CONDITION

Ear barotrauma

Ear barotrauma is an ear injury caused by unequal pressure across the eardrum.

WHAT IT IS
Pressure injury affecting the middle or inner ear

BODY SYSTEM
Ears and hearing

MAIN SYMPTOMS
Ear pain, fullness, muffled hearing, ringing

WHAT CAUSES IT
Unequal pressure across the eardrum

HOW IT IS DIAGNOSED
Ear examination and hearing tests when needed

MAIN TREATMENT
Pressure equalisation, pain relief, and healing time

CAN IT BE CURED?
Sometimes - most injuries heal; severe damage can persist

IS IT AN EMERGENCY?
Sometimes - severe vertigo with sudden hearing loss

LONG-TERM OUTLOOK
Most recover fully; inner-ear damage may persist

Overview

Ear barotrauma is an injury caused by a difference between the air pressure inside your ear and the pressure around you. It is sometimes called "airplane ear," but it can also happen during scuba diving, freediving, hyperbaric oxygen treatment, or other rapid pressure changes.

The middle ear is the air-filled space behind the eardrum. A narrow passage called the Eustachian tube connects it to the back of the nose and throat. This tube opens when you swallow, yawn, or deliberately equalise your ears. It allows pressure on both sides of the eardrum to balance.

If the tube does not open quickly enough, the eardrum is pushed inward or outward. This can cause pain, swelling, trapped fluid, or bleeding. In more severe cases, the eardrum may tear. Pressure can also injure the delicate structures of the inner ear, although this is less common.

Most mild cases improve after the pressure has equalised. Sudden hearing loss, severe spinning dizziness, or symptoms that continue after a pressure change need medical assessment.

Symptoms

Symptoms often begin during an aircraft's descent or while descending underwater. They may affect one or both ears.

Common symptoms include:

More significant injury can cause severe pain, blood or clear fluid from the ear, or a sudden drop in hearing. A torn eardrum may cause a sharp pain followed by partial relief as the pressure escapes.

Inner-ear barotrauma can cause sensorineural hearing loss, meaning hearing loss from damage to the sound-sensing structures or hearing nerve. It may also cause intense vertigo, which feels as though you or the room are spinning. Nausea, poor balance, and vomiting can occur with vertigo.

Symptoms after diving need particular care. Dizziness underwater can make it difficult to tell which way is up and can increase the risk of drowning.

- Ear pain or pressure
- A blocked or full feeling
- Muffled hearing
- Popping or crackling
- Ringing or buzzing, called tinnitus
- Mild dizziness

Causes and risk factors

During an aircraft landing or an underwater descent, outside pressure rises. Air must enter the middle ear through the Eustachian tube to balance it. During ascent, expanding air must be able to leave.

Barotrauma develops when this pressure cannot equalise. The risk is higher when the Eustachian tube is swollen, narrow, or blocked.

Factors that can make equalisation more difficult include:

Young children may be more likely to have difficulty because their Eustachian tubes are smaller and more horizontal. Babies also cannot deliberately equalise their ears.

Divers can experience a "reverse block" during ascent. This happens when expanding air becomes trapped in the middle ear. Inner-ear injury may result from a large pressure difference or a very forceful equalising manoeuvre.

- A cold, sinus infection, or nasal congestion
- Nasal allergies
- Enlarged adenoids, which are immune tissues behind the nose
- Scarring or structural differences around the Eustachian tube
- Rapid aircraft descent or rapid movement underwater
- Continuing to descend while an ear remains blocked
- Forceful attempts to "pop" the ears
- Previous ear surgery or repeated barotrauma

Diagnosis

A clinician will ask when the symptoms started and whether they followed flying, diving, a blast, or another pressure change. Details such as sudden hearing loss, spinning dizziness, discharge, or trouble balancing help show which part of the ear may be affected.

The ear is examined with an otoscope, a lighted instrument used to view the ear canal and eardrum. Barotrauma may cause the eardrum to look pulled inward, swollen, bruised, or red. Fluid or blood may be visible behind it. An opening may be seen if the eardrum has torn.

If hearing has changed, an audiogram may be arranged. This test measures hearing at different pitches and can help distinguish a blockage in the middle ear from inner-ear hearing loss.

Tympanometry may also be used. It measures how the eardrum moves as air pressure changes in the ear canal. Severe vertigo or suspected inner-ear damage usually requires prompt assessment by an ear, nose, and throat specialist.

Treatment and management

Treatment depends on the severity of the injury and whether the middle or inner ear is involved.

For mild symptoms during a flight, swallowing, yawning, chewing, or sipping a drink may help open the Eustachian tube. A gentle equalising manoeuvre may also help: close your mouth, pinch your nose, and breathe out very gently against it. Stop if this causes pain or dizziness. Forceful blowing can make an injury worse.

A diver who cannot equalise during descent should stop, rise slightly, and try again gently. Continuing downward through pain can cause more damage. The dive should be ended if equalisation remains difficult.

After the pressure exposure, mild barotrauma is usually managed with time and pain relief. Non-prescription pain medicines may be suitable for some people when used according to the label. A pharmacist can help check whether they are safe with your health conditions and other medicines.

Nasal or oral decongestants are sometimes considered when congestion is present, but they do not treat an established ear injury and are not suitable for everyone. Their benefits for barotrauma are limited. Ask a clinician or pharmacist before using them, especially if you have heart or blood-pressure problems, are pregnant, or take other medicines.

Antibiotics like amoxicillin or doxycycline are not routinely needed because pressure injury is not an infection. They may be prescribed if an infection develops or if contamination is a concern.

A torn eardrum often closes without surgery. Keep the ear dry and do not put drops, oils, or other objects into it unless a clinician confirms they are safe. A persistent hole may need a procedure to repair it.

Severe hearing loss, ongoing vertigo, or suspected inner-ear injury needs specialist treatment. In selected cases, procedures may be used to release middle-ear pressure or repair a leak involving inner-ear fluid. Treatment is most time-sensitive when hearing has dropped suddenly.

Complications

Most ear barotrauma is temporary, but complications can occur.

Fluid trapped behind the eardrum can cause fullness and reduced hearing for days or weeks. It can occasionally become infected. A torn eardrum may lead to discharge or repeated infections if it does not close.

Less common complications include:

Repeated barotrauma can scar the eardrum or middle ear. Persistent symptoms do not

necessarily mean permanent damage, but they should be assessed rather than repeatedly exposed to more pressure.

- Persistent conductive hearing loss from middle-ear damage
- Damage to the tiny hearing bones behind the eardrum
- Ongoing tinnitus
- Long-lasting problems with balance
- Permanent inner-ear hearing loss
- A perilymph fistula, meaning an abnormal leak of inner-ear fluid

Prevention

Ear barotrauma cannot always be prevented. A sudden pressure change or an Eustachian tube that does not open normally may cause symptoms despite reasonable precautions.

When possible, avoid flying or diving while you have a heavy cold, marked nasal congestion, or an active ear infection. If travel cannot be delayed, ask a clinician or pharmacist whether any preventive medicine is appropriate for you.

During aircraft descent:

Pressure-regulating earplugs may slow the pressure change during a flight, but they do not guarantee protection.

Divers should learn equalising techniques from a qualified instructor. Equalise early and often, descend slowly, and never continue descending through ear pain. Do not dive with unresolved ear symptoms, a torn eardrum, or significant congestion.

If you have had severe or repeated barotrauma, an ear specialist or diving-medicine clinician can assess whether an underlying blockage or Eustachian tube problem is present.

- Stay awake so you can equalise your ears
- Swallow, yawn, or chew regularly
- Begin equalising before pain develops
- Use only gentle pressure when trying to pop your ears
- Offer a baby a feed or pacifier while the aircraft descends

Living with it and what to expect

Mild pain and pressure often improve within hours after the pressure returns to normal. Muffled hearing or fullness may last longer if fluid remains behind the eardrum.

A small eardrum tear often heals over several weeks, although healing time is not the same for everyone. Follow-up may include another ear examination or a hearing test to confirm recovery.

Avoid swimming and keep the affected ear dry if the eardrum has torn. Do not return to diving until the eardrum has healed, hearing is back to your usual level, and a clinician familiar with diving has confirmed that equalisation is safe.

Most people return to normal activities without lasting problems. However, another episode can occur during future pressure changes, especially if nasal congestion or Eustachian tube dysfunction continues.

Inner-ear injury has a less predictable course. Vertigo may settle while tinnitus or hearing loss remains. Rehabilitation, hearing devices, or balance therapy may help when symptoms continue.

When to get medical help

Arrange routine medical assessment if pain, blocked hearing, or fullness is not improving after a flight or dive. You should also be checked if symptoms repeatedly occur with pressure changes.

Seek prompt or same-day medical care for:

Call emergency services if symptoms after diving include breathing difficulty, chest pain, confusion, weakness, numbness, loss of coordination, or loss of consciousness. These may suggest decompression illness or another diving emergency rather than isolated ear barotrauma.

Do not return underwater to try to relieve symptoms. A diver with possible decompression illness needs specialist emergency advice.

- Sudden or major hearing loss
- Severe or continuing vertigo
- Blood, pus, or clear fluid coming from the ear
- Severe pain that does not settle
- A suspected torn eardrum
- Symptoms after diving that continue after surfacing

Common questions

How long does ear barotrauma last?

Mild symptoms may settle within hours. Fullness and muffled hearing can last days or weeks if fluid is trapped behind the eardrum. A tear or inner-ear injury may take longer and needs follow-up.

Can ear barotrauma cause permanent hearing loss?

It can, but permanent hearing loss is uncommon in mild middle-ear barotrauma. The risk is greater when the inner ear, hearing bones, or eardrum has been seriously damaged. Sudden hearing loss should be assessed urgently.

Can I fly with ear barotrauma?

Flying before swelling or fluid has cleared may cause more pain or another injury. Whether it is reasonable to fly depends on your symptoms, the condition of the eardrum, and any recent ear procedure. Seek medical advice if you have a tear, significant pain, or reduced hearing.

When can I dive again?

Do not dive while you have pain, fullness, dizziness, reduced hearing, infection, or a torn eardrum. Return only after the injury has healed and you can equalise normally. Significant or repeated injuries should be cleared by an ear or diving-medicine specialist.

How do I know if my eardrum burst?

Possible signs include sudden sharp pain, bleeding or fluid from the ear, and reduced hearing. Pain may lessen once pressure escapes, but this does not confirm a tear. An examination with an otoscope is needed.

Why will my ear not pop after a flight?

The Eustachian tube may still be swollen or blocked, and fluid may remain behind the eardrum. Avoid forceful popping. Arrange an examination if symptoms are severe, hearing drops suddenly, or the blockage does not begin to improve.

Sources

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