

SELECTED ARTICLE AND NOTES FROM DAN'S MEDICAL WEB PAGES

(with URL links)

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From DAN's website on DCS & Diving Medicine:

In an emergency situation, please call 911 or your local emergency services provider number. If you think you might be experiencing decompression illness, please call the 24-hour DAN Emergency Hotline at +1-919-684-9111.

NOTE: in all of below DAN recommends getting the DCS individual to an emergency facility ASAP ... and THEN call DAN.

From <<https://www.diversalernetnetwork.org/medical/>>

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DAN Medical Information Line (+1-919-684-2948)

If you have a question that isn't an emergency, you can call our Medical Information Line during regular business hours and speak directly to one of our medical information specialists. You can also email your question by clicking on the [Ask a Medic](https://www.diversalertnetwork.org/medical/) link and filling out the form. From <<https://www.diversalertnetwork.org/medical/>>

Other Services

- [2012 DAN \(RCAP\) Meeting Recompression Chamber Assistance Program](#). This is a program specifically developed for chamber technicians working at remotely located, under-served recompression chambers within the DAN World and DAN regions.
- [Physician referrals](#). DAN maintains a database of more than 1,000 doctors worldwide who are trained in dive medicine.
- **Physician consult services**. DAN medical information staff provide assistance to physicians as well as allied health-care providers — whether evaluating patients with dive-related illness or injury or assessing fitness to dive.
- **Educational webinar presentations for divers**. If your club, organization or medical facility would like to have us present on a dive medicine topic at your next meeting, call the DAN Medical Information Line, +1-919-684-2948, Option 2.
- [Online seminars](#). Access to our online dive medicine and safety presentations is a benefit of DAN membership.

From <<https://www.diversalertnetwork.org/medical/>>

DAN does not and cannot engage in the practice of medicine, which is the sole province of licensed physicians.

From <<https://www.diversalertnetwork.org/medical/>>

Divers often represent a complex set of problems for hyperbaric centers, and these problems are not always easy to evaluate. Injured divers usually show up in busy emergency departments at odd hours, often with vague symptoms that can represent a wide variety of possible medical conditions.

Since injured divers rarely make scheduled appearances, they frequently undergo evaluation by physicians and staff who are relatively unfamiliar with assessing dive-related illnesses.

As an unfortunate consequence, these patients may become delayed in hospital waiting rooms, or worse, faced with a battery of tests of questionable benefit in the diagnosis of decompression illness (DCI).

There is a bright side to this. About 10 to 12 percent of the calls to DAN's 24-Hour Diving Emergency Hotline each year come from physicians and hospital emergency room staff seeking consultation and guidance for the assessment of dive-related injuries. Situations like these allow DAN to provide the evaluating physician with the ability to recognize DCI and establish an action plan that is likely to include identifying and contacting the nearest appropriate hyperbaric center.

From <https://www.diversalertnetwork.org/medical/faq/Chamber_Location_and_Availability>

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Treatment - Call DAN!

The treatment for DCI is recompression. However, the early management of air embolism and decompression sickness is the same. **Although a diver with severe DCS or an air embolism requires urgent recompression for definitive treatment, it is essential that he be stabilized at the nearest medical facility before transportation to a chamber.**

Early oxygen first aid is important and may reduce symptoms substantially, but this should not change the treatment plan. Symptoms of air embolism and serious decompression sickness often clear after initial oxygen breathing, **but they may reappear later.** **Because of this, always contact DAN or a dive physician in cases of suspected DCI - even if the symptoms and signs appear to have resolved.**

Treatment involves compression to a treatment depth, usually 60 feet, and breathing high oxygen fraction gases at an oxygen partial pressure of between 2.8 ata (atmospheres) and 3.0 ata. Delays in seeking treatment have a higher risk of residual symptoms; over time, the initially reversible damage may become permanent. After a delay of 24 hours or more, treatment may become ineffective and symptoms may not respond to treatment. Even if there has been a delay, however, consult a diving medical specialist before drawing any conclusions about possible treatment effectiveness.

In some cases, there may be residual symptoms after a treatment. Soreness in and around a joint that was affected by DCS is common and usually resolves in a few hours. If the DCI was severe, significant residual neurological dysfunction may be present, even after the most aggressive treatment. In these cases, there may be follow-up treatments, along with physical therapy. The good news is that the usual outcome is eventual complete relief from all symptoms, provided treatment was begun promptly.

From
<https://www.diversalertnetwork.org/medical/articles/Decompression_Illness_What_Is_It_and_What_Is_The_Treatment>

Care Of The Diver With Decompression Illness

I. Determine the Urgency of the Injury

Make an initial evaluation at the dive site. Suspect decompression illness if any of the signs or symptoms previously described occur within 24 hours of surfacing from a dive. The initial state of the affected diver will determine the order and urgency of the actions taken. Based on a classification used by the U.S. Navy, the diver can be placed in one of three case categories:

- - emergency
- - urgent
- - timely

Category A - Emergency Cases Of DCI

Symptoms are severe and appear rapidly, within an hour or so of surfacing. Unconsciousness may occur. **Symptoms may be progressing, and the diver is obviously ill.** The diver may be profoundly dizzy, have trouble breathing or have major abnormalities in consciousness.

Obvious neurological injury is seen in altered consciousness, abnormal gait or weakness.

These divers are obviously very sick, and a true medical emergency exists. **If necessary (e.g., if the diver is unconscious), begin CPR and take immediate action to have the diver evacuated.** Check for foreign bodies in the airway. If ventilatory or cardiac resuscitation is required, the injured diver must be supine (lying on the back). Vomiting in this position, however, is **extremely dangerous**; if it occurs, quickly turn the diver to the side until the airway is cleared and resuscitation can resume in the supine position.

If available, use supplemental oxygen while administering breaths to increase the percentage of oxygen received by the injured diver. Even if CPR is successful and the diver regains consciousness, 100 percent oxygen should be provided and continued until the diver arrives at a medical facility.

If Trained Healthcare Personnel Are Available . . .

... then an intravenous (IV) infusion using isotonic fluids without dextrose should be started. An initial rapid infusion of 1 liter over 30 minutes should begin to correct any dehydration and reduce hemoconcentration. Once this is accomplished, then the rate of administration should be reduced to a 100-175 cc / hour maintenance rate.

Additional 1-liter boluses may be required to further correct dehydration and maintain blood pressure but should only be given by trained healthcare personnel capable of weighing the need for further fluid with possible complications. These would include fluid overload problems and discomfort from urinary retention in divers with abnormal bladder function due to spinal cord decompression sickness. If trained personnel are available, a urinary catheter should be placed in all unconscious divers and in those who cannot urinate.

Call DAN

After stabilization and arrangements for evacuation, contact DAN for advice on the nearest chamber location. DAN medical experts can get in touch with the receiving facility to assist in diagnosis and, if necessary, treatment. Do this even if the diver appears to be improving on oxygen. **While awaiting evacuation, take as detailed a history as possible and try to evaluate and record the diver's neurological status. These facts are useful to the receiving medical facility.** If air evacuation is used, cabin pressure should be maintained near sea level and not exceed 800 feet / 244 meters unless aircraft safety is compromised.

Place the diver in the lateral recumbent position, also known as the recovery position. This puts the person on one side (usually left) with head supported at a low angle and the upper leg bent at the knee. If vomiting occurs in this position, gravity will assist in keeping the airway clear.

Category B - Urgent Cases Of DCI

Here, the only obvious symptom is severe pain that is unchanging or has progressed slowly during the past few hours. The diver does not appear to be in distress except for the pain, and the neurological signs and symptoms are not obvious without a careful history and examination.

Immediately place the injured diver on 100 percent oxygen and give fluids by mouth. Do not attempt to treat the pain with analgesics until advised to do so by medical personnel. Continue providing oxygen until arrival at the medical treatment facility.

Contact DAN or the nearest medical facility for advice on what sort of transport is necessary and where the diver should be evacuated to, even if symptoms improve or are relieved with oxygen. Emergency air transport may not be necessary in all cases.

While awaiting evacuation, take as detailed a history as possible and try to evaluate and record the diver's neurological status. This information will be useful to those at the receiving medical facility. If air evacuation is used, cabin pressure should be maintained near sea level and not exceed 800 feet unless aircraft safety is compromised.

Category C - Timely Cases Of DCI

Symptoms are either not obvious or have progressed slowly for several days. Usually the main signs or symptoms are vague complaints of pain or an abnormality of sensation; the diagnosis of DCI may be in question. Obtain as complete a diving history as possible and do a neurological evaluation. Then call DAN or the nearest medical facility for advice or go to the nearest medical facility, if nearby, for evaluation.

II. Get the Dive History

If possible, obtain and document the following information for all suspected cases of DCI:

- **- For 48 hours preceding the injury, get a description of all dives: depths / times, ascent rates, intervals between dives, breathing gases, problems or symptoms at any time before, during or after the dive;**
- **- Ask for symptom onset times and progression after the diver has surfaced from last dive;**
- **- Get a description of all first aid measures taken (including times and method of 100 percent oxygen delivery) and their effect on symptoms since the injury;**
- **- Record the results of the on-site neurological examination (described below);**
- **- Make a description of all joint or other musculoskeletal pain including: location, intensity and changes with movement or weight-bearing maneuvers;**
- **- Get a description and distribution of any rashes; and**
- **- Provide a description of any traumatic injuries before, during or after the dive.**

III. Conduct an On-Site Neurological Examination

Information regarding the injured diver's neurological status will be useful to medical personnel in not only deciding the initial course of treatment but also in the effectiveness of treatment. Examination of an injured diver's central nervous system soon after an accident may provide valuable information to the physician responsible for treatment.

The On-Site Neuro Exam is easy to learn and can be done by individuals with no medical experience. Perform as much of the examination as possible, but do not let it interfere with evacuation to a medical treatment facility. The examination is given on the DAN website and is also in the DAN *Dive and Travel Medical Guide*.

IV. Get the Injured Diver to the Nearest Medical Facility and Call DAN

Call for local EMS first; then call DAN. Depending on the severity of the injury (see above), take immediate care for the diver's airway, breathing and circulation and contact local EMS. After making contact with EMS, then call DAN.

From

<https://www.diversalertnetwork.org/medical/articles/Decompression_Illness_What_Is_It_and_What_Is_The_Treatment>

Call the DAN Emergency Hotline

Call +1-919-684-9111 to talk to an expert in diving medicine. You may call collect. DAN medical staff is on call 24 hours a day to handle diving emergencies.

When You Call the DAN Emergency Hotline:

1. **Tell the operator you have a diving emergency.** The operator will either connect you directly with DAN or have someone call you back at the earliest possible moment.
2. The DAN staff member may make an immediate recommendation or call you back after making arrangements with a local physician or the DAN Regional Coordinator. DAN Regional Coordinators are familiar with chamber facilities in their area, and because they're qualified in diving medicine, they make recommendations about treatment.
3. The DAN staff member or Regional Coordinator may ask you to wait by the phone while he / she makes arrangements. **These plans may take 30 minutes or longer, as several phone calls may be required.**

This delay should not place the diver in any greater danger. However, if the situation is life-threatening, arrange to transport the diver immediately to the nearest local medical facility for immediate stabilization and assessment of his or her condition. Call the DAN Emergency Hotline **(+1-919-684-9111)** if you need evacuation assistance through DAN *TravelAssist*.

From

<https://www.diversalertnetwork.org/medical/articles/Decompression_Illness_What_Is_It_and_What_Is_The_Treatment>

On-Site Neurological Examination

By Ed Thalmann, M.D., Assistant Medical Director of DAN

Information regarding the injured diver's neurological status will be useful to medical personnel in not only deciding the initial course of treatment but also in the effectiveness of treatment. Examination of an injured diver's central nervous system soon after an accident may provide valuable information to the physician responsible for treatment. The On-Site Neuro Exam is easy to learn and can be done by individuals with no medical experience. Perform as much of the examination as possible, but do not let it interfere with evacuation to a medical treatment facility.

Perform the following steps in order, and record the time and results.

1. Orientation

- Does the diver know his/her own name and age?
- Does the diver know the present location?
- Does the diver know what time, day, year it is?

Note: Even though a diver appears alert, the answers to these questions may reveal confusion. Do not omit them.

2. Eyes

- Have the diver count the number of fingers you display, using two or three different numbers.
- Check each eye separately and then together.
- Have the diver identify a distant object.
- Tell the diver to hold head still, or you gently hold it still, while placing your other hand about 18 inches/0.5 meters in front of the face. Ask the diver to follow your hand. Now move your hand up and down, then side to side. The diver's eyes should follow your hand and should not jerk to one side and return.
- Check that the pupils are equal in size.

3. Face

- Ask the diver to purse the lips. Look carefully to see that both sides of the face have the same expression.
- Ask the diver to grit the teeth. Feel the jaw muscles to confirm that they are contracted equally.
- Instruct the diver to close the eyes while you lightly touch your fingertips across the forehead and face to be sure sensation is present and the same everywhere.

4. Hearing

- Hearing can be evaluated by holding your hand about 2 feet/0.6 meters from the diver's ear and rubbing your thumb and finger together.
- Check both ears moving your hand closer until the diver hears it.
- Check several times and compare with your own hearing.

Note: If the surroundings are noisy, the test is difficult to evaluate. Ask bystanders to be quiet and to turn off unneeded machinery.

5. Swallowing Reflex

- Instruct the diver to swallow while you watch the "Adam's apple" to be sure it moves up and down.

6. Tongue

- Instruct the diver to stick out the tongue. It should come out straight in the middle of the mouth without deviating to either side.

7. Muscle Strength

- Instruct the diver to shrug shoulders while you bear down on them to observe for equal muscle strength.
- Check diver's arms by bringing the elbows up level with the shoulders, hands level with the arms and touching the chest. Instruct the diver to resist while you pull the arms away, push them back, up and down. The strength should be approximately equal in both arms in each direction.
- Check leg strength by having the diver lie flat and raise and lower the legs while you resist the movement.

8. Sensory Perception

- Check on both sides by touching lightly as was done on the face. Start at the top of the body and compare sides while moving downwards to cover the entire body.

Note: The diver's eyes should be closed during this procedure. The diver should confirm the sensation in each area before you move to another area.

9. Balance and Coordination

Note: Be prepared to protect the diver from injury when performing this test.

- First, have the diver walk heel to toe along a straight line while looking straight ahead.
- Have her walk both forward and backward for 10 feet or so. Note whether her movements are smooth and if she can maintain her balance without having to look down or hold onto something.
- Next, have the diver stand up with feet together and close eyes and hold the arms straight out in front of her with the palms up. The diver should be able to maintain balance if the platform is stable. Your arms should be around, but not touching, the diver. Be prepared to catch the diver who starts to fall.
- Check coordination by having the diver move an index finger back and forth rapidly between the diver's nose and your finger held approximately 18 inches/0.5 meters from the diver's face. The diver should be able to do this, even if you move your finger to different positions.
- Have the diver lie down and instruct him to slide the heel of one foot down the shin of his other leg, while keeping his eyes closed. The diver should be able to move his foot smoothly along his shin, without jagged, side-to-side movements.
- Check these tests on both right and left sides and observe carefully for unusual clumsiness on either side.

Important Notes:

- Tests 1,7, and 9 are the most important and should be given priority if not all tests can be performed.
- The diver's condition may prevent the performance of one or more of these tests. Record any omitted test and the reason. If any of the tests are not normal, injury to the central nervous system should be suspected.
- The tests should be repeated at 30- to 60-minute intervals while awaiting assistance in order to determine if any change occurs. Report the results to the emergency medical personnel responding to the call.

- Good diving safety habits would include practicing this examination on normal divers to become proficient in the test.
- Examination of an injured diver's central nervous system soon after an accident may provide valuable information to the physician responsible for treatment.
- The On-Site Neuro Exam is easy to learn and can be done by individuals with no medical experience at all.

From <<https://www.diversalertnetwork.org/medical/neuroexam.asp>>

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Multiple Symptoms Associated with Diving Accidents

Whatever the reason for diving, all divers are subject to a special set of environmental and physiological factors. **Diving emergencies present unique issues for EMS providers**, so having a general understanding of concepts related to diving will be valuable in the event you ever need to respond to the scene of a diving emergency.

Mike Comment: (Additional factors detailed in this article that are not included here)

- General Environmental Considerations: Hypothermia, Hyperthermia & Dehydration
- Barotrauma
- Ears & Sinuses
- Effects on the Lungs
 - AGE (arterial gas embolism)
 - Mediastinal & subcutaneous emphysema
 - CAGE (cerebral arterial gas embolism)
- Breathing Dangers
 - Nitrogen Narcosis
 - Oxygen Toxicity
 - Carbon Monoxide Poisoning

DCI Treatment

The treatment for suspected cases of any DCI, including AGE and DCS, are essentially the same, with the ABCs as a priority. *The importance of administering 100% oxygen cannot be over-emphasized in suspected cases of DCI.* In addition to providing respiratory support as it does in any emergency, oxygen promotes the elimination of inert gas bubbles in the tissues. Dive boats often have oxygen on hand, and someone may have begun administering oxygen prior to EMS's arrival. *DCI can be life-threatening*, and any suspected DCI requires immediate transport to a medical facility where a complete diagnosis and treatment, such as hyperbaric chamber therapy, can be done. Note that changes in altitude can exacerbate a case of DCI, so if the patient needs to be transported by helicopter, it should be at the lowest safe altitude possible. The current recommendation is 1,000' or lower . A physical exam, including a thorough neurological examination, should be performed

and changes should be monitored carefully. **Never attempt “recompression” by placing a diver back into the water.**

Asking Questions On Scene

As in any other emergency, fact-gathering is important. Divers are trained to dive in a way that reduces the chance of DCI or other injury, but they may still experience problems even if they follow all the rules. In addition to medical history and other information you normally gather, there is information particular to diving that treating physicians will find useful.

Questions that need to be asked include:

- “How long did it take the diver to ascend to the surface, and did he stop along the way?” A slower controlled ascent coupled with one or more stops helps the body off gas before bubbles form and also helps prevent barotraumas from air expansion.
- “How deep and long was the dive?” There are recommendations on how long a diver may remain at various depths in order to minimize the risk of bubble formation.
- “How long was it before the diver showed signs or symptoms?” DCI (including different forms of DCS) will present at various times based on severity and the type of DCI.
- “What type of breathing gas was the diver using?” The gas mixture can help determine what illness or injury occurred. Divers are normally trained to dive with a buddy, who may be able to provide information.

Don’t interfere with the equipment the diver was using other than to close the valves on the tank and note the number of turns it took to close the valve.¹² There may be regional differences regarding what actions should be taken, including whether you should close the valves on a tank, so follow local procedures and defer to the judgment of law enforcement or other investigators on scene.

Extracts above come from **EMSWORLD website:**

<https://www.emsworld.com/article/10287444/diving-emergencies>

Why the Emergency Facility rather than direct to a Hyperbaric Chamber

Below is the link to the hyperbaricLink webpage. HOWEVER, you should never assume that any of the hyperbaric sites listed are the appropriate site to take a diver suspected for DCS. Why? Because all of these facilities have different day/hours of operation ... and many do NOT have any staff on 7/24 to treat DCS. It takes special

training for a hyperbaric facility (and special medical staff) to treat DCS.

THEREFORE, you should ALWAYS take the diver suspected of DCS to the closest major emergency facility (e.g. hospital) where they are knowledgeable of closest “operating” facility qualified to treat DCS. They will immediately be looking to diagnosis all of the above potential medical issues (many of which have overlapping symptoms) and can begin immediate treatment. And, they can initiate and prep the diver ... and treat while EnRoute to the appropriate nearest hyperbaric facility!!! This is very important to remember!!! Many of the facilities only treat burn patients, etc. and cannot treat DCS patients.

Below comes from: <http://www.hyperbariclink.com/treatment-centers/treatment-centers.aspx>

Hyperbaric Oxygen Therapy Treatment Centers Directory

The HyperbaricLink treatment center directory includes hundreds of hospitals, outpatient facilities, and independent clinics with hyperbaric facilities. The list of treatment centers in each region includes the type of facility and important features. Each listing includes contact information, diseases and conditions treated, and the types of hyperbaric chambers available at the facility.

Click on the links below to access the treatment center list for each region.

United States

[Alabama](#)

[Alaska](#)

[Arizona](#)

[Arkansas](#)

[California](#)

[Colorado](#)

[Connecticut](#)

[Delaware](#)

[District of Columbia](#)

[Florida](#)

[Georgia](#)

[Hawaii](#)

[Idaho](#)

[Illinois](#)

[Indiana](#)

[Iowa](#)

[Kansas](#)

[Kentucky](#)

[Louisiana](#)

[Maine](#)

[Maryland](#)

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