TEST

CSF analysis

CSF analysis examines the fluid around your brain and spinal cord for infection, bleeding, inflammation, and other changes.

WHAT IT MEASURES
Cells, proteins, glucose, antibodies, pressure, and signs of infection

SAMPLE
Cerebrospinal fluid collected through a lumbar puncture

FASTING NEEDED?
No, unless sedation or another procedure requires it

HOW LONG IT TAKES
Usually 30 to 60 minutes

RESULTS IN
Hours to several days; specialized tests take longer

USED FOR
Diagnosing infection, bleeding, inflammation, cancer, and pressure disorders

MAIN LIMITATION
Results overlap among conditions, and collection can introduce blood

Overview

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

CSF analysis is a group of laboratory tests performed on a small sample of this fluid. Most samples are collected through a lumbar puncture, also called a spinal tap. A thin needle is placed between bones in your lower back, below where the spinal cord usually ends.

The exact tests depend on what your healthcare team is looking for. They may measure:

The opening pressure may also be measured during the lumbar puncture. This shows the pressure of the fluid when the needle first enters the CSF space.

- White and red blood cells
- Protein and glucose
- Bacteria, viruses, fungi, or their genetic material

- Antibodies linked with inflammation
- Abnormal or cancerous cells

Why the test is ordered

CSF analysis helps investigate conditions affecting the brain, spinal cord, or their protective coverings. It is not a routine screening test because collecting the sample is invasive.

It may be ordered when there is concern about meningitis or encephalitis. Meningitis is inflammation around the brain and spinal cord, while encephalitis is inflammation within the brain. Infections are one possible cause.

The test can also help investigate bleeding around the brain when initial imaging does not provide a clear answer. Other uses include assessing inflammatory conditions such as multiple sclerosis, certain nerve disorders such as Guillain-Barré syndrome, and possible spread of cancer into the CSF.

Opening pressure can help assess disorders involving unusually high or low CSF pressure.

Who should have the test

You may be offered CSF analysis if your symptoms, examination, blood tests, or scans suggest a condition involving the central nervous system. The expected benefit must outweigh the risks of a lumbar puncture.

Some people need a brain scan before the procedure. This may be necessary when there are signs that pressure inside the skull could be raised or that a mass could affect the safety of lumbar puncture.

The procedure may be delayed or avoided if you have a serious blood-clotting problem, an infection over the planned needle site, or another condition that makes it unsafe. Medicines that reduce blood clotting require individual planning.

How to prepare

You can usually eat and drink normally. Fasting may be needed if sedation is planned or if another procedure requiring fasting is being performed at the same time.

Tell your healthcare team about all medicines and supplements you take. This is particularly important for anticoagulants and antiplatelet medicines, which reduce blood clotting.

Examples include warfarin, apixaban, rivaroxaban, dabigatran, clopidogrel, and aspirin.

Do not stop a prescribed medicine unless the healthcare team arranging the procedure tells you to. The safest timing depends on the medicine, why you take it, your kidney function, and your bleeding and clotting risks.

You may have blood tests beforehand to check platelet levels and clotting. Arrange help getting home if you will receive sedation.

What happens during the test

You usually lie curled on your side or sit leaning forward. This opens the spaces between the bones in your lower back.

The skin is cleaned, and a local anesthetic is injected to numb the area. This may briefly sting. A thin needle is then guided between two lower-back bones into the fluid-filled space.

You may feel pressure. Contact with a nearby nerve can occasionally cause a brief tingling or electric-shock feeling down a leg. Tell the person performing the procedure if this happens.

If opening pressure is needed, it is usually measured while you lie on your side and remain as relaxed and still as possible. CSF then drips into several sterile tubes. The needle is removed, and a dressing is applied.

The sample collection itself often takes several minutes, although positioning and preparation make the full appointment longer. You may be observed briefly afterward.

Understanding your results

There is no single "normal CSF result." Reference ranges differ between laboratories. Interpretation may also vary with age, sex, pregnancy status, medicines, the tests used, and your clinical situation.

Results are considered together rather than one at a time.

A raised white blood cell count can suggest infection or inflammation. The types of white cells present provide additional clues, but they do not identify the cause by themselves.

High protein can occur with infection, inflammation, bleeding, disrupted CSF flow, and some nerve conditions. A low CSF glucose level, especially compared with blood glucose, may occur with certain infections or cancer involving the CSF.

Red blood cells may reflect bleeding around the brain. They can also enter the sample if the needle passes through a small blood vessel during collection. This is called a traumatic tap.

Cultures attempt to grow bacteria or fungi. Molecular tests, often called PCR tests, look for genetic material from specific organisms. Oligoclonal bands are antibodies that can support evidence of inflammation within the central nervous system, but they are not unique to multiple sclerosis.

What affects the results

Several factors can change CSF findings without indicating a laboratory error.

A traumatic tap can add blood, red cells, white cells, and protein to the sample. Comparing results across separate collection tubes may help with interpretation, but it does not always fully resolve the issue.

Antibiotics like amoxicillin or doxycycline taken before collection can reduce the chance that bacteria will grow in culture. Some molecular tests may remain useful, although they only detect the organisms included in the test.

Delays in transporting or processing the sample can affect cell counts, glucose, and the ability to identify certain organisms. Laboratories therefore handle urgent CSF samples promptly.

Blood glucose affects CSF glucose, so a blood glucose measurement taken around the same time may be needed. Position, straining, coughing, anxiety, and sometimes sedation can affect opening-pressure measurements.

Recent surgery, spinal injections, bleeding, or infection can alter CSF findings. Medicines that affect the immune system may change the inflammatory response or the chance of detecting infection.

Accuracy and limitations

No CSF pattern can identify every cause or completely exclude a condition. Early infection may sometimes produce limited changes, while noninfectious inflammation can resemble infection.

Culture can confirm some infections and show which medicines may work, but it can miss an infection after antibiotics or when few organisms are present. PCR can detect some infections faster and may find organisms that are difficult to grow. However, it only tests for selected targets and can occasionally detect contamination or material from a past infection.

Cytology, which looks for cancer cells, may miss cancer when few abnormal cells are present. Additional samples, imaging, or other tests may be needed when concern remains.

For suspected bleeding around the brain, a CT scan is generally the first test. CSF analysis may

be considered when imaging does not settle the question. Timing and sample handling affect how useful the findings are.

Results for inflammatory or demyelinating conditions must be combined with symptoms, examination findings, MRI scans, and blood tests. CSF analysis alone usually cannot establish the diagnosis.

Risks and complications

A headache can develop after lumbar puncture, often worsening when upright and improving when lying down. Mild lower-back soreness or bruising can also occur.

Bleeding and infection are uncommon. Serious nerve injury is rare because the needle is placed below the usual end of the spinal cord. A dangerous pressure shift around the brain is also rare; checking for risk factors and using brain imaging when appropriate helps reduce this risk.

Tell your healthcare team routinely if a headache persists, interferes with normal activity, or is not improving. Treatments are available for a persistent post-lumbar-puncture headache.

Seek urgent medical advice for fever, increasing redness or drainage at the needle site, severe or worsening back pain, or a persistent severe headache. Call emergency services for new weakness, loss of bladder or bowel control, confusion, a seizure, or difficulty staying awake.

What happens next

Some basic results, such as cell counts, protein, and glucose, may be available within hours. Cultures usually take longer because organisms need time to grow. Antibody, molecular, or cancer-cell testing may take several days or longer, depending on the laboratory.

Your healthcare team will interpret the CSF findings alongside your symptoms, examination, blood tests, scans, and any treatment already received.

Normal or unclear results do not always end the investigation. Depending on the reason for testing, the next step may be routine follow-up, imaging, blood tests, specialist review, or occasionally another CSF sample.

Common questions

Can I drink coffee before CSF analysis?

Usually, yes. Coffee does not generally interfere with routine CSF tests. Follow different

instructions if you are fasting for sedation or another procedure.

Does the time of day matter?

Usually not for routine CSF analysis. Timing can matter in relation to when symptoms began, when antibiotics were started, or when suspected bleeding occurred.

Can I exercise beforehand?

Ordinary activity is unlikely to change most CSF tests. Avoid strenuous exercise if your healthcare team advises it or if you are unwell, dizzy, or being assessed for raised pressure.

Can I drive home afterward?

Local rules differ. You should not drive after sedation. Even without sedation, consider arranging transport because headache, soreness, or light-headedness can occur.

Will a lumbar puncture cause paralysis?

Serious nerve injury is rare. The needle is normally inserted in the lower back below the level where the spinal cord ends.

Do I need to lie flat afterward?

You may be asked to rest briefly, but prolonged bed rest has not been shown to reliably prevent headache. Follow the instructions given by the service performing your procedure.

Sources

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