Test Definition: THEO

Theophylline, S

Overview

Useful For

Assessing and adjusting theophylline dosage for optimal therapeutic level

Assessing theophylline toxicity

Method Name

Kinetic Interaction of Microparticles in a Solution (KIMS)

NY State Available

Yes

Specimen

Specimen Type

Serum

Specimen Required

Container/Tube:

Preferred: Serum gel

Acceptable: Red top

Submission Container/Tube: Plastic vial

Specimen Volume: 0.5 mL

Collection Instructions:

1. Serum gel tubes should be centrifuged within 2 hours of collection.

2. Red-top tubes should be centrifuged and the serum aliquoted into a plastic vial within 2 hours of collection.

Forms

If not ordering electronically, complete, print, and send a Therapeutics Test Request (T831) with the specimen.

Specimen Minimum Volume

0.25 mL

Reject Due To

Gross hemolysis	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Serum	Refrigerated (preferred)	14 days	
	Frozen	28 days	
	Ambient	72 hours	

Clinical and Interpretive

Clinical Information

Theophylline and its congener, aminophylline, are used to relax smooth muscles of the bronchial airways and pulmonary blood vessels to relieve and prevent symptoms of asthma and bronchospasm.

Theophylline is administered orally at a dose of 400 mg/day or 6 mg/kg, whichever is lower, or intravenously as aminophylline at 0.6 mg/kg/hour. Oral dosage may be increased at 200-mg increments to a maximum of 900 mg/day, or 13 mg/kg if the steady-state blood concentration is within the therapeutic range of 8.0 to 20.0 mcg/mL.

Theophylline has a half-life of 4 hours in children and adult smokers, and 7 hours in nonsmoking adults, thus steady-state is reached in approximately 1 day. The volume of distribution is 0.5 L/kg, and the drug is approximately 50% protein bound. Theophylline exhibits zero-order clearance kinetics like phenytoin, small increases in dose yield disproportionately large increases in blood concentration.

Coadministration of cimetidine and erythromycin will significantly inhibit theophylline clearance, requiring dosage reduction. Other drugs such as allopurinol, ciprofloxacin, oral contraceptives, and propranolol inhibit theophylline clearance to a lesser degree.

Smoking induces the synthesis of cytochrome P448, the antipyrine-dependent cytochrome, which significantly increases the rate of metabolism of theophylline. Drugs such as phenobarbital, phenytoin, carbamazepine, and rifampin slightly increase the rate at which the drug is cleared.

Theophylline exhibits rather severe toxicity that is proportional to blood level.

Reference Values

Therapeutic:

Bronchodilation: 8.0-20.0 mcg/mL

Neonatal apnea (< or =4 weeks old): 6.0-13.0 mcg/mL

Critical value: >20.0 mcg/mL

Interpretation

Response to theophylline is directly proportional to the serum level.

Patients usually receive the best response when the serum level is above 8.0 mcg/mL, with minimal toxicity experienced as long as the level is less than or equal to 20.0 mcg/mL.

Cautions

Many drugs affect the plasma level of this drug (as outlined in Clinical Information).

Clinical Reference

1. Pesce AJ, Rashkin M, Kotagal U: Standards of laboratory practice: theophylline and caffeine monitoring. Clin Chem 1998 May;44(5):1124-1128

2. McCudden CR, Broussard LA: Caffeine, lithium and theophylline. In Therapeutic Drug Monitoring Data: A Concise Guide. Third edition. Edited by CA Hammett-Stabler, A Dasgupta, AACC Press, 2007

3. Vassallo R, Lipsky JJ: Theophylline: recent advances in the understanding of its mode of action and uses in clinical practice. Mayo Clin Proc 1998;73:346-354

4. Nader R, Horwath AR, Wittwer CT: Tietz Textbook of Clinical Chemistry and Molecular Diagnostics Sixth Edition. St. Louis. Elsevier 2018

Performance

Method Description

The assay is based on the kinetic interaction of microparticles in a solution (KIMS). Theophylline antibody is covalently coupled to microparticles and the drug derivative is linked to a macromolecule. The kinetic interaction of microparticles in solutions is induced by binding of drug-conjugate to the antibody on the microparticles and is inhibited by the presence of theophylline in the sample. A competitive reaction takes place between the drug conjugate and theophylline in the serum sample for binding to the theophylline antibody on the microparticles. The resulting kinetic interaction of microparticles is indirectly proportional to the amount of drug present in the sample.(Package insert: Roche Theophylline reagent, Roche Diagnostic Corp, Indianapolis, IN; 09/2017)

PDF Report

No

Day(s) and Time(s) Test Performed

Monday through Saturday

Analytic Time

Same day/1 day

Maximum Laboratory Time

1 day

Specimen Retention Time

2 weeks

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.

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Test Classification

This test has been modified from the manufacturer's instructions. Its performance characteristics were determined by Mayo Clinic in a manner consistent with CLIA requirements. This test has not been cleared or approved by the U.S. Food and Drug Administration.

CPT Code Information

80198

LOINC® Information

Test ID	Test Order Name	Order LOINC Value
THEO	Theophylline, S	4049-3

Result ID	Test Result Name	Result LOINC Value
8661	Theophylline, S	4049-3