Diving Medicine Articles
Headaches and Diving (update 2005)

By Dr. Allan Kayle

Q: I get a headache about 10-15 minutes into my dive. It lasts throughout my dive but disappears within a few minutes of surfacing. What is it due to and what must I do?

A: You pose an interesting problem. Your headaches appear to be unrelated to descent, ascent or depth. The only constant factors are time - about 10-15 minutes into the dive - and the fact that pain disappears within a few minutes of surfacing.

Headaches usually follow a distinct pattern in each diver who experiences them. They can occur regularly during or after a dive, at the bottom, on ascent and, very commonly, immediately after surfacing.

Aside from the perennial diver hangover headache or a direct bang on the head during an ascent, the following are the usual causes of headaches in divers.

Psychological Causes

Anxiety is a common cause of headaches in tense novice divers. It shows up as a classic tension headache, with pain over both sides of the head and at the back of the neck. It is due to insecurity about being exposed to a potentially dangerous underwater environment. With increasing experience and underwater skill, it invariably disappears.

New divers with a fear of losing their air supply under water often bite too tightly on the regulator mouthpiece. This may cause spasm of the temporalis muscles in the temples and produce headache. A malaligned bite or a filling that is riding too high may result in uneven stress of the joints between the jawbone and the skull. This will also cause headache when clamping a mouthpiece tightly between the teeth.

Physical Causes

Tight gear is another common cause of headache in inexperienced divers. Adjusting mask straps too tightly in the hope of avoiding mask leakage during the dive causes pressure right around the head, exactly like a very tight hat or glasses that are too small for the wearer. This pressure effect of the mask straps starts some minutes into the dive and gets worse the longer the dive. It is relieved by removing the mask after the dive and pain usually disappears rapidly.

Wetsuit collars fitting too tightly around the neck is another cause of headache. Tight collars compress the veins that drain blood from the skull and brain and can cause retention of carbon dioxide in the brain. This can precipitate a typical carbon dioxide headache (see below). If the collar is very tight, compression of the carotid sinuses in the carotid arteries in the neck can occur with a reflex drop in blood pressure and even sudden unconsciousness - the so-called carotid sinus reflex. Headaches can also occur with wetsuits, straps or buoyancy compensators that are too tight-fitting around the chest and restrict easy breathing. This again can cause carbon dioxide build-up and headache.

Sinus squeeze causes headaches that are referred to the sinuses involved. Nasal and sinus allergy, polyps or infection can easily cause obstruction to the small openings between the sinuses and the
nose. This makes it difficult or impossible for air to pass freely between the sinuses and nose and, with the increasing pressure of descent, Boyle's Law* operates and sinus barotrauma occurs.

The most common site of sinus squeeze is the forehead, relating to the frontal sinuses. Pain over one or both cheeks or even the upper teeth is referred from the maxillary sinuses. Pain in the eyeballs is due to ethmoid sinus squeeze, and pain at the back of the head on descent often relates to sphenoid sinus squeeze. The pain is usually relieved by ascent. The reverse can also occur. Compressed air trapped in a sinus after a successful descent will cause headache on ascent. Management is obviously avoidance of diving in the presence of significant nasal obstruction and having allergy or infection treated.

**Neck problems** related to previous motor vehicle accident whiplash injuries to the cervical spine, or other head or neck trauma, quite commonly result in headaches while diving. The pain is usually right at the back of the head and neck and can radiate to the forehead and shoulders.

It is caused by the extended neck position that all divers have to adopt in order to see in front of them while swimming horizontally under water. It is equivalent to walking on land and looking up at the sky for up to an hour. Neck muscle spasm or compression of neck spinal nerves can occur. This causes headache. The diver may be totally pain-free at all other times, the pain only occurring when assuming the abnormal neck position under water. It usually occurs in divers with a history of neck injury and it can last for minutes, hours or even days after diving.

It is often helped by swimming forward with the body axis at a 30-degree angle to the sea bed. This allows the diver to see in front and progress forwards without excessive extension of the neck. However, divers assuming this position must remain vigilant to the environment around them: kicking may damage fragile marine organisms.

Some divers may choose to substitute ankle weights for some of the belt weights to help them in adopt this position underwater. Other divers may find them fatiguing, so make this choice with particular care.

**Cold** causes a severe throbbing headache in cold-sensitive divers, occurring in the forehead or back of the head. It is very similar to the "brain-freeze" experienced when rapidly eating ice cream. This type if headache is variable: it can occur right away or some some minutes into the dive, usually gets worse the longer the dive, and persists for a while after leaving the water.

This type of headache can be mitigated by wearing a hood, but not always. For frequent cold headaches, combine the hood with habituating the skin prior to immersion. Try wetting the face with progressively colder water before entry: this usually help eliminate cold-water headaches.

**Carbon dioxide build-up,** in the whole body due to skip breathing or contamination of the air supply, or locally in the brain due to the congestive effect of a tight neoprene wetsuit collar, results in a headache that gradually develops during the dive as the amount of retained carbon dioxide slowly increases, or occurs almost immediately after surfaced and breathing atmospheric air with the resultant sudden decrease in blood carbon dioxide, one of the carbon dioxide "off effects." Some divers develop high CO2 in the blood even without these factors.

Carbon dioxide headaches are severe and throbbing, are not always relieved by painkillers and can last for hours after the dive. Other gases responsible for headaches are carbon monoxide following air supply contamination, and CO2 toxicity following deep diving on oxygen-enriched mixes or after using pure oxygen rebreathers.

**Saltwater inhalation** that occurs inadvertently during a sea dive can cause headaches. These headaches generally commence about half an hour after diving, are usually accompanied by body aches and pains and are worsened by exercise and exposure to cold.

**Acute neurological decompression illness** usually occurs within minutes of surfacing. It is manifested by a headache following a long or deep dive with a heavy nitrogen or other inert gas load, or it may be due to arterial gas embolism following lung barotrauma. Headache is an
extremely serious symptom when it's due to inert gas overload. It is usually accompanied by other manifestations of central nervous system bubble injury such as weakness or paralysis, confusion and abnormalities of sensation. For treatment, immediate surface mask oxygen, urgent contact and discussion with a diving doctor, and emergency recompression therapy are absolutely essential.

**Looking into the sun or glare** on the water for prolonged periods during a diving cruise can cause headache due to spasm of the scalp and forehead muscles. The solution is obviously to wear dark glasses, preferably with polarized lenses, when exposed to prolonged glare.

All of the above causes of headache in divers can precipitate an underwater migraine, a potentially dangerous event. This type of headache, whether contracted above or below the waterline, can cause nausea and vomiting. Some people experience neurological abnormalities in association with a migraine, such as partial blindness, weakness and numbness. A blindingly painful headache can result in confusion, inability to react to the challenges of the underwater milieu, vertigo and vomiting through a regulator.

Individuals with frequent migraine headaches should not dive, especially if there are accompanying neurological manifestations. Migraine is sometimes precipitated by diving. Furthermore, severe headache after a dive, especially associated with neurological symptoms, may be impossible to distinguish from acute cerebral decompression illness including arterial gas embolism. Should a migraine sufferer with headaches of this type insist on diving, trio or double buddy pair teams may be helpful to ensure that a diver totally incapable of saving his or her life if a migraine hits can safely be returned to the surface and professional help. The best advice, however, is to avoid diving.

Headaches remain a problem in divers. The causes are manifold, and proof of the exact cause can be difficult to determine. In many cases, the exact cause is never clearly determined. If you are an underwater headache sufferer, consider the above causes clearly and honestly.

If the reason for your pain is still a mystery, consult a diving doctor or request an opinion from a neurologist - there are many less common causes for headache and you could fit the bill. Enjoy diving, and do it with care.

*Boyle's Law states that at a constant temperature and mass, the volume of a gas is inversely proportional to the pressure exerted on that gas. This means that when the pressure is doubled - as in descending in the water column - the volume is reduced to one half of its original amount.

**About the Author**

Dr Allan Kayle is the author of *Salvage of the Birkenhead, Safe Diving: A Medical Handbook for Scuba Divers and How to Manage Diving Problems*. He is the medical journalist for *Divestyle* magazine in South Africa, a past president of the Southern African Undersea and Hyperbaric Medical Association, and on the board of DAN Southern Africa.

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Diving Medicine Articles
Headaches and Diving (2003)

By Dr. Frans Cronje, M.D., President & Medical Director, DAN Southern Africa

DAN gets many inquiries regarding headaches and diving. Probably very few divers who dive regularly have not left the water at least once with some cranial discomfort. This piece reviews the common causes of headaches in diving and offers some simple advice that should solve the problem in most cases.

Finding the cause of a headache is probably unnecessary if it only happens once or twice, occurs in the absence of any other symptoms and clears spontaneously or with only mild analgesics. However, a few divers complain of frequent and more troublesome headaches, and it is for these individuals that the following considerations and suggestions are intended.

One way to find the cause of a headache is to run through a checklist of possible causes and eliminate them one by one. While not an exhaustive list, these may include:

- Anxiety / Tension
- Sinus or Ear Barotrauma
- Sinus and Ear Infections
- Cold
- Saltwater Aspiration
- Mask Squeeze
- Temporomandibular Joint Pain (TMJ)
- Dental Problems
- Gas Toxicity (especially high CO2)
- Decompression Illness
- Migraine
- Hyperextension of the Neck
- Cervical Spondylosis
- Caffeine and Other Drugs

By simply looking at the list, one can already see that the origins of headaches are truly diverse. However, important clues can usually be found in the history taken from someone who develops headaches regularly. These five key questions may provide an answer to the causes of headaches:

1. **Have you had previous head or neck problems, injuries or regular headaches, even when not diving?**
   Divers who develop headaches regularly above water are also very likely to get them underwater. Such headaches, especially if they are associated with symptoms of nausea, vomiting, abnormal sensations, vision, abnormal smell or even paralysis, may be serious and require assessment by a specialist neurologist.

Migraine, a relative contraindication to scuba diving, requires expert assessment. Headaches may also result from tension, large caffeine intake and menstrual changes, among other reason.

A bad-fitting mouthpiece can also cause headache: Some regulators are quite heavy in the water and require a constant "bite" to stay in place. Swapping regulators or trying different mouthpieces may spell the end of a continuous string of headaches. In the end, it is always better to own your own equipment once you have found what works for you.
Divers with previous neck or upper back problems or injuries are very prone to develop headaches underwater or even as a result of a bumpy boat trip. The underlying bony problems lead to muscle spasms, which in turn cause the headache. A medical specialist such as an orthopedic surgeon should assess these problems. Physiotherapy and muscle strengthening exercises are often of value. Some report improvement after visiting a chiropractor. Back surgery is usually a last resort.

2. **What is the position of your tank on your back?**
   Is the diver constantly avoiding the pillar valve by bending the part of the neck closest to the shoulders downwards, and then having to hyperextend the part closest to the skull to curl around the valve? As odd as this may sound, it is a very common cause of headache in divers. The solution is to ensure that the neck, when extended normally, does not bring the head against the pillar valve by simply adjusting the position of the cylinder as needed.

3. **Where is the pain, and what does the pain feel like?**
   Pain related to neck problems is usually a persisting non-throbbing pain that gradually spreads from the back of the head to the temples. Sinus pain is usually over the forehead or cheekbones or sometimes behind the eyes or on top of the head. Ear pain is mostly quite obvious, but it is always worth asking whether ear equalizing was easy and effective during a dive.

4. **What is your surface air consumption?**
   Many divers boast about low air consumption or try to artificially reduce their air consumption by skip breathing. The truth of the matter is that removing carbon dioxide from the lungs is very analogous to rinsing dye out of a carpet. The bigger the spill (in our comparison, this would be the amount of exercise which produces more carbon dioxide) and the bigger the carpet (in our example, the size of the person's lungs), the more water you would need to rinse it clean - that is, the more air you will require to wash the carbon dioxide out. Larger lungs require larger breaths and consequently an increase in air consumption. That is why female divers typically have better air consumption than males.
   
   The only way to effectively reduce breathing requirements without building up carbon dioxide is to reduce underwater exercise, ensure adequate thermal protection and to relax; take slow deep breaths (better gas exchange - good rinsing) rather than shallow ones. A healthy breathing pattern is the key to solving many headaches.

5. **What was the dive profile?**
   Long or deep dives, rapid ascents, breath-holding and panic ascents followed by headache all raise the suspicion of decompression illness (DCI) as a possible cause. Although fortunately uncommon, DCI is a cause that would require immediate treatment. Abnormal symptoms following any exposure to compressed air should always prompt a suspicion of DCI. Don't deny symptoms; when in doubt call DAN.

Some quick-fix solutions that may be useful (and are good diving practice anyway) include:

1) **Loosen your mask strap** to avoid pressure on the nose, forehead or cheekbones. If necessary, change your mask to a more comfortable one.

2) **Relax during your dives.** After all, you are on holiday.

3) **Take slow deep breaths.** These relax you and provide a more efficient way of removing carbon dioxide.

4) **Relax your neck** during dives. Even though it spoils your trim momentarily, rotating the body rather than the head to look at objects underwater may avoid the strain and the discomfort of hyperextending the neck.

5) **Stay in shape.** Exercise reduces the incidence of headaches.

6) **Avoid caffeine and tobacco** with diving.
7) **Always follow safe diving practices.** Spend three to five minutes at a safety stop at 3-5 meters (10-15 fsw) below the surface. It is relaxing (weather and conditions permitting) and allows time to reduce the carbon dioxide built up from finning to the surface.

8) **Wear adequate thermal protection.**

9) **Go for regular dive medical examinations:** at least every two years for those younger than 40, and annually for those older than 40.

Headaches can spoil a dive trip or vacation and detract from the wonderful underwater experience. Fortunately, once the cause has been determined, many headaches are simple to cure. Those who experience frequent, severely incapacitating, or chronic headaches may require an intensive evaluation by a physician to determine the underlying problem.

Remember, it is always better to go for a check-up unless the headache is trivial or can be explained. Call DAN if you need additional advice or assistance in determining if your headache is a cause for concern.

Safe Diving!

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