TEST

CSF smear

A CSF smear uses a microscope to look for microbes or abnormal cells in fluid surrounding the brain and spinal cord.

WHAT IT MEASURES
Microbes or abnormal cells seen directly under a microscope

SAMPLE
Cerebrospinal fluid from a lumbar puncture or existing drain

FASTING NEEDED?
No, unless another planned procedure requires fasting

HOW LONG IT TAKES
Lumbar puncture usually takes 30 to 60 minutes

RESULTS IN
Often same day; timing differs by laboratory

USED FOR
Diagnosing infection or abnormal cells in cerebrospinal fluid

MAIN LIMITATION
A negative smear cannot reliably rule out infection

Overview

A CSF smear is a microscope test on cerebrospinal fluid, the clear fluid surrounding the brain and spinal cord. Laboratory staff spread a small amount of CSF onto a glass slide and may add a stain to make organisms or cells easier to see.

"CSF smear" may refer to:

The smear is usually part of a wider CSF analysis that may include cell counts, protein and glucose measurements, cultures, antigen tests, cytology, or molecular tests such as PCR.

- A Gram stain for bacteria
- An acid-fast stain for bacteria that cause tuberculosis
- A fungal stain, such as India ink
- A cell smear looking for abnormal or cancerous cells

Why the test is ordered

A CSF smear may be ordered when infection or abnormal cells in the nervous system are suspected. A Gram stain can provide an early clue about bacterial meningitis. Other stains may be used when tuberculosis or a fungal infection is possible.

A cell smear can look for cancer cells that have reached the CSF, although specialist tests such as cytology or flow cytometry are often needed.

Because some CSF infections require urgent treatment, testing may begin quickly. Treatment sometimes starts before smear or other test results are available.

Who should have the test

The test may be used when symptoms, examination findings, medical history, or other results suggest a condition affecting the brain, spinal cord, or surrounding tissues. Possible reasons include fever with severe headache or neck stiffness, confusion, seizures, unexplained neurological symptoms, or concern that cancer has spread to the CSF.

CSF may also be tested from a spinal fluid drain, reservoir, or shunt if infection or another complication is suspected.

Lumbar puncture is not suitable in every situation. The healthcare team may check for bleeding risk or signs of increased pressure inside the skull, and some people need brain imaging first.

How to prepare

Fasting is not normally required. Follow separate instructions if sedation or another procedure is planned.

Tell the healthcare team about all medicines and supplements you take, especially anticoagulants and antiplatelet medicines. Do not stop prescribed medicine unless the team arranging the procedure tells you how and when.

Also tell them if you have:

Blood tests may be used to check clotting. Imaging may be needed if your symptoms or examination suggest increased pressure inside the skull.

- A bleeding disorder or low platelet count
- An infection or rash near the lower back

- Previous lower-back surgery
- A severe allergy to local anaesthetic
- A possibility of pregnancy

What happens during the test

Most samples are collected by lumbar puncture, or spinal tap. You lie on your side with your knees drawn up or sit leaning forward. The lower back is cleaned and numbed with local anaesthetic.

A thin needle is passed between two bones in the lower spine, below the usual end of the spinal cord. You may feel pressure, but report sharp or severe pain immediately. CSF drips into sterile tubes, and the clinician may measure its opening pressure. The needle is removed and a dressing applied.

If you have a CSF drain, reservoir, or shunt, the sample may be collected from the device using sterile technique.

In the laboratory, CSF is placed on a slide, stained if needed, and examined under a microscope.

Understanding your results

A report may say that no organisms were seen. This lowers the chance of an infection readily visible with that stain, but it does not rule infection out.

If organisms are seen, their shape and staining pattern may suggest a broad group. A Gram stain usually cannot identify the final bacterial species or determine which antibiotics like amoxicillin or doxycycline will work; culture or molecular testing is needed.

An acid-fast result can support tuberculosis or a related infection, while a fungal stain may show yeast or other fungal forms. Further testing is required to identify the organism. Cryptococcal antigen testing is generally more reliable than India ink microscopy for suspected cryptococcal meningitis.

A cell smear may report atypical or malignant-appearing cells. These findings require specialist review alongside cytology, flow cytometry, imaging, and medical history.

There is no universal normal range for a CSF smear. Interpretation depends on the stain, laboratory method, and clinical context.

What affects the results

Antibiotics taken before collection can reduce visible or living bacteria. Antifungal or tuberculosis treatment can have a similar effect.

Small numbers of organisms may be missed, especially when little CSF is available. Delayed transport or processing can damage cells, which is particularly important when looking for cancer cells.

A traumatic lumbar puncture can introduce blood into the sample. Skin organisms may also contaminate samples collected by lumbar puncture or from a drain or shunt. With a device, bacteria could indicate contamination, colonization, or genuine infection.

Different stains detect different organisms, and debris or stain deposits can occasionally resemble microbes.

Accuracy and limitations

A smear provides rapid visual information but is less sensitive than many culture, antigen, or molecular tests. Its accuracy varies with the organism, stain, sample volume, previous treatment, stage of illness, and laboratory method.

A Gram stain detects many cases of bacterial meningitis but misses enough that a negative result must not be used alone to exclude it. False-positive findings can occur because of contamination, stain deposits, or cell fragments.

PCR can detect genetic material from certain organisms. Culture can identify living bacteria and help guide antibiotic treatment. Antigen testing is preferred for suspected cryptococcal infection, while molecular testing and culture are more useful than an acid-fast smear alone for CSF tuberculosis.

A single negative cell smear can also miss cancer cells. Cytology, flow cytometry, a larger CSF volume, or another sample may be recommended if concern remains.

Risks and complications

The microscope test itself has no direct risk. Risks come from collecting CSF.

Temporary lower-back soreness and headache are the most common problems after lumbar puncture. The headache often worsens when sitting or standing and improves when lying down.

Bleeding, infection, or nerve irritation are uncommon. Serious complications related to pressure inside the skull are rare because the healthcare team checks for relevant warning signs beforehand.

What happens next

The smear is interpreted with symptoms, examination findings, cell counts, glucose, protein, cultures, molecular tests, and imaging. An early result may guide treatment, but the plan can change as more specific results become available.

If the smear is negative and you are stable, follow-up may involve waiting for culture, PCR, cytology, or other results. Some cultures take longer because the organisms grow slowly.

Contact the team that performed the lumbar puncture if you develop a severe or persistent headache, increasing back pain, fever, redness, or fluid leaking from the puncture site.

Seek emergency help for new confusion, a seizure, fainting, new weakness or numbness, loss of bladder or bowel control, difficulty breathing, or bleeding that does not stop. Severe headache with fever, neck stiffness, confusion, or a rapidly spreading rash also needs urgent assessment.

Common questions

Can I drink coffee before a CSF smear?

Usually, yes. Avoid food or drink only if instructed because of sedation or another procedure.

Does the time of day matter?

Usually not. Once collected, CSF should be transported and processed promptly.

Can I exercise beforehand?

Ordinary activity does not usually affect the smear. Follow the procedure unit's instructions and avoid arriving dehydrated or exhausted.

Will the lumbar puncture hurt?

The local anaesthetic may sting briefly, followed by pressure during needle placement. Immediately report sharp pain, tingling, or pain travelling down a leg.

Can antibiotics make the smear negative?

Yes. Tell the healthcare team what you took and when, but do not delay prescribed treatment to improve the test result.

Does a negative smear mean I do not have meningitis?

No. Culture, PCR, antigen tests, cell counts, and your overall condition remain important.

Sources

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