Decompression Illness Symptoms & First Aid

Decompression Illness

To many people, the terms 'decompression sickness' (DCS), 'decompression illness' (DCI) and 'the bends' are synonymous. However, although there should be no difference in the immediate treatment of anyone suffering from these conditions, the terms do not necessarily mean the same.

Decompression Illness (DCI) is an umbrella term for both decompression sickness (DCS) and Cerebral Arterial Gas Embolism (CAGE).

Arterial gas embolism (AGE) and Decompression Illness (DCI) are the two most common diving related accidents. Symptoms may occur on surfacing or within 36 hours.

Decompression Sickness

Decompression sickness can be classified as either Type 1 or Type 2. The different classification reflects the effect, and therefore the severity, of the condition. Diagnosing DCS as one (or both) of just two categories does not enable proper identification or discrimination. However, for the sake of completeness, the two types are described here.

Type 1 DCS can occur when bubbles affect the tissues around skeletal joints. Symptoms usually include unilateral (on one side of the body) discomfort or pain in one or more joints. The areas most often affected are the knees, elbows and shoulders.

Decompression sickness might also present as a skin (cutaneous) disorder. Nitrogen bubbles can cause mottling, lumps or a rash. "Skin bends", as they are colloquially termed, are more common during hyperbaric chamber 'dives' and when diving using a dry suit. Although not usually in themselves serious, skin symptoms may indicate the presence of problems elsewhere. A particularly serious cutaneous sign of DCS is 'cutis marmorata' marbling, in which an area of skin becomes pale with dark mottling. This is associated with considerable development of inert gas bubbles within the body.

If left untreated, Type 1 DCS may progress to Type 2.

Type 2 DCS reflects involvement of the Central Nervous System (CNS) and / or the cardio-respiratory system. More than half of those diagnosed with DCS will be classified as Type 2.Cerebral symptoms arise from interruption of the blood supply to the main part of the brain, and include confusion, reduced mental function and unconsciousness. Involvement of the cerebellum may lead to tremors, loss of balance ("staggers") and a lack of co-ordination. Balance may also be affected by damage to part of the inner ear.

Spinal DCS may present as back pain, pins and needles, paralysis and loss of urinary sphincter control - resulting in either incontinence or retention.

The formation of small inert gas bubbles does not necessarily lead to the development of DCS. Likewise, when bubbles become trapped in the tiny blood vessels around the lungs' alveoli (air sacs), problems do not always arise. In fact, it is thought that their accumulation in this area may increase the rate that the gas is excreted from the body. However, if too many bubbles collect, breathing will become adversely affected (the "chokes"). Symptoms include breathlessness, an increase in breathing rate, chest pain and coughing. Although symptoms may resolve, this should be regarded as a life-threatening condition as it may progress to fatal respiratory collapse.

Signs and Symptoms of Decompression Sickness

A more useful classification of DCS can be achieved by noting the area(s) of the body affected. These are detailed in the following list:

General signs

- Nausea, weakness or fatigue

Skin

- Itching
- Generalised rash
- Lumps
- Cutis marmorata marbling (serious sign)
- Crackling feeling - not usually around collarbone

Musculo-skeletal (muscles and joints).

- Joint or muscle discomfort and / or pain ("bends")
- Limitation of limb movement
- Crunching sound in joint

Gastrointestinal (stomach and bowel).

- Nausea, vomiting
- Abdominal cramps, diarrhoea

Cardiorespiratory (heart and lungs).

- Coughing
- Chest pain made worse on inspiration
- Tachypnoea (increase in breathing rate)

Neurological (cerebrum, cerebellum, spinal cord, inner ear and peripheral nerves).

- Headache
- Confusion
- Memory loss
- Tremors
- Visual disturbance
- Involuntary eye movement
- Lack of co-ordination
- Numbness or altered sensation
- Pins and needles
- Urinary retention
- Ringing sound in ears
- Hearing loss
- Dizziness, loss of balance
- Partial or full paralysis of lower limbs
- Unconsciousness

It must be emphasised that even in the absence of obvious symptoms, the possibility of DCS should be considered if the diver's circumstances suggest such a risk. If in any doubt, administer 100% Oxygen and contact the appropriate emergency service.

Those with any symptoms of DCS, however mild, are at risk of further episodes.

Cerebral Arterial Gas Embolism

The term is self-explanatory; gas (air) forms an embolism (blockage) in an artery (vessel supplying blood) in the cerebrum (brain). This is caused by the rupture of the fragile lining of the lung's alveoli allowing large quantities of air to enter the blood vessels leading to the small arteries in the brain via the heart.

CAGE is a life-threatening emergency and requires immediate medical treatment.

Signs and symptoms of CAGE

Cerebral Arterial Gas Embolism is the result of pulmonary barotrauma, which may present with the following symptoms.

- Crackling feeling - particularly around collarbone area
- Chest pain
- Shortness of breath
- Coughing, possibly with blood
- Increase in heart rate
- Decrease in blood pressure

The resulting cerebral damage may result in the following symptoms.

- Severe headache
- Paralysis
- Numbness
- Unconsciousness

Symptoms similar to those of neurological DCS may also be present. Any confusion between the diagnosis of CAGE or neurological DCS should not influence the immediate care of the affected diver - both are medical emergencies treated initially in the same way.

First Aid for DCI

IMPORTANT : In any incident assume DCI until informed otherwise.

Initial treatment for all suspected cases of decompression illness, whether thought to be DCS or CAGE, should be the same. Firstly, the accepted practice of "Danger, Responses, Airways, Breathing, Compressions - DrABC" should be used.

- Safety first - do not place yourself at risk of becoming another casualty, it is more difficult to treat two divers than just one.

- If unconscious, place the casualty in the recovery position and ensure airway is open.

- **Immediately** administer high concentration oxygen if available (the first 15 minutes are crucial). Be prepared for an initial deterioration in the symptoms.

- Perform Basic Life Support if required (preferably oxygen enriched)

- Seek medical assistance immediately- see the contact section for details.

In addition, rescuers should ensure the following.

- Lay the casualty down and keep them horizontal - this may help prevent bubble migration to the brain.

- Encourage the diver to remain calm and still and re-assure them.

- Protect against hypothermia - replace wet clothes with dry. Do not expose to excessive heat.

- Encourage fluid intake (water or preferably cordial - aim for 1 litre if given by mouth) - if the casualty has a reduced conscious level or has difficulty in swallowing then avoid giving oral fluids. If available, intravenous fluid therapy is preferred. Check for urination and continue to give fluids if urination regular (about 25 minutes).

- Monitor for deterioration and record observations. This is important – good notes will assist the medical professionals to administer the correct treatment quickly.

- Do NOT administer pain killers, leave the casualty unattended, or move to a higher elevation.

Bear in mind that there may be more than one diver in the group with decompression illness.

Notify the appropriate emergency service of any deterioration:

Never administer Entonox ("gas and air"). This will worsen the condition because it consists of 50% Nitrous Oxide, which is highly soluble.

IMPORTANT:

If DCI is suspected, DO NOT delay in treating the casualty. Administer 100% Oxygen and contact the emergency services:

At sea:

All incidents contact the **coastguard** on **VHF channel 16**
Decompression Illness issue a **Pan Pan**
Lives in Danger issue a **Mayday**

On land:

For **DCI** :

In **England, Wales or Northern Ireland** - telephone the British Hyperbaric Association/Royal Navy Helplines on **(07831) 151523** (24 hours)

In **Scotland -** call the on-call hyperbaric consultant at Aberdeen Royal Infirmary on **(01224) 681818** (24 hours)

Other areas - contact the Divers Alert Network

For **Near Drowning:**

Call the Ambulance on **999** or **112**

For **Lost Diver:**

Call the **coastguard/Police** on **999** or **112**

IN ALL CASES GIVE YOUR NAME, THE TYPE OF EMERGENCY AND YOUR LOCATION

Casualty Assessment

Use an Incident Procedure/Casualty Assessment sheet to record details of the incident and the casualty – these are available from the BSAC or the branch Diving Officer. The purpose of the sheet is to give the medical professionals any relevant information to facilitate the correct diagnosis and treatment. It is important that details are recorded correctly – give this task to ONE person. The casualty assessment is used to ascertain the extent of any DCI. Follow the assessment as laid down on the sheet in a logical order, so that no detail is missed.

Orientation:

- Does the diver know name and age, day and date?
- Do they know where they are?

Check their level of response:

- Are they alert?
- Do they respond to voice?
- Do they respond to pain (pinching an ear lobe)?
- Are they unresponsive?

If they are alert, ask questions:

- Where does it hurt?
- When did symptoms occur; when was it worse?

Is there are change in personality?

Do they have chest pains?

Carry out an assessment of their condition:

- Respiration – Check how many breaths a minute they are making, and if deep or shallow
- Check the casualty pulse rate
- Eyes, Check each one separately. Hold up fingers and ask the casualty to identify different numbers
- Ask the diver (from 0.5 meter) to follow one finger. First up and down and then side to side. Is the movement smooth and are the divers pupils the same size? Do both eyes track?
- Face. Ask them to smile; is the muscle contraction the same both sides?
- Tongue. Stick out tongue; it should come straight out with no sideways deviation.

Tingling/Numbness:

- Does the casualty feel any tingling?
- Close both the divers eyes and lightly touch points down each side of the body using a pointed instrument. Where do they **not** feel it?

Muscle strength:

- Push down on the shoulders whilst they shrug; is the pressure equal and strong?
- Lay the diver flat and ask to raise each leg and push against your hands. Are both strong? Use the same procedure for arms.

Co-ordination:

- Ask the diver to touch his/her nose and your finger (0.5m away) rapidly, a few times.

Feet:

- (Babinski Reflex). Take off diver's sock and run a pointed instrument up the sole. If the toes curl down, this is normal. If nothing happens, no conclusion can be drawn. If the toes curls up, this is a reliable sign of spinal involvement.

With any DCI assessment it is important to look for and record any changes without causing the patient unnecessary emotional stress. When asking a question such as 'do you feel pain?' ask for the answer on a scale of one to ten. Ask the same question again after a short period of time and note any changes. **Record all results and despatch them with the casualty.**

If in doubt, assume DCI and at the very least administer 100% oxygen and contact the emergency services as soon as possible.

After the assessment, keep monitoring the casualty (and their buddy) and record any changes. Make sure the casualty's dive computer accompanies the casualty, together with the Incident/Assessment form to the medical facility.

Speed of administration of 100% Oxygen is vital.

After **10 to 15 minutes of onset of symptoms** permanent damage may have taken place. Denying the onset of DCI is very dangerous. If you have any symptoms from mild pain, headache, nausea through to muscle weakness, do not hesitate – **ADMINISTER OXYGEN.**

Further information on Decompression Illness and recompression (hyperbaric) treatment can be found on the following website:

www.hyperchamber.com