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Original Article

Comparison of Using Cold Versus Regular Temperature Tube on Successful Nasogastric Intubation for Patients in Toxicology Emergency Department: a Randomized Clinical Trial

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ABSTRACT

Introduction: In view of the contradictory results for the use of cold tubes for the purpose of enhancing nasogastric tube insertion success there is a pressing need for further research in this area. This study aimed to determine the effect of using cold versus regular temperature nasogastric tube on successful nasogastric tube insertion for patients referring to toxicology emergency department.

Methods: This study is a clinical trial with two groups design of 65 patients admitted to toxicology emergency department who were divided into two groups by random allocation. Nasogastric tubes used in the intervention group had been stored in a refrigerator at 2°-8° C while the ones employed in the control group had been maintained at the room temperature of 22-28° C. Nasogastric tube insertions in both groups were done by the investigator according to standard methods. The data were analyzed using SPSS ver. 13.

Results: The placement of nasogastric tube was done in the first attempt with 27 (%84.4) of the subjects in the control group and 33 (%100.0) in the intervention group. The chi-square test results showed that the frequency of the number of attempts for gastric intubation in subjects between the two groups was statistically significant.

Conclusion: Cooling gastric tubes reduces the time required for nasogastric intubation. Thus, it is suggested that the gastric tubes be cooled before the application of the procedure so as to reduce complications, increase patient comfort and save nurses time.

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Introduction

Nasogastric intubation is considered as one of the basic skills in nursing[1,2] and medicine in general.[3] In clinical situations, whether outpatient or inpatient, medical teams use nasogastric intubation for many reasons.[4] One of the most common nasogastric intubation applications is in poisoning cases, nasogastric intubation is one of the primary measures for gastric irrigation, which plays an important role in reduction, or even prevention of poisoning complications.[5]

Due to the prevalence of patients with poisoning in emergency wards of the hospitals in the country (approximately 35,000 over 13-year-old patients annually refer to the Emergency ward of the Luqman hospital in Tehran,[5] the importance of nasogastric intubation in these patients is quite clear.

Failure in correct placement of the catheter and prolonged intubation process are the common problems in nasogastric intubation, such that the average rate of failure in the usual nasogastric intubation processes without the use of any additional maneuvers is reported around 50-66% in the first time.[6] This means that, each nasogastric intubation process requires at least two attempts. However, repeated and prolonged intubation techniques are accompanied with complications such as mucosal bleeding, , entanglement, folding and twisting of the tube due to increasing softness of the tube by temperature of the body[7] and instability of vital signs and arrhythmia signs.[6] Different techniques have been suggested in the literature for the facilitation of nasogastric intubation, which are divided into three categories. The first category deals with the use of the device such as a guide for the passage of the tube that includes guide wire,[8] stylet[6] and gel caps.[9] The second category deals with the use of a special technique during intubation, which includes tilting the head forward[10], tilting the head sidewise,[9,10] and inserting a finger into the mouth.[10]The third category deals with changing the elastic properties of the tube by freezing,[7] cooling,[11,12] or filling the tube with water.[10] The use of a guide is mainly practiced in unconscious or semi-unconscious patients and since this technique requires some tools other than a tube, it is very difficult to apply and requires additional training. The special techniques of intubation are applicable together with the other two categories and is quite compatible with other methods. However, the technique of changing catheter's elasticity is most applicable due to requiring no additional device or special training and due to imposing no additional costs.

Since the cooled tubes are less flexible, they can retain their curved shape for a longer period and this can reduce the chances of passing the tube through the tracheal tube, or entanglement of that in the pharynx.[12] Entanglement of tube in the sinus fullness is the most common cause of failure in nasogastric intubation.[7]

The studies carried out by Penrod et al., provide us with eight comforting security strategies in the emergency cares. One of these strategies is keeping the equipment cold.[13] Study carried out by Sherazi showed that coldness can significantly enhance the pain threshold and this method can be used for treatment techniques, which are followed by mild pains.[14]

Investigations of the clinical skills training literature shows that some of the studies have not approved the use of chilled tubes in nasogastric intubation,[15,16] and some have disapproved the use of cold catheter due to complications such as mucosal bleeding[17] and some have recommended cold catheters to facilitate the passage of the tube.[11] The use of cold catheter has also been recommended in official website of the department of Medical Emergency in University of Ottawa, Canada[18] in an article published in the Nursing Times magazine.[12]

Despite these inconsistencies between the above sources, searches in the database of Medical Sciences studies showed that only one clinical interventional study for assessment of the effect of ice-bath chilled catheter on the frequency of attempts in nasogastric intubation in unconscious, semiconscious and conscious patients has been indexed.[19] This search also showed that only one interventional study has been carried out for assessment of the frozen catheter effect on the successful intubation in unconscious patients.[7] The latter case showed that frozen gastric tube (injection of distilled water into the catheter package and freezing it in the refrigerator), compared to the conventional tubes, can increase gastric intubation success rate by 30%, in unconscious patients.[7] Freezing the tube through the above methods is very difficult and may be associated with high contamination of tubes and resistance of conscious patients.[7]

Despite the different views of the reference books in this regard and lack of indexed scientific studies, clinical observations of the researcher suggest that in areas such as surgery, emergency and emergency poisoning where gastric catheters are of great use, some nasogastric tubes are kept in the refrigerator. In addition, the experienced nurses and doctors approve the effect of chilled gastric tubes on the success of nasogastric intubation.[19]

Since, according to the evidence-based care principles, clinical practices should be based on the three pillars of experience, research and scientific resources, and since clinical experience is the only existing element here, the necessity of scientific research in this field is therefore evident. In addition, the technique which is investigated in this study is easily and affordably applicable and is not associated with higher rates of complications compared to conventional tubes. Therefore, in this study, the researcher tried to address this question: can chilled catheters increase the success rate of gastric intubation?

Materials and methods

The study is a clinical trial conducted in Imam Reza hospital in Mashhad from December 2013 to February 2014. This paper was extracted from a master's degree thesis in Medical-Surgical Nursing major, Nursing and Midwifery department in Mashhad University of Medical Sciences and is recorded in Iranian registry of clinical trials with IRCT2013041713050N1 code. The population included all patients in the emergency department of Imam Reza Hospital who required a nasogastric catheter. The selected individuals were conscious patients with American Society of Anesthesiologists (ASA) physical status class 1 and 2, with the age range of 18-55. They required nasogastric intubation for gastric lavage and were willing to cooperate in the research. They did not suffer from particular systemic conditions or mental retardation (specific acute and chronic diseases, and lack of mental health problems, etc.), they did not use drugs to affect blood coagulation nor did they have anatomical abnormalities. At first a participant selection form, including the exclusion and inclusion criteria, was completed by the researcher through interviews with the patients or their attendants as well as examining the patients and the eligible patients were selected. Then necessary explanations about research purposes were provided by the researcher to all of the participants treated in the emergency department of Imam Reza hospital, for one minute face-to-face. Informed written consents were obtained from the patients and gastric intubation was conducted. Personal information form was completed by interview and using patients' records after stabilizing the patient. The minimum time required for silicone catheters to reach a temperature of 2-8° C was estimated by the researcher by keeping a catheter in the refrigerator at 2-8° C and measuring its temperature by thermometer every 20 minutes while twice this time was considered for keeping the catheter in the refrigerator before the intervention, which lasted for at least 2 hours. In order to determine the sample size, the ratio comparison formula with a certainty coefficient of 95% was used. A pilot study was performed to determine the sample size (with 95% confidence interval) for gastric intubation success variable. The sample size was estimated 35 people in each group while, finally, 33 patients in the intervention group and 32 patients in control group, were studied. Participants were randomly divided by throwing coins into the intervention and control groups.

In the intervention group gastric intubation was conducted using catheters stored in a refrigerator at a temperature of 2 to 8°C for at least two hours. In case of failure of intubation in two attempts, another catheter was used. In the control group, gastric intubation was performed, using catheters stored at room with a temperature of 22 to 28°C and in case of failure of

intubation in two attempts, another similar catheter was used. Gastric intubation in both groups was performed by the investigator according to standard methods.

Assessment of indicators was done by a colleague who was not aware of the type of used catheter, so that to determine the duration of intubation a digital stopwatch was used and to determine bleeding outbreak the following methods were used:

1) Observing blood on catheter (in the case of catheterization)
2) Active bleeding from nose
3) Observing blood in examination of throat by a flashlight
4) Observing blood in nasal cavity in nose examination by a flash light

The investigation above was done during tubing and up to 3 minutes after its end. The validity of authenticity determination tool of tubing was assessed by content validity method by ten faculty members of nursing and midwifery faculty of Mashhad University of Medical Sciences., and the reliability of the tool for proper gastric-nasal tubing was assessed by the observers' agreement, such that the tubing accuracy was investigated in 10 tubing cases by two people separately and the results were compared. To analyze the data, SPSS software (version 13.0, Chicago, IL, USA) and chi-square and Mann-Whitney statistical tests were used.

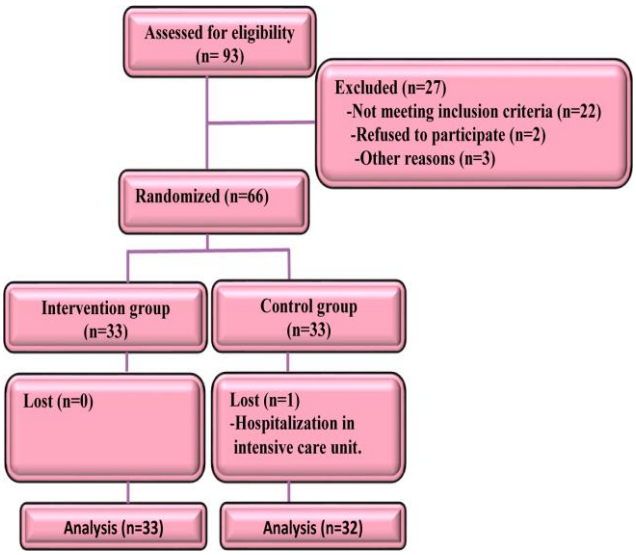

Figure 1. Flow chart of the study

Results

The mean age of the participants was 28.5(9.8) of whom 21 (65.6%) were male in the control group and 17 (51.5%) were female in the intervention group. 27 of the participants in the control group (84.4%) and 28 participants (84.8%) in the intervention group had had a record of hospitalization. As for poisoning cause, it has to be mentioned that the cause of poisoning was intentional for 16 participants in the control group (50.0%) and for 18 participants (54.5%) in the intervention group. As far as toxicity was concerned, the cause of poisoning was using drugs for 20 participants (62.5%) in the control group and for 24 participants (72.7%) in the intervention group. In terms of gastric tubing record, 31 (96.9%) of the participants in the control group and 32 participants (97.0%) in the intervention group had no history of gastric tubing .In cases where the participants had a history of gastric tubing, 31 subjects (96.9%) in the control group and 33 subjects (100%) in the intervention group had no problem record in gastric tubing. Using Chi-square statistical test showed that the participants had no significant differences in terms of variables frequency in both groups and were almost equal (P> 0.05).

The results showed that the mean and standard deviation of gastric tubing duration changed from 2 (0.25) in the control group to 1.6 (0.48) in the intervention group. Thus, based on Mann-Whitney test, the mean of gastric tubing duration was significantly different in the control and intervention groups (P = 0.001) (Table 1).

Table1. The mean and standard deviation of gastric tubing duration in patients referring to poisoning emergency, in control and intervention groups

Group	Mean(SD)	Number	Domain	Median
Control	2(0.25)	32	1-3	2
Intervention	1.6(0.48)	33	1-2	2
Test- result	Z=-3.4,	P=0.001*		

SD: Standard deviation, *statistically significant

The variable of gastric tubing duration was divided into 3 groups while the comparison of two groups showed that tubing duration less than 1 minute increased from 1.3% in the control group to 4.36% in the intervention group. The chi-square test results indicated that frequency of test units was significantly different in terms of tubing duration between the two groups (control and intervention group) (P = 0.003) (Table 2).

Table 2. The frequency distribution of patients referring to poisoning emergency in terms of gastric tubing duration, considered separately in two groups (control group and intervention group)

Gastric tubing duration(minute)	Group	
	Control N (%)	Intervention N (%)
Less than 1	1(3.1)	12(36.4)
1.1-2	30(93.8)	21(63.6)
More than 2.1	1(3.1)	0.0(0.0)
Total	32(100)	33(100)
Test results	Chi-Square=11.8, df=2, P=0.003*	

*statistically significant

The findings showed that 3 participants had bleeding during tubing in the control group and zero participants in the intervention group. The Chi-square results showed that frequency of bleeding occurrence among the participants in the two groups was not significantly different (P = 0.072). (Table 3)

The results showed that for 31 participants (96.9%) in the control group and for 33 participants (100%) in the intervention group, catheter is correctly positioned in the stomach and chi-square test results showed that the frequency of correct placement of catheter in the stomach in the two groups was not significantly different (P=0.306) (Table 4).

Table 3. The frequency distribution of patients referring to poisoning emergency in terms of bleeding during gastric tubing considered separately in two groups (intervention and control)

Bleeding during gastric tubing	Group	
	Control N (%)	Intervention N (%)
Yes	3(9.4)	0 (0)
No	29(90.6)	33(100)
Total	32(100)	33(100)
Test results	Chi-Square=3.2, df=1, P=0.072	

df: degree of freedom

Table 4. The frequency distribution of patients referring to poisoning emergency in terms of correct placement of the catheter in stomach, considered separately in two groups (control group and intervention groups)

Correct placement of catheter in stomach	Group	
	Control N (%)	Intervention N (%)
Yes	31(96.9)	33(100)
No	1(3.1)	0(0)
Total	32(100)	33(100)
Test results	Chi-Square=1.0, df=1, P=0.306	

df: degree of freedom

The findings showed that, for 27 participants (84.4%) in control group and 33 participants (100%) in the intervention group nasal-gastric catheter was positioned in stomach only with one attempt, so that attempts to gastric re-tubing was reduced from 5 participants in the control group to zero participants in the intervention group and chi-square results showed that the number of attempts for gastric tubing was significantly different between the two groups (P = 0.018) (Table 5).

Table 5. The frequency distribution of patients referring to poisoning emergency in terms of number of attempts for gastric tubing, considered separately in two groups (the control and intervention groups)

Number of attempts for gastric tubing	Group	
	Control N (%)	Intervention N (%)
One time	27 (84.4)	33 (100)
Two time	5 (15.6)	0 (0)
Total	32 (100)	33 (100)
Test results	Chi-Square=5.5, df=1, P=0.018*	

df: degree of freedom, *statistically significant

Gastric tubing complications such as stomach discomfort and bleeding from the nose and mouth did not differ in the two groups. The test results of linear log analysis showed that there is no significant relationship between personal information and the number of attempts for tubing (P>0.05).

Discussion

The findings of this research showed that tubing duration were statistically different, but bleeding during tubing was not significantly different in the control and intervention groups. On the other hand, attempt frequency for gastric tubing in participants (for whom cold catheter was used) reduced more than 15%, but the frequency of correct placement of catheter was not significantly different in the two groups (control group and intervention group). This indicates cooling effect on the success of nasogastric tubing. In an extensive search of studies on factors affecting the success of nasogastric tubing and also cooling effect of nasogastric catheters on the success of nasogastric tubing, no study was found to be fully similar to the present study. As a result, in the analysis and discussion of the findings, the researcher tried to draw on similar studies that had investigated the effects of factors such as cold on the success of nasogastric tubing in different patients.

Chun et al.,[7] in Korea conducted a study about the success of nasogastric catheter tubing, using frozen catheter in intubated patients in which 100 intubated patients were randomly divided into two groups (control group and intervention group). The results showed that 44 out of 50 patients (88%) in the intervention group, and 29 out of 50 cases (58%) in the control group were successfully intubated. The Chi-square test results showed that success rate in the intervention group was significantly higher than that of control group (P=0.001). The overall time required for gastric tubing in the intervention group was shorter than that in the control group but was not statistically significant (P=0.078).[7] Chun et al., results, according to their definition of success in nasogastric tubing, are in line with those of the current study. It should be noted that in this study frozen catheters were used for gastric tubing in anesthetized intubated patients. Tsai et al.,[6] conducted a study in Taiwan on nasogastric tubing in anesthetized intubated patients with a new and valid method in which 103, patients 23 to 70 years old, had gastrointestinal and liver surgeries requiring nasogastric tubing during surgery. The participants had been divided by random allotment computer software to control and intervention groups. In the control group gastric tubing was performed while the patients were in a state of intubation (normal mode) and in the intervention group gastric tubing was done by stealth Rach which was tied to catheter tip by string and the success ratio, duration of tubing and complications were compared between the two groups. Success ratio in the intervention group was (98.1%) in the control group was (64%). The mean duration of tubing in the intervention group was 40.3 (23.2) seconds while it was 39.5 (19.5) seconds in the control group.[6] Since cooling catheters leads to their hardness and makes a mode similar to stealth Rach in catheters, Tsai study is similar to the current study and its results sort of confirm the findings of the current study. However, the tubing duration might have increased in intervention group due to the tube and stealth Rach being put together, thus increasing the thickness of the catheter used for tubing.

The tube elasticity increased by cooling catheters, and without having their thickness increased, the length of stomach tubing was considerably shortened. One of the limitations of this study can be different vomiting reflex stimulus thresholds in people and also different tolerance of patients in gastric catheter acceptance which may be effective in tubing success and was out of researcher control but the effect of this variable is controlled to a large extent by random allocation method of people into

two groups.

Conclusion

Given that the bleeding as well as the correct placement of the catheter in the stomach did not change in both groups during tubing, the duration of nasogastric tubing and the number of attempts for nasogastric tubing were reduced by cooling catheters, and the difference was statistically significant. It can be said that the cooling method of nasogastric catheters is an effective method to increase the success of nasogastric tubing in patients, which the results confirm the study hypothesis.

Since one of the goals of evidence-based nursing program is to improve health care quality and promotion of patients' safety, the results of this study can be offered to nursing educational and clinical directors to use them in training and retraining courses and improve clinical skills and subsequently, improve the quality of nursing care and services.

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Ethical issues

None to be declared.

Conflict of interest

The authors declare no conflict of interest in this study.

Research Highlights

What is the current knowledge?

The current knowledge is that there are clear contradictions between sources regarding the use of hot or cold tubes in gastric intubation.

What is new here?

Determining the most appropriate method for gastric tube success using cold tubes with conventional probes.

Author's contributions

Conception and design: MM and SRM; Acquisition of data: MM, HMN, AGhT; Analysis and interpretation of data: SRM; Drafting the article: MM, AAF; Review of article and find approval: MM, AAF.

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