TDM of Theophylline

|  |  |
| --- | --- |
| Theophylline Level | Homeprint |
| Lab Tests and Diagnostic Procedures |

Top of Form



Bottom of Form

Content Updated2008-12-15

Overview

Theophylline is an older, rarely prescribed, bronchodilator used in the treatment of asthma and chronic obstructive pulmonary disease (COPD). Once commonly prescribed for asthma and COPD, its use has become controversial due to treatment-associated adverse effects including fatal atrial and ventricular arrhythmias; however, the slow-release preparations have proven useful in patients with COPD and it is still considered to be a third-line treatment option. (Fromer, 2008) Due to wide variability of pharmacokinetics, a narrow therapeutic window, and dose-related toxic effects, monitoring of theophylline blood levels is recommended.

Use/Indications

• Assess for theophylline toxicity

• Monitor therapeutic drug level (detect noncompliance and subtherapeutic levels)

Specimen

1 mL serum or plasma (0.2 mL minimum)

Container

Red top tube (no additive tube), serum separator tube, green top (heparin) tube, lavender top (EDTA) tube, gray top (sodium fluoride/potassium oxalate) tube, or blue top (citrate) tube; **Note:** Container may be methodology/container specific.

Collection

Routine venipuncture. Centrifuge and separate serum or plasma from cells as soon as possible. "For sustained-release theophylline, specimen should be obtained in the middle of the dosing interval, at least 3-5 days after initiation of therapy and at least 2 days after initiation of any factor that might affect theophylline clearance." (NIH, 2007)

Time to peak serum concentration:

• Oral: 1 hour

• Extended-release capsules and tablets: 4-7 hours; in overdoses up to 27 hours

Storage Instructions

Refrigerate

Methodology

Fluorescence polarization immunoassay (FPIA); enzyme immunoassay (EIA); high performance liquid chromatography (HPLC); gas chromatography (GC)

Normal Values/Findings

Asthma: 5-15 μg/mL; **Note:** Laboratory/methodology/patient demographics specific

Critical Values

• >20 μg/mL; toxicity can take place at 15 μg/mL.

• Chronic seizures: 30-50 μg/mL

• Acute toxicity seizures and malignant arrhythmias: >80 μg/mL

Laboratory/Diagnostic Pearls

• Several studies have questioned the correlation between the blood concentration and toxic effect of theophylline. (Aitken, 1987) Theophylline may cause sinus tachycardia even at therapeutic serum concentrations. (Bittar, 1991) Levels should be interpreted in light of the patient's clinical status and use of other medications.

Additional Information

Theophylline half-life varies between individuals. See table.

| Theophylline Half-Life |
| --- |
| **Half-life****(h)** | **Patient Population** |
| 6-10 | Normal healthy adults |
| 2-9 | Children |
| 15-58 | Premature infants |
| 18-24 | Severe congestive heart failure |
| 29 | Cirrhosis |

Changes in diet may affect the elimination of theophylline. Allopurinol, amiodarone, cimetidine, ciprofloxacin, and erythromycin may ***increase*** theophylline concentrations.

Aminoglutethimide, carbamazepine, phenobarbital, phenytoin, protease inhibitors, rifampin, and thyroid products may ***decrease*** theophylline concentrations.