Test Definition: T4

T4 (Thyroxine), Total Only, S

Overview

Useful For

Monitoring treatment with synthetic hormones (synthetic triiodothyronine [T3] will cause a low total thyroxine [T4])

Monitoring treatment of hyperthyroidism with thiouracil and other anti-thyroid drugs

Index of thyroid function when the thyroxine-binding globulin (TBG) is normal and non-thyroidal illness is not present

Testing Algorithm

See Thyroid Function Ordering Algorithm in Special Instructions.

Special Instructions

- Thyroid Function Ordering Algorithm

Method Name

Electrochemiluminescence Immunoassay

NY State Available

Yes

Specimen

Specimen Type

Serum

Advisory Information

This test cannot be used in patients receiving treatment with lipid-lowering agents containing dextrothyroxine (D-T4) unless therapy is discontinued for 4 to 6 weeks to allow the physiological state to become reestablished prior to testing.

Specimen Required

Patient Preparation: For 12 hours before specimen collection do not take multivitamins or dietary supplements containing biotin (vitamin B7), which is commonly found in hair, skin, and nail supplements and multivitamins.

Collection Container/Tube:

Preferred: Serum gel

Acceptable: Red top

Submission Container/Tube: Plastic vial

Specimen Volume: 1 mL

Specimen Minimum Volume

0.5 mL

Reject Due To

Gross hemolysis	Reject
Gross lipemia	OK
Gross icterus	OK

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	7 days	
	Frozen	30 days	

Clinical and Interpretive

Clinical Information

Thyroxine (T4) is synthesized in the thyroid gland. T4 is metabolized to triiodothyronine (T3) peripherally by deiodination. T4 is considered a reservoir or prohormone for T3, the biologically most active thyroid hormone. About 0.05% of circulating T4 is in the free or unbound portion. The remainder is bound to thyroxine-binding globulin (TBG), prealbumin, and albumin.

The hypothalamus secretes thyrotropin-releasing hormone (TRH), which stimulates the pituitary to release thyrotropin (previously thyroid-stimulating hormone: TSH). TSH stimulates the thyroid to secrete T4. T4 is partially converted peripherally to T3. High amounts of T4 and T3 (mostly from peripheral conversion of T4) cause hyperthyroidism.

T4 and T3 cause positive feedback to the pituitary and hypothalamus with resultant suppression or stimulation of the thyroid gland as follows: decrease of TSH if T3 or T4 is high (hyperthyroidism), and increase of TSH if T3 or T4 is low (hypothyroidism).

Measurement of total T4 gives a reliable reflection of clinical thyroid status in the absence of protein-binding abnormalities and non-thyroidal illness. However, changes in binding proteins can occur that affect the level of total T4, but leave the level of unbound hormone unchanged.

See Thyroid Function Ordering Algorithm in Special Instructions.

Reference Values

Pediatric

0-5 days: 5.0-18.5 mcg/dL

6 days-2 months: 5.4-17.0 mcg/dL

3-11 months: 5.7-16.0 mcg/dL

1-5 years: 6.0-14.7 mcg/dL

6-10 years: 6.0-13.8 mcg/dL

11-19 years: 5.9-13.2 mcg/dL

Adult (> or =20 years): 4.5-11.7 mcg/dL

For SI unit Reference Values, see https://www.mayocliniclabs.com/order-tests/si-unit-conversion.html

Interpretation

Values of more than 11.7 mcg/dL in adults or more than the age-related cutoffs in children are seen in hyperthyroidism and in patients with acute thyroiditis.

Values below 4.5 mcg/dL in adults or below the age-related cutoffs in children are seen in hypothyroidism, myxedema, cretinism, chronic thyroiditis, and occasionally, subacute thyroiditis.

Increased total thyroxine (T4) is seen in pregnancy and patients who are on estrogen medication. These patients have increased total T4 levels due to increased thyroxine-binding globulin (TBG) levels.

Decreased total T4 is seen in patients on treatment with anabolic steroids or nephrosis (decreased TBG levels).

A thyrotropin-releasing hormone (TRH) stimulation test may be required for certain cases of hyperthyroidism.

Clinical findings are necessary to determine if thyrotropin, TBG, or free T4 testing is needed.

Cautions

In pregnancy, incomplete release of thyroxine (T4) from its binding proteins might result in falsely low total T4 levels. Therefore, total T4 should not be used as the only marker for thyroid function evaluation.

Thyrotropin (TSH) may be better than T4 as the initial test of thyroid status. TSH is elevated in primary hypothyroidism. TSH is low in primary hyperthyroidism.

Free T4 may more accurately measure the physiologic amount of T4.

Some patients who have been exposed to animal antigens, either in the environment or as part of treatment or imaging procedure, may have circulating anti-animal antibodies present. These antibodies may interfere with the assay reagents to produce unreliable results.

Autoantibodies to thyroid hormones can interfere with testing.

Binding protein anomalies may cause values that deviate from the expected results. Pathological concentrations of binding proteins can lead to results outside the reference range, although the patient may be in a euthyroid state.

In rare cases, interference due to extremely high titers of antibodies to analyte-specific antibodies, ruthenium or streptavidin can occur.

Clinical Reference

1. Ross DS, Burch HB, Cooper DS, et al: 2016 American Thyroid Association Guidelines for Diagnosis and Management of Hyperthyroidism and Other Causes of Thyrotoxicosis. Thyroid 2016 Oct 26(10):1343-1421

2. Persani L, Cangiano B, Bonomi M: The diagnosis and management of central hypothyroidism in 2018. Endocr Connect 2019 Feb;8(2):R44â€“R54. doi:10.1530/EC-18-0515

Performance

Method Description

The Roche Elecsys T4 (thyroxine) assay is a competitive assay using electrochemiluminescence detection. Bound T4 is released from binding proteins by 8-anilino-1-naphthalene sulfonic acid (ANS). Patient specimen is incubated with sheep polyclonal anti-T4 antibody labeled with ruthenium. Streptavidin-coated microparticles and biotinylated T4 are added for a second incubation during which the still free binding sites of the labeled antibody become occupied. The resulting immunocomplex becomes bound to the solid phase by interaction of biotin and streptavidin. The reaction mixture is aspirated into the measuring cell where the microparticles are magnetically captured onto the surface of the electrode. Unbound substances are then removed and application of a voltage to the electrode induces the electrochemiluminescent emission. This signal is measured against a calibration curve to determine patient results.(Package insert: Roche Elecsys T4, Roche Diagnostics, V 2.0 English 03/2020)

PDF Report

No

Day(s) and Time(s) Test Performed

Monday through Friday; 5 a.m.-12 a.m.

Saturday; 6 a.m.-6 p.m.

Analytic Time

Same day/1 day

Maximum Laboratory Time

3 days

Specimen Retention Time

14 days

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

84436

LOINC® Information

Test Definition: T4

T4 (Thyroxine), Total Only, S

Test ID	Test Order Name	Order LOINC Value
T4	T4 (Thyroxine), Total Only, S	83119-8

Result ID	Test Result Name	Result LOINC Value
T4	T4 (Thyroxine), Total Only, S	83119-8