Otitis Externa: Can You Prevent It?

The diving has been great all week. Now, while sitting in your room, you notice that one of your ears itches and feels wet. You look in the mirror and don't see any problem, so you go to bed. Next morning when you wake up, you feel some fullness in your ear and a twinge of pain. What a time for an earache! You wonder if you should cancel the day's diving. What's wrong with your ear?

Your problem is probably otitis externa (OE), the medical moniker for an external ear infection often called swimmer's ear. As the name implies, it's usually associated with someone who swims a lot – and divers certainly fit that bill on dive-intensive scuba holidays.

The Cause

Despite what most people believe, it's not waterborne bacteria that cause otitis externa: Instead, it's triggered by the bacteria normally found in your own external ear canal. Here's how these normally innocuous bacteria can cause trouble. With frequent immersion, water swells the cells lining the ear canal. Eventually, these cells pull apart, far enough for the bacteria normally found on the surface of your ear canal to get underneath the skin, where they find a warm environment conducive to growth, and they start to multiply.

Next thing you know, your ear canal itches. Eventually it becomes sore and inflamed, and if left untreated, the swelling can spread to the nearby lymph nodes. At that point, it can cause enough pain that moving your jaw becomes uncomfortable. (The timing varies with individuals, but it can happen as quickly as within a couple of days.) At this point, the only treatment is antibiotics, and diving is definitely out.

Some History

Many on the DAN staff have had some firsthand experience with OE, including Dr. Edward D. Thalmann, former Assistant Medical Director at DAN and a retired Captain in the U.S. Navy Medical Corps.* "When I first entered the Navy in 1972, I was asked to look into the problem of ear infections in saturation divers," noted Dr. Thalmann. "These divers spend up to a month in diving chambers aboard ships, where they are kept at the same depth as the job they are performing in the sea, whether it's salvaging a sunken vessel or performing a research project.

Each day these divers are transferred from the chamber to the work site in a diving bell. The divers spend a great deal of their time immersed. Both the chamber and the bell provide a hot, humid environment, perfect for breaking down the cellular lining of the ear canal. The result is often otitis externa."

Prevention

"Otitis externa was so prevalent at the time I entered the Navy that up to 20 percent of all saturation divers were expected to get it," Thalmann continued. So he went to work on the problem. "I searched the medical literature and found an article that had the answer: Instructors at a summer camp found that dripping an acidic drying solution into the ear at the beginning and end of each day virtually eliminated swimmer's ear in their young charges."

There was a caveat to this apparently simple solution: The solution had to remain in each canal a full five minutes. If the swimmers ignored this part of the treatment, their ear infections returned. Dr. Thalmann then took the same approach with his charges. "To treat the Navy divers, I decided to use Domeboro Otic(r) solution: 2 percent acetic acid, water, aluminum acetate, sodium acetate and boric acid.

The acid retards bacterial growth, while the aluminum and sodium acetate act as astringents, drawing excess water out of the cells lining the ear canal. We had the divers put this solution in each ear canal twice a day and hold the solutions for at least five minutes at a time, timing them from outside the chamber." The result? Otitis externa is no longer a problem in Navy saturation divers, and the above external ear prophylaxis remains a standard part of the U.S. Navy saturation diving procedure to this day. It's useful for sport diving, too, when divers make frequent dives over several days.

Using the Solution

The only problem for sport divers is that Domeboro Otic solution is a prescription drug, so you'll need to get it through a doctor. Ask your doctor about similar products; other preparations are available over the counter and are less expensive. Many of these solutions usually consist of 95 percent isopropyl alcohol with anhydrous glycerine. These preparations will certainly take care of drawing excess water out of the cells, but their lack of acidity makes them less powerful at inhibiting bacterial growth. Unfortunately, none of these over-the-counter preparations has been tested in the diving environment, so whether they will work as well as Otic Domeboro solution is unknown.

Whatever preparation you choose to use, the trick is in the application. Before your first dive in the morning and after your last dive each night, apply as directed, at right.

Remember, this is a prophylactic procedure that should be started before the ear becomes infected; beginning the treatment after an infection occurs is not effective. One word of warning: Do not put drops in your ear if you have any reason to suspect you may have a ruptured eardrum from a squeeze. If you do, you may wash bacteria into the middle ear, where an infection will require antibiotics.

Clearing That Waxy Buildup

If you're diving for an extended period of time, the cerumen (earwax) in your ear may build up and cause the external ear canal to become blocked off. Once this happens, it greatly reduces the effectiveness of cleaning the external ear and consequently makes an infection much more likely. If you think your ear canal is blocked, the best way to find out is to have someone who is trained to use an otoscope use one to look in your ear. If the eardrum isn't visible, remove the excess earwax, but don't use swabs or other instruments to clean it. Instead, gently flush the canal with warm water while showering. Or use hydrogen peroxide. Your best bet, however, is a commercial over-the-counter solution designed to remove earwax.

If none of these works for you, see a doctor to have the wax removed: Any intrusion into the ear canal should be done by trained medical personnel only. For preventive measures, gently flush the ear canal when showering: Cup your hand next to your ear, and let it fill with water. This will overflow into the ear canal. Don't let the shower stream enter your ear directly, though; it could damage your eardrum or hearing. * Dr. Thalmann passed away in 2004, but much of his work stands the proverbial test of time.

Why Domeboro Otic(r)? Here's Some Background

In the article on otitis externa, we named Domeboro Otic simply because it is the only solution tested by the Navy. However, there are other solutions that may work as well and be less expensive. Ask your pharmacist for recommendations. When the Navy set out to tackle otitis externa in saturation divers, it did not want to use a "home brew": It needed a remedy that was pre-packaged, off-theshelf, readily available, easy to use and one that worked. Domeboro Otic fit the bill; and the $1-perday cost of preventing mission-compromising ear infections was insignificant considering the tens of thousands of dollars a day that many saturation dives cost.

The paper that inspired the choice of Domeboro Otic for the Navy otitis externa study was written by Dr. Edley H. Jones (Prevention of "Swimming Pool Ear," Laryngoscope 1971; 81:731-3). Dr. Jones began his

observations back in 1924 at a local YMCA summer camp. He found that a saturated solution of boric acid in 90 percent ethyl alcohol prevented swimmer's ear because the solution rapidly dried moist ear canals.

During the next 10 years he tried other solutions and found that 75 percent isopropyl alcohol worked as well. In 1938 someone contacted him with the information that the solution no longer worked. Upon investigation, however, Dr. Jones discovered that the user had not allowed the solution to remain in the canal long enough for the full dehydrating effect to work. Later, in 1961, Dr. Jones reported that five minutes of exposure to 5 percent acetic acid killed all bacteria normally found in the ear canal. He then judged that this would be an effective way to prevent swimmer's ear, so he mixed some isopropyl alcohol with 5 percent acetic acid solution in several varieties to try at the camp. He found that 5 percent acetic acid in 85 percent isopropyl alcohol worked best.

Adding a moisturizer (2 percent Alpha Keri(r) oil) added nothing; and adding 10 percent propylene glycol (another moisturizer) caused the cells lining the ear canal to slough off, which was undesirable. Other medical papers have stressed that it is the acidic pH that is the most important feature of solutions used for otitis externa. A 2 percent acetic acid solution has a pH of 3.0 and was found to drop the ear canal pH to 4-5: bactericidal to the normally found bacteria in the ear canal. (Domeboro Otic was chosen for the Navy study because the 2 percent acetic acid gave it the right pH, and it also had drying agents.)

Make Your Own 'Home Brew'

So what's all this leading up to? You can make your own "home brew" to prevent ear infection, as many of our members have shared with us to share with you. White wine vinegar is 4-6 percent acetic acid, and if it is mixed with an equal amount of isopropyl alcohol, it would probably work fine. Using undiluted vinegar may make the solution too acidic and cause irritation. Using less alcohol may be wise if you find that the 50:50 mix provides too much drying. Too much drying can make your ear canal a bit sore after several days of use.

In principle, just diluting the acetic acid 50:50 with water might work since it appears that the acidic pH is more important than the drying effect of the alcohol. Adding propylene glycol or other moisturizers would seem either to be a waste of time in a home brew, or it might produce undesirable effects according to Dr. Jones' observations.

Terence M. Davidson, M.D., the Director of the Nasal Dysfunction Clinic at the University of California, San Diego, recommends another mixture with acetic acid (vinegar) using 1 part water, 1 part white table vinegar (approximately 5 percent acetic acid) and 1 part rubbing alcohol (70 percent isopropyl alcohol). "This works well, but smells like vinegar, so that most people prefer the Domeboro Otic," he noted. Another option is using Burrow's solution or Burrow's tablets, which can be purchased as an over-thecounter medication. You can make can make Domeboro Otic by mixing 1 part Burrow's solution with 1 part water and 1 part 70 percent isopropyl alcohol, Dr. Davidson noted.

Could lemon juice, which contains citric acid instead of acetic acid, be used instead of vinegar, as some members have advised? In principle, if a solution was mixed to a pH of 3.0 it might, but whether other substances in lemon juice might promote bacterial growth is uncertain. For home brew, stick to what works: vinegar and isopropyl alcohol. No matter what solution you use, remember its effectiveness is drastically reduced unless it remains in the ear canal a full five minutes. Another caution: The above solutions are for use in the otherwise normal ear with an intact eardrum. If there is any hint that the eardrum may be torn, do not use these solutions as they may cause damage to middle ear structures. And

if any solution causes irritation, stop using it.

Using Domeboro Otic Solution

The U.S. Navy Diving Manual recommends this procedure:

1. Tilt the head to one side and fill the external ear canal gently with the solution.
2. Leave the solution in the ear canal for a full five minutes.
3. Then tilt the head to the other side, allowing the solution to run out.
4. Repeat this procedure in the other ear.

For optimum results, time the five-minute treatment with a watch. If the solution does not remain in the ear a full five minutes, the effectiveness of the procedure is greatly reduced.