TEST

Pleural fluid analysis

Pleural fluid analysis examines fluid from around a lung to help identify why it has collected

WHAT IT MEASURES
Cells, chemicals, germs, and other features of pleural fluid

SAMPLE
Fluid drained from around the lung

FASTING NEEDED?
No, unless sedation is planned

HOW LONG IT TAKES
Usually 30 to 60 minutes

RESULTS IN
Hours to several days; cultures longer, laboratory-dependent

USED FOR
Diagnosing the cause of a pleural effusion

MAIN LIMITATION
No single result reliably identifies every cause

Overview

Pleural fluid analysis examines fluid from the pleural space, the thin space between a lung and the inside of the chest wall. Normally, this space contains only a small amount of fluid to help the lung move smoothly.

An abnormal collection is called a pleural effusion . The fluid is usually collected by thoracentesis , also called pleural aspiration. During this procedure, a needle or small tube is passed through the chest wall using local anaesthetic.

The laboratory may examine the fluid's appearance, cell types, protein, lactate dehydrogenase or LDH, glucose, acidity, and other chemicals. It may also look for bacteria, tuberculosis, or cancer cells. The exact tests depend on the suspected cause.

Pleural fluid analysis is only one part of the assessment. Your symptoms, examination, blood tests, and imaging such as ultrasound, chest X-ray, or CT scan also matter.

Why the test is ordered

The test helps distinguish between two broad kinds of pleural effusion.

A transudate usually forms because pressure or protein levels in the bloodstream have changed. Heart failure, liver disease, and kidney disease can cause this pattern.

An exudate forms when inflammation, infection, injury, or abnormal tissue affects the pleura. Possible causes include pneumonia, cancer, blood clots in the lung, inflammatory conditions, and tuberculosis.

The test may be ordered to:

Removing fluid can also ease breathlessness when an effusion is large, although symptom relief comes from the drainage rather than the laboratory analysis.

- Investigate a new or unexplained pleural effusion
- Look for infection around the lung
- Check for cancer cells
- Identify blood, lymphatic fluid, or pancreatic fluid
- Help decide whether the fluid needs further drainage

Who should have the test

You may be offered pleural fluid analysis if imaging shows an effusion whose cause is uncertain. It is particularly useful when the fluid is mainly on one side, infection or cancer is possible, or an effusion has not improved as expected.

Not every pleural effusion needs sampling. A very small collection may not be safe to reach. Sampling may also be unnecessary when the cause appears clear and the fluid improves with treatment, such as some effusions caused by heart failure.

The decision takes account of the amount and location of fluid, your symptoms, ultrasound findings, bleeding risk, and whether the result is likely to change your care.

How to prepare

Fasting is not usually needed because thoracentesis is commonly performed with local anaesthetic alone. If sedation is planned, you will receive specific instructions about food, coffee, and other drinks.

Tell the healthcare team about:

Do not stop prescribed medicines unless you have been given individual instructions. Whether

a blood thinner needs changing depends on the medicine, the procedure, and your risk from interrupting it.

You may have an ultrasound shortly before or during the procedure. If sedation is used, arrange transport home as instructed.

- Blood-thinning medicines, aspirin, and anti-inflammatory medicines
- Bleeding disorders or previous unusual bleeding
- Allergies to local anaesthetics, dressings, or antiseptics
- Pregnancy or possible pregnancy
- Previous reactions during procedures

What happens during the test

You will usually sit upright and lean slightly forward, although some people lie on their side. Ultrasound is used to locate the fluid and choose a safer entry point.

The skin is cleaned, and local anaesthetic is injected. This may sting briefly. A needle or thin catheter is then passed between the ribs into the pleural space. You may feel pressure and may need to cough, but you should report sharp or worsening pain.

A small amount of fluid may be collected for testing, or a larger amount may be drained. The needle or catheter is then removed and a dressing applied.

Blood may be taken at about the same time. Comparing pleural fluid protein and LDH with blood levels helps classify the effusion.

You will be observed afterward. A chest X-ray is not always needed after an uncomplicated ultrasound-guided procedure, but imaging may be arranged if symptoms or procedural findings suggest a problem.

Understanding your results

Results must be interpreted together rather than one at a time. Laboratory methods and reference ranges can vary. Interpretation may also be affected by age, sex, pregnancy, medicines, kidney or liver function, and the wider clinical situation.

Common findings include:

Light's criteria are commonly used to classify fluid as an exudate. They compare pleural fluid protein and LDH with blood measurements. These criteria are designed to catch most

exudates, but they do not identify the specific disease causing the fluid.

The fluid's colour or cloudiness can provide clues, but appearance alone cannot confirm a diagnosis.

- Protein and LDH: Compared with blood results to classify the fluid as a transudate or exudate
- Cell count: Neutrophils may suggest a more recent inflammatory process; lymphocytes can occur in longer-lasting inflammation, tuberculosis, or cancer
- pH and glucose: Low levels can occur with a complicated infection, cancer, or rheumatoid inflammation
- Gram stain and culture: Look for bacteria, although a negative culture does not exclude infection
- Cytology: Looks for cancer cells
- Triglycerides: May help identify leakage of lymphatic fluid, called a chylothorax
- Amylase: May be useful when pancreatic disease or an oesophageal leak is suspected
- Haematocrit: Measures how much of the fluid consists of red blood cells when bleeding is suspected

What affects the results

Several factors can change the numbers or make them misleading even when the laboratory has processed the sample correctly.

Diuretic medicines, sometimes called water tablets, can concentrate pleural fluid. An effusion caused by heart failure may then meet the laboratory definition of an exudate. Comparing albumin or protein differences between blood and pleural fluid may help clarify this.

Antibiotics like amoxicillin or doxycycline taken before sampling can reduce the chance of growing bacteria. Infection may still be present when cultures are negative.

Pleural fluid pH is especially sensitive to collection and handling. Air in the syringe can raise the result. Local anaesthetic contamination can lower it. Delayed analysis can also alter the value.

Blood introduced while the needle passes through the chest wall can increase red cell counts and affect protein or LDH measurements. This is sometimes called a traumatic tap.

Blood used for comparison should ideally be collected near the time of the pleural sample. Changes in blood protein or LDH between samples can affect classification.

Recent chest surgery, trauma, pneumonia, or another pleural procedure may produce blood

and inflammation that influence the findings. Kidney, liver, and heart function also shape how results are interpreted. Age, sex, pregnancy, and recent transfusion are not usually major direct causes of inaccurate pleural fluid results, but they may affect the broader clinical assessment.

Accuracy and limitations

Pleural fluid analysis often narrows the possibilities, but it may not provide a final answer.

Light's criteria identify most inflammation-related exudates, so they are less likely to miss one. However, they sometimes label a pressure-related transudate as an exudate, particularly after diuretic treatment. Alternative blood-to-fluid comparisons may be more helpful when heart failure remains likely.

Cytology can confirm cancer if malignant cells are found, but it misses some cancers. The chance of detection differs by tumour type and how much abnormal tissue reaches the fluid. A negative result does not rule out cancer. Repeat sampling, image-guided pleural biopsy, or thoracoscopy may be more informative.

Bacterial cultures can also miss infection, especially after antibiotics or when organisms are difficult to grow. Testing fluid in blood culture bottles may improve the chance of detection. Tuberculosis may require additional tests, such as adenosine deaminase, mycobacterial culture, or pleural biopsy.

A result can also suggest disease when another condition is responsible. Low glucose, low pH, or a high lymphocyte count each has several possible causes. Imaging and sometimes tissue sampling are needed to distinguish between them.

Risks and complications

Because fluid must be removed from the chest, the risks are greater than those of a routine blood draw. Temporary pain, coughing, bruising, or feeling faint can occur.

A pneumothorax , or air leak causing part of the lung to collapse, is an important complication. Ultrasound guidance lowers this risk. Small pneumothoraces may only need observation, while larger or symptomatic ones may require a chest drain.

Bleeding and infection are uncommon. Rare complications include injury to nearby organs or fluid collecting in the lung after a large effusion is drained too quickly, called re-expansion pulmonary oedema.

After going home, seek urgent medical advice for increasing breathlessness, persistent chest pain, fever, redness or drainage from the site, or ongoing bleeding. Call emergency services for severe breathing difficulty, blue or grey lips, fainting, confusion, or coughing up a significant amount of blood.

Mild soreness or a small bruise can usually be discussed during routine follow-up if it does not worsen.

What happens next

Some results, including appearance, cell counts, protein, LDH, glucose, and pH, may be available within hours. Cytology commonly takes several days. Bacterial and tuberculosis cultures may take longer.

If results suggest infection, further drainage and antimicrobial treatment may be considered. If cancer remains possible despite negative cytology, additional imaging or a pleural biopsy may be offered.

A likely transudate may lead to treatment of the underlying heart, liver, or kidney condition. An unexplained exudate usually needs further assessment.

Your follow-up plan should explain what has been found, which results are still pending, and whether repeat imaging or another procedure is needed.

Common questions

Can I drink coffee before pleural fluid analysis?

Usually, yes. Fasting is generally unnecessary when only local anaesthetic is used. Follow different instructions if sedation is planned.

Does the time of day matter?

Usually not. More important issues are prompt sample handling and collecting comparison blood tests close to the procedure time.

Can I exercise beforehand?

Ordinary activity is unlikely to alter the fluid analysis. Avoid strenuous exercise if it worsens breathlessness or chest discomfort, and follow any instructions from the procedure unit.

Will the procedure hurt?

The local anaesthetic may sting, and you may feel pressure during fluid removal. Tell the

healthcare team if you develop sharp pain, marked breathlessness, or feel faint.

Does a negative cytology result rule out cancer?

No. Some cancers do not release many cells into pleural fluid. Imaging, repeat sampling, or a biopsy may be needed if concern remains.

Can the fluid come back after it is drained?

Yes. Drainage removes existing fluid but does not always remove its cause. Whether it returns depends on the underlying condition and its treatment.

Sources

- British Thoracic Society Guideline for pleural disease , Thorax , 2023
- British Thoracic Society Clinical Statement on pleural procedures , Thorax , 2023
- Light RW, Macgregor MI, Luchsinger PC, Ball WC Jr. Pleural effusions: the diagnostic separation of transudates and exudates , Annals of Internal Medicine , 1972;77(4):507-513
- Shen-Wagner J, Gamble C, MacGilvray P. Pleural Effusion: Diagnostic Approach in Adults , American Family Physician , 2023;108(5):464-475
- Feller-Kopman DJ and colleagues. Management of Malignant Pleural Effusions: An Official ATS/STS/STR Clinical Practice Guideline , American Journal of Respiratory and Critical Care Medicine , 2018;198(7):839-849