Activated charcoal is the most commonly used method of gastrointestinal decontamination in the hospital setting. According to the American Association of Poison Control Centers, activated charcoal was a reported therapy in 107,928 cases in 2006. In comparison, gastric lavage was performed in 9,995 cases, ipecac syrup was used in 2,176 cases, and whole bowel irrigation was performed in 2,740 cases. The use of activated charcoal has declined from 7.7% of all poison exposures reported to poison centers in 1995 to 4.6% in 2006. Limited evidence is available to demonstrate that administration of activated charcoal improves outcomes in the poisoned patient. The purpose of this article is to discuss the indications, contraindications, efficacy, adverse events, and recommendations for the most appropriate use of activated charcoal in the poisoned patient.

One gram of activated charcoal has a surface area between 950 to 2,000 m². The high surface area and porosity of activated charcoal allows it to adsorb poisons in the gastrointestinal tract and limits the absorption into systemic circulation thereby decreasing the toxic effects of a poisoning. The United States Pharmacopeia recommends the following oral dosing regimens:

- **Age < 1 yr**: 10–25 g or 0.5–1.0 g/kg
- **Age 1-12 yrs**: 25–50 g or 0.5–1.0 g/kg
- **Age > 12 yrs**: 25 to 100 g

**Indications**
Activated charcoal is indicated in the treatment of a recent potentially toxic ingestion. Activated charcoal can adsorb almost any carbon-based substance to some extent. It is not indicated for ingestion of lithium, iron, heavy metals, or alcohols because it does not bind well to these substances and would not provide any therapeutic benefit. Although charcoal does bind hydrocarbons, it is not recommended for hydrocarbon ingestion due to an increased risk of vomiting and subsequent aspiration.

**Contraindications**
Activated charcoal is contraindicated in patients at risk for aspiration (e.g., unprotected airway, decreased level of consciousness, seizures, hydrocarbon ingestion). It is also contraindicated in the ingestion of acids or alkalis (cont. on pg. 2).

Body packers, also called “swallowers,” “internal carriers,” or “mules,” transport illegal drugs by internal concealment in order to avoid arrest at international checkpoints, usually by ingesting the well-packaged substances prior to departure. At or just prior to rendezvous with their handlers, body packers will typically induce catharsis to pass the product in their stool. Heroin and cocaine are the most common substances smuggled by body packers, but amphetamines, marijuana, and hashish are also transported. “Body pushers” are body packers that conceal illicit substances by inserting them into the rectum or vagina. Ingestion is preferred over body pushing for smuggling, as physical examination will more easily disclose the product in a pusher. In contrast to body packers, “body stuffers” are individuals who impulsively swallow containers of illicit substances with the intention of avoiding arrest. While a packer usually ingests multiple containers that are thoroughly wrapped and secured (often by an automated process), a stuffer will usually swallow relatively small amounts of poorly wrapped drug, increasing the risk of leakage and subsequent toxicity.

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because it can cause vomiting, obscure endoscopic visualization, and leak into the peritoneum or mediastinum if perforation occurs. Activated charcoal should be used with caution in patients at risk for developing seizures or a sudden decrease or loss of consciousness.

**Adverse Events**

The most common adverse event is vomiting. In a prospective series of pediatric patients given activated charcoal, 20% vomited.\(^4\) Risk factors for vomiting include vomiting prior to administration of activated charcoal and use of a nasogastric or orogastric tube to administer activated charcoal.\(^4\)

Activated charcoal can cause constipation.\(^2\) The addition of sorbitol can cause abdominal cramping, diarrhea, dehydration, and electrolyte imbalance.

Charcoal aspiration is the most serious complication and often results in the need for intubation and mechanical ventilation. In a study investigating the frequency of complications from multidose activated charcoal, 5 out of 878 patients had a clinically significant charcoal aspiration. No patients died and none had lasting complications from the aspiration.\(^3\) A patient given activated charcoal through a nasogastric tube with a protected airway developed obstructive laryngitis. The patient made a full recovery and was discharged without lasting complications.\(^6\)

Long-term complications of activated charcoal aspiration are rare. In a case report, a woman developed pulmonary lesions 35 years after charcoal aspiration. The lesions were found to contain charcoal particles.\(^7\)

**Clinical Data**

There are no controlled studies that demonstrate that activated charcoal improves outcome in overdose patients. A prospective, randomized, controlled trial of 1479 patients was conducted to test the hypothesis that the administration of activated charcoal together with supportive care provides no more benefit than supportive care alone in the treatment of the adult overdose patient.\(^8\)

They compared the incidence of vomiting, length of stay, and incidence of complications associated with the overdose or the treatment between the two groups. Patients assigned to the activated charcoal group received a 50 mg dose of activated charcoal in the ED. They found a significantly higher incidence of vomiting in the activated charcoal treatment group (23% vs. 13% p<0.01). Activated charcoal did not affect the duration of intubation, duration of ICU stay, or length of inpatient hospitalization. Based on these findings and the fact that no patients in the supportive care treatment group deteriorated, the authors concluded that activated charcoal showed no demonstrable positive effects in the self-poisoned patient.

A recent randomized controlled trial assessed whether multiple doses of activated charcoal, compared with no charcoal, or a single dose would reduce the rate of death and complications in self-poisoned patients in rural Sri Lanka.\(^9\) All patients (n=4,632) presenting to area hospitals with a history of self poisoning were randomized to receive multiple dose activated charcoal, single-dose activated charcoal or no activated charcoal. The primary outcome measure was all-cause mortality. Secondary outcome measures were intubation, time ventilated, seizures, and cardiac dysrhythmias.

No difference was seen in mortality or in any other outcome measure. The majority of patients in this study received the first dose of activated charcoal greater than two hours after ingestion which may have limited the efficacy of activated charcoal.

**Conclusion**

Activated charcoal has been used for over a hundred years as an antidote despite lack of evidence demonstrating improved clinical outcome. Considering its widespread use there are relatively few reported adverse events. Evidence in volunteers shows the most benefit when given within one hour after ingestion. It should not be used routinely in the management of all poisonings. Each patient should be evaluated to determine if administering activated charcoal is likely to confer more benefit than risk by considering the substance ingested, the time of ingestion, and the clinical status of the patient. Activated charcoal should not be used in patients who have ingested a substance that has little potential for serious toxicity, patients who have an altered mental status or have the potential to lose consciousness. Activated charcoal should be considered in poisonings involving potentially lethal substances or with potential to cause serious morbidity and charcoal can be given within one hour of ingestion.

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References


References


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SEROTONIN SYNDROME

by Carl Seger, MD
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Serotonin syndrome is a potentially life-threatening, drug-induced condition that results in increased serotonergic activity. It is described by a triad of findings consisting of altered mental status, autonomic hyperactivity, and neuromuscular abnormalities. Medications affect serotonergic activity by increasing production, release, or receptor stimulation, or by inhibition of metabolism or reuptake.

Serotonin syndrome often occurs after the recent change in medication or addition of a new medication that affects the serotonergic activity. Symptoms often develop within 24 hours and include confusion, fever, diaphoresis, myoclonus, hypertonia, tremor, shivering, and/or hyperreflexia. The Hunter criteria for diagnosis require ingestion of a serotonergic agent and one of the following: spontaneous clonus, inducible clonus plus agitation or diaphoresis, oculus clonus plus agitation or diaphoresis, tremor and hyperreflexia, or temperature greater than 38 degrees Celsius. Rhabdomyolysis, ventricular tachycardia, metabolic acidosis, seizures, coma and disseminated intravascular coagulation can occur in severe cases.

Treatment is centered on treating hyperthermia (temperature > 41 degrees Celsius) with intubation, sedation and paralysis. Treat hypertension with esmolol or nitroprusside; hypotension with phenylephrine or epinephrine; and agitation with benzodiazepines. If benzodiazepines are not adequate, then cyproheptadine, a serotonin receptor antagonist, may be effective. Symptoms usually resolve within 24-36 hrs after serotonergic agents are discontinued.

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Sherrie Pace is a Health Educator at the Utah Poison Control Center. She graduated with a Bachelor of Science degree in Health Promotion from Weber State University in 2006. Sherrie enjoys many aspects of her job duties including public outreach, developing programs and lesson plans, and teaching children poison prevention strategies. She has worked at the Poison Center since 2006. In her spare time, Sherrie enjoys spending time with her family. She has one daughter, two sons, and one granddaughter. Sherrie also enjoys reading, crossword puzzles, and Saturday night “dates” with her husband.

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Thank you

The Utah Poison Control Center expresses its sincere thanks to the health care professionals, public health officials and toxicology colleagues that work together to treat and prevent poisonings.