



The influence of cold versus room temperature charcoal on reducing nausea of poisoned patients: A randomized clinical trial

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Abstract

Objective: Intoxication is among the most common causes of emergency department (ED) visits. Activated charcoal is one of the useful treatments preventing poison absorption. However, nausea caused by using charcoal has made this substance less acceptable among patients. This study aims at investigating the influence of using cold charcoal on reducing the nausea among poisoned patients.

Methods: This clinical experimental trial study approved by the Medical Ethics Committee of Regional School of Medicine of Mashhad University of Medical Sciences with the code 930106. Randomization was provided by Sealed Envelope. Accordingly, the experimental group received cold charcoal (4°C), while the control group received room temperature charcoal (23°C).

We used the coding method in order to double blind the study. After half and one hour, nausea was checked in patients by visual numeric scale (VNS). Data were described by using descriptive and analytic test indices including frequency, mean \pm standard deviation and suitable charts and tables.

Results: The average age of participants was 25.83 ± 7.05 . The severity of nausea half an hour after consuming charcoal in cold charcoal group and experimental group was 1.3 and 2.73, respectively ($P < 0.001$). One hour after consuming charcoal, the severity of nausea in cold charcoal group and experimental group was 0.39 and 1.38 ($P < 0.001$). As indicated by the results of the study and after investigating the changing trend of nausea severity, nausea severity decreased in both groups by passing time from half to one hour ($P < 0.001$).

Conclusion: Cold charcoal can reduce the rate of nausea and make it more acceptable among patients.

Keywords: Charcoal, Drug overdose, Nausea

Introduction

Drug overdose is one of the most common causes of emergency department (ED) visits, which is defined as physical condition or status caused by swallowing, injecting and/or breathing of a harmful substance (1). Today, intoxication is considered as one of the main causes of death, most specifically in highly populated cities. Given the striking growth of intoxication by three times for three years, it is becoming one of the main three death causes (2). Due to the nature of intoxication, which involves young people (3) and imposes much morbidity and long-term consequences, it needs special attention owing to the economic costs as well as the psychological stress.

Reducing poison absorption is the cornerstone of intoxication treatment. Different approaches concerning

the prevention of skin, eye, and breathing absorption are explained (4). However, it is more connected with digestive absorption. Some of the preventive approaches regarding the digestive absorption include vomiting, gastric lavage, activated charcoal prescription, laxative prescription, and washing and removing intestinal drugs through endoscopic approaches (4).

Activated charcoal is known as one of the best anti toxic non-professional substances. This is actually the same as wood coal whose absorption surface is increased through blowing air. In gastric system, this substance absorbs toxin or drugs preventing it to enter into gastric mucosa. Taking the most efficiency from this substance necessitates its urgent prescription instantly after drug or toxin consumption (5).



Activated charcoal administration is recommended in guidelines in the first hours after intoxication (6). Nausea and vomiting caused by charcoal consumption make it less acceptable among patients. Unpleasant taste, bad color, and the whimsical feeling of drinking are main causes of nausea. Although some recommendations have been presented in some guidelines regarding activated charcoal use (including drinking cold cola while swallowing charcoal) (6-8), no comprehensive research has been carried on how-to-make it more acceptable. In some studies, other substances added to the charcoal could not influence the level of charcoal consumption acceptance in children. Other studies have presented some contradictory results regarding charcoal consumption acceptance mixed with milk chocolate, cola, cherry and orange juice, and ice cream (9). Using activated charcoal with less feeling of nausea makes it feasible to prevent the consequences of nausea like esophageal bleeding (Mallory-Weiss syndrome). This study tries to design a cost-effective approach on improving the usability of activated charcoal in poisoned patients. The present study aims at investigating the influence of using cold charcoal on reducing the nausea condition among poisoned patients.

Methods

This double-blinded clinical trial was undertaken on patients with acute poisoning and indication of decontamination with activated charcoal, in Imam Reza hospital during 2017-2018 based on consort guidelines. In this study, 308 patients with severe drug intoxication referring to the ED who were candidate for single-dose charcoal administration were enrolled. These patients were admitted in the intoxication center. This center has admission of 13 000-17 000 patients per year.

The indication of charcoal consumption is defined as consuming toxic substances during the past one hour and being poisoned by substances that can be decontaminated with charcoal. The branded charcoal F. Trenka Austria was administered for patients. Patients with unstable vital signs, nausea and history of allergies to charcoal were excluded from the study. We explained the objectives of the study for all patients, but in order to keep the study double blinded, we did not explain the temperature of the charcoal. Informed consent was taken from all participants before charcoal administration. A nurse gave activated charcoal (AC) and cold AC to participants and simple randomization was done sequentially and coding method was used in order to double blind the study. Cold AC group received coal charcoal 50 gram with 100 cc distilled water at 4°C and the control group received the same volume but in room temperature. After half and one hour, the emergency resident asked patients to rate their nausea using a 10-cm visual analog scale (VAS). Ten for the most nausea and zero for no nausea; the resident was blinded to charcoal temperature. The obtained results

were recorded, collected, classified, and analyzed. Sample size was calculated based on the following formula and was equal to 180 samples for each group (totally 360 samples).

$$n = \frac{(z_{1-\alpha/2})^2 p(1-p)}{d^2}$$

Data were described by using descriptive statistic indices including frequency, mean \pm standard deviation and suitable charts and tables. The data distribution was evaluated by Kolmogorov-Smirnov test. In order to investigate the relationship and correlation between quantitative variables, *t* test and Pearson and Spearman correlation tests were used, respectively. Also, the relationship between qualitative variables was evaluated by chi-square test. Statistical analysis was done by SPSS software version 16. *P* value less than 0.05 was considered as statistically significant.

Results

A total of 152 participants received normal AC as control group and 156 received cold AC at 4°C as experimental/case group (Figure 1). Sixty-four participants (20.8%) were male and 244 participants (79.2%) were female. In cold AC group, 32 (20.5%) were male and 124 (79.5%) were female which was analyzed by chi-square test. In the control group, 32 (21.1%) were male and 120 (78.9%) were female (*P*=1). The youngest and the oldest participants were 14 and 52 years old, respectively. The average time interval between intoxication and referring to the ED was 1 hour and 52 minutes. The average time interval between intoxication and referring to ED, analyzed by independent *t* test, in cold AC group and in the control group was 2.27 and 1.48 hours, respectively (*P*<0.001) (Table 1).

As for the causes of intoxication, acetaminophen consumption with 44 (14.3%) cases was identified as the highest followed by Alprazolam, Clonazepam and Tramadol with 40 (13%), 28 (9.1%) and 20 cases (6.5%), respectively (Figure 2).

The nausea severity caused by charcoal consumption half and one hour after charcoal consumption was evaluated by VAS. The averages of nausea severity half and one hour after consumption were 2.01 and 0.87, respectively. Comparing the nausea severity half and one hour after charcoal consumption, Wilcoxon signed-rank test indicated that the nausea severity decreased in 128 patients by passing time, but it did not change in 108 cases. Conversely, it increased in 20 patients (*P*<0.001). In cold charcoal group, the severity of nausea half and one hour after consumption was respectively 1.3 and 0.39 and in the control group it was 2.73 and 1.38 (*P*<0.001).

As for the change in nausea severity, Wilcoxon signed-rank test indicated that in both groups by passing time from half hour to one hour after charcoal consumption, nausea was reduced (*P*<0.001).

Comparing nausea between the two genders, this study

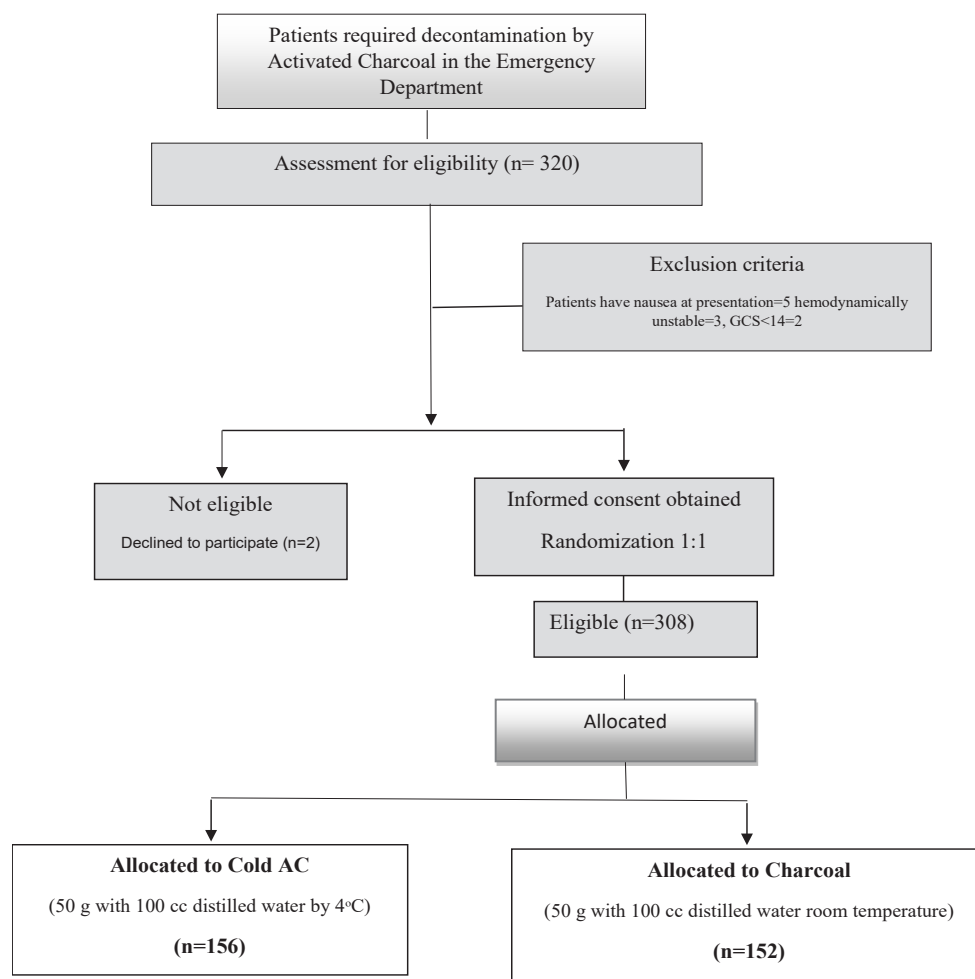


Figure 1. Study Protocol.

Table 1. Demographic data, mean time interval between toxicity and ED visit and Charcoal dose

Variable	Control group	Case group	P value
Patients			
Female	120	124	0.1 ^a
Male	32	32	
Mean age	24.66	26.4	0.15 ^b
Average time interval between toxicity and ED visit	1.48	2.27	0.09 ^b
Charcoal dose	50gr	50gr	1 ^a

^a Chi-square test, ^b Independent samples *t* test.

found that half an hour after consumption, VAS values for males was 1.93 and for females it was 2.03 ($P=0.473$). The values one hour after consumption for males was 0.86 and for females it was 0.88 ($P=0.196$). The evaluations of the relationship between age and nausea severity by Pearson correlation test for half and one hour after charcoal consumption were respectively -0.123 and $P=0.042$ (Figure 3) and -0.209 and $P=0.001$ (Figure 4) indicating poor negative correlations between variables of both half an hour and one hour after charcoal consumption.

Discussion

Nausea and vomiting are common side effects of prescribing activated charcoal. Several studies (10-12) reported high acceptance (83%-90%) in patients receiving activated charcoal.

Nausea as the main result of charcoal consumption makes it less favorable. Obviously, using activated charcoal with less feeling of nausea makes it feasible not only to carry more decontamination effect but also to prevent the consequences of severe nausea such as gastric bleeding or even aspiration.

In this study 79.2% of participants were female and the average age of study participants was 25.83 years old. As indicated by previous literature, most patients are among youths (18-29 years old). In western countries, most patients are older than 60 (12-14). This difference is justified by the fact that in Iran, elderly people are more supported by families, and they have a greater desire of spirituality, which prevents them from intentional poisoning.

The average time interval between intoxication and the time arrival to the emergency ward was 1.87 ± 1.15 hours. The study conducted by Kline et al (15) showed that the

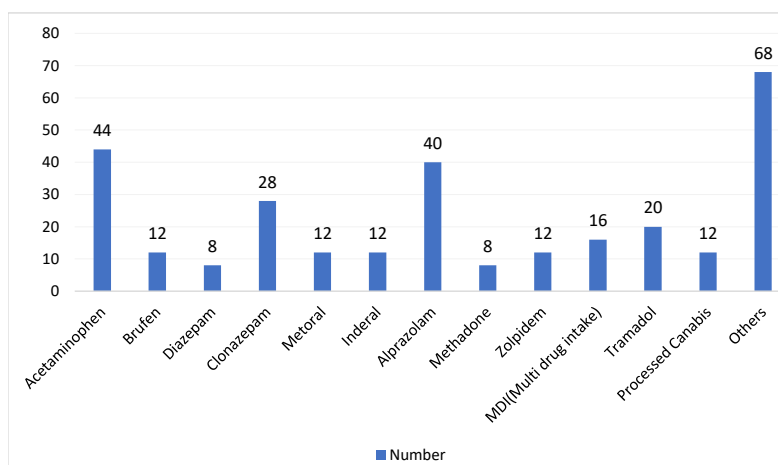


Figure 2. Distribution of toxicity reason based on Kolmogorov-Smirnov test.

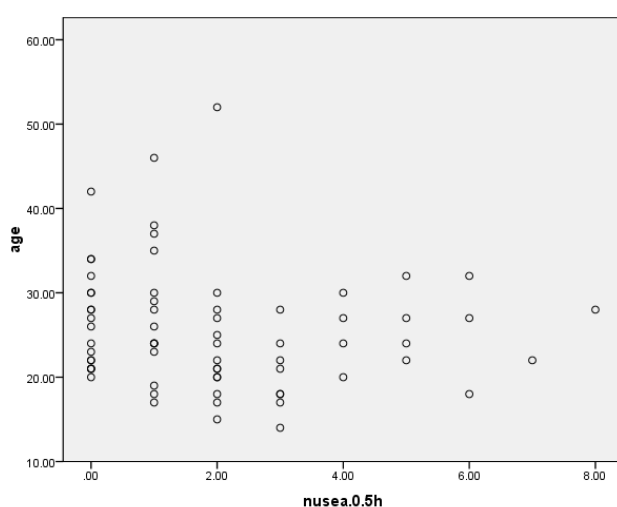


Figure 3. The relationship between age and nausea severity 30 minutes after charcoal consumption. * Pearson correlation test was used.

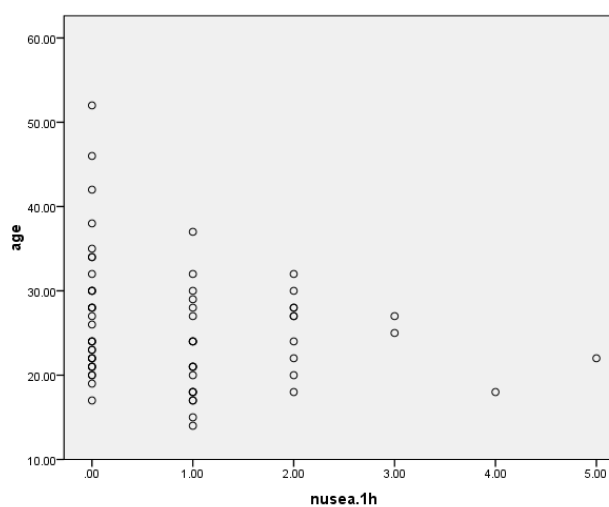


Figure 4. The relationship between age and nausea severity 60 minutes after charcoal consumption. * Pearson correlation test was used.

average time interval from swallowing to arrival to the ED was 1.2 hours. The level of nausea half and one hour after consumption was significantly less in cold charcoal group than in normal charcoal indicating that cold charcoal reduced the severity of nausea. There has never been a study showing improved clinical outcomes from these techniques. However, other studies have been conducted using methods to increase the acceptance of charcoal consumption, the results of which are contradictory.

In some studies, other substances added to the charcoal could not influence the level of charcoal consumption acceptance in children. Other studies presented some contradictory results regarding the acceptance of charcoal consumption mixed with milk chocolate, cola, cherry and orange juice, and ice cream (16,17). Kline et al similarly found the same results indicating that adding other substances could not increase the level of acceptance (15). In other similar studies, Cheng and Ratnapalan (18) evaluated the use of additives for the taste acceptance

and the easiness of swallowing charcoal. In their study, charcoal was mixed with three substances of milk chocolate, cola, and water. Then, 10-cm VAS evaluated taste acceptance and swallowing easiness. The mean scores of charcoal acceptance mixed with milk chocolate, coca cola, and water were 5.5, 6.3, and 2, respectively. Therefore, study participants preferred charcoal taste mixed with milk chocolate and coca cola more than water. As indicated by statistical analysis, there was no significant difference between the easiness of swallowing in three groups. Generally, 48%, 45%, and 7% of patients preferred charcoal mixed with milk charcoal, coca cola, and water, respectively. We evaluated our patient by using VAS, but did not add any substances to charcoal. The study conducted by Eizember et al (19) carried out on 187 patients (81 control and 106 experimental groups) obtained interesting results. The experimental group was treated with acupuncture. The activated charcoal was necessarily given to the patients with NG tube, and nausea

was evaluated after one hour of consumption. As indicated by the results, the pre-consumption 5-minute acupressure reduced the level of nausea in the experimental group by 46%. Although differences found in the two groups were statistically significant, clinically a 1-point difference in nausea in an intoxicated person does not seem much important.

There is a paucity of research concerning the topic under investigation, but our study investigated the effectiveness of using cold charcoal in reducing nausea caused by charcoal. However, instead of 'taste acceptance and easiness of swallowing' as the focus of other studies, our study concentrated on the evaluation of nausea severity by VAS. Therefore, the present study suggests novel ideas as the production of cold charcoal with the explained specifications is simple, cost-effective and practical.

The other strong point is that this study was conducted on patients with the average age of 26 with the high rate of intoxication probability.

Study limitation

Nausea is one of the common side effects of drug consumption depending on different factors including the substance consumed, the amount of consumed substance, and the physiologic condition of the consumer. Therefore, nausea caused by intoxication itself can ruin the results. The prescribed drugs in the process of treatment can also cause side effects. For this, patients consuming drugs other than charcoal were not included in this study.

Conclusion

The present study aimed at investigating the influence of using cold charcoal on the severity of nausea caused by charcoal consumption. We conclude that cold charcoal can reduce nausea caused by charcoal consumption leading to more acceptance among patients.

Ethical issues

This study was approved by the Medical Ethics Committee of Regional School of Medicine of Mashhad University of Medical Sciences with IR.MUMS.REC1393.181 ethic code and IRCT registration code was IRCT2014120811956N5. Written informed consent was obtained from all study participants.

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Authors' contributions

MTD conceived and designed the experiments. BD and MTD guided the performance of experiments. VV analyzed and

interpreted the data. BRK and EVM composed the first draft of the manuscript. EVM wrote the paper and all authors approved the final version.

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