



Clinical Practice Guidelines: Environmental/Diving emergencies

Policy code	CPG_EN_DE_0221
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.
Source of funding	Internal – 100%
Author	Clinical Quality & Patient Safety Unit, QAS
Review date	February, 2024
Information security	UNCLASSIFIED – Queensland Government Information Security Classification Framework.
URL	https://ambulance.qld.gov.au/clinical.html

While the QAS has attempted to contact all copyright owners, this has not always been possible. The QAS would welcome notification from any copyright holder who has been omitted or incorrectly acknowledged.

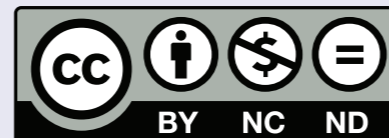
All feedback and suggestions are welcome. Please forward to: Clinical.Guidelines@ambulance.qld.gov.au

Disclaimer

The Digital Clinical Practice Manual is expressly intended for use by appropriately qualified QAS clinicians when performing duties and delivering ambulance services for, and on behalf of, the QAS.

The QAS disclaims, to the maximum extent permitted by law, all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs incurred for any reason associated with the use of this manual, including the materials within or referred to throughout this document being in any way inaccurate, out of context, incomplete or unavailable.

© State of Queensland (Queensland Ambulance Service) 2021.



This work is licensed under the **Creative Commons Attribution-NonCommercial-NoDerivatives V4.0 International License**

You are free to copy and communicate the work in its current form for non-commercial purposes, as long as you attribute the State of Queensland, Queensland Ambulance Service and comply with the licence terms. If you alter the work, you may not share or distribute the modified work. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/deed.en>

For copyright permissions beyond the scope of this license please contact: Clinical.Guidelines@ambulance.qld.gov.au

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]

