as acetaminophen or aspirin in the management of heat stroke, since the underlying mechanism does not involve a change in the hypothalamic set-point and these medications may worsen complications such as hepatic injury or disseminated intravascular coagulation (DIC).
- **IV Fluid should not be routinely administered** to patients suffering from heat stress unless signs of dehydration, hypotension, or shock are present, in which case it should be started after initiating full-body cooling and given with caution with the goal of correcting hypoperfusion. Ensure that saline solution is NOT WARM to the touch.
- **Oral hydration is not an effective cooling technique**. Dehydration can be a concomitant pathology that demands attention, as mentioned above. Patients who are dehydrated and able to ingest liquids should self-administer oral rehydration solution (electrolytes) if available without delaying transport.

Additional Treatment Information

- Induced hypothermia is an unwarranted concern for paramedic care of heat-injured patients.
- Consultation with CliniCall may help to guide care planning in call cases of hyperthermia. Pre-arrival notification to receiving facilities can improve transition of care and initiation of core temperature monitoring and management.
- The basic treatments for heat emergencies are the same across all license levels and vary only in the case of critically ill patients suspected of heat stroke.
- The management of classic heat stroke consists of ensuring adequate airway protection, breathing, circulation, **rapid active cooling**, and treatment of complications.
- In-hospital treatment consists of full-body ice-water immersion in a dedicated tank or in body bags with core temperature monitoring and management of end-organ complications. Full-body cooling is continued until core temperature drops to 38.3–39°C; manifestations of organ damage are managed specifically and separately (e.g. coma, adult respiratory distress syndrome, disseminated intravascular coagulation, hepatic failure, renal failure, rhabdomyolysis).
- Be sure to differentiate shaking and tremors from seizures. Manage seizures in accordance with F02: Seizures.

Referral Information

ASTaR for heat emergencies - includes alternative destination and access to cooling centres and advice for home

General Information

Heat stroke has a remarkably high mortality rate, between 21-63% in heat stroke patients who arrive to hospital. The first cells affected by core body temperature ≥ 40º C are: neurons, hepatocytes (liver cells) and vascular endothelial cells (the inner lining of all blood vessels), yet all body organs will be injured by hyperthermia.

It can be hard to fully recognize the threat of heat stroke because the damage is at a cellular/tissue level. It is therefore critical that the paramedics identify abnormalities in any body system during their initial and ongoing assessments, and record and report their findings during patient handover in hospital.

The importance of initiating cooling on-scene cannot be overstated. All heat illness patients should receive immediate cooling on-scene and during transport, regardless of proximity of higher level of care or predicted time of conveyance.

Environmental risk factors for development of heat illness include:

- Hot weather, with or without high environmental humidity
- Enclosed spaces with poor ventilation
- Outdoor spaces with no shade
- Lack of access to water

Patient-specific risk factors for the development of heat illness include:

- Elderly individuals: the body has a lower water content in older age, which predisposes elders to severe heat injury compared to younger people
- Mental illness, specifically schizophrenia, can predispose individuals to severe heat injury.

Caution: These two groups are considered the highest-risk cohorts for the development of lethal heat injuries. Exercise extreme care while developing patient care plans, consult with CliniCall as required, and convey patients to appropriate destinations if safety cannot be assured.

- Obesity: adipose tissue insulates the body and retains heat; it may also generate additional heat
- Physical exertion
- Concomitant or chronic illnesses
- Use of alcohol, drugs, or other medications (including anticholinergics, antidopaminergics, antihistamines, antipsychotics, beta- and calcium channel blockers, diuretics, antidepressants, and lithium).
- Pregnancy
- Socioeconomic and/or Occupational vulnerability

Signs and Symptoms of Heat illness and Injury:

The formal definition of heat stroke – either exertional or classic heat illness from high environmental temperatures, with or without physical activity – is a core temperature above 40°C with central nervous system dysfunction. Measurement of core temperature is only authorized for CCP providers, meaning that other providers must use clinical findings as part of their assessment. History is critically important. Use observations of the environment as well as patient signs and symptoms to guide treatment planning.

Differentiating between heat exhaustion and heat stroke can be difficult. The key element is the degree of central nervous system impairment. The treatment for both is the same.

Heat exhaustion and heat stroke can mimic or present concurrently with many other illnesses. Paramedics must consider the possibility of sepsis, ischemic strokes, hypoglycemia, toxic ingestion, or drug misuse.

Prevention is critical and can save lives. Patients with stable vital signs, fully intact level of consciousness and orientation and no signs of heat exhaustion or heat stroke can be moved to a cool environment and encouraged to rest and stay hydrated. When providing on-scene guidance and support to patients, remember that fans alone are insufficient for cooling purposes, and may exacerbate heat exposure due to convective air movement in areas where ambient temperatures exceed 35°C.

“Heat cramps” are localized and painful muscle spasms most often due to electrolyte loss from strenuous activity in a hot environment, cramp onset is usually at rest immediately after activity. Heat cramp patients have no evidence of dehydration. Paramedics, emergency medical responders, and first responders can encourage heat cramp patients to self-administer oral electrolyte drinks.

Heat stroke or heat exhaustion should be assumed in any patient exposed to extreme environmental heat with any of the following signs and symptoms:

- Extreme weakness
- Flushed, hot skin; pale, cold skin; with or without sweating
- Shivering
- Pallor
- “Prickly heat” sensation
- Dehydration
- Fatigue
- Headache
- Light-headedness
- Altered mental status
- Confusion
- Behavioural changes
- Imbalance (ataxia)
- Unresponsive
- Seizure
- Tachycardia
- Hypotension
- Dysrhythmia
- Tachypnea or bradypnea
- Low SpO2
- Abdominal cramps, nausea, vomiting, or diarrhea
- Persistent muscle cramps

Interventions

First Responder

- Recognize early signs of heat injury and treat accordingly:
- Heat cramps: rest in a cool place and recommend oral electrolytes

Open any ventilation sources if indoors / move patient to shade if outdoors.

If any signs/symptoms of heat exhaustion or heat stroke are present, begin immediate cooling:

- Remove all clothing on patient
- To maximal extent possible, based on patient presentation (primarily level of consciousness, patient capacity to follow instructions, absence of other priority intervention needs) and available resources, begin cooling with coldest water possible. The goal is to promote rapid, continuous heat loss. Options may include:
  - If available, begin convective cooling with air conditioning set to maximum cold in conjunction with any other interventions
  - Application of cold, wet towels to head, torso, and thighs to promote evaporative cooling
  - Full-body immersion in bath tub with cold water and ice
  - High-flow cold water in shower while seated in chair
  - Immersion of feet and legs in a bucket or basin of ice water
  - **Caution!** Do not attempt immersion or shower-based cooling in patients who are not able to ambulate safely. Apply principles of safe patient movement as described in PR01: Ambulating Patients prior to selecting a cooling strategy.

- Assess patient continually during cooling.
- Notify follow-on responders of clinical findings and request response time updates

Emergency Medical Responder – All FR interventions, plus:

- Continue cooling efforts for a minimum of 10 minutes prior to beginning conveyance to hospital.
- Assess and record vital signs every 10 minutes. Initial vital signs must include blood glucose measurement.
- The most aggressive cooling method available should be applied during transport and continued until the recommended treatment endpoints are reached.
- Continue evaporative cooling with soaked towels (head, torso and thighs).
- Begin or continue convective cooling with AC of ambulance on maximum cold.

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

After immediate rapid cooling is underway:

- Consider need for fluid replacement in patients with signs and symptoms of dehydration. **Do not administer intravenous fluids that are warm to the touch.**
  - → D03: Vascular Access and Fluid Administration
  - CliniCall Consultation recommended to discuss fluid resuscitation and care planning options.
- Record history: exposure time, details of environment, all symptoms patient is able to communicate. Ask about headache, visual disturbances, palpitations, shortness of breath, nausea, vomiting, urine output.
- Continual serial assessments of neurological status, blood pressure and pulse
- Assess capillary blood glucose; correct hypoglycemia as required
  - → E01: Diabetic Emergencies
- For obtunded, unresponsive patients, consider supraglottic airway
  - → PR08: Supraglottic Airways

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

- Obtain and interpret 12 lead ECG when possible.
  - Manage dysrhythmias as required. Note that dysrhythmias associated with heatstroke do not usually resolve until patient is normothermic. VF/VT can be defibrillated, but cooling remains the definitive treatment
- Consider anticonvulsant
  - → F02: Seizures
- Consider endotracheal intubation in unresponsive patients
  - → PR18: Anesthesia Induction

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

- Consider rectal or esophageal core temperature read within 2 minutes of patient contact and ongoing throughout cooling.
- Stop cooling when body temperature reaches 38-39°C
- Monitor for and correct metabolic derangements (hypernatremia, hyperkalemia, acidosis)

Evidence Based Practice

Hyperthermia

Supportive

- External Cooling

Neutral

- IV Fluid as a cooling agent
- Temperature Monitoring

Against

References

1. Rublee, C, [et al]. Evidence-Based Heatstroke Management in the Emergency Department. 2021. [Link]
2. Douma, M J, [et al]. First aid cooling techniques for heat stroke and exertional hyperthermia: A systematic review and meta-analysis. 2020. [Link]
3. Hirschhorn, R, [et al]. Exertional Heat Stroke Knowledge and Management among Emergency Medical Service Providers. 2021. [Link]
4. Ito, C, [et al]. Safety and efficacy of cold-water immersion in the treatment of older patients with heat stroke: a case series. 2021. [Link]
5. Szymanski, M, [et al]. Emergency Medical Service Directors' Protocols for Exertional Heat Stroke. 2020. [Link]
6. Leyk, D, [et al]. Health Risks and Interventions in Exertional Heat Stress. 2019. [Link]
7. Wasserman, D, [et al]. EMS Methods To Cool A Patient In The Field. 2022. StatPearls Publishing.
8. Parker, K, [et al]. Do Alternative Cooling Methods Have Effective Cooling Rates for Hyperthermia Compared With Previously Established CWI Cooling Rates? 2020. [Link]
9. O'Connor, G, [et al]. Exertional heat illness in adolescents and adults: Epidemiology, thermoregulation, risk factors, and diagnosis. 2022. UptoDate.
10. Belval, L. [et al]. Consensus Statement- Prehospital Care of Exertional Heat Stroke. 2018. [Link]
11. Monseau, A J, [et al]. Status of US Emergency Medical Service Protocols Regarding Pre-Transfer Cooling for Exertional Heat Stroke. 2021. [Link]

Practice Updates

- 2022-09-22: Typographical corrections.
- 2022-06-04: Revised and re-published. The previous version archived, no longer publicly available.
- 2022-07-29 - Addition of Heat Emergency ASTaR Pathway in the referral section.

I03: Diving & Scuba Injuries

John Merrett and Mike Sugimoto

Updated: May 25, 2021
Reviewed: March 01, 2021

Introduction

Although scuba divers can experience a myriad of injuries from wildlife and trauma, the two most serious forms of diving injuries are decompression sickness (DCS) and arterial gas embolism (AGE), both of which are directly related to the behaviour of pressurized gases. In many cases, the signs and symptoms of decompression sickness and gas emboli overlap significantly; it is not important to differentiate between the two in the out-of-hospital environment with treatment for both being essentially identical.

Decompression Sickness ("The Bends")

Scuba divers breathe compressed air. At depth, the nitrogen in this air dissolves into the bloodstream and diffuses into body tissues at variable rates. The water pressure around the diver keeps this gas dissolved in the blood and tissues, but as a diver ascends, water pressure decreases, allowing the dissolved gases to withdraw. (This is similar to opening a pop can – the carbon dioxide remains in the liquid because of the pressure inside the can – and the behavior of gases under pressure is described by Henry's Law.) Normally, during an ascent, divers change depths slowly and breathe constantly ensuring that the nitrogen is released from their lungs. Under some circumstances – a rapid ascent from too deep a dive, for instance – the dissolved gas may not diffuse into the lungs and may instead accumulate in the blood, musculoskeletal system, or other body tissues, as bubbles.

Type 1 DCS is limited to the capillaries of the skin, lymphatic vessels, and the musculoskeletal system. It generally includes skin rashes or urticarial and joint pain. In its milder form, the symptoms can be fleeting and last only a few minutes as the bubbles break down and the diver off-gases; these do not generally require treatment. Pain at or around joints is rarely symmetrical. In more severe cases, the pain can increase over 12 to 24 hours after surfacing, and if untreated, will resolve slowly over the next three to seven days to a dull ache.

Type 2 DCS is more serious. It involves the central nervous, cardiovascular, and respiratory systems; common symptoms include headache, blurred vision, nausea, dizziness, and ataxia. Shortness of breath, hypotension, and weakness can occur. In many cases, Type 1 symptoms are also present.

Arterial Gas Embolism

The pressurized gas breathed by a diver at depth expands as they ascend, following the relationship described by Boyle's Law. If the expansion is not accommodated or controlled, the expansion can be fatal. In the lungs, gas can expand and rupture alveoli, introducing air into the bloodstream. Once in the blood, the bolus of air is carried into the heart, and then into the arterial circulation. Air can also be forced into the pleural space between the lungs and chest wall; in some cases, this is the result of a congenital weakness. Pleural air expansion can lead to either mediastinal emphysema (a collection of air in the mediastinum) or subcutaneous emphysema in the neck or upper chest.

AGE is the most common cause of death in scuba diving.

Essentials

- DCS should be considered in any diver who, within 24 hours of completing a dive, complains of a persistent headache, dizziness, joint pain, or difficulty balancing. Most DCS cases are mild and treatment is often successful, but recognition can be difficult and expert consultation is required.
- AGE presentations are sudden, catastrophic events that become obvious upon surfacing. A diver who surfaces in distress should be assumed to have an AGE or other barotrauma until proven otherwise.

Additional Treatment Information

- The immediate history of the dive can provide clues to the probability of DCS. Some of the risk factors include:
  - Strenuous work at depth
  - Deep dives on air only (e.g., no mixed gas)

    - Long bottom times
    - Cold water dives
    - Repetitive dives
    - Missed or shortened safety stops
    - Dehydration and/or recent alcohol consumption
- Individual susceptibility to DCS is not well understood and the phenomenon is not predictable. Divers can strictly follow tables and use computers to monitor their dives and still develop DCS. Every dive carries some risk of DCS and the absence of risk factors on any given dive does not preclude the possibility of the disorder. A diver demonstrating symptoms consistent with DCS, and who lacks any of the risk factors listed above, should still be considered a potential diving injury until appropriately assessed.
- Individuals who have experienced DCS are at significant risk of subsequent episodes. A prior history of a patent foramen ovale, or other structural heart disease resulting in a right-to-left intracardiac shunt, is also at high risk of developing DCS.
- Although joint pain within 30 minutes of surfacing is considered a classic symptom of DCS, headaches and flu-like symptoms are also common. Joints commonly involved include the shoulders and elbows with the pain being unchanged on movement. These symptoms may take up to 24 hours to develop. Joint pain often resolves in several days.
- AGE presentations are often associated with rapid, buoyant ascents as might occur when a diver panics; breath holding during an ascent is a common cause. An AGE is an abrupt onset event: divers may be in obvious difficulty on the surface. The development of symptoms beyond 10 minutes post-dive is unlikely to be due to an AGE (consider DCS in this case).
    - Signs and symptoms of AGE include:
        - Collapse and unconsciousness
        - Seizures
        - Visual field disturbances or blindness
        - Weakness or paralysis
        - Disorientation
        - Bloody, frothy sputum
        - Chest pain
        - Shortness of breath
    - Barotrauma can occur when compressed gas becomes trapped within a space in the body such as a dental filling, sinus, or the middle or inner ear. Pain and bleeding are common; dizziness, vertigo, and loss of hearing in the affected ear may be present as well.
    - Carbon monoxide toxicity can develop from breathing contaminated air, either in the scuba tank itself, or in the air on a boat. Treat in accordance with J02: Carbon Monoxide.
    - Every breathing gas mixture has a critical limit, below which the oxygen becomes toxic. For air, that limit is roughly 200 feet; as the concentration of oxygen in the breathing mixture increases, the limit becomes shallower. Oxygen toxicity develops only in the context of increased partial gas pressures (i.e., it does not happen at atmospheric pressure), and can cause dizziness, nausea, facial tics, visual field disturbances, or seizures. These often develop at depth and remain present upon surfacing. Distinguishing between oxygen toxicity and DCS can be difficult, though a history of the dive (depth, breathing gas mixture) will help.
    - Marine life can cause a variety of injuries ranging from punctures and lacerations to venomous stings. Follow standard wound care procedures in managing these types of injuries.
    - In jellyfish stings, flush the affected area using seawater, as fresh water can cause the nematocysts to fire. Do not use vinegar or other fluids for stings occurring in Canadian coastal waters. After flushing, paramedics and EMRs/FRs should attempt to cautiously, and gently, remove any remaining tentacles by scraping with the dull edge of a knife or plastic card.

Referral Information

Signs of DCE can be subtle, and may take time to develop. An emergency physician should always see patients suspected of having suffered a dive injury. Consultation with a specialist in hyperbaric medicine is highly recommended.

General Information

- Deliver oxygen at the highest possible percentage and flow rates to symptomatic patients. Continue providing oxygen even if symptoms appear to resolve. Use a non-rebreather face mask, or bag-valve mask with reservoir. CPAP and PEEP are contraindicated due to the risk of exacerbating an underlying barotrauma.
- To the maximum extent possible, patients should be kept supine. If required to protect the airway, an injured diver may be positioned laterally, left side down.
- Dive injuries can be multifaceted. Hypothermia can complicate management and physical trauma sustained during the dive must be addressed. Do not focus on dive-related injuries to the exclusion of other clinical problems.
- The sole hyperbaric chamber accessible to civilians in the province of British Columbia is at Vancouver General Hospital. Follow clinical pathway guidelines – recompression therapy must be coordinated with the hyperbaric unit at VGH prior to patient arrival at the facility; in the absence of traumatic injuries requiring a trauma centre, patients should be conveyed to their nearest facility for assessment and referral. If the patient is to be flown to VGH, cabin altitude should be kept below 300 metres (1,000 feet) where possible.
- When communicating with other health care providers, paramedics and EMRs/FRs must be clear about terminology: these patients have experienced a *dive injury* or a *scuba injury*, not a *diving injury*.
- Paramedics and EMRs/FRs should make a concerted effort at gathering information relating to the dive, interviewing the injured diver's buddy, and securing the diver's gear (particularly any computer or monitoring equipment that recorded the depth profile).

Interventions

First Responder

- Position patient supine where possible
- Provide high flow oxygen
  - → A07: Oxygen Administration
  - → B01: Airway Management

Emergency Medical Responder – All FR interventions, plus:

- Obtain thorough dive history
- Consider activation of air conveyance resources

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

- Consider conveyance to a decompression chamber
- Consider altitude restrictions for conveyance
  - Does not necessarily require sea level but should not exceed the altitude of the sending hospital or scene

Evidence Based Practice

Diving Injury (Decompression Sickness or Bends)

Supportive

Neutral

- Direct Transport To Hyperbaric Facility
- NSAIDs
- Oxygen

Against

References

1. British Columbia Drug and Poison Information Centre. Jellyfish. 2010. [Link]
2. Divemar Inc. DCIEM Sport Diving Tables. [Link]
3. Divers Alert Network. Health & Diving. [Link]
4. Government of Canada. Dealing with Accidents at Sea. [Link]
5. Grover I et al. The SANDHOG criteria and its validation for the diagnosis of DCS arising from bounce diving. 2007. [Link]
6. Nitrox. Nitrox Basics: Oxygen Management (Part 1). [Link]