Clinical Practice Guidelines:
Environmental/Diving emergencies

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Date	February, 2021
Purpose	To ensure consistent management of diving emergencies.
Scope	Applies to Queensland Ambulance Service (QAS) clinical staff.
Health care setting	Pre-hospital assessment and treatment.
Population	Applies to all ages unless stated otherwise.
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Diving emergencies

February, 2021

Diving emergencies result from changes in ambient pressure, encompassing: decompression illness (decompression sickness and arterial gas embolism), barotrauma and hypoxic blackouts.[1–6]

- ***Decompression sickness (DCS)*** [1]
  Occurs if a diver is unable to perform a slow controlled ascent. Inhaled nitrogen is unable to leave the body naturally, causing bubbles to form in the diver's blood and tissues. These bubbles cause a reduction in blood flow and subsequent end tissue/organ cellular ischaemia.

- ***Arterial gas embolism (AGE)*** [1]
  Results from pulmonary barotrauma when expanding gas within the alveoli ruptures the alveoli/capillary membrane allowing bubbles to enter the arterial circulation via the lungs.

- ***Barotrauma*** [2,3]
  Occurs when trapped air expands during the diver's ascent, due to decreasing pressure, causing trauma. This can occur in any gas filled space including the pulmonary system, ears, eyes, sinuses, dental structures, gastrointestinal tract and even the dive mask or dive suit.

- ***Hypoxic/shallow water blackout*** [6]
  Loss of consciousness while swimming or diving underwater, during an apnoea submersion, often preceded by hyperventilation prior to diving, when other causes of unconsciousness have been excluded. The term 'shallow water blackout' can be misleading, as drowning can occur at depths greater than five metres, hence the term 'hypoxic blackout' may be more appropriate than shallow water blackout.[6]

Diving Emergencies relative to type of diving

Free Diving	No form of diving equipment. Divers simply hold their breath	- Hypoxic/shallow water blackout
SCUBA Diving	Self Contained Underwater Breathing Apparatus or 'dive set' that consists of a buoyancy vest, regulator and compressed air cylinder	- DCS & AGE
Surface Supplied Breathing Apparatus	Diver breathes compressed air through a helmet or regulator via an umbilical air line attached to a wharf or boat	- DCS & AGE - Severed or contaminated umbilical air line
Rebreather Diving	Expired gas is recycled through a breathing loop and granular CO_2 absorbent. Use various gas mixtures including Helium-Oxygen, Nitrogen-Oxygen or Oxygen.	- DCS & AGE - CO_2 build up – hypercarbia - Caustic steam airway burns from water contamination in CO_2 absorbent
Saturation Diving	Chamber/bell pressurised to a set depth that can be rapidly raised or lowered from a ship, allowing divers to remain at 'depth' for up to four weeks	- Explosive decompression - Other cardiac/medical/ respiratory problems

Clinical features

Neurological:

- headache
- visual changes
- motor/sensory deficit
- cranial nerve palsies
- seizures
- paralysis
- ALOC

Respiratory:

- dyspnoea
- haemoptysis
- chest pain
- APO
- pulmonary barotrauma
  - pneumothorax
  - pneumomediastinum
  - subcutaneous emphysema

Cardiac:

- chest pain
- cardiac arrest.

Clinical features *(cont.)*

Localised symptoms:

- skin itch and/or rash
- pain in the joints (the 'bends') and/or muscles (especially shoulders/elbows)
- tremors.

Risk Assessment

- Onset of decompression illness symptoms may occur more than 24 hours after any form of deep diving.

Additional information

- Presentations may be subtle, but **ALL** symptoms should be considered relevant. Clinicians should have a low threshold for seeking expert advice *(see below)* or transporting patients to definitive care.
- **Divers Alert Network (DAN)** is a worldwide diving safety association providing 24/7 medical information for diving related illnesses – phone: [redacted]

CPG: Clinician safety
CPG: Standard cares

Cardiac arrest?

Y

Manage as per appropriate CPG:

- CPG: Resuscitation (age specific)
- CPG: Resuscitation – Special circumstances

N

Unconscious or respiratory distress?

N

- Posture the patient supine
- Oxygen
- Maintain normothermia

Consider:

- IV fluid

Y

- Posture the patient supine (without leg elevation)
- Oxygen (high flow)
- Maintain normothermia

Consider:

- IPPV
- IV fluid
- LMA/ETT

Transport to hospital
Pre-notify as appropriate

Note: *Clinicians must only perform procedures for which they have received specific training and authorisation by the QAS.*

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