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**theophylline (thee-off-il-n)**

Elixophyllin, Pulmophylline, Theo-24, Theochron, Theolair, Uniphyl

**Classification**

Therapeutic: Bronchodilators

Pharmacologic: xanthines

**Pregnancy Category C**

**Indications**

Long-term control of reversible airway obstruction caused by asthma or COPD.

**Action**

Inhibit phosphodiesterase, producing increased tissue concentrations of cyclic adenosine monophosphate (cAMP). Increased levels of cAMP result in: Bronchodilation, CNS stimulation, Positive inotropic and chronotropic effects, Diuresis, Gastric acid secretion.

**Therapeutic Effects:** Bronchodilation.

**Pharmacokinetics**

**Absorption:** Well absorbed from PO dosage forms; absorption from extended-release dosage forms is slow but complete.

**Distribution:** Widely distributed; crosses the placenta and into breast milk; does not distribute into adipose tissue.

**Metabolism and Excretion:** 90% metabolized by the liver to several metabolites (including the active metabolites, caffeine, and 3–methylxanthine); metabolites are renally excreted; 10% excreted unchanged by the kidneys.

**Half-life:** Theophylline—Premature infants: 20–30 hr; Term infants: 11–25 hr; Children 1–4 yr: 3.4 hr; Children 6–17 yr: 3.7 hr; Adults: 9–10 hr (in patients >60 yr, patients with HF or liver disease; patients with heart failure, liver disease, or hypothyroidism; patients who smoke; cigarette smokers).

**TIME/ACTION PROFILE (bronchodilation)**

<table>
<thead>
<tr>
<th>ROUTE</th>
<th>ONSET</th>
<th>PEAK</th>
<th>DURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO</td>
<td>rapid</td>
<td>1–2 hr</td>
<td>6 hr</td>
</tr>
<tr>
<td>ER</td>
<td>delayed</td>
<td>4–8 hr</td>
<td>8–24 hr</td>
</tr>
<tr>
<td>IV</td>
<td>rapid</td>
<td>end of infusion</td>
<td>6–8 hr</td>
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†Provided that a loading dose has been given and steady-state blood levels exist.

**Contraindications/Precautions**

**Contraindicated in:** Hypersensitivity to aminophylline or theophylline.

**Use Cautiously in:** Cardiac arrhythmias; 

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**Adverse Reactions/Side Effects**

**CNS:** SEIZURES, anxiety, headache, insomnia, irritability.

**CV:** ARRHYTHMIAS, tachycardia, angina, palpitations.

**GI:** Nausea, vomiting, anorexia.

**Neuro:** tremor.

**Interactions**

**Drug-Drug:** Additive CV and CNS side effects with adrenergics (sympathomimetics). May increase the therapeutic effect of lithium and phenytoin and may decrease effectiveness. Erythromycin, beta blockers, clarithromycin, calcium channel blockers, cimetidine, disulfiram, doxycycline, estrogens, fluoxetine, isoniazid, ketoconazole, mexiletine, nefazodone, protease inhibitors, quinidine, some fluoroquinolones, and large doses of theophylline may metabolize and may lead to toxicity.

**Drug-Natural Products:** Caffeine-containing herbs (cola nut, guarana, mate, tea, coffee) may increase serum levels and risk of CNS and CV side effects. Serum levels and effectiveness with St. John’s wort.

**Drug-Food:** Excessive regular intake of charcoal-broiled foods may decrease effectiveness.

**Route/Dosage**

**Dose should be determined by theophylline serum level monitoring. Loading dose should be 1/2 or eliminated if theophylline preparation has been used in preceding 24 hr.**

**PO (Adults Healthy, Non-smoking):**

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<td>PO</td>
<td>10 mg/kg, followed by 10 mg/kg/day divided q 8–12 hr (not to exceed 600 mg/day).</td>
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**PO (Adults with HF, Cor Pulmonale, or Liver Dysfunction):**

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**PO (Children 12–16 yr, Non-smoking):**

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**PO (Children 6–11 yr):**

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PO (Children 9–12 yr, adolescent and adult smokers /H11021 50 yr): Loading dose—5 mg/kg, followed by 16 mg/kg/day divided q 8–12 hr.

PO (Children 1–9 yr): Loading dose—5 mg/kg, followed by 20–24 mg/kg/day divided q 8–12 hr.

PO (Infants 6 mo–1 yr): Loading dose—5 mg/kg, followed by 12–18 mg/kg/day divided q 6–8 hr.

PO (Infants 6 wk–6 mo): Loading dose—5 mg/kg, followed by 10 mg/kg/day divided q 6–8 hr.

PO (Neonates up to 6 wks): Loading dose—4 mg/kg, followed by 4 mg/kg/day divided q 12 hr.

IV (Adults and Children): See aminophylline monograph for IV doses.

NURSING IMPLICATIONS
Assessment
- Assess BP, pulse, respiratory status (rate, lung sounds, use of accessory muscles) before and throughout therapy. Ensure that oxygen therapy is correctly instituted during acute asthma attacks.
- Monitor intake and output ratios for an increase in diuresis or fluid overload.
- Patients with a history of cardiovascular problems should be monitored for chest pain and ECG changes (PACs, supraventricular tachycardia, PVCs, ventricular tachycardia). Resuscitative equipment should be readily available.
- Monitor pulmonary function tests before and periodically during therapy to determine therapeutic efficacy in patients with chronic bronchitis or emphysema.
- Lab Test Considerations: Monitor ABGs, acid-base, and fluid and electrolyte balance requirements occurring parenteral therapy or whenever required by patient’s condition.
- Toxicity and Overdose:
  - Monitor drug levels routinely, especially in patients requiring high doses or during prolonged intensive therapy. Obtain serum sample at time of peak absorption. Evaluate peak levels 30 min after a 30 min IV loading dose, 12–24 hr after initiation of a continuous infusion and 1–2 hr after rapid-acting oral forms, and 6–12 hr after extended-release oral forms. Therapeutic plasma levels range from 10–15 mcg/mL for asthma and 6–14 mcg/mL for apnea of prematurity. Drug levels in excess of 20 mcg/mL are associated with toxicity. Caffeine ingestion may falsely elevate drug concentration levels.
  - Observe patient for symptoms of drug toxicity (anorexia, nausea, vomiting, stomatitis, diarrhea, confusion, behavioral, respiratory, flushing, increased urination, insomnia, tachycardia, arrhythmia, seizures). South Texas care professionals immediately if these occur. Tachycardia, ventricular arrhythmias, or seizures may be the first sign of toxicity. Geri: Patients over 60 yr have 3% risk of toxicity and sensitivity to toxic effects due to age-related pharmacokinetic and pharmacodynamic changes. Theophylline doses should not exceed 600 mg.

Potential Nursing Diagnoses
Indelible airway clearance (Indications)
Activity maintenance (Indications)
Implementation
- Administer around the clock to maintain therapeutic plasma levels. Administer once-a-day doses in the morning.
- Do not refrigerate elixirs or solutions; crystals may form. Crystals should dissolve when liquid is warmed to room temperature.
- Wait at least 1 hr before stopping therapy to begin immediate-release oral dosing for extended-release oral dosage form, 1 hr after start of IV infusion or discontinuation.
- PO: Administer oral preparations with food or a full glass of water to minimize GI irritation. Food slows but does not reduce the extent of absorption. May be administered 1 hr before or 2 hr after meals for more rapid absorption. Swallow tablets and capsules whole; do not crush, break, open or chew controlled-release or extended-release tablets or capsules (extended-release tablets may be broken if scored). PO: Use calibrated measuring device to ensure accurate dose of liquid preparations.
- PO (Children): Monitor ABGs, acid-base, and fluid and electrolyte balance requirements occurring parenteral therapy or whenever required by patient’s condition.
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THEOPHYLLINE

**Y-Site Compatibility:** acyclovir, allopurinol, alfentanil, aminophylline, amphotericin B lipid complex, amphotericin B liposome, amikacin, aztreonam, bivalirudin, bleomycin, bumetanide, busulfan, cisplatin, clindamycin, cyclophosphamide, dapsone, diltiazem, docetaxel, doxorubicin, doxycycline, diphenhydramine, diltiazem, dopamine, drotaverine, drotaverine hydrochloride, drotaverine maleate, droperidol, eculizumab, eptifibatide, erythropoietin, etoposide, etoposide phosphate, famotidine, fentanyl, fluconazole, fludarabine, fluorouracil, furosamide, gemcitabine, gentamicin, glycoprotein A, granisetron, heparin, hydromorphone, idarubicin, imipenem, indomethacin, insulin, irinotecan, isoproterenol, levofloxacin, lidocaine, linezolid, lorazepam, magnesium sulfate, mannitol, mechlorethamine, meperidine, mesna, metaraminol, methotrexate, methyldopate, methylprednisolone sodium succinate, metoclopramide, metoprolol, metronidazole, micafungin, midazolam, minocycline, mitomycin, mitoxantrone, misonidazole, morphine, nafcillin, nalbuphine, naloxone, norepinephrine, ondansetron, oxacillin, oxaliplatin, oxytocin, paclitaxel, palonosetron, pantoprazole, papaverine, penicillin G, pentamidine, pentazocine, pentobarbital, phenobarbital, phentolamine, phenylephrine, phytonadione, piperacillin/tazobactam, potassium acetate, potassium chloride, potassium thiocyanate, propofol, pyridoxine, quinapristin/dalfopristin, ranitidine, remifentanil, rituximab, rocuronium, sodium acetate, sodium bicarbonate, streptokinase, succinylcholine, sufentanil, tacrolimus, teniposide, thiamine, thiotepa, ticarcillin/clavulanate, tigecycline, tirofiban, tobramycin, tolazoline, trastuzumab, vasopressin, vecuronium, verapamil, vinblastine, vincristine, voriconazole, zolendronic acid.

**Y-Site Incompatibility:** azathioprine, cefepime, dantrolene, diazepam, diazoxide, doxorubicin liposomal, ganciclovir, hetastarch, inamrinone, phenytoin, trimethoprim/sulfamethoxazole.

**Additive Incompatibility:** Admixing is not recommended because of dose titration and incompatibilities.

**Patient/Family Teaching**

- Emphasize the importance of taking only the prescribed dose at the prescribed time intervals. Take missed doses as soon as possible or omit if close to next dose.
- Encourage the patient to drink adequate liquids (2000 ml/day minimum) to decrease the viscosity of the airway secretions.
- Advise patient to notify health care professional of all Rx or OTC medications, vitamins, or herbal products being taken and to consult with health care professional before taking other medications, especially OTC cough, cold, or breathing preparations, may increase side effects and cause arrhythmias.
- Encourage patients not to smoke. A change in smoking habits may necessitate a change in dose.
- Advise patient to minimize intake of xanthine-containing foods or beverages (coffee, colas, chocolate) and not to eat charcoal-broiled foods.
- Instruct patient not to change brands without consulting health care professional.
- Advise patient to contact health care professional promptly if the usual dose of medication fails to produce the desired results, symptoms worsen after treatment, or toxic effects occur.
- Advise female patient to notify health care professional if pregnancy is planned or suspected or if breast feeding.

**Evaluation/Desired Outcomes**

- Increased ease in breathing.
- Clearing of lung fields on auscultation.
- Why was this drug prescribed for your patient?