TEST

CSF cell count

A CSF cell count measures red and white blood cells in the fluid surrounding your brain and spinal cord.

WHAT IT MEASURES
Red and white blood cells in cerebrospinal fluid

SAMPLE
Cerebrospinal fluid from a lumbar puncture

FASTING NEEDED?
No, unless sedation is planned

HOW LONG IT TAKES
Usually 30 to 60 minutes including preparation

RESULTS IN
Often within hours; timing varies by laboratory

USED FOR
Diagnosis and monitoring of brain and spinal cord conditions

MAIN LIMITATION
Needle-related bleeding can falsely raise cell counts

Overview

A cerebrospinal fluid, or CSF, cell count measures cells in the clear fluid surrounding your brain and spinal cord. It reports white blood cells, which are involved in immune responses, and red blood cells.

The laboratory may also perform a differential count to identify types of white blood cells, such as neutrophils or lymphocytes. The pattern can suggest possible causes of inflammation but cannot establish a diagnosis by itself.

CSF is usually collected through a lumbar puncture , or spinal tap. A thin needle is placed between bones in the lower back, below where the spinal cord ends.

The test is interpreted with your symptoms, examination, medical history, imaging and other CSF results.

Why the test is ordered

A CSF cell count may be ordered to:

Meningitis affects the membranes covering the brain and spinal cord, while encephalitis affects the brain itself. Both can have infectious or non-infectious causes.

The cell count is usually performed with tests such as CSF protein, glucose, microbiology and, when needed, tests for abnormal or cancerous cells.

- Look for signs of meningitis or encephalitis
- Investigate bleeding around the brain
- Assess inflammatory or immune-related conditions
- Look for cancer involving the nervous system
- Monitor a condition or response to treatment

Who should have the test

You may be offered this test for symptoms such as severe headache with fever or neck stiffness, unexplained confusion, seizures or new neurological symptoms. It may also be used when imaging has not fully answered a question about infection, inflammation or bleeding.

A lumbar puncture requires further assessment if you have a bleeding disorder, take medicines that affect clotting or may have increased pressure inside the skull. Blood tests or brain imaging may be needed first.

How to prepare

You can usually eat and drink normally. If sedation is planned, follow the fasting instructions provided.

Tell the clinical team about:

Do not stop prescribed medicine unless the clinician arranging the procedure tells you to. Blood-thinning medicines require an individual plan.

You may be asked to empty your bladder. Wear comfortable clothing and arrange transport if you will receive sedation or have been told not to drive afterward.

- Blood-thinning medicines or medicines that affect platelets
- Bleeding disorders or unusually easy bruising
- Allergies, including reactions to local anaesthetic

- Previous back surgery or major spinal problems
- Pregnancy or possible pregnancy
- Recent infections or antibiotics like amoxicillin or doxycycline

What happens during the test

You usually lie on your side with your knees drawn up or sit leaning forward. This curves your lower back and opens the spaces between the bones.

The skin is cleaned, and local anaesthetic is injected. This may sting briefly. A thin needle is then guided into the fluid-filled space in your lower back. You may feel pressure. Tell the clinician immediately about sharp pain or pain travelling down a leg.

CSF drips into several labelled tubes. Separate tubes allow different tests and can help assess whether blood was introduced by the needle.

The needle is removed, a dressing is applied and you may be observed briefly. The sample is tested promptly because cells can change or break down over time.

Understanding your results

Your report may include:

Healthy CSF generally has very few white blood cells and no red blood cells, but reference ranges vary. Results also require age-specific interpretation, particularly in newborns and young infants.

A raised white blood cell count suggests inflammation but not its cause. Possible explanations include infection, immune conditions, bleeding, seizures, cancer, stroke or recent nervous-system procedures.

Red blood cells may indicate bleeding around the brain. They may also enter the sample if the needle passes through a small blood vessel, known as a traumatic tap .

White cell types provide additional clues. Some patterns are more common with bacterial infection and others with viral infection, but there is substantial overlap. The differential cannot confirm or exclude a cause on its own.

- White blood cell count: immune cells in the sample
- Red blood cell count: blood cells in the sample

- Differential: proportions of different white blood cell types

What affects the results

Blood introduced during the lumbar puncture can add red and white blood cells to the sample. Comparing collection tubes may help, but correction formulas are not completely reliable.

Other influences include:

A recent transfusion does not usually change the CSF count directly, although it may affect related blood results.

- Delayed transport or testing, allowing cells to break down
- A clotted sample, which can trap cells
- Uneven cell distribution among tubes
- Recent brain or spinal surgery, bleeding, stroke or seizures
- Medicines that suppress immune responses
- Antibiotics taken before testing
- Age, especially during the newborn period

Accuracy and limitations

A carefully collected and promptly tested sample can measure cells accurately. Automated equipment may be less reliable when cell numbers are very low or unusual cells are present. The laboratory may then perform a manual count or examine cells under a microscope.

A normal or mildly raised white cell count does not always exclude infection. Early infection, prior treatment or a weakened immune response may produce fewer cells than expected. Culture, staining and molecular tests such as polymerase chain reaction, or PCR, may provide stronger evidence.

A raised count does not prove infection because inflammation, bleeding, cancer, seizures and recent procedures can cause similar findings.

For suspected bleeding around the brain, imaging and tests for blood-breakdown pigments may be more informative. If cancer is suspected, cytology or flow cytometry is used to identify abnormal cells.

Risks and complications

Temporary soreness or bruising at the needle site is common. Some people develop a headache that worsens when sitting or standing and improves when lying down.

Bleeding and infection are uncommon. Temporary tingling or pain down a leg can occur if the needle irritates a nearby nerve.

Contact the clinical team promptly for a persistent or worsening headache, repeated vomiting, fever, increasing back pain, or redness or fluid leaking from the puncture site.

Seek emergency help for new weakness, loss of consciousness, severe confusion, a seizure or rapidly worsening neurological symptoms. These are not routine after-effects and require urgent assessment.

What happens next

The cell count may be available within hours. Cultures, PCR, cytology and specialised studies can take longer.

The result is reviewed with your symptoms, examination and other findings. If infection or another urgent problem is suspected, treatment may begin before every result is available.

If results are reassuring and symptoms are stable, follow-up may involve discussing the complete results with the clinician who arranged the test. Further imaging, another test or a repeat lumbar puncture may be needed if the sample was bloody, too small, delayed in processing or inconsistent with the wider clinical picture.

Common questions

Can I drink coffee before a CSF cell count?

Usually, yes. Food and caffeine do not directly affect the count. Follow different instructions if you will receive sedation.

Does the time of day matter?

Usually not. Prompt laboratory delivery matters more because cells can deteriorate after collection.

Can I exercise beforehand?

Ordinary activity is unlikely to alter the result. Avoid strenuous activity afterward for the period recommended, especially if you feel sore or develop a headache.

Does a lumbar puncture hurt?

The local anaesthetic can sting, and you may feel pressure. Report sharp or radiating pain immediately so the needle can be adjusted.

Does blood in the sample mean I have bleeding around the brain?

Not necessarily. The needle can introduce blood from a small vessel. Results must be interpreted with symptoms, imaging, collection-tube patterns and other CSF findings.

How soon can I return to normal activities?

Many people resume light activity the same day. Follow your instructions, and delay driving or strenuous activity if you had sedation or feel unwell.

Sources

- American Academy of Family Physicians: Cerebrospinal Fluid Analysis , American Family Physician , 2021
- National Institute for Health and Care Excellence: Meningitis (bacterial) and meningococcal disease-recognition, diagnosis and management , NICE guideline NG240
- Merck Manual Professional Edition: Lumbar Puncture , overview of indications, technique and complications
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- Deisenhammer F, Bartos A, Egg R, et al. "Guidelines on routine cerebrospinal fluid analysis." European Journal of Neurology . 2006;13(9):913-922