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Activated charcoal: To give or not to give?

Georgina M. Elder BA (Hons) RGN (Staff Nurse) *

Emergency Dept, Bristol Royal Infirmary, Bristol BS2 8HW, UK

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Abstract
There has been much debate about the use of activated charcoal in patients who have taken overdoses and then present to Emergency Departments. There are clinical trials, research and position statements that have examined the effectiveness of activated charcoal in a number of overdoses of different medications, but there is still a debate surrounding the evidence based practice of administering activated charcoal in patients who have taken a drug overdose due to lack of evidence. This article will examine on the two main guidelines on activated charcoal, one produced by the National Institute for Clinical Excellence and the second produced by American Academy of Clinical Toxicology. It will discuss the methods of administration on activated charcoal, contraindications and the difficulties or challenges in adhering to these guidelines in the clinical setting.

Introduction

Self poisoning accounts for a large number of attendances to Emergency Departments (ED). According to the National Institute for Clinical Excellence (NICE) report on self harm, there are an estimated 150,000 attendances each year for self harm (NICE, 2004). Of these 80% of the patients had taken overdoses of prescription or over-the-counter medications, but less than 1% of these cases ends in mortality (Vale et al., 1999). The Department of Health is hoping to reduce the number of patients self harming by 20% by 2010 by introducing structure to the care of these patients through NICE guidelines (Jones and Avies-Jones, 2007).

The National Institute for Clinical Excellence worked in partnership with the National Collaborating Centre for Mental Health (NCCMH) in 2004 in order to produce a guideline called 'Self Harm: The short term physical and psychological management and secondary prevention of self harm in primary and secondary care' (NICE, 2004). The NCCMH is jointly led by the British Psychological Society and the Royal College of Psychiatrists; together they systematically reviewed all relevant research and evidence available on self harm to produce the NICE guideline (NCCMH, 2008).

The self harm guideline addresses the administration and use of charcoal in Sections 4.1.4 and 4.5.1 (NICE, 2004, p. 53, 59). It states that ambulance and emergency department staff should consider giving activated charcoal to patients that have taken an overdose of medication within 1 h, that is adsorbed by charcoal, to prevent and reduce the absorption of the medication (NICE, 2004). The

* Tel.: +44 771 926 1467; fax: +44 117 342 3951.
E-mail address: e_georgina@hotmail.com.

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guideline highlights that health care professionals should know which poisons charcoal works upon, the contraindications, dangers of administering charcoal to patients, be able to use resources such as TOXBASE or the National Poisons Information Service (NPIS) and ensure that activated charcoal is readily available within the healthcare setting (NICE, 2004).

In 1997 a position statement was produced by the American Academy of Clinical Toxicology, European Association of Poisons Centres and Clinical Toxicologists on the use of single-dose administration of activated charcoal in the treatment of acute poisoning (Chyka and Seger, 2005). In 1999 the same organisations produced a position statement on the use of multi-dose administration of activated charcoal (Vale et al., 1999). These two statements critically reviewed all scientific literature, well conducted clinical, experimental and case studies, a statement was then drafted and approved by the board of two societies. The statements give clear guidelines on the use of charcoal. Both statements state that activated charcoal should only be used in patients that have ingested life threatening amounts of certain medications and is contraindicated in patients who do not have an intact or protected airway (Chyka and Seger, 2005; Vale et al., 1999).

Activated charcoal is a fine black powder that is produced from the decomposed material of various organic materials, which is then exposed to oxidizing gases at high temperatures to activate and increase the surface area, which adds to the absorbency of the charcoal (Clegg and Hope, 1999). Charcoal has been used for the past 100 years (Chyka and Seger, 2005) and in the mid 1970s activated charcoal was accepted as an antidote in the adsorption and elimination of a variety of medications (Davies, 1991). Charcoal will adsorb most poisons, but there are exceptions; lithium, boric acid, ethanol, malathion, methanol, petroleum distillates, iron, cyanide, strong acids and alkalis (Vale and Proudfoot, 1993 and TOXBASE, 2006).

Methods of administration

Single-dose activated charcoal

A single-dose administration of charcoal is used to adsorb the drugs in the gastrointestinal tract to try and minimise the drugs being absorbed systemically. The charcoal must come in direct contact with the drug to adsorb it, so administration of charcoal needs to be given as soon as possible after ingestion (Chyka and Seger, 2005).

The administration of a single dose of activated charcoal is 50 g orally or via a nasogastric tube, up to 1 h after ingestion of the poison (TOXBASE, 2006). Chyka and Seger (2005) and Lynch and Robertson (2003) state that single dose use of activated charcoal should not be used routinely in patients that present having taken an overdose because there is currently no evidence published stating that charcoal improves patient outcomes. According to the position statement written by Chyka and Seger (2005) it should be considered only in those patients that have ingested a potentially toxic amount of medication, which are known to be adsorbed by activated charcoal and has been ingested within the hour (Chyka and Seger, 2005). The NICE guidelines advise that charcoal should be given to all patients that present with overdoses within 1 h of ingestion that is known to be absorbed by charcoal (NICE, 2004). The clinical evidence and volunteer studies show that there could be benefits in administering charcoal after 1 h and that this group should not be excluded, but there are no satisfactory clinical studies that assess the benefits of the use of single-dose administration of activated charcoal (Yeates and Thomas, 2000).

Multi-dose activated charcoal

Multi-dose administration of activated charcoal is thought to interrupt the enteroenteric and in some cases the entrohepatic and enterogastric circulation of the drugs ingested. The charcoal will act in three different ways to attempt to eliminate the drugs, a term called gastrointestinal dialysis (Vale et al., 1999). The first stage of the process involves the charcoal adsorbing the drugs which remain in the gut, this is important especially in patients that have taken slow release medication (Yeates and Thomas, 2000). Next, the charcoal will adsorb any drugs that are secreted in bile, which then prevents them returning to the entrohepatic circulation. Lastly the charcoal will adsorb any drug that diffuses from the circulation into the gut lumen to prevent its re entering the enteroentric circulation, this is all dependent on the concentration gradient, the intestinal surface area, the permeability of the mucosa and blood flow (Vale and Proudfoot, 1993).

The regime for multi-dose administration of charcoal is 50—100 g every 4 h if the patient is not vomiting. If vomiting is a problem the dose can be reduced to 12.5 g hourly or 25 g every 2 h along with an antiemetic. This regime should be continued until there is a clinical improvement in the patient or their blood results are improving (Vale et al., 1999). According to TOXBASE an osmotic laxative such as lactulose 20 ml, sorbitol, or magnesium sulphate 20—30 g can be given with the first dose (TOXBASE, 2008), but this remains unproven and is not recommended especially in children as it can cause fluid and electrolyte imbalances (Vale et al., 1999).

Vale et al. (1999) and Dorrington et al. (2003) state that multi-dose administration of activated charcoal should only be used in patients who have taken a life threatening amount of carbamazepine, dapsone, phenobarbital, quinine or theophylline and have a protected airway. Currently, there is no convincing evidence to demonstrate that the administration of multi dose charcoal reduces mortality or morbidity in poisoned patients (Vale et al., 1999).

According to the NICE guidelines on self harm, they recommend that multiple doses of activated charcoal should only be used if advised by the National Poisons Information Service or TOXBASE (NICE, 2004).

Contraindication and complications

The complications of administrating activated charcoal are relatively low (Vale et al., 1999 and Dorrington et al., 2003). It should not be given to patients that have an unprotected airway as there is a high risk of aspiration into the lungs. If the patient is unconscious, then a secure airway should be attained and a nasogastric (NG) tube inserted to administer the charcoal (Clegg and Hope, 1999), but it is

important to ascertain the position of the NG tube before use, as there are reported cases of accidental administration of activated charcoal into the lungs instead of the stomach causing an aspiration pneumonia. Fortunately the patient did recover (Vale et al., 1999).

It is contraindicated in patients who have intestinal obstruction, decreased peristalsis or any previous gastrointestinal tract surgery, as charcoal can cause constipation and occasionally bowel obstruction (Vale et al., 1999). Also, charcoal should not be given if there is an oral antidote for the drugs taken. (Martindale, 1996 cited in Clegg and Hope, 1999, p. 1363).

Discussion

To give or not to give charcoal? This is a very interesting question. According to the NICE (2004) guidelines every patient who attends hospital with an overdose within 1 h should be given activated charcoal. Unfortunately there are many potential delays, according to Sato et al. (2003), patients usually attend hospital several hours post ingestion, which rules out administration of charcoal. Another difficulty is obtaining an accurate history from the patient or delays within the ED which results in delays in administration of charcoal (Karim et al., 2001). Karim et al. (2001) has suggested that this problem could be overcome by the administration of charcoal in the pre-hospital phase by the paramedics and a study was undertaken by Greene et al. (2005). A postal questionnaire was sent out to 39 National Health Service Ambulance Services in the United Kingdom 2004 for 6 months. The response rate was 92%. The results of the study showed that the ambulance service was unwilling to administer charcoal pre-hospital for a variety of reasons including; lack of a protocol on the administration of charcoal, lack of evidence on the benefit in administering charcoal, cost implications, the affect of turnabout times due to patients vomiting in the ambulance due to charcoal and the risk of aspiration. The study found that out of the 39 ambulance services, none of them administer charcoal pre-hospital due to the reasons mentioned. The study suggests that there is a need for further research in this area and this could provide evidence of the benefits of charcoal (Greene et al., 2005).

Lynch and Robertson (2003) conducted a study within an emergency department looking at charcoal administration to patients who had taken an overdose and found that there were a large proportion of patients refusing to have the treatment. They suggest that health professionals should convince patients of the benefits of taking the charcoal with 'gentle persuasion'. According to McCann et al. (2007) emergency nurses lack the skills in caring for self harm patients and this lack of confidence attributes to the negative attitude nurses have towards self harm patients, which could make it difficult to provide 'gentle persuasion'.

As health professionals our practice is developed through evidence based research. The research surrounding the use of activated charcoal is limited, as the clinical trials undertaken are generally preformed on healthy volunteers or animals (Yeates and Thomas, 2000) who are given relatively small overdoses in controlled environments, which does not simulate real life situations and does not take into account the ingestion of food or alcohol on the effects of the charcoal (Chyka and Seger, 2005). The NICE guidelines recognise this and have recommended further 'appropriately designed and adequately powered study' to achieve this (NICE, 2004, p. 35). Although there are a large number of studies on healthy volunteers or animals that show that the administration of charcoal is beneficial, there are no randomised controlled clinical trials (Karim et al., 2001) in actual poisoned patients that show that charcoal is of any benefit in reducing mortality or morbidity (Vale et al., 1999).

According to Vale et al. (1999), less than 1% of patients attending with overdoses will end in mortality and it is the judgment of the clinician to identify those patients that could develop serious complications, who could benefit from the use of activated charcoal (Chyka and Seger, 2005). Lynch and Robertson (2003) state that every ED should have a standardised guideline on the administration of charcoal, to help guide clinicians on the correct dosage and use of charcoal in patients attending with overdoses.

Conclusion

This discussion paper has highlighted some interesting points. There are two very well established organisations that have produced guidelines on the administration of charcoal, in which, they have both systematically reviewed all the available research, interpreted the information and have concluded the information differently. This could make it difficult in practice to produce clear and concise guidelines.

Charcoal is widely used in the treatment of patients that have taken drug overdoses. According to Vale et al. (1999) and Chyka and Seger (2005) charcoal should only be administered to patients that have taken a life threatening amount of medication that is adsorbed by charcoal and have a secure airway. According to NICE (2004) guidelines all patients should be given charcoal who attend ED within 1 h of overdose, but this has its limitations. Even though these two papers give different advice, they have both systematically reviewed the available research to give clear and concise advise to health care professionals, but ultimately it is up to the clinician to utilise this information and decide if charcoal should be administered or not.

As Karim et al. (2001) states appropriate administration of charcoal 'will remain a challenge' and there will need to be a 'change in the prioritisation and initial treatment of poisoned patients' to comply with the position statement and the NICE guidelines (Karim et al. (2001), p. 392).

Direction for practice

In order to achieve clear and concise guidelines in Emergency Departments discussions between healthcare professionals are needed. This could be achieved through teaching sessions that could open up debate on different clinicians practices, views of administering charcoal and review of the available research and guidelines. These should include intensive care practitioners, as patients who have taken life threatening amount of medication are

usually cared for on the intensive care unit and may need further charcoal administered.

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