



Clinical Pharmacology & Toxicology Pearl of the Week

~ Activated Charcoal (AC) ~

Background and Rationale

- ✓ AC is a highly porous carbonaceous material with a large surface area that allows for adsorption to a wide range of substances.
- ✓ The purpose of single-dose activated charcoal is to decrease absorption of the xenobiotic, whereas the purpose of multiple-dose activated charcoal (MDAC) is to interrupt the enterohepatic or enteroenteric recirculation of a xenobiotic.
- ✓ The use of AC is relatively safe in the absence of any contraindications to its administration. Adverse effects include emesis, constipation, diarrhea, pulmonary aspiration, intestinal obstruction, and peritonitis (if AC is given in the setting of GI perforation).
- ✓ Even substances not known to prolong gastric emptying in therapeutic situations may do so in the overdose setting thus increasing the window for GI decontamination.
- ✓ The risk of charcoal aspiration is highest in patients with CNS depression, poor airway control, and seizures. This can lead to lung injury, airway obstruction, difficulty with intubation, hypoxia, cardiac arrest, and death. Aspiration risk is reduced, but not eliminated, with intubation.
- ✓ While studies involving single and multiple-dose activated charcoal do not demonstrate a survival benefit in all poisoned patients, there are some clinical situations in which AC is likely to be beneficial. These include xenobiotics with life-threatening toxicities for which few therapies are available, and sustained release preparations that are likely to be present in the GI tract for several hours after ingestion.

Administration

- ✓ AC should **not** be routinely administered to all poisoned patients. In every case, a risk: benefit analysis should be carried out prior to the administration of AC. In addition to the indications and contraindications below, the xenobiotic, patient's mental status, airway status, and presence of a normal abdominal examination without distention or signs of an acute abdomen are essential prior to recommending the administration of AC.

The following are indications and contraindications for both single and multiple-dose AC:

Single-dose AC

Indications:

- ✓ Ingestion of potentially toxic amount of xenobiotic that is known to be adsorbed by AC, especially where serious toxicity is expected, no antidote or alternative therapy exists, and a large amount of xenobiotic is expected to be present in the stomach.
- ✓ The patient is awake and alert with intact protective airway reflexes and the ability to safely take PO, or the airway has been protected with an endotracheal tube (reduces but does not eliminate the risk of aspiration).
- ✓ Ingestion has occurred within a time frame amenable to adsorption by AC or clinical factors are present that suggest that not all of the xenobiotic has already been systemically absorbed. This may be much longer than 1 hour post ingestion (e.g. substances with antimuscarinic features, opiates or sustained release preparations, large overdoses).

Contraindications:

- ✓ AC is known to not adsorb a clinically meaningful amount of the ingested xenobiotic (e.g. lithium, potassium, iron, heavy metals, hydrocarbons, methanol, and ethylene glycol).
- ✓ Non-intubated patients with a GCS <15, seizures, somnolence, respiratory depression, or absent airway protective reflexes **If any of these conditions are present and AC is indicated, intubation is recommended prior to AC.**
- ✓ Gastrointestinal obstruction or decreased GI motility. If this is a concern, AC should be withheld until the

stomach is decompressed to reduce the risk of vomiting and aspiration.

- ✓ Gastrointestinal perforation is a concern (e.g. caustic ingestions).
- ✓ AC may increase the risk and severity of aspiration (e.g. hydrocarbons with high aspiration potential).
- ✓ Endoscopy will be an essential diagnostic modality (e.g. caustic ingestions).

Multiple-dose activated charcoal

Indications:

- ✓ Ingestion of a life-threatening amount of carbamazepine, dapsone, phenobarbital, quinine, salicylates, or theophylline (agents for which the enhanced elimination effect of MDAC may be beneficial).
- ✓ Ingestion of a life-threatening amount of another xenobiotic that undergoes enterohepatic or enteroenteric recirculation.
- ✓ Ingestion of a substantial amount of any slowly released xenobiotic (e.g. extended-release formulations) or of a xenobiotic known to form concretions or bezoars.

Contraindications:

- ✓ Any contraindication to single-dose AC.
- ✓ Presence of ileus or other causes of diminished peristalsis.

Dosing:

- ✓ **Single dose AC:** 1 g/kg body weight (adults and children) PO/NG*/OG*. Combination activated charcoal with sorbitol products is no longer recommended. In large ingestions or with sustained release preparation, it may be indicated to repeat this single dose for the purpose of completing GI decontamination (e.g. if the 10:1 ratio is not obtained with 1 mg/kg of AC)
 - *Caution if recommending administration of AC by NG or OG in an unprotected airway as the NG/OG stimulates the gag reflex and may increase vomiting and thus increase the risk of charcoal aspiration.*
- ✓ **Multiple dose AC:** 1 g/kg body weight (adults and children) PO/NG*/OG* followed by 0.5 g/kg every 4-6 hours for 12-24 hours. This should be tailored to the dose and dosage form of the xenobiotic, clinical status, and serum concentrations of the xenobiotic (if available). Combination activated charcoal with sorbitol products is no longer recommended.
 - *Caution if recommending administration of AC by NG or OG in an unprotected airway as the NG/OG stimulates the gag reflex and may increase vomiting and thus increase the risk of charcoal aspiration.*

References

1. Eddleston M et al. Multiple-dose activated charcoal in acute self-poisoning: a randomized controlled trial. Lancet 2008; 371: 579-87.
2. Juurgens G et al. The Effect of Activated Charcoal on Drug Exposure in Healthy Volunteers: A Meta-Analysis. Clin Pharm Therapeutics 2009; 85 (5):501-505.
3. Dorrington C et al. The frequency of complications associated with the use of multiple-dose activated charcoal. Ann Emerg Med 2003; 41:370-377.
4. Merigian K et al. Single-Dose Oral Activated Charcoal in the Treatment of the Self-Poisoned Patient: A Prospective, Randomized, Controlled Trial. Am J Ther 2002; 9: 301-308.
5. Moll J et al. Incidence of aspiration pneumonia in intubated patients receiving activated charcoal. The Journal of Emergency Medicine, Vol. 17, No. 2, pp. 279-283, 1999.



The Calgary Clinical Pharmacology physician consultation service is available Mon-Fri, 9am-5pm. The on-call physician is listed in ROCA. Click [HERE](#) for clinical issues the CP service can assist with.



The Poison and Drug Information Service ([PADIS](#)) is available 24/7 for questions related to poisonings. Please call 1-800-332-1414, and select option 1.