Acetylcysteine (a-se-teel-sis-teen)
Acetadote, Mucomyst, Parvolex

Classification
Therapeutic: antidotes (for acetaminophen toxicity), mucolytic
Pregnancy Category B

Indications
PO: Antidote for the management of potentially hepatotoxic overdose of acetaminophen (administer within 8–10 hours [IV] or 24 hours [PO] of ingestion).
Inhaln: Mucolytic in the management of conditions associated with thick, viscous mucus secretion.

Unlabeled Use: Prevention of radiocontrast-induced renal dysfunction (oral).

Action
PO: Decreases the buildup of a hepatotoxic metabolite in acetaminophen overdose.
IV: Decreases the buildup of a hepatotoxic metabolite in acetaminophen overdose.
Inhaln: Degrades mucus, allowing easier mobilization and expectoration.

Therapeutic Effects: PO: Prevention or lessening of liver damage following acetaminophen overdose. Inhaln: Lower viscosity of mucus.

Pharmacokinetics
Absorption: Absorbed from the GI tract following oral administration. Action is local following inhalation; remainder may be absorbed from pulmonary epithelium.
Distribution: Crosses the placenta; 0.47 L/kg.
Protein Binding: 83% bound to plasma proteins.
Metabolism and Excretion: Partially metabolized by the liver, 22% excreted renally.
Half-life: Adults—5.6 hr (in hepatic impairment); newborns—11 hr.

Contraindications/Precautions
Contraindicated in: Hypersensitivity.
Use Cautiously in: Severe respiratory insufficiency, asthma, or history of bronchospasm; History of GI bleeding (oral only); GFR: Lactation: Safety not established.

Adverse Reactions/Side Effects
CNS: Drowsiness.
CV: Vasodilation, tachycardia, hypotension.
EENT: Rhinorrhea.
Resp: Bronchospasm, bronchial/tracheal irritation, chest tightness, phlegm, rales.
GI: Nausea, vomiting, stomatitis.
Derm: Rash, clamminess, pruritus, urticaria.
Misc: Allergic reactions (primarily with IV), including anaphylaxis, angioedema, chills, fever.

Interactions
Drug-Drug: Activated charcoal may adsorb orally administered acetylcysteine and reduce effectiveness as an antidote.

Route/Dosage
Acetaminophen Overdose
PO (Adults and Children): 140 mg/kg initially, followed by 70 mg/kg q 4 hr for 17 additional doses.
IV (Adults and Children): Loading dose—150 mg/kg (maximum: 15 g) over 60 min initially followed by first maintenance dose—50 mg/kg (maximum: 5 g) q 4 hr, then second maintenance dose—100 mg/kg (maximum: 10 g) q 16 hr.

Mucolytic
Inhaln (Adults and Children 1–12 yrs): Nebulization via face mask—3–5 mL of 20% solution or 6–10 mL of the 10% solution 3–4 times daily; nebulization via tent or croupette—volume of 10–20% solution required to maintain heavy mist; direct instillation—1–2 mL of 10–20% solution 4–6 hr; intratracheal instillation via tracheostomy—0.2 mL of 10–20% solution q 4–6 hr up to 2–5 mL in 24 hr.

TIME/ACTION PROFILE
ROUTE ONSET PEAK DURATION
PO (antidote) unknown 30–60 min 4 hr
Inhaln (mucolytic) 1 min 5–10 min short

Preparation
PO: Dilute 140 mg/mL to 280 mg/mL.
IV: Usually diluted in D5W.

Compatibility
PO: Administration sets.
IV: D5W, NS.
Inhaln: Appropriate nebulization solutions; see manufacturer’s labeling.

Incompatibility
IV: Y-site: Foscarnet, ganciclovir, tetracyclines.

Pharmacoeconomics

Heritage: costs

Generic equivalency: Available generically.

Cost

Stability

Storage: Oral—Shelf stable; refrigerate solutions used for IV administration.
During IV: Stable for 24 hr; discard if cloudy.

Dosage Forms

PO: Tablets 300, 600 mg; Oral Solution 140 mg/mL; Injection 140 mg/mL.
IV: Injection 100 mg/mL (5 g/50 mL), 150 mg/mL (15 g/50 mL; 25 g/100 mL), 15 mg/mL (0.75 g/50 mL; 1.5 g/100 mL), 50 mg/mL (5 g/100 mL).
Inhaln: Powder—Acetaminophen Inhalation Powder for Inhalation 20%.

Off-Label Use

PO: Oral Suspension 280 mg/mL (children).
IV: Oral Suspension 280 mg/mL (children), Oral Solution 140 mg/mL (children), 280 mg/mL (adults).

Footnotes
• Generic name.

Genetic Implication. CAPI TALS indicate life-threatening, underline indicate most frequent, strikethrough indicates discontinued.
2 mL of 20% solution instilled into particular segments of the bronchopulmonary tree.

Inhaln (Infants): Nebulization—1–2 mL of 20% solution or 2–4 mL of 10% solution 3–4 times daily.

Prevention of Radiocontrast-Induced Renal Dysfunction
PO (Adults): 600 mg twice daily for 2 days, beginning the day before the procedure.

NURSING IMPLICATIONS

Assessment

● Antidote in Acetaminophen Overdose: Assess type, amount, and time of acetaminophen ingestion. Assess plasma acetaminophen levels. Initial levels are drawn at least 4 hr after ingestion of acetaminophen. Plasma level determinations may be difficult to interpret following ingestion of extended-release preparations. Do not wait for results to administer dose.

● IV: Assess for anaphylaxis. Erythema and flushing are common, usually occurring 30–60 min after initiating infusion, and may resolve with continued administration. If rash, hypotension, wheezing, or dyspnea occurs, initiate treatment for anaphylaxis (antihistamine and epinephrine). Intravenous acetylcysteine infusion until symptoms resolve and respiratory status returns to normal. If anaphylaxis recurs, discontinue acetylcysteine and use alternative form of treatment.

● Assess patient for nausea, vomiting, and urticaria. Notify health care professional if these occur.

● Mucolytic: Assess respiratory function (lung sounds, dyspnea) and color, amount, and consistency of secretions before and immediately following treatment to determine effectiveness of therapy.

● Lab Test Considerations:Monitor AST, ALT, and bilirubin levels along with prothrombin time every 24 hr for 96 hr in patients with plasma acetaminophen levels indicating potential hepatotoxicity. Monitor cardiac and renal function (creatinine, BUN), serum glucose, and electrolytes. Maintain fluid and electrolyte balance, correct hypoglycemia, and administer vitamin K or fresh frozen plasma or clotting factor concentrate if prothrombin time ratio exceeds 1.5 or 3, respectively.

Potential Nursing Diagnoses

● Risk for self-directed violence (Indications)

● Ineffective airway clearance (Indications)

● Deficient knowledge, related to medication regimen (Patient/Family Teaching)

Implementation

Do not confuse Mucomyst with Mucinex.

After opening, solution for inhalation may turn light purple; does not alter potency. Refrigerate opened vials and discard after 96 hr.

Drug reacts with rubber and metals (iron, nickel, copper); avoid contact.

PO: Dilute 20% solution with cola, water, or milk to a final concentration of 1:3 for patients weighing more than 20 kg, to increase palatability. May be administered by duodenal tube if patient is unable to swallow. If patient vomits loading dose or maintenance dose within 1 hr of administration, readminister dose.

Acetaminophen Overdose—Empty stomach contents by inducing emesis or lavage prior to administration.

IV Administration

● pH: 6–7.5.

● Intermittent Infusion: Most effective if administered within 8 hr of acetaminophen ingestion. Dilution: Dilute in D5W. Concentration: For loading dose: For patients 5–20 kg: Dilute 150 mg/kg in 100 mL. For patients 21–40 kg: Dilute 150 mg/kg in 200 mL. For patients 41–100 kg: Dilute 150 mg/kg in 500 mL. For Second Dose: For patients 5–20 kg: Dilute 75 mg/kg in 100 mL. For patients 21–40 kg: Dilute 75 mg/kg in 250 mL. For patients 41–100 kg: Dilute 75 mg/kg in 500 mL. For Third Dose: For patients 5–20 kg: Dilute 37.5 mg/kg in 500 mL. For patients 21–40 kg: Dilute 37.5 mg/kg in 1000 mL. Adjust fluid volume for patients requiring fluid restriction. Vials are single-use. Discard after using. Reconstituted solution is stable for 24 hr at room temperature. Rate: Administer Loading Dose over 1 hr.

● Administer For Second Dose: over 4 hr.

● Administer For Third Dose: over 16 hr.

Inhaln: Mucolytic—Encourage adequate fluid intake (2000–3000 mL/day) to decrease viscosity of secretions.

For nebulization, the 20% solution may be diluted with 0.9% NaCl for injection or sterile water for injection. May use 10% solution undiluted. May be administered by nebulization, or 1–2 mL may be instilled directly into airway. During administration, when 2% solution remains in nebulizer, dilute with equal amount of 0.9% NaCl or sterile water.

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CONTINUED
acetylcysteine

- An increased volume of liquefied bronchial secretions may occur following administration. Have suction equipment available for patients unable to effectively clear airways.

- If bronchospasm occurs during treatment, discontinue and consult health care professional regarding possible addition of bronchodilator to therapy. Patients with asthma or hyperactive airway disease should be given a bronchodilator prior to acetylcysteine to prevent bronchospasm.

- Rinse patient’s mouth and wash face following treatment, as drug leaves a sticky residue.

**Patient/Family Teaching**

- Acetaminophen Overdose: Explain purpose of medication to patient.

- Inhalation: Instruct patient to clear airway by coughing deeply before taking aerosol treatment.

- Instruct patient that unpleasant odor of this drug becomes less noticeable as treatment progresses and medicine dissipates.

**Evaluation/Desired Outcomes**

- Decreased acetaminophen levels.

- No further increase in hepatic damage during acetaminophen overdose therapy.

- Decreased dyspnea and clearing of lung sounds when used as mucolytic.

- Prevention of radiocontrast-induced renal dysfunction.

Why was this drug prescribed for your patient?