

TOXICOLOGY



The University of Utah
Utah Poison Control Center

RETHINKING ROUTINE USE OF ACTIVATED CHARCOAL

by Paul Martz, PharmD

Introduction

Activated charcoal administration 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 2006.¹ 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.² *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.³ Although charcoal does bind hydrocarbons, it is not recommended for hydrocarbon ingestion due to an increased risk of

vomiting and subsequent aspiration.

Based on volunteer studies activated charcoal is most effective if administered within one hour of ingestion. A critical review of the literature showed that activated charcoal administration was associated with the following mean reductions in absorption: at 30 minutes, - 50%, 60 minutes-38%, 120 minutes-34%, 180 minutes-21%, 240 minutes-29%, and 360 minutes-14%.² This data suggests that activated charcoal administered more than one hour after ingestion is of questionable clinical benefit but can be considered if the drug is a sustained or delayed release formulation or one that slows gastric motility.

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

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TOXICOLOGY MANAGEMENT OF BODY PACKERS AND STUFFERS

by Ryan Steed, PharmD

Introduction

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.

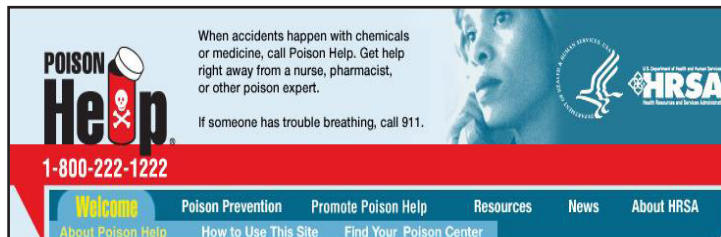
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NEW POISON HELP CAMPAIGN

Health Resources and Services Administration (HRSA) Poison Control Program has launched the new Poison Help Campaign and Web site, PoisonHelp.hrsa.gov. The focus of the Campaign is to serve as a resource for poison prevention information and inform Americans about the national Poison Help toll-free number (1-800-222-1222) for expert advice on poisoning. On the site are educational materials, including downloadable

brochures, tip sheets, and digital ads. In addition, visitors to the site can learn the 1-800-222-1222 jingle in English and Spanish! The Web site links to each poison control center and provides other poison information resources.

Visit our website for more information
www.utahpoisoncontrol.org



2007 ANNUAL REPORT

The UPCC published its 2007 annual report this spring. Along with highlighting the many accomplishments of the UPCC and important statistics, 5 stories representing 5 different stakeholder perspectives are presented. If you would like a copy, you can access it on our website at www.utahpoisoncontrol.org, or call 587-0600 to request a copy.



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Activated Charcoal

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.⁵ 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

1. Bronstein AC, Spyker DA, et al. 2006 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS). *Clin Toxicol (Phila)*. 2007;45(8):815-917.
2. Chyka PA, Seger D, Krenzelok EP, Vale JA. Position paper: Single-dose activated charcoal. *Clin Toxicol (Phila)*. 2005;43(2):61-87.
3. Lapus RM. Activated charcoal for pediatric poisonings: the universal antidote? *Curr Opin Pediatr*. 2007;19(2):216-22.
4. Osterhoudt KC, Durbin D, Alpern ER, Henretig FM. Risk Factors for Emesis After Therapeutic Use of Activated Charcoal in Acutely Poisoned Children. *Pediatrics* 2004;113;806-810
5. Dorrington CL, Johnson DW, Brant R. The Frequency of Complications Associated With the Use of Multiple-Dose Activated Charcoal. *Ann Emerg Med*. 2003;41(3):370-7.
6. Donoso A, Linares M, León J, et al. Activated charcoal laryngitis in an intubated patient. *Pediatr Emerg Care*. 2003;19(6):420-1
7. Huber M, Pohl W, Reinisch G, et al. Lung disease 35 years after aspiration of activated charcoal in combination with pulmonary lymphangiomyomatosis. A histological and clinicopathological study with scanning electron microscopic evaluation and element analysis. *Virchows Arch*. 2006;449(2):225-9.
8. Merigian KS, Blaho KE. Single-Dose Oral Activated Charcoal in the Treatment of the Self-Poisoned Patient: A Prospective, Randomized, Controlled Trial. *American Journal of Therapeutics* 2002;9:301-308.
9. Eddleston M, Juszczak E, Buckley NA, et al. Multiple-dose activated charcoal in acute self-poisoning: a randomised controlled trial. *Lancet*. 2008;371(9612):579-87.

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Body Stuffers

Toxicity Management

The general approach to a body stuffer or packer is to remove un-ruptured packets and to manage toxicological consequences in patients in whom the packets rupture.

Initial Assessment

The majority of body packers and stuffers present to the emergency department (ED) asymptomatic, escorted by police after arrest. A small number present with signs or symptoms of toxicity or have had an intestinal obstruction.

Plain abdominal radiography may detect concealed packets in body packers. Abdominal radiography had a sensitivity of 47% to 95% in detecting concealed cocaine packets but is rarely positive in body stuffers.⁴ CT and barium-enhanced radiography are more sensitive than plain abdominal radiography, and may be useful in identifying containers in body packers when plain radiography is negative and suspicion of packing is high. However, a negative study does not rule-out drug packets in the GI tract. Urinalysis has not been shown to be a reliable screening test for the detection of body packers.

In symptomatic patients, physical examination, vital signs and evaluation of autonomic findings may help identify a toxidrome.

Asymptomatic Patients

Activated charcoal 50 g should be administered to bind any drug that might leak from a packet. Whole bowel irrigation with a polyethylene glycol/electrolyte lavage solution, such as GoLyteLy, at a rate of 2 liters per hour should also be performed

to speed passage of the containers. The duration of observation depends on the results of the whole bowel irrigation and clinical circumstances; a minimum of 8 hours and up to 24 hours has been recommended.

Symptomatic Patients

Body stuffers are at greater risk for leaking contents and developing toxic effects from the drug ingested. Due to unpredictable amounts ingested in body stuffers and likely lethal amounts ingested in body packers, patients who become symptomatic should be treated early and aggressively.

Prompt surgical intervention should be considered in body packers who have evidence of drug toxicity and/or have evidence of bowel obstruction or perforation. In a retrospective case series⁶ of 4,660 cocaine packers, 64 developed toxic symptoms from packet rupture. Twenty of these patients underwent emergency surgery for packet removal, and all 20 survived. The other 44 died before the cocaine packets could be removed.

Conclusion

Body stuffing tends to result in more drug packet rupture than body packing because of poorly wrapped containers, but because the amount of drug is substantially smaller, treatment is usually effective if the patient can be evaluated in a timely manner. Body packing involves specialized wrapping, so the chance of rupture is less than with stuffing. However, when rupture does occur, it can be more devastating because of the large quantity of drug released. Healthcare professionals should be aware of the differences in presentation between cocaine and heroin ingestion, and should be able to respond to a rupture of either agent in both packers and stuffers.

References

1. Deitel M, Syed AK. Intestinal obstruction by an unusual foreign body. *Can Med Assoc J* 1973;109:211-212.
2. Claffy M. Stampede of drug mules at Kennedy: after 9/11 lull, heroin & ecstasy busts soar. *New York Daily News*. May 5, 2002:5.
3. Traub SJ, Hoffman RS, Nelson LS. Body packing-the internal concealment of illicit drugs. *N Engl J Med* 2003;349:2519-2526.
4. Sporer KA, Firestone J. Clinical course of crack cocaine body stuffers. *Ann Emerg Med* 1997;29(5):596-601.
5. Tomaszewski C, McKinney P, Phillips S, et al. Prevention of toxicity from oral cocaine by activated charcoal in mice. *Ann Emerg Med* 1993;22:1804.
6. Schaper A, Hofmann R, Bargain P, et al. Surgical treatment in cocaine body packers and body pushers. *Int J Colorectal Dis* 2007;22:1531-1535.

SEROTONIN SYNDROME

by Carl Seger, MD
Emergency Medicine Resident

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, ocular 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.



SHERRIE PACE, BS, CHES 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.

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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*CSPI denotes Certified Specialist in Poison Information.



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.



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