Assessing Potential Diving Related Illness

90% of illnesses after diving are dive-related

The attached form is a guide for assessing unwell divers

Unique specialities like Diving Medicine are difficult especially if your experience is limited. This guide aims to be user friendly and straight forward. Add any information you feel necessary and do not feel obligated to complete every detail regarding the patient's clinical picture.

History taking should be self-explanatory

The front of the form deals with diving history, risks for diving illnesses and general medical history. The back of the form outlines examples of symptoms experienced by the patient and related examination findings. The focus of assessment is mainly neurological and musculoskeletal systems. Some history hints include:

- Use the patient's log book or computer to get the dive profile information.
- A **Decompression (deco) Stop** is a planned stop in accordance with dive tables.
- A **Safety Stop** is a recommended stop done even if a 'deco' stop in unnecessary.

Examination is essentially the same for any patient

Specific dive-related examinations include the Sharpened Romberg Test and looking for **Barotrauma** (LUNGS-pneumomdiastinum / pneumothorax / surgical emphysema and EAR). ***Do not perform this test if you suspect CAGE (Cerebral Arterial Gas Embolism). Keep patient supine.***

Sharpened Romberg Test (SRT)❖

Sharpened Romberg Test, when performed properly, is very beneficial to diver assessment:

Patient stands with feet in heel to toe position and arms crossed over the chest. Once stable, the patient should close their eyes and attempt to maintain that position for 60 seconds. If the patient fails to maintain the position, by movement of either arms or feet or by opening their eyes, the time taken to failure is noted. If not achieved, the patient is to attempt up to 3 further trials of 60 seconds. If any attempt is successful, no further testing is required.

Record results in the 'SRT results' section (page 2) *'Diving Injury Assessment'* form.

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DIVING INJURY ASSESSMENT

If you are suspicious of an illness requiring Hyperbaric Therapy or you need advice, please contact:

Diving Emergency Services (funded by DAN)
24hr Emergency Hotline: **1800 088 200**

OR

Hyperbaric Medicine Unit
The Townsville Hospital: **07 4433 1111**
Royal Brisbane and Women's Hospital: **07 3636 8111**

If the patient needs to attend a Hyperbaric Unit

- He / she must travel either by land (<200 metes altitude) or by aircraft pressurised to sea level equivalent. Discuss transport options with the Hyperbaric Team. **You** will need to organise transport. If person comes by personal car please ensure they are not the driver.
- Administer 100% oxygen (with air breaks as per advice).
- Keep the patient well hydrated (either oral or IV fluids).
- Tell the patient that:
  - » The first treatment takes a minimum of almost 5 hours;
  - » Subsequent treatments are once a day;
  - » Anywhere from 1–8 treatments may be necessary (average is 2–4);
  - » Treatment is usually as an outpatient;
  - » Present to the hospital main entrance and ask for directions to the Hyperbaric Medicine Unit;
  - » Illness may impact on air travel after treatment.
- Please ensure patient's belongings are transported with them.

Photocopy the completed *'Diving Injury Assessment'* form to send as your referral letter

❖ C.R. Gibbs, K.H. Commons, L.H. Brown & D.F. Blake . Diving and Hyperbaric Medicine, Vol.40 No.4; 2010

Assessing Potential Diving Related Illness

Decompression Illness (DCI) results from the development of bubbles within the body.

DCS - Decompression Sickness ('The Bends')*

DCS is a subset of DCI. This term specifically refers to the formation of bubbles from dissolved nitrogen or another inert gas. It is a complex process, which may potentially involve many systems, with the spinal cord and peripheral nerves thought to be commonly involved (e.g. musculoskeletal, neurological, dermatological etc).

Symptom onset is often within 30–60 minutes of surfacing; nearly all within 24 hours and unlikely after 48 hours.

- **Mechanisms are through Nitrogen bubbles:**
  - » Forming in tissues - causing pressure on and compression of various structures;
  - » Forming in vessels - causing altered blood flow;
  - » Activating inflammatory proteins, cascades and reactions.
- **Hyperbaric Oxygen Therapeutic mechanisms include:**
  - » ↑ Pressure → ↓ Nitrogen bubble size;
  - » Oxygen to hypoxic tissues
  - » Accelerating nitrogen elimination;
  - » Anti-inflammatory.
- **Symptoms of DCS include:**

» Rash	» Dizziness	» Weakness	» Headache
» Difficulty breathing	» Paralysis	» Joint pain	» Nausea
» Pruritus	» Paraesthesia / tingling	» Extreme fatigue	» Difficulty walking
» Visual disturbances	» Altered level of consciousness		

CAGE - Cerebral Arterial Gas Embolism*

CAGE is a subset of DCI. This term refers specifically to the introduction of bubbles to the arterial circulation by pulmonary barotrauma or PFO. **If you suspect CAGE keep the patient supine.**

Rapid neurological syndrome as a result of gas bubbles in the arteries supplying the brain.

Associated with rapid ascent, breath holding leading to barotrauma or a large nitrogen load.

Clinical picture includes any rapid onset with altered neurology (e.g. ↓ GCS, power, co-ordination) within 10 mins of surfacing due to the passage +/- trapping of bubbles in the cerebral circulation. Divers usually show an initial improvement or recovery. Systemic response is one of cerebral vasodilation and ↑ BP with relapse within hours. This delayed deterioration is due to bubble activated inflammatory reactions and damage to vessel walls.

The air bubbles enter the circulation as a result of shearing and tearing of pulmonary tissue. Surprisingly enough, the incidence of CAGE and pneumothorax / mediastinum together is quite low but still must be considered. There is also the possibility of nitrogen venous bubbles entering the arterial circulation via a patent Foramen Ovale (28%–30% of the population), but most venous bubbles are 'filtered' by the pulmonary circulation. Bubbles in larger vessels distribute according to buoyancy, therefore if diver is vertical they can go to the brain. Obviously though, intravascular bubbles are not limited to the cerebral circulation.

- **DCI definition: includes DCS and CAGE - describing the clinical picture in terms of:**
  - » Acute / chronic
  - » Evolution (progressive, stable / static, relapsing, resolving etc);
  - » Organ system involved (neurological - central or peripheral, musculoskeletal etc);
  - » +/- degree of severity (mild / moderate / severe);
  - » Evidence of barotrauma (ear - middle / inner, pulmonary-pneumothorax / mediastinum / CAGE);
  - » e.g. acute, stable, mild neurological DCS.

It is very difficult to differentiate between Cerebral DCS and CAGE. Sometimes both may be present. However, it is unnecessary to differentiate between the two as treatment is the same.

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* Edmonds C, Lowry C, Pennefather J & Walker R. Diving and Subaquatic Medicine, 4th ed. London: Hodder Arnold; 2005.

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Diving Injury Assessment

Facility: .....

(Affix identification label here)

URN:

Family name:

Given name(s):

Address:

Date of birth: Sex: ☐ M ☐ F ☐ I

Staff should be familiar with the Clinical Practice Guideline 'Diving Injuries' prior to commencement. Refer to '*Assessing Potential Diving Related Illness*' for instructions.

Supine position if significant barotrauma or suspect CAGE (Cerebral Arterial Gas Embolism) ☐ Yes ☐ No

Dive profile

Date	**Depth** (m)	**Dive time** (min)	**Surface interval** (min)	**Safety stop** (min)

Breathing gas: ☐ Air ☐ Nitrox (..... % O_2) ☐ Other (specify: .....)

Diving apparatus: ☐ Scuba ☐ Rebreather ☐ Surface supply

Risk factors for decompression sickness / barotrauma

Rapid ascent	☐ Yes	☐ No	Altitude >200m since dive	☐ Yes	☐ No
Breath holding during ascent	☐ Yes	☐ No	Repetitive dives in single day (>3)	☐ Yes	☐ No
Difficulty equalising ears	☐ Yes	☐ No	Reverse profiles (shallow then deep)	☐ Yes	☐ No
Previous decompression sickness	☐ Yes	☐ No	Multiple ascents	☐ Yes	☐ No
Dehydration	☐ Yes	☐ No	Inadequate safety stops	☐ Yes	☐ No
Obesity	☐ Yes	☐ No	Inadequate surface interval (<2 hours)	☐ Yes	☐ No
Excessive physical exertion during dive	☐ Yes	☐ No	Multiple days of diving (>3)	☐ Yes	☐ No
Dive in excess of table / computer	☐ Yes	☐ No			

History:

Symptoms

ALOC	☐ Yes	☐ No	Paraesthesia	☐ Yes	☐ No
Weakness	☐ Yes	☐ No	Severe lethargy	☐ Yes	☐ No
Nausea or vomiting	☐ Yes	☐ No	Arthralgia / myalgia	☐ Yes	☐ No
Poor concentration	☐ Yes	☐ No	Palpitations	☐ Yes	☐ No
Behavioural change	☐ Yes	☐ No	Chest pain	☐ Yes	☐ No
Vertigo	☐ Yes	☐ No	Dyspnoea	☐ Yes	☐ No
Poor balance or ataxia	☐ Yes	☐ No	Rash	☐ Yes	☐ No
Hearing loss or tinnitus	☐ Yes	☐ No			

Time to onset of symptoms post dive: :

Symptoms improved by (e.g. O_2, fluid, re-dive):

Symptoms worsened by:

Management prior to attending emergency department:

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DIVING INJURY ASSESSMENT

v2.00 - 10/2012

SW210

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Diving Injury Assessment

(Affix identification label here)

URN:

Family name:

Given name(s):

Address:

Date of birth: Sex: ☐ M ☐ F ☐ I

Examination

Pulse:	BP:	Temp:	RR:	O_2Sats:

		If *abnormal*, specify:
Neurological - peripheral nerves		
Tone	☐ NAD ☐ Abnormal	
Power	☐ NAD ☐ Abnormal	
Reflexes	☐ NAD ☐ Abnormal	
Sensation	☐ NAD ☐ Abnormal	
Neurological - cranial nerves		
II–XII	☐ NAD ☐ Abnormal	
Neurological - cerebellum		
Nystagmus	☐ NAD ☐ Abnormal	
Finger nose	☐ NAD ☐ Abnormal	
Dysdiadokinesis	☐ NAD ☐ Abnormal	
Heel - shin	☐ NAD ☐ Abnormal	
Gait	☐ NAD ☐ Abnormal ☐ N/A	
Higher mental function		
Serial 7s	☐ NAD ☐ Abnormal	
MMSE	..... / 30	
SRT results (see *Assessing Potential Diving Related Illness* for instructions)	**1:** ..... / 60 **2:** ..... / 60 **3:** ..... / 60 **4:** ..... / 60 ☐ N/A	
Joints and muscles		
Local tenderness	☐ NAD ☐ Abnormal	
ENT		
Tympanic membrane	☐ NAD ☐ Abnormal	
Other		
Abd	☐ NAD ☐ Abnormal	
Chest	☐ NAD ☐ Abnormal	
Rash	☐ Yes ☐ No	

Other examination findings:

Investigations (CXR if any evidence of pulmonary barotrauma):

Management

Oxygen	☐ Yes ☐ No	Case discussed with Hyperbaric Medicine Unit	☐ Yes ☐ No
Oral fluid	☐ Yes ☐ No	Intravenous fluid	☐ Yes ☐ No

Differential diagnosis:

Dr Signature:	Printed name:	Time:	Date:

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