Clinical Practice Guidelines:
Environmental/Diving emergencies

<table>
<thead>
<tr>
<th>Policy code</th>
<th>CPG_EN_DE_0416</th>
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<tbody>
<tr>
<td>Date</td>
<td>April, 2016</td>
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<tr>
<td>Purpose</td>
<td>To ensure consistent management of diving emergencies.</td>
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<tr>
<td>Scope</td>
<td>Applies to Queensland Ambulance Service (QAS) clinical staff.</td>
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<tr>
<td>Health care setting</td>
<td>Pre-hospital assessment and treatment.</td>
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<tr>
<td>Population</td>
<td>Applies to all ages unless stated otherwise.</td>
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<tr>
<td>Source of funding</td>
<td>Internal – 100%</td>
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<tr>
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<td>Clinical Quality &amp; Patient Safety Unit, QAS</td>
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Diving emergencies result from changes in ambient pressure, encompassing: decompression illness (decompression sickness and arterial gas embolism), barotrauma and hypoxic blackouts.\(^{1-5}\)

- **Decompression sickness (DCS)**
  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)**
  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**
  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**
  Is a loss of consciousness that may occur during free diving near the surface or just after surfacing. This is commonly due to hypoxia secondary to relative hypocapnia from hyperventilating prior to the dive.

<table>
<thead>
<tr>
<th>Diving Emergencies relative to type of diving</th>
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<tr>
<td><strong>Free Diving</strong></td>
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<tr>
<td><strong>SCUBA Diving</strong></td>
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<td><strong>Surface Supplied Breathing Apparatus</strong></td>
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<td><strong>Rebreather Diving</strong></td>
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<td><strong>Saturation Diving</strong></td>
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### 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 > 24 hours after any form of deep diving.

### Additional information

- Presentations may be subtle and **ALL** symptoms should be considered relevant and discussed with an expert **OR** require medical attention.
- The **Diving Emergency Services (DES)** – [link], is a 24-hour emergency service providing advice for all diving related illnesses.
Cardiac arrest?

- IPPV
- IV fluid
- LMA/ETT

Transport to hospital
Pre-notify as appropriate

Unconscious or respiratory distress?

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

Manage as per appropriate CPG:
- CPG: Resuscitation (age specific)
- CPG: Resuscitation – Special circumstances

Consider:
- IV fluid

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