Test Your Knowledge

INCIDENT 1

The Diver

This 42-year-old man has been a certified diver since 1992. In that time, he made more than 80 dives, completing 11 over the past year. His regular exercise regime included mountain biking. He had no history of medical problems, no history of diving injuries and he was taking no medications.

The Dives

On a weeklong diving vacation in the South Pacific, the diver in question and his diving buddy had made a total of 11 dives, three to four daily. Diving depths averaged between 50-60 fsw (15-18 msw), with air as the breathing gas. Their maximum depth was 85 fsw (26 msw), and none of their bottom times exceeded the limits of their dive computers.

Only one of the dives had complications: the diver had difficulty with buoyancy and made a rapid ascent on the second day. This was confirmed by the ascent alarm on his computer.

Following this incident, the diver had no immediate symptoms, but on the next day he felt intermittent soreness in his left shoulder. He continued to dive, however, and did not seek medical attention, considering he had had no previous problems with his shoulder.

The Complications & A Concerned Friend

The diver finished his dive week with no substantial change in his condition. He and his buddy stopped diving approximately 30 hours before their flight home. During the flight, which lasted more than 10 hours, the diver felt a tingling sensation in both hands and both feet approximately halfway through the flight. The soreness in his shoulder was sporadic in intensity, periodically increasing then dropping back to the original level of discomfort.

At the request of his diving buddy, the flight crew provided oxygen, but it seemed to have little effect on his symptoms. After landing his concerned diving buddy, a DAN Member, contacted the DAN on-call medic to describe his friend’s symptoms. He provided the diving history and events leading to his friend’s condition. The medic advised the caller to encourage his diving buddy go to a hospital for evaluation, providing tname of a facility with a hyperbaric unit.

At the Hyperbaric Center

An experienced hyperbaric physician conducted an examination and determined that the shoulder soreness had been in the trapezius, a superficial triangular muscle attaching the shoulder blade to much of the upper spinal column. The diver’s neurological evaluation was normal, but the tingling persisted.

TEST YOUR KNOWLEDGE

Based on the information set out, answer these questions:

1. What is the most likely diagnosis?

- **a.** Decompression sickness (DCS) Type I (severe pain, urgent)
- **b.** Arterial gas embolism (AGE)
- **c.** Decompression sickness Type II (neurological, emergency)
- **d.** Musculoskeletal strain

2. What would the best treatment be?

- **a.** None
- **b.** Oxygen alone
- **c.** Hyperbaric chamber treatment
- **d.** Anti-inflammatory medicines

The Conclusion

The physician did not uncover any objective findings, but because of the tingling, he could not rule out mild Type II (neurological) decompression sickness in the diver. Standard protocols called for the diver to undergo a U.S. Navy Treatment Table 6.

The diver noticed that the tingling he felt subjectively increased and decreased throughout the treatment, not an unusual finding for DCS. The bilateral tingling, however, was atypical for DCS, which often affects one side of the body.

Despite the resolution of symptoms after the hyperbaric treatment, the attending physician's final conclusion was that the diver's shoulder pain was most likely a musculoskeletal injury. The diver had not returned to diving at the time of this writing and has remained symptom-free.

It is difficult to say whether receiving oxygen earlier – i.e., while aboard the boat versus receiving oxygen some 30 hours later while in flight — would have cleared the diver's tingling sensations, but cases show that early treatment often helps resolve symptoms more quickly. Based on this diver's history, the appropriate course of care was to treat him with hyperbaric oxygen.

For Question 1, the answers are C and D. Choice C is the answer to Question 2.

INCIDENT 2

The Diver

The diver, a 28-year old woman, is an active and experienced diving instructor. She has reported nearly 1,500 dives, averaging 500 to 600 dives each year. She has no history of medical problems, takes no medicines and has no previous history of dive-related injuries or illnesses.

The Dives

On a weeklong diving trip in the Caribbeans, she and others in her diving group averaged three to four dives a day, making all dives using air as the breathing gas. Her maximum depth was 120 fsw (37 msw) on day four. Most of the dives were the typical Caribbean reef dives: calm, clear waters and no excessive depths. The average depths were from 30-60 fsw (9-18 msw). For exposure protection, she wore a full 3mm wetsuit and fullfoot fins.

The Complications

After the 12th dive, she developed what seemed to be a rash on the top of her feet and her forearms: the areas were red, blotchy and itchy. The diver described it as having a bubblelike appearance. She continued to dive.

Later in the day, the diver noticed that the same type of rash had developed on the front of both knees. The symptoms did not worsen, but they showed no sign of improvement, either.

After her last dive that week, she contacted the DAN on-call medic to describe her rash. With a flight home the next day, she had become concerned that the symptoms might be a sign of DCS. Questioning by the DAN medic revealed, however, that she felt no joint pain, no numbness or tingling and no neurological indications such as loss of strength or balance.

The medic continued with questions. Had she had any direct contact with marine life? She said she did not recall touching anything while underwater. Had the rash spread? The rash, which had not changed in position, size or appearance, was confined to areas already mentioned. Did she have allergies? The diver has no known medical history of allergies.

TEST YOUR KNOWLEDGE

Based on the information set out, answer these questions:

1. What is the most likely diagnosis?

- **a.** Allergic skin reaction (contact dermatitis)
- **b.** "Skin bends" (cutaneous DCS)
- **c.** Marine life stings
- **d.** Sun poisoning

2. What would the best treatment be?

- **a.** Hyperbaric chamber treatment
- **b.** Oxygen only
- **c.** Antibiotic cream
- **d.** Antihistamines

The Conclusion

So, how did we come to the conclusion of contact dermatitis? The location of the rash was not consistent with cutaneous DCS. Most often "skin bends" will manifest itself across the top of the chest, the abdomen, buttocks and thighs. Of course, it is not limited exclusively to these areas.

With cutaneous DCS the skin usually has a mottled or marbled appearance and may even resemble bruising; it can also be painful or sore to the touch. In addition, the affected areas were not sore or painful to touch, and the symptoms did not worsen with additional diving. Considering all these points, it is reasonable to have some suspicion of skin bends.

We suspect marine life stings in situations where skin is exposed. Organisms that sting, however, can find their way into exposure suits, too, usually in the areas of the ankles, wrists or neck. However, in this diver's case, the only areas of exposed skin that developed a rash were the top of her feet, as she was wearing full-foot fins: she had no rash on her hands, face or neck. Stings, therefore, from marine life were unlikely causes for the bubblelike eruptions on her knees, feet and forearms.

The symptoms resolved on their own in two to three days. This is uncommon for marine animal envenomation, which may continue to produce symptoms for weeks or months. Antihistamines may have been of benefit, but she gave no indication of having used such medications.

The most likely cause of her symptoms is a contact dermatitis, a sensitivity to a specific (though often unknown) allergen. What the irritant was in this diver's case may never be determined.

She has returned to diving with no further symptoms or problems.

For Question 1, the answer is A – an allergic skin reaction, or contact dermatitis. Since this diver did not seek definitive medical evaluation with a physician at a medical facility, a conclusive diagnosis was not available. To answer Question 2, she could have used antihistamines to get a measure of relief (D).

The Summary

At times, even trained medical professionals can have difficulty diagnosing a diver's injury or illness. The list of possible signs and symptoms of DCI, for example, can be broad. Some signs and symptoms can be subtle or even vague. Plus, in both cases, the divers made multiple dives over a week, which poses the question of whether multiple exposures could have caused symptoms of DCI.

It can be more difficult for divers with no training in first aid to effectively recognize and provide assistance to a potentially injured diver. If you're involved in a diving accident, try to provide the medical professionals — the DAN on-call medic, the local paramedics or the attending physician at the local emergency department — with as much information as possible.

And keep in mind that questions about diving profiles are not meant to be judgmental: they are necessary to help evaluate the potential nitrogen load on divers. This is especially helpful because so many nondiving injuries, illnesses and conditions may mimic DCI.

Every year divers are treated in hyperbaric chambers despite the fact that it may not be clear they sustained a decompression injury. This is because most treating physicians would rather err on the side of caution and treat divers proactively for DCI rather than potentially complicate their recovery by not treating them.

If a symptom resolves during a hyperbaric treatment, it does not prove that the ailment was DCI. High partial pressure of oxygen can help relieve a multitude of symptoms, even if they're not related to any bubble-inducing dive injury.

Also remember that telephone interviews are useful, often essential, in determining a course of action, but only a physician can make a treatment diagnosis, and this has to be done in person. In the field, it is our responsibility as good diving buddies to recognize signs and symptoms and then provide appropriate assistance.

If you suspect a dive injury, call the DAN Diving Emergency Hotline: it's available 24 hours a day, seven days a week, to help you make a healthy decision about what to do next.

When you call, have the recent diving profile, any medical history and medications ready to report. We can help you assist the diver, and we'll notify the appropriate agencies for medical and logistic support.

What's a Treatment Table?

Tables 5 and 6 refer to U.S. Navy Treatment Tables used to treat decompression sickness. Both tables involve compression in a dry chamber to ambient pressures equivalent to 60 fsw* (18 msw) while the patient breathes 100 percent oxygen. The time at 60 fsw is followed by more time at 30 fsw (9 msw) before ascent to the surface. According to U.S. Navy protocol, a Treatment Table 5 (TT5) is generally used for joint pain and lasts two hours 15 minutes; the sequence: 45 minutes at 60 fsw (18 msw), followed by a 30-minute ascent to 30 fsw (9 msw); then 30 minutes at 30 fsw, with a 30-minute ascent to surface.

TT6 is the standard first treatment for most DCI cases and in most serious neurological DCI cases. It involves more time at depth and oxygen breathing; the sequence: 75 minutes at 60 fsw, followed by a 30-minute ascent to 30 fsw; 150 minutes at 30 fsw, followed by a 30-minutes ascent to surface, making the treatment four hours 45 minutes long.

* feet of sea water (with equivalent msw, or meters of sea water).

DAN Training

DAN offers training courses to all divers and medical professionals. These courses range from the basic Oxygen First Aid for Scuba Diving Injuries to the physician-level diving and hyperbaric medicine program.

The greater our knowledge, the better our recognition skills become. To see course listings go to www.daneurope.org; call Training for provider, instructor and trainer classes, courses for medical professionals and dive leaders.