Overview

Useful For
Indirect test for *Mycobacterium tuberculosis* infection, to be used in conjunction with risk assessment, radiography, and other medical and diagnostic evaluations

Special Instructions
- *Mycobacterium tuberculosis Infection Determination by QuantiFERON-TB Gold Plus Collection and Processing Instructions*

Method Name
Enzyme-Linked Immunosorbent Assay (ELISA)

NY State Available
Yes

Specimen

Specimen Type
Whole blood

Advisory Information
This test is not recommended for use for diagnosis of active tuberculosis (TB) infection. It can be used as an aid to detect latent TB infection.

Specimen Required

Supplies:
- Standard Altitude: QuantiFERON-TB Gold Plus Collection Kit (T794)
- High Altitude: QuantiFERON-TB Gold Plus High Altitude Collection Kit (T795)

Collection Instructions:
1. Special collection, incubation, and centrifugation procedures must be followed.

2. For blood collection options (1-tube collection or 4-tube collection) and specimen transport instructions, see *Mycobacterium tuberculosis Infection Determination by Quanti-FERON-TB Gold Plus Collection and Processing Instructions* (T688); available in Special Instructions.

Forms
If not ordering electronically, complete, print, and send 1 of the following forms with the specimen:

- General Request (T239)
- Microbiology Test Request (T244)

Specimen Minimum Volume
4 mL: 1 mL per tube (4 tubes)
Latent tuberculosis infection (LTBI) is a noncommunicable, asymptomatic condition that persists for many years in individuals and may progress to active tuberculosis disease, particularly in immunosuppressed patients. The primary goal for diagnosis of LTBI is to initiate medical treatment in order to prevent progression to active disease. Historically, detection of LTBI has been done using the tuberculin skin test (TST). The TST has certain limitations, however, including subjective interpretation, limited sensitivity in immunosuppressed patients, and the possibility of false-positive results in individuals who have received the bacille Calmette-Guerin (BCG) vaccine or are infected with other mycobacteria.

The QuantiFERON-TB Gold Plus (QFT-Plus) test is an interferon (IFN)-gamma release assay (IGRA) that assesses the cell-mediated immune response to 2 Mycobacterium tuberculosis complex antigens, ESAT-6 and CFP-10, by measuring IFN-gamma levels in plasma. These 2 proteins are absent from all bacille Calmette-Guerin (BCG) strains and from most nontuberculosis mycobacteria with the exception of M kansasi, M szulgai, and M marinum. Individuals infected with M tuberculosis complex agents, including M tuberculosis, M bovis, M africanum, M microti, M caprae, and M canetti, usually have lymphocytes in their blood that recognize these specific antigens and this recognition leads to the generation and secretion of IFN-gamma. This cytokine is subsequently detected and quantified using an IFN-gamma enzyme-linked immunosorbent assay.

In an M tuberculosis infection, CD4+ T-cells play a critical role in immunological control through secretion of IFN-gamma. The prior version of the QFT-Plus assay, the QuantiFERON-TB Gold In-Tube (QFT-Gold) assay, only detected IFN-gamma secreted from CD4+ T-cells. Evidence now supports a role for CD8+ T-cells in host defense against M tuberculosis infection by likewise producing IFN-gamma, but by also stimulating macrophages to suppress the growth of M tuberculosis, to kill infected cells and to directly lyse intracellular M tuberculosis bacteria. IFN-gamma-producing M tuberculosis specific CD8+ T cells have been detected in subjects with LTBI and in patients with active TB. ESAT-6 and CFP-10 specific CD8+ T-cells have also been more frequently described in patients with active tuberculosis (TB) versus patients with LTBI, and have been detected in HIV-positive patients and children with TB disease.

The QFT-Plus assay has 2 distinct TB antigen tubes: TB Antigen Tube 1 (TB1) and TB Antigen Tube 2 (TB2). Both tubes contain peptide antigens from ESAT-6 and CFP-10 for stimulation of a CD4+ T-cell IFN-gamma response. However, the TB2 tube also contains an additional set of ESAT-6 and CFP-10 peptides specifically designed to stimulate a CD8+ T-cell response.

For the most up-to-date information regarding use of IGRA, refer to the most recent guidelines on the Diagnosis of Tuberculosis in Adults and Children from the American Thoracic Society, the Infectious Diseases Society of America, the Centers for Disease Control and Prevention by DM Lewinsohn and colleagues.(1)
Reference Values

Interpretation

A single positive result by this test should not be used solely to diagnose latent tuberculosis (TB). Results should be used in conjunction with risk assessment, radiography, and other medical and diagnostic evaluations.

Positive:

Interferon-gamma (IFN-gamma) response to *Mycobacterium tuberculosis* antigens detected, suggesting infection with *M tuberculosis*. Positive results in patients at low-risk for TB should be interpreted with caution and repeat testing on a new sample should be considered as recommended by the 2017 ATS/IDSA/CDC Clinical Practice Guidelines for Diagnosis of Tuberculosis in Adults and Children.(1) False-positive results may occur in patients with prior infection with *M marinum*, *M szulgai*, or *M kansasii*.

Negative:

No IFN-gamma response to *M tuberculosis* antigens was detected. Infection with *M tuberculosis* is unlikely. A single negative result does not exclude infection with *M tuberculosis*. In patients at high risk for *M tuberculosis* infection, a second test should be considered in accordance with the 2017 ATS/IDSA/CDC Clinical Practice Guidelines for Diagnosis of Tuberculosis in Adults and Children.(1)

Indeterminate due to Low Mitogen Value:

Indeterminate results due to a low IFN-gamma level in the mitogen (positive control) tube. This may occur due to a low lymphocyte count, reduced lymphocyte activity, or inability of the patient's lymphocytes to generate IFN-gamma.

Indeterminate due to High Nil value:

Indeterminate results due to a high level of IFN-gamma in the Nil (negative control) tube. This may occur due to heterophile antibody effects or nonspecific, circulating IFN-gamma in the patient's blood sample. Repeat testing on a new specimen is suggested.

Cautions

A negative QuantiFERON-TB Gold Plus (QFT-Plus) result does not preclude the possibility of *Mycobacterium tuberculosis* infection or tuberculosis disease. False-negative results can be due to the stage of infection (eg, specimen obtained prior to the development of cellular immune response), comorbid conditions that affect immune functions, incorrect handling of the blood collection tubes following venipuncture, or other individual immunological factors. Additionally, heterophile antibodies or nonspecific interferon-gamma (IFN-gamma) production from other inflammatory conditions may mask specific responses to ESAT-6 or CFP-10 peptides.

A delay in incubation may cause false-negative or indeterminate results, and other technical parameters may affect the ability to detect a significant IFN-gamma response.

A positive QFT-Plus result should not be the sole or definitive basis for determining infection with *M tuberculosis*. Positive results should be followed by further medical evaluation for active tuberculosis disease (eg, acid-fast bacilli smear and culture, chest X-ray).

While ESAT-6 and CFP-10 are absent from all bacille Calmette-Guerin (BCG) strains and from most known nontuberculous mycobacteria, it is possible that a positive QFT-Plus result may be due to infection with *M kansasii*, *M szulgai*, or *M marinum*. If such infections are suspected, alternative tests should be performed.
The effect of lymphocyte count on reliability is unknown. Lymphocyte counts may vary over time for any individual person and from person to person. The minimum number required for a reliable result has not been established and may also be variable.

The predictive value of a negative QFT-Plus result in immunosuppressed patients has not been determined.

**Clinical Reference**


**Performance**

**Method Description**

The QuantiFERON-TB Gold Plus test uses specialized blood collection tubes, which are used to collect whole blood via venipuncture. Two of the 4 collection tubes contain antigens representing certain *Mycobacterium tuberculosis* proteins and 2 of the tubes are controls. TB Antigen Tube 1 (TB1) and TB Antigen Tube 2 (TB2) both contain peptide antigens from the *Mycobacterium tuberculosis* (MTB)-complex-associated antigens ESAT-6 and CFP-10 and are designed to elicit a cell-mediated immunity (CMI) response from CD4+ T-helper lymphocytes. The TB2 tube contains an additional set of peptides targeted to the induction of a CMI response from CD8+ cytotoxic T lymphocytes. Following collection, the tubes are incubated for 16 to 24 hours, then plasma is tested for the presence of interferon-gamma (IFN-gamma) produced in response to the peptide antigens. The QFT-Plus test is performed in 2 stages. First, whole blood is collected into QFT-Plus blood collection tubes, which include a Nil Control tube (negative control tube), TB1 antigen tube, TB2 antigen tube, and a Mitogen tube (positive control tube). The tubes are immediately shaken after collection to mix antigen with the blood and then incubated at 37 degrees C + or - 1 degree C within 16 hours from collection. Following a 16 to 24 hour incubation period, the tubes are centrifuged, and the amount of IFN-gamma is measured by enzyme-linked immunosorbent assay in IU/mL.

A test is considered positive for an IFN-gamma response to the TB antigen cocktail when results are significantly above the negative control value. The Nil tube adjusts for background, heterophile antibody effects, or nonspecific IFN-gamma in blood samples. The IFN-gamma level of the Nil tube is subtracted from the IFN-gamma level for the TB1 and TB2 antigen tubes and Mitogen tube. The mitogen-stimulated plasma sample serves as an IFN-gamma positive control for each specimen tested. A low response to mitogen (<0.5 IU/mL) indicates an indeterminate result when a blood sample also has a negative response to the TB Antigens. This pattern may occur with insufficient lymphocytes, reduced activity due to prolonged specimen transport, or improper specimen handling, including filling/mixing of blood tubes or inability of the patientâ€™s lymphocytes to generate IFN-gamma. Elevated levels of IFN-gamma in the Nil tube may occur with the presence of heterophile antibodies or due to intrinsic IFN-gamma secretion.(Package insert: QuantiFERON-TB Gold Plus (QFT-Plus), Qiagen, Germantown, MD, August 2017)

**PDF Report**

No

**Day(s) and Time(s) Test Performed**

Monday through Friday; 9 a.m.
Test Definition: QFT4
QuantiFERON-Tb Gold Plus, B

Analytic Time
2 days

Maximum Laboratory Time
4 days

Specimen Retention Time
Until testing is complete

Performing Laboratory Location
Rochester

Fees and Codes

Fees
- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their Regional Manager. For assistance, contact Customer Service.

Test Classification
This test has been cleared or approved by the U.S. Food and Drug Administration and is used per manufacturer’s instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

CPT Code Information
86481

LOINC® Information

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Test Order Name</th>
<th>Order LOINC Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>QFT4</td>
<td>QuantiFERON-Tb Gold Plus, B</td>
<td>71775-1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Result ID</th>
<th>Test Result Name</th>
<th>Result LOINC Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>QFTQ2</td>
<td>QuantiFERON-Tb Gold Plus Result</td>
<td>71773-6</td>
</tr>
<tr>
<td>DEXQE</td>
<td>TB1 Ag minus Nil Result</td>
<td>64084-7</td>
</tr>
<tr>
<td>DEXQF</td>
<td>TB2 Ag minus Nil Result</td>
<td>88517-8</td>
</tr>
<tr>
<td>DEXQG</td>
<td>Mitogen minus Nil Result</td>
<td>71774-4</td>
</tr>
<tr>
<td>DEXQH</td>
<td>Nil Result</td>
<td>71776-9</td>
</tr>
</tbody>
</table>