CONDITION

CSF leak

A CSF leak is an escape of fluid that normally cushions the brain and spinal cord

WHAT IT IS
Leakage of fluid surrounding the brain and spinal cord

BODY SYSTEM
Nervous system

MAIN SYMPTOMS
Positional headache, clear drainage, nausea, hearing changes

WHAT CAUSES IT
Injury, surgery, weak tissue, or spontaneous tears

HOW IT IS DIAGNOSED
Fluid testing and specialised CT or MRI scans

MAIN TREATMENT
Blood patch, surgical repair, or fistula closure

CAN IT BE CURED?
Sometimes - sealing the leak can resolve it

IS IT AN EMERGENCY?
Sometimes - fever, confusion, or sudden neurological symptoms

LONG-TERM OUTLOOK
Often improves after closure, but leaks can recur

Overview

Cerebrospinal fluid, or CSF, is a clear liquid surrounding the brain and spinal cord. It cushions these structures, carries nutrients, and helps remove waste.

A CSF leak happens when fluid escapes through a hole or weak area in the protective covering called the dura. The leak may be in the skull or along the spine.

A cranial CSF leak is in the skull. Fluid may drain through the nose or ear, creating a possible pathway between the outside environment and the tissues around the brain.

A spinal CSF leak can reduce the fluid supporting the brain. This may cause spontaneous intracranial hypotension, meaning symptoms related to low CSF volume or pressure. Despite the name, measured pressure can be normal.

Cranial leaks can increase the risk of meningitis. Many CSF leaks can be sealed, although

specialised testing may be needed to find the exact site.

Symptoms

The most typical symptom of a spinal leak is a headache that worsens when sitting or standing and improves after lying down. This is called a positional or orthostatic headache. It may start within minutes of standing or take several hours to develop.

The positional pattern can become less obvious over time. Some people develop a constant headache, and a small number have no headache.

Other spinal leak symptoms can include:

A cranial leak often causes clear, watery fluid to drain from one side of the nose or an ear. Drainage may increase when bending forward or straining. Some people notice a salty or metallic taste or fluid running down the throat.

Clear nasal drainage is more commonly caused by allergies or infections, so appearance alone cannot confirm a leak. Cranial leaks may also cause headache, ear fullness, hearing changes, or repeated meningitis. An ear leak may remain hidden behind the eardrum.

- Neck pain or pain between the shoulder blades
- Nausea, dizziness, or poor balance
- Ringing in the ears or muffled hearing
- Sensitivity to light or sound
- Double or blurred vision
- Tiredness and difficulty concentrating

Causes and risk factors

A CSF leak can follow an injury, surgery, or medical procedure. Skull fractures may tear the dura. Operations involving the brain, spine, sinuses, ear, or skull base can also create an opening. A lumbar puncture or spinal injection may cause a spinal leak.

Leaks without an obvious injury are called spontaneous leaks.

A spontaneous spinal leak may occur when a bone spur or calcified spinal disc tears the dura. It may also develop at a weak pouch around a spinal nerve. A CSF-venous fistula is an abnormal connection that lets CSF drain directly into a vein.

Some affected people have unusually flexible or fragile connective tissue, which helps

strengthen the dura and other body structures. Flexible joints alone do not mean that someone has a CSF leak or inherited disorder.

Spontaneous cranial leaks are sometimes associated with raised pressure around the brain, which may weaken the skull base. Managing this pressure can be important after repair. A CSF leak is not contagious.

Diagnosis

Diagnosis considers the symptom pattern, recent injuries or procedures, and neurological and ear, nose, and throat examinations. Tests differ for cranial and spinal leaks.

Fluid draining from the nose or ear can be tested for beta-2 transferrin or beta-trace protein . These proteins are found mainly in CSF. Home glucose strips are not reliable for identifying a leak.

High-resolution CT may show a skull-base bone defect. MRI can identify fluid, soft-tissue changes, or tissue protruding through an opening. More specialised imaging may be needed for an intermittent leak.

For a suspected spinal leak, brain MRI with contrast may show thickened outer coverings, enlarged veins, fluid collections, or downward movement known as "brain sag." A normal brain MRI does not exclude a leak.

Spinal MRI can look for fluid outside the dura. CT myelography or digital subtraction myelography may then locate the opening. These procedures place contrast material into the spinal fluid before carefully timed imaging. Special positioning or rapid imaging may be needed for fast leaks or CSF-venous fistulas.

A lumbar puncture can measure CSF pressure, but many people with confirmed spontaneous intracranial hypotension have a normal result. It is not usually performed only to check pressure when symptoms and imaging can guide assessment, because the procedure can create another dural puncture.

Treatment and management

Treatment depends on the leak's location and cause, symptom severity, and whether there is a connection with the nose or ear.

A recent spinal leak after a procedure may close without surgery. Short-term care can include rest, fluids, caffeine, and medicines for pain or nausea. Prolonged bed rest has risks and should

not replace reassessment if symptoms continue.

A common spinal leak treatment is an epidural blood patch . A clinician injects some of the patient's own blood into the space outside the dura to help seal the leak. The patch may cover a general area or target a site found on imaging. More than one procedure may be needed.

A persistent, clearly located leak may be treated with a targeted blood or sealant patch. Surgery can repair a dural tear, remove a bone spur, or close a weak nerve-root pouch. Some CSF-venous fistulas can be treated surgically or by transvenous embolisation, which closes the abnormal vein from inside a blood vessel.

Cranial leaks often need surgery, particularly when they persist or arise spontaneously. Many skull-base openings can be repaired through the nose using an endoscope. Other approaches may be needed for ear leaks or certain injuries.

Raised pressure around the brain may also require treatment after a spontaneous cranial leak. Care can involve neurology, neurosurgery, radiology, ear, nose and throat surgery, or spinal surgery. Persistent symptoms may require different imaging or assessment for another cause of headache.

Complications

A cranial leak can allow bacteria from the nose, sinuses, or ear to reach tissues around the brain, causing meningitis. This risk remains while the pathway is open.

Spinal leaks can cause blood or fluid collections around the brain. Long-standing leaks may rarely lead to iron deposits around the brain or spinal cord. Ongoing low CSF volume can also cause disabling headaches, hearing or balance problems, and difficulty thinking clearly.

Diagnostic and repair procedures have risks, including infection, bleeding, contrast reactions, or another dural puncture.

After a blood patch, a new headache that is worse when lying down may reflect higher pressure as the leak seals. Report this change for assessment rather than assuming the leak has returned.

Prevention

Not every CSF leak can be prevented. Spontaneous leaks may result from tissue weakness, bone spurs, abnormal veins, or pressure changes.

Head protection and seat belts reduce the risk of injuries that may fracture the skull. Medical

teams use careful techniques during procedures, but no procedure is risk-free.

If a CSF leak persists, clinicians may review vaccination against pneumococcal infection. Vaccination can reduce infection risk but does not seal the opening.

No exercise, diet, or supplement prevents all spontaneous leaks. After treatment, follow your clinical team's activity instructions while tissues heal.

Living with it and what to expect

A small leak after a procedure may settle within days or weeks. Other leaks continue until sealed. Recovery can be rapid or gradual.

Headache may improve before tiredness, tinnitus, neck discomfort, or concentration problems. Return to work, study, exercise, and driving may need to happen in stages.

Some people require more than one blood patch or procedure. Spinal leaks can be difficult to locate when they are intermittent, drain directly into a vein, or leave no large fluid collection.

Leaks may recur at the same site or develop elsewhere, particularly with underlying tissue weakness or unresolved pressure. However, many people return to their usual activities after successful closure.

For follow-up, record whether symptoms improve when lying down, how quickly they appear after standing, and whether clear drainage occurs. Contact the treating team if symptoms persist, return, or change after treatment.

When to get medical help

Arrange prompt medical assessment for a new headache that is consistently worse upright and better lying flat, especially after a lumbar puncture, spinal injection, operation, or injury.

Clear watery drainage from one side of the nose or an ear also needs assessment, particularly after head trauma or skull, sinus, or ear surgery. Do not repeatedly sniff or taste the fluid. If practical, collect a clean sample for testing, but do not delay care to do so.

Seek emergency care for:

These signs may have causes other than a CSF leak but require urgent assessment.

Stable positional headaches, tinnitus, or slowly changing symptoms usually need planned clinical review. Contact the team managing the leak sooner if symptoms return after treatment or change from an upright headache to one that is worse lying down.

- Fever with severe headache, stiff neck, light sensitivity, or a new rash
- Confusion, unusual drowsiness, collapse, or a seizure
- New weakness, numbness, trouble speaking, or loss of coordination
- A sudden severe headache unlike your usual symptoms
- Clear nose or ear drainage after a significant head injury
- Repeated vomiting or rapidly worsening neurological symptoms

Common questions

Can a CSF leak heal on its own?

Some recent leaks, particularly those caused by a needle puncture, may close without surgery. Persistent, spontaneous, or cranial leaks may need a blood patch or repair. Continuing symptoms should be reassessed rather than managed indefinitely with bed rest.

What does a CSF leak headache feel like?

It is often a pressure, pulling, or throbbing pain that worsens while upright and improves after lying flat. It may occur with neck pain, nausea, tinnitus, or hearing changes. Not every positional headache is caused by a CSF leak.

How can I tell CSF from ordinary nasal mucus?

CSF is often clear and watery, sometimes with a salty or metallic taste. Appearance and taste cannot confirm it. Laboratory testing for CSF-specific proteins is more reliable.

Will a normal MRI rule out a spinal CSF leak?

No. Brain and spine MRI can be normal, particularly with an intermittent leak or CSF-venous fistula. Specialised myelography may be considered when symptoms remain concerning.

Is a CSF leak always an emergency?

No. Many spinal leaks are assessed through planned specialist care. Urgent assessment is needed for signs of meningitis, sudden neurological changes, a severe new headache, or clear drainage after major head trauma.

Can a CSF leak come back after treatment?

Yes. The original site may reopen, or another weak area may leak. Report a returning positional headache, renewed clear drainage, or a marked change in symptoms.

Sources

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