The Feasibility of Administration of Activated Charcoal with Respect to Current Practice Guidelines in Emergency Department Patients

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ABSTRACT

Objective: The American Academy of Clinical Toxicology, European Association of Poisons Centres, and Clinical Toxicologists recommend administration of activated charcoal (AC) within one-hour of an acute toxic ingestion [1]. Our poison control center periodically and upon request faxes an abbreviated protocol to hospital emergency departments, reminding physicians of these current AC recommendations. This study was conducted to describe how often patients present within the one-hour time frame and how often the guidelines in the above position statement are being followed.

Methods: Following a brief training of systematic chart review, reviewers blinded to the purpose of the study completed a standardized data collection sheet. Three years after publication of these consensus statements, a period of 3 consecutive years of poison center patient encounters were reviewed. Recorded data included age, outcomes, and time to administration of charcoal.

Results: Approximately 150,000 reported toxic exposures were reviewed, of which 16,914 patients of acute ingestions presented to a health care facility. The mean age of the group that presented was 25 years [range 1 month–87 years]. A total of 2,700 (16%) patients that presented were within 60 minutes of an acute overdose and all were administered AC in accordance with the recommended guidelines. Interestingly, pre-hospital personnel administered AC within 60 minutes to 762 (28% of 2,700) patients. Correspondingly, 14,214 (84%) patients presented more than 60 minutes after an acute overdose. Of this latter group AC was withheld in 341 (2.4% of 14,214) patients, and 13,873 (97.6% of 14,214) patients received charcoal despite having arrived more than 60 minutes after ingestion. The mean time to the first administration of AC in this latter group was 225 minutes [range of 61–2160 minutes] following ingestion.

Conclusions: Only a small percentage of patients treated for an acute overdose (16%) present within 60 minutes and are given charcoal according to the current guidelines. A large subset of these patients (28%) is given AC in a pre-hospital setting. Few patients presenting to a health care provider after an acute toxic ingestion are treated in accordance with the current recommendations for activated charcoal.

INTRODUCTION

Despite widespread use of single dose activated charcoal (AC), not much data is available to show that administration of AC affects outcome [1,2]. Nonetheless, guidelines have been agreed upon for its proper administration. The American Academy of Clinical Toxicology, European Association of Poisons Centres, and Clinical Toxicologists recommend administration of activated charcoal (AC) within one-hour of an acute toxic ingestion [1]. Although undetermined, the benefits of administering AC within the first hour of ingestion outweigh the risk of adverse affects [2]. Conversely, there is insufficient evidence to exclude or recommend

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AC treatment after this time frame [1,3]. Unfortunately, due to the nature of an acute overdose, the poisoned patient rarely presents within one hour. For this reason, much ambiguity exists when a poisoned patient presents after the *golden hour* of toxicology.

The clearest benefit of AC is in the first hour of presentation. This demonstrates the importance of timely administration. Some studies have looked at delayed administration of charcoal, but they have arrived at varying conclusion on its utility [3–6]. To date there have been no large scale investigations looking into the time of AC administration of patients presenting to health care providers after acute toxic ingestions.

Our study, conducted from an urban poison control center, looks at the incidence with which patients present in the recommended one-hour time frame and how often the current guidelines are followed. We hypothesized that there is a lack of adherence to current guidelines regarding the use of charcoal in the poisoned patient.

METHODS

Following a brief training of systematic chart review, reviewers blinded to the purpose of the study completed a standardized data collection sheet. Three years after publication of these consensus statements, we reviewed the poison center patient encounters over a period of 3 consecutive years (2000–2003). Recorded data included age, outcomes (such as aspiration pneumonia, etc.), and time to administration of charcoal. Time to administration of charcoal was reported as the time from ingestion of drug to the time of charcoal administration. If the time of drug ingestion was unknown and unable to be estimated, the time of ED arrival (plus 5 minutes) was considered as time of drug ingestion.

Using Crystal Reports™, charts were reviewed for the use of charcoal. Data were analyzed using Excel™ and STATA™ software. The body of the text and the therapies were reviewed for charcoal use during the study periods by text scanning.

The two reviewers, who were blinded to the purpose of the study, extracted the data and a third reviewer reviewed all the charts and a Kappa value was calculated. This study was approved by the IRB via an expedited review.

RESULTS

Over a period of 3 years, approximately 150,000 reported toxic exposures were reviewed for the assessment of toxic exposures and the initial treatment with activated charcoal. The mean age of the group that presented was 25 years [range 1 month–87 years]. There were a total of 16,914 acute ingestions that presented to health care facilities. The number of patients that presented within 60 minutes of an acute overdose totaled 2,700 (16%); all of these patients were administered AC. Correspondingly, 14,214 (84%) patients presented more than 60 minutes after an acute overdose. Of this latter group AC was withheld in 341 (2.4% of 14,214) patients; however, in 13,873 (97.6% of 14,214) cases, patients received charcoal despite having arrived more than 60 minutes after ingestion. The mean time to the first administration of AC in this latter group was 225 minutes [range of 61–2160 minutes] following ingestion.

It should be noted that pre-hospital personnel administered charcoal in accordance with recommended guidelines to 762 (28% of 2,700) patients within 60 minutes of the acute ingestion.

A kappa score for inter-reviewer reliability was 0.68, 95%, CI [0.56–0.72].

DISCUSSION

This review of 4 consecutive years of poison center patient encounters examined approximately 150,000 cases of toxic exposures. From the data collected in this study, we found that the majority of patients, (16,573 of 16,914 patients, [97%]) who presented to a health care provider received charcoal regardless of the time of initial toxic ingestion. In fact, most cases (84%) were given charcoal after the current 60-minute recommendation. Only the minor percentage of patients (16%) received charcoal within the recommended 60-minute time frame. Our poison control center, to maintain awareness, periodically and upon request faxes an abbreviated protocol to hospital emergency departments reminding physicians and health care providers of current AC recommendations. The exact impact of these faxes is unknown. Despite the attempt to maintain awareness, current practices do not appear to correlate with current guidelines. There are a number of possible explanations: the relative lack of adverse outcomes recorded in the literature when charcoal is administered and difficulty ascertaining precise times of ingestions to name a few. (If a patient is seen quickly in the health care setting, most clinicians may err on the side of presumed recent exposure and give charcoal).

As noted above, pre-hospital personnel administered charcoal to a little more than $\frac{1}{4}$ (28%) of the cases. Other studies have reviewed the issue of pre-hospital administration of AC and have arrived at mixed conclusions [8,9]. One study suggested that while there may be a small increase in compliance to recommended administration guidelines, there may also be an increase in the potential for adverse outcomes [8]. Depending on the future directions of AC use, pre-hospital administration is an opportunity for more timely administration of charcoal.

LIMITATIONS

This study has several potential limitations. There is a selection bias that must be accounted for when including only ingestions reported to a poison control center. These encounters are likely biased to a more serious toxic exposure. Our study may underestimate the administration of AC following toxic ingestion because some incidents are perceived as not serious enough to warrant a call to the Poison Control center. In some of these incidents, patients may have received AC within 60 minutes of exposure in accordance with recommended guidelines. Another limitation of this study is the retrospective study design. We

relied on accurate chart documentation of AC administration and accurate recording of the presumed exposure time. Many of the ingestions likely occur without witnesses so that all times recorded are estimates. Despite the fact that we adhered to strict cutoff times of either less than 60-minutes and equal to or greater than 60-minutes, some recorded exposures within 60-minutes may be inaccurately recorded and in actuality occur past the 60-minute cutoff. This could result in significantly altered percentages of patient groupings. As a final procedural limitation in study design, there is no single phrasing in the poison control logs that documents charcoal. This transcription may have resulted in the omission of some cases where charcoal was given if a cryptic method of the charcoal administration was transcribed. This resulted in various notations in the record and must be searched. To minimize the problem of determining whether and when AC was given, each record was searched using several keywords in addition to human, log reviews. These two methods were then compared. When compared to human searches, computer based searching was more sensitive in finding cases of charcoal administration. As noted, the exact impact and effect periodic faxes have on physician behavior, concerning the timing and frequency of charcoal administration, is not known.

DISCUSSION

The concept of a universal antidote has been recorded since King Mithridates, in 132 BC, had a concoction created to protect him against any possibility of being poisoned. A universal antidote in the form of tannic acid from tea, charcoal from burnt toast, and milk of magnesia, was often popularized up to the 1980s, but it has never been shown to have any efficacy as an antidote. More recently, Ipecac in 1997 and in 2004 has not been shown to improve the outcome in toxic ingestions and is not recommended for routine administration in the emergency department [7,10]. Thus, activated charcoal remains one of the last vestiges of a universal antidote. Currently, AC, as we have shown here, is widely used as a universal antidote in the treatment of acute toxic ingestion, despite proven efficacy. The later point is not the purpose of the paper.

Current guidelines for the use of activated charcoal recommend a one-hour cutoff time for administration. This current trend of widespread usage could possibly result in the increase of adverse outcomes such as aspiration or bowel obstruction. Further, monitoring of charcoal use should continue with the hopes of delineating its efficacy [10–11]. This study did not address whether charcoal is efficacious or not in most overdoses or whether the guidelines are accurate in all overdoses. However, these points deserve further study. In our experience, current guidelines are not followed accurately.

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REFERENCES

1. Chyka PA, Seger D. Position stataement: single-dose activated charcoal. American Academy of Clinical Toxicology; European Association of Poisons Centres and Clinical Toxicologists. *J Toxicol Clin Toxicol*. **1997;**35(7):721–741.

2. Seger D, Single-dose activated charcoal-backup and reassess. *J Toxicol Clin Toxicol*. **2004;**42(1):101–110.

3. Green R, Grierson R, Sitar DS, Tenenbein M.How long after drug ingestion is activated charcoal still effective? *J Toxicol Clin Toxicol*.**2001;**39(6):601–605.

4. Dawling S, Crome P,Braithwaite R, Effect of delayed administration of activated charcoal on nortirptyline absorption. *Eur J Clin pharmacol*. Dec 18 **1978;**14(6):445–447.

5. Laine K, Kivisto KT, Pelttari S, Neuvonen PJ. The effect of activated charcoal on the absorption of fluoextine, with special reference to delayed charcoal administration. *Pharmacol Toxicol*. Nov **1996**;79(5):270–273.

6. Laine K, Kivisto KT, Ojala-Karlsson P, Neuvonen PJ. Effect of activated charcoal on the pharmacokinetics of pholcodine, with special reference to delayed charcoal ingestion. *There Drug Monit*. Feb **1997**;19(1):46–50.

7 [No authors]Position paper: Ipecac syrup. *J Toxicol Clin Toxicol*. **2004**;42(2):133–43.

8. Isbister GK, Dawson AH, Whyte IM. Feasibility of prehospital treatment with activated charcoal: Who could we treat, who should we treat? *Emerg Med J*. **2003** Jul;20(4):375–8.

9. Thakore S, Murphy N. The potential role of prehospital administration of activated charcoal. *Emerg Med J*. **2002** Jan;19(1):63–5.

10. Bond GR. The role of activated charcoal and gastric emptying in gastrointestinal decontamination: a state-of-the-art review. *Ann Emerg Med*. **2002** Mar;39(3):273–86.

11. Cooper GM, Le Couteur DG, Richardson D, Buckley NA. A randomized clinical trial of activated charcoal for the routine management of oral drug overdose. *QJM*. 2005 Sep;98(9):655–60. Epub **2005** Jul 22.