PREHOSPITAL CARE

Prehospital activated charcoal: the way forward

S L Greene, M Kerins, N O'Connor

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See end of article for
authors' affiliations

Correspondence to:
Dr S L Greene, Medical
Toxicology Unit, Avonley
Road, New Cross, London
SE14 5ER, UK; shaun.
greene@gstt.nhs.uk

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Objectives: Single dose activated charcoal (SDAC) may be an effective method of gastric decontamination when administered to patients within an hour of drug overdose. However, few patients who may benefit from this treatment attend an emergency department within this timeframe. The authors sought to determine the current attitudes of ambulance NHS trusts to recent recommendations that the administration of SDAC should be considered as a prehospital therapy.

Methods: A postal questionnaire was used to determine the current level of use of prehospital activated charcoal by ambulance NHS trusts, the incidence of associated complications, and barriers preventing the routine use of prehospital SDAC.

Results: A completed questionnaire was returned by 36 of the 39 ambulance NHS trusts in the UK (response rate 92%). Currently none of the trusts that responded to the questionnaire provides prehospital SDAC as an intervention. The most common barriers to the provision of prehospital SDAC are the current lack of evidence in the medical literature proving it is effective in improving patient outcome and the lack of a recognised protocol for its administration. Other issues included concerns regarding potential complications, ambulance turnaround times, lack of availability of SDAC, and lack of funding.

Conclusions: A lack of published evidence proving efficacy remains the most important factor in preventing the routine administration of SDAC to appropriate patients in the prehospital environment. Further research in this setting is required to determine the usefulness of this therapy.

The administration of a single dose of oral activated charcoal (SDAC) has become an increasingly common part of the general management of patients who have ingested an acute drug overdose and are treated in emergency departments within the United Kingdom.

Activated charcoal is administered as a slurry which is ingested orally. Its highly porous structure and large surface area makes it effective in adsorbing many poisons within the gastrointestinal tract and therefore preventing systemic absorption. It is well known that the effectiveness of SDAC in reducing drug absorption within the gastrointestinal tract is time dependant; current guidelines do not support its use beyond one hour of drug ingestion.¹

Several authors have highlighted the difficulties in administering SDAC to acutely poisoned patients within an hour of drug ingestion.²⁻⁴ Although ambulance technicians or paramedics may reach patients who have taken a drug overdose within the previous hour, the time taken to transfer the patient to hospital, triage procedures, and time waiting to see a doctor often mean the golden hour has passed by the time SDAC is considered. The observation that a significant number of acutely poisoned patients are seen by ambulance officers or paramedics within an hour of drug ingestion has prompted the suggestion that SDAC should be administered in the prehospital environment.²⁻⁴

The aim of this study is to examine the current level of use of prehospital SDAC among ambulance NHS trusts within the UK, and to determine the types of problems encountered with its use. The study also examines the reasons why ambulance NHS trusts are not currently administering prehospital SDAC. We also sought to determine if ambulance NHS trusts would consider the use of prehospital SDAC charcoal if it were readily available and a protocol existed for its use.

METHODS

Information was collected from UK Ambulance NHS Trusts during the first six months of 2004 using a postal

questionnaire constructed by the authors. The questionnaire is shown in figure 1. Questionnaires were sent to the medical director or advisor responsible for clinical services at all 39 ambulance service NHS trusts within the UK, who were asked to answer the questionnaire in a manner reflecting the policy of their individual ambulance service trust. A stamped, addressed envelope was enclosed for the return of the questionnaire. If no response was received after six weeks, a repeat questionnaire was sent.

RESULTS

Completed questionnaires were received from 36 of the 39 ambulance service NHS trusts (response rate 92%). At the time of the survey none of the 36 ambulance service NHS trusts who responded was administering prehospital SDAC.

The most common reason cited for not providing prehospital SDAC was the lack of a protocol indicating the appropriate use and administration of SDAC (58% of ambulance NHS trust respondents). Eleven per cent of ambulance NHS trusts indicated a possible delay in transporting the patient to hospital as a reason for not administering prehospital SDAC, while 19% of respondents cited potential patient risk through vomiting and aspiration of activated charcoal. Potential soiling of ambulance vehicles with a subsequent delay in turnaround time, and lack of availability of activated charcoal where both given as reasons for not administering prehospital SDAC by 8% of respondents.

The majority of the ambulance NHS trusts (27 of 36) said that they would consider prehospital SDAC if there was a protocol guiding appropriate administration. Six trusts said they would not consider prehospital SDAC and three trusts were unsure.

Abbreviations: AACT, American Academy of Clinical Toxicology; EAPCCT, European Association of Poisons Centres and Clinical Toxicologists; SDAC, single dose activated charcoal.

1. Do you currently administer activated charcoal to overdose patients who present within one hour of ingestion of a potentially toxic amount of a substance?	Yes []	No []
2. How long have you used it for? < 6 months _____ 6–12 months _____ 1–2 years _____ > 2 years _____		
3. What problems have you encountered with its use? _____		
4. If you are not currently using it what are your reasons?	Reasons? Yes	
A. No protocol available to indicate which drug ingestions are appropriate for activated charcoal administration	[]	
B. Would delay transfer to hospital	[]	
C. Risk to patient e.g. vomiting and aspiration	[]	
D. Potential soiling of ambulance vehicle leading to prolonged turnaround time at hospital	[]	
E. Lack of availability of activated charcoal	[]	
F. Other _____	[]	
5. If activated charcoal was readily available and a protocol for correct administration was provided would you be willing to introduce pre-hospital administration of activated charcoal in appropriate patients?	Yes []	No []
Comments _____ _____ _____		

Figure 1 Questionnaire used to collect information regarding prehospital single dose activated charcoal administration.

Many respondents made comments regarding the conditions that would be necessary for them to introduce prehospital SDAC as an intervention. Of the 27 ambulance NHS trusts who indicated they would be willing to administer SDAC if guided by an agreed protocol, 15 said that they were unconvinced by the current evidence that the intervention would improve patient outcome. Eight trusts said they would only consider the intervention if it had been approved for use by the Joint Royal Colleges Ambulance Liaison Committee (JRCALC). Concerns regarding lack of funding were highlighted by three respondents.

All six of the ambulance NHS trusts who said they would not use SDAC indicated a lack of evidence supporting efficacy as the main reason for this decision. A London Ambulance Service prehospital SDAC study currently in progress reportedly showing that patients are unwilling to take SDAC was cited by three ambulance NHS trusts as a further reason for not providing this intervention (Greene *et al*, unpublished data).

DISCUSSION

Does SDAC change patient outcome?

The lack of evidence demonstrating that SDAC improves patient outcome was indicated by almost all ambulance NHS trusts as a reason for not currently administering prehospital SDAC. Volunteer studies show a clear reduction in gastrointestinal absorption of drugs when at least 50 g of activated charcoal is administered at 30 minutes (mean reduction of 47.3%) or 60 minutes (mean reduction of 40.1%) following drug ingestion.¹ When activated charcoal is administered 120 minutes following drug ingestion there is only a 16.5%

reduction in gastrointestinal absorption.¹ However, despite the widespread use of SDAC in emergency departments as a decontamination procedure for acutely poisoned patients, there is currently no well designed clinical trial showing that SDAC changes clinical outcome.

Two studies that have examined clinical outcome following the administration of SDAC are worth examining further. Buckley *et al* conducted a retrospective study of 981 consecutive patients who had ingested paracetamol in overdose.⁵ Patients were either treated with activated charcoal, gastric lavage followed by activated charcoal, or no treatment. Patients who were treated with activated charcoal were significantly less likely to develop potentially hepatotoxic concentrations of paracetamol. However, patients who received no treatment ingested on average 2.5 g more paracetamol than patients receiving gastric decontamination. The median time to presentation was 135 minutes in patients receiving activated charcoal, but 385 minutes in those who received no treatment. A minority of patients were given activated charcoal within 60 minutes of tablet ingestion.

A recent study by Merigian and Blaho examined 1479 patients treated in an emergency department over a 24 month period.⁶ Patients who had taken an acute drug overdose were treated with SDAC on even days of the month and supportive treatment alone on odd days. Patients who had ingested a potentially toxic dose of paracetamol (>140 mg/kg) were excluded (paracetamol accounts for 50% of self poisonings in the UK). There was no significant difference in clinical outcome between the two groups. Patients who received SDAC spent a significantly longer time

in the emergency department. There is no information provided regarding the time between ingestion of tablets and administration of activated charcoal.

Although both of these studies have limitations one of the most important is the time course of activated charcoal administration. The outcome of patients who received activated charcoal compared with no gastrointestinal decontamination within one hour of drug ingestion in either study is unknown. Evidence from volunteer studies demonstrates that activated charcoal significantly reduces drug absorption if given within one hour of drug ingestion. The American Academy of Clinical Toxicology (AACT) and European Association of Poisons Centres and Clinical Toxicologists (EAPCCT) have produced a position paper¹ which states: "Single dose activated charcoal should not be administered routinely in the management of poisoned patients. Based on volunteer studies, the administration of activated charcoal may be considered if the patient has ingested a potentially toxic amount of a poison which is known to be adsorbed by activated charcoal up to one hour previously; there are insufficient data to support or exclude its use after one hour of ingestion. There is no evidence that the administration of activated charcoal improves clinical outcome."

The position statement indicates that there is currently *no evidence* that activated charcoal improves clinical outcome; it does not say that activated charcoal *does not* improve clinical outcome. There are currently no well designed clinical studies evaluating the patient population in which activated charcoal is likely to be beneficial and improve clinical outcome, namely those patients who have ingested a toxic amount of a drug within the previous hour. Because of delays in provision of activated charcoal within an hour of drug ingestion in patients attending emergency departments, a study of activated charcoal versus no treatment may only provide convincing evidence for or against the efficacy of activated charcoal as an intervention, if it is conducted in the *prehospital* environment.

Recently published clinical practice recommendations contained in the NICE guidelines on the management of self harm recommend that ambulance service staff should consider administering activated charcoal to appropriate poisoned patients in the prehospital environment.⁷

Does SDAC lead to ambulance delays?

There are currently no published data examining the impact of SDAC administration on ambulance turnaround times. On-scene turnaround times and patient transit times should not be influenced by SDAC administration. Assessment of an individual patient's suitability for treatment with SDAC and its subsequent administration can take place in the ambulance vehicle during transfer to hospital.

The reported incidence of vomiting in patients given activated charcoal following an acute drug overdose varies between 6% and 16%.¹ Vomiting is more likely in this group as a consequence either of the ingestion of a possible toxic amount of a drug or the co-ingestion of significant quantities of alcohol and may occur even if activated charcoal is not ingested.¹ Vomiting is more likely if activated charcoal is administered with sorbitol.^{6,7} The cleaning of ambulance vehicles following soiling with activated charcoal may increase ambulance turnaround times in a small number of cases.

Is the administration of SDAC dangerous?

There are relatively few reports of adverse effects related to SDAC in the literature compared to its widespread use.¹ Vomiting and subsequent pulmonary aspiration is the most feared complication highlighted by survey respondents. The vast majority of case reports describing activated charcoal

aspiration have occurred in patients who have been given charcoal without adequate airway protection or who have had activated charcoal administered directly into the lungs by the incorrect placement of a nasogastric tube.¹ The only large published study examining the feasibility of prehospital administration of SDAC to poisoned patients observed no serious complications in 500 patients who received SDAC.⁸ There are no reports of SDAC causing gastrointestinal obstruction.¹

The AACT and EAPCCT position statement notes that there have been a number of complications in patients who have received SDAC when gastric decontamination was unnecessary, because of the ingestion of a non-toxic amount of a drug.¹ This finding has contributed to the recommendation that activated charcoal should not be routinely administered to *all* poisoned patients.

Do the majority of patients refuse prehospital SDAC?

Three ambulance NHS trusts quoted a current London Ambulance Service study as one reason for not considering implementation of the SDAC as an intervention. The authors of this paper were involved in the design and implementation of the quoted study. The initial feasibility study required that all patients give consent before they were randomised to receive prehospital SDAC or no treatment at all. Patients often declined to take part in the study because of the possibility of being randomised to not receive the intervention. This led to the perception by these three ambulance trusts that patients often refuse prehospital SDAC. In the light of the feasibility study, the study protocol has been changed so that all patients meeting the inclusion criteria are offered activated charcoal with the subsequent finding that the majority of patients accept activated charcoal when it is offered.

A way forward

A well designed clinical trial of SDAC compared with supportive care alone conducted in the prehospital environment may be the most effective method of obtaining evidence for or against SDAC as a routine prehospital intervention and as a general intervention for acutely poisoned patients. An initial step would be the design and implementation of a feasibility study to examine the administration of activated charcoal to patients in the prehospital environment who meet the current criteria outlined in the AACT and EAPCCT guidelines. Once prehospital administration of activated charcoal is proven to be feasible in the prehospital environment the path will be clear for further studies to examine efficacy. Future studies could also examine the role of activated charcoal administration up to two hours after ingestion of agents likely to delay gastric emptying, or modified release preparations where there is the possibility of prolonged gastrointestinal adsorption.

Administration of SDAC should not affect on-scene turnaround times or patient transit times, and should only lead to ambulance vehicle soiling in a minority of cases. Adverse effects are unlikely in patients who are not vomiting, have a normal conscious state, and are maintaining their airway. There is no evidence that the majority of patients refuse SDAC when it is offered as a treatment.

If future studies provide evidence that SDAC is an effective prehospital intervention, protocols should be designed guiding ambulance technicians and paramedics in the safe, routine provision of activated charcoal to appropriate patients.

CONCLUSIONS

None of the 36 ambulance NHS trusts in the UK that responded to this study currently administer prehospital

SDAC. An absence of evidence supporting the efficacy of SDAC was the most commonly quoted reason for not using this intervention.

As with many interventions in toxicological practice, there is currently no evidence that SDAC changes patient outcome. There are currently no well designed clinical trials that have compared gastrointestinal decontamination with activated charcoal to supportive care alone during the first hour following the ingestion of a potentially toxic amount of a drug. Only a minority of patients are medically assessed in an emergency department within an hour of drug ingestion; however, a significantly greater number are reached by ambulance technicians or paramedics. The design and implementation of a study administering SDAC in the prehospital environment may be the only way to determine if SDAC has a beneficial role to play in treating the acutely poisoned patient.

Authors' affiliations

S L Greene, Associate Specialist Clinical Toxicology, National Poisons Information Service (London), Guys and St Thomas' NHS Trust, UK

M Kerins, Consultant in Emergency Medicine, Accident and Emergency Department, Kings College Hospital, London, UK

N O'Connor, Consultant in Emergency Medicine, Accident and Emergency Department, Lady of Lourdes Hospital, Ireland

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