TEST

Complement fixation test for C burnetii

A blood test that looks for antibodies produced after exposure to Coxiella burnetii, the bacterium that causes Q fever

WHAT IT MEASURES
Antibodies that fix complement after exposure to Coxiella burnetii

SAMPLE
Blood

FASTING NEEDED?
No

HOW LONG IT TAKES
Usually 5 to 10 minutes

RESULTS IN
Several days; timing differs by laboratory

USED FOR
Diagnosis and follow-up of Q fever

MAIN LIMITATION
Less sensitive than immunofluorescence, especially early in infection

Overview

The complement fixation test for Coxiella burnetii is a blood test for antibodies against the bacterium that causes Q fever. It does not detect the bacterium directly. Instead, it measures whether antibodies in your blood react with C. burnetii antigens and use, or "fix," proteins called complement.

Results are usually reported as a titer, which shows how far the blood can be diluted while antibodies remain detectable. A higher titer generally means more antibody was found, but it does not by itself show when exposure occurred or whether infection is active.

C. burnetii has phase I and phase II antigens. Phase II antibodies usually predominate in recent Q fever, while high phase I levels can be associated with persistent infection. These patterns are generally assessed with an indirect immunofluorescence antibody test, or IFA. IFA is now preferred in many laboratories because it is more sensitive, although complement fixation may still be used for serial testing or comparison with older results.

Why the test is ordered

The test may be ordered when symptoms and exposure history suggest Q fever. Exposure often involves sheep, goats, or cattle and can occur by breathing dust contaminated by animal birth products, urine, stool, or milk.

Reasons for testing include:

Antibodies take time to develop, so an early sample may be negative. A second sample collected several weeks later may show a meaningful rise in antibody levels.

- Unexplained fever after a relevant animal or workplace exposure
- Pneumonia or liver inflammation without a clear cause
- Follow-up after Q fever
- Possible persistent infection involving a heart valve or blood vessel
- Investigation of a suspected outbreak

Who should have the test

This is not a routine screening test. It is most useful when there is a clinical reason to suspect current or previous C. burnetii infection.

Testing may be considered for compatible symptoms after a relevant exposure or during follow-up after Q fever. People who are pregnant or who have heart valve disease, certain blood vessel conditions, or weakened immune systems may need more detailed assessment because they can have different risks and follow-up needs.

Complement fixation may not be the best first test. The testing plan may instead include IFA, a polymerase chain reaction test known as PCR, or both.

How to prepare

You do not need to fast. You can usually eat, drink water, and have coffee before the blood draw.

Tell the healthcare professional arranging the test about:

Do not stop prescribed medicines unless specifically instructed. Ordinary daily activity does not usually affect the test.

- When your symptoms began
- Contact with farm animals or contaminated dust
- Previous Q fever or Q fever vaccination
- Recent antibiotics or immune-suppressing medicines
- Pregnancy
- A recent blood transfusion

What happens during the test

A healthcare professional cleans the skin, usually inside your elbow, and inserts a small needle into a vein. Blood is collected into a tube and sent to a laboratory. The draw usually takes less than 10 minutes, and you may feel a brief scratch or pressure.

If paired testing is needed, another sample is collected several weeks later. Using the same laboratory and method makes the results easier to compare.

Understanding your results

Results may be reported as negative, positive, or as a titer such as 1:8 or 1:32. The titer is the highest dilution at which antibodies remain detectable.

There is no single cutoff for every laboratory or situation. Interpretation depends on the method, timing, previous exposure or vaccination, immune function, medicines, pregnancy, and reason for testing.

A negative result means complement-fixing antibodies were not detected above the laboratory cutoff. It does not rule out early Q fever, particularly during the first days of illness.

A positive result means antibodies reacted with C. burnetii antigens. This may reflect recent or previous infection, vaccination, or occasionally a cross-reaction.

A fourfold rise in titer between early and later samples provides stronger evidence of recent infection than one result alone. Both samples should be tested with the same method.

If phase-specific titers are reported, phase II antibodies are generally more prominent in recent infection. High or rising phase I antibodies can raise concern for persistent infection, but IFA and further clinical assessment are usually needed.

What affects the results

Timing is the main influence. Antibodies may not be detectable during the first week or two of illness.

Other factors include:

Antibiotics like amoxicillin or doxycycline can reduce the chance of detecting the bacterium by PCR, especially after treatment begins, but they do not usually remove antibodies already formed.

- Previous Q fever or vaccination: Antibodies may remain detectable
- Weakened immune response: Illnesses or medicines may reduce antibody production
- Cross-reactions: Antibodies to organisms such as Bartonella or Legionella may react in some methods
- Recent transfusion: Donated blood products may temporarily introduce antibodies
- Different laboratories: Procedures, cutoffs, and titers may differ
- Sample quality: Hemolysis, contamination, or improper storage may make testing unreliable

Accuracy and limitations

Complement fixation is less sensitive than IFA and may miss early infection, low antibody levels, or antibodies that do not fix complement effectively. Its performance varies with collection timing, antigens, laboratory procedures, and the type of infection being investigated.

Previous infection, vaccination, or cross-reacting antibodies can produce a positive result when there is no current infection. A single positive result cannot reliably show when infection occurred, and a single negative result cannot exclude early infection. Comparing early and later samples is more informative.

IFA is generally preferred because it is more sensitive and separately measures phase I and phase II antibodies. PCR may be useful early in illness before antibodies develop. Suspected persistent infection may require IFA, PCR, imaging, heart tests, or tissue examination.

Risks and complications

The risks are those of an ordinary blood draw. You may have brief discomfort, a small bruise, or feel faint. Applying pressure after the needle is removed usually limits bruising. Serious

complications are uncommon.

What happens next

The result should be interpreted with your symptoms, exposure history, examination, and other tests. The result alone does not establish or exclude Q fever.

If an early test is negative but suspicion remains, follow-up may include a second antibody sample several weeks later, IFA, or PCR. A positive result may be confirmed with IFA. If persistent infection is suspected, further assessment may include blood tests, heart imaging, or blood vessel imaging.

Do not delay urgent care while waiting for a result. Seek emergency help for severe difficulty breathing, new severe chest pain, fainting, confusion, or signs of shock. Ongoing fever, fatigue, or questions about a result generally require routine follow-up unless symptoms are rapidly worsening.

Common questions

Can I drink coffee before the test?

Yes. Fasting is not usually required, so coffee and normal food are generally acceptable.

Does the time of day matter?

No. Antibody titers do not normally change enough during the day to require morning testing.

Can I exercise beforehand?

Yes. Ordinary exercise does not usually affect the result. If exercise makes you dehydrated or likely to feel faint, drink water and rest before the blood draw.

Why do I need a second blood test?

Antibodies may be absent from the first sample. A later sample can show whether the titer has risen, providing stronger evidence of recent infection.

Does a positive result mean I currently have Q fever?

Not necessarily. Antibodies may come from recent infection, older infection, or vaccination. The titer, timing, pattern, symptoms, and other tests guide interpretation.

Is this the same as an IFA test?

No. They use different laboratory techniques. IFA is generally more sensitive and is usually preferred for measuring phase I and phase II antibodies.

Sources

- Centers for Disease Control and Prevention. Clinical and Laboratory Diagnosis for Q Fever
- Centers for Disease Control and Prevention. Diagnosis and Management of Q Fever-United States, 2013: Recommendations from CDC and the Q Fever Working Group . MMWR Recommendations and Reports . 2013;62(RR-03):1-30
- Eldin C, Mélenotte C, Mediannikov O, et al. From Q Fever to Coxiella burnetii Infection: a Paradigm Change . Clinical Microbiology Reviews . 2017;30(1):115-190
- Peter O, Dupuis G, Peacock MG, Burgdorfer W. Comparison of enzyme-linked immunosorbent assay and complement fixation and indirect fluorescent-antibody tests for detection of Coxiella burnetii antibody . Journal of Clinical Microbiology . 1987;25(6):1063-1067