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Comparison of Three Methods for NG Tube Placement in Intubated Patients in the Emergency Department

Mehdi Nasr Isfahani[1], Farhad Heydari[1], Ahmad Azizollahi[1]*, Pegah Noorshargh[2]

1. Department of Emergency Medicine, School of Medicine, Isfahan University of Medical Sciences, Isfahan, Iran.
2. Young Researchers and Elite Club, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran.

***Corresponding author:** Ahmad Azizollahi; **Email:** Azizollahi.ahmad@yahoo.com

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Abstract

Introduction: Tubular feeding is used, in patients who cannot take food through their mouths, but their digestive system is able to digest food. This method is safe and affordable for the patient and results in maintaining the function of the digestive system and reducing the risk of infection and sepsis.

Objective: The purpose of this study was to compare the three methods of the NG tube placement in intubated patients in the emergency department.

Methods: This study is a randomized, prospective clinical trial conducted between 2016 and 2018. 75 patients who had been referred to the emergency department were enrolled in the study and divided into three groups, to have their NG tube insertion using either the conventional method (Group C), or using brake cable (Group B) or applying Rusch intubation stylet (Group S) for highwayman's hitch or draw hitch.

Results: The mean duration of NG tube insertion was not significant between three groups (p=0.459), but the mean duration of NG tube insertion in group B was 18.43 ± 2.71 seconds and less than the other groups. NG tube insertion by first attempt in the group B was associated with the highest success rate. There was no significant difference, however, in the success rate in NG tube insertion on first and second attempts (p=0.376, p=0.353).

Conclusions: The use of brake cable as a guide wire during insertion of a nasogastric tube increases the success rate on first attempt. No meaningful difference, however, was noted in the overall success rate in NG tube insertion on first and second attempts.

Key words: Emergency Service, Hospital; Intubation, Gastrointestinal; Methods

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INTRODUCTION

Nutrition is a vital component of health that is essential for life, natural growth and development, maintenance and repair of tissue, cell metabolism, organ function, energy supply for movement and stabilization of body temperature (1). The human body needs adequate food composition for cellular function, and considering the various roles of nutrition in metabolism and health (2). Oral nutrition is the most effective way to feed the patients, and appropriate nutrition support can significantly reduce the associated mortality rate (3, 4). When the patient is not able to feed through the mouth, another method of support for his nutrition is needed, among which the best ones are the alimentary method, or the feeding with the tubes entering into the digestive system via nostrils (5). The benefits of this type of nutrition are that it allows the stomach to act as a natural reservoir and regulates the amount and type of food released into the intestine, and since it is consumed without appetite or peristalsis, it contributes to a reduced catabolism-related damage, maintains the mucosal integrity of the intestine, reduces the placement of intestinal bacteria, and improves wound healing process (6). This nutrition method is used in situations, such as loss of consciousness, inability to swallow, esophagus / stomach trauma or cancer, oral trauma, oral or abdominal surgery, or for people who require extra nutrition due to a particular condition, such as burns, infections, surgery or fractures (7). The nasogastric (NG) tube is a flexible tube that enters the throat and esophagus, and ultimately the stomach through the nose, and is also the most common method for providing short-term nutrition (8, 9). The NG tubes inserted to prevent aspiration of gastric contents in abdominal surgeries, as a standard and common practice by surgeons (10-12). NG tube placement is associated with several side effects and discomforts for the patient, such as sore throat,

nausea, vomiting or other complications, such as tearing in the esophagus, or the entry of the tube into the skull or a rare complication, such as stomach pneumatosis (13). It also may lead to the accidental entry of a nutritional tube into the airways rather than the digestive tract (14). So far, studies have been conducted to compare the different methods of NG tube placement in intubated and unconscious patients and to investigate the best and most successful method for NG tube insertion (15-17). To the best of our knowledge, no procedure that is universally accepted and used as a gold standard has been found in this regard yet. Moreover, recent studies have been conducted on patients subjected to anesthetic drugs in the operating room. Therefore, this study was conducted to compare 3 different methods for NG tube placement in patients undergoing intubation with a rapid sequence intubation (RSI) in emergency department.

Methods

Study design and setting

This study was a randomized clinical trial, conducted between 2016 and 2018 in the emergency department of Al-Zahra and Ayatollah Kashani hospitals, Isfahan, Iran. The study was approved by the research ethics committee of Isfahan University of Medical Sciences. The study protocol was also registered at clinicaltrials.gov with identifier: NCT03699306. The informed consent was obtained from all participants and/or their legal guardians.

Study population

All patients intubated with RSI method, who required NG tube placement, in the age range of 18-65 years were included. The presence of symptoms of skull base fracture, bleeding disorders and coagulopathies, maxillofacial trauma, which may lead to deformity and impairment of NG tube, upper respiratory tract diseases and anomalies, nasal congestion and nostril stenosis, esophageal disorder (esophageal stenosis and esophageal varicose veins), and a history of head and neck radiotherapy were considered as exclusion criteria. Patients who had been intubated in other centers, referred to these two centers were also excluded.

Setting the power of the study at 80% and at 95% confidence limit, the calculated sample size by the following formula: N= (Z1- a/2 + Z1- b) [P1(1-P1) + P2(1-P2)]/d2, in which p1 was considered 54% as for conventional blind technique and p2 was 92% as for McGill technique, becomes 22 for each group. Expecting a 10% dropout, 25 patients were enrolled for each group. So for three groups, a total of 75 patients were enrolled for this study.

The enrolled patients were randomly allocated into three groups including: the control group (C), the stylet group (S) and the brake cable group (B). A permuted block randomization software (available at www.graphpad.com/quickcalcs) was used in this regard, while maintaining a balance across treatment groups.

Intervention

All patients were treated with oxygen via bag valve mask, for 3 minutes after continuous heart and blood pressure monitoring, and after ensuring that the intubation is possible and recovery equipment are close at hand, then all patients were intubated with the same drugs (fentanyl: 3µ/kg, etomidate: 0.3mg/kg and succinylcholine: 1.5mg/kg), using the RSI method and by tubes of appropriate size (men: tubes # 8 and 7.5 and women: tubes # 7 and 7.5). In addition, the cuff of the tracheal tube was also blown for all patients to maintain a pressure between 15 and 25 cm H2O, and then the tube was fixed in its proper location.

Two attending physician and two senior emergency medicine residents were responsible for all NGT placements, who had practiced in a workshop before our study began. The investigators did not perform any NG tube insertion to avoid operator bias. Before placing the NG tube in patients, a series of initial measures were taken in all subjects. First, the precise length of the NG tube required to enter into the stomach was measured, by holding the NG tube tip at the zyphoid process of patient and dragging it to the tip of the patient's nose, and then to the auricle. The patient's nostrils were also selected to enter the NG tube. Due to the patient's lack of cooperation in deep exhalation through the nose, the left or right nostril was selected based on the size, and the larger one, was assigned for the NG tube insertion. Three to five minutes before placing the NG tube, 3 ml of lubricant gel and lidocaine anesthetizing agents were added to the nasal drop of phenylephrine in the selected nostril, and for all patients, NG tube No. 14 - 16 (proportional to the selected method) was used. The endo-tracheal tube cuff was deflated just before NG tube insertion so as to facilitate the hypopharyngeal passage of the NG tube.

Patients were assigned into three groups as follows:

* Group C (Conventional method): NG tube was inserted in a conventional manner, the usual blind method of placing the NG tube, and without neck flexion, through the selected nostril and up to the measured length. The NG tube was fixed, after

ensuring of the correct location.

* Group B (Brake cable method): First, a brake cable was placed inside the NG tube graded as 14-16fr, with the tip of the cable reaching the blinded distal end of the NG tube, and then gently inserted through the selected nostril. In this method, after insertion of 20 cm of the tube, by pulling the trachea out aligned with cricoid cartilage, the NG tube could be introduced with less force. Eventually, after the measured length entered, the brake wire was pulled out slowly and then the wire was placed in a 2% glutaraldehyde solution to be used for other applications.

* Group S (Rusch intubation stylet method): The NG tube was tied by a special knot called Highway Man's Hitch to the Rusch intubation stylet (2.6 mm in diameter and 40.5 cm in length) by a thread of silk 3.0, so that the NG tube tip was about 1 cm away from the tip of the stylet. Then, the NG tube was inserted into the selected nostril up to the measured length, and then the knot was opened and stylet was pulled out.

In all three groups, by injecting 10 to 20 ml of air through the gavage syringe and hearing the gurgling sound of the air entering into the stomach on the epigastric area or observing the aspiration of the contents of the stomach into the NG tube, the tube position was confirmed. In cases where the first NG tube insertion was successful, it was considered as a successful attempt. However, in people that the NG tube was not fitted correctly with the first attempt, the NG tube was considered unsuccessful, in which case the NG tube was completely pulled out and, after cleaning, NG tube was tried again with the same method. In people that the second attempt was not successful in placing the NG tube correctly, it was considered as a failure, and another method was used for NG tube insertion, but the patient was not excluded.

Data gathering

For each patient the variables such as the age, gender, weight and height were recorded. In all groups, the duration of the NG tube insertion was measured by someone else, using a stopwatch. The start time was considered when the NG tube entered the nostril, and the end time was when the measured length of the NG tube was fully inserted. For all patients, possible complications, including mucosal hemorrhage, hemodynamic disorders (hypertension, tachycardia, and arrhythmia), esophagus perforation, and kinking and torsion of the NG tube were recorded on a pre-prepared checklist. The results of the mean comparison of heart rate (HR), mean arterial pressure (MAP), and O2-saturation (SPO2) were evaluated and compared in three stages between the three groups: The means before insertion, the means after insertion, and the mean differences before and after insertion of NG. The operator satisfaction rate was measured by a 10-item Likert scale. This scale of measuring satisfaction would offer 10 answer options such as extremely satisfied and extremely dissatisfied as the poles along with a neutral option at the midpoint.

Statistical analysis

Statistical analysis was performed using SPSS version 21 statistical software (SPSS Inc., Chicago, IL, USA). All numerical data were tested for normal distribution by Kolmogorov–Smirnov test. In cases of normal distribution and similar variances, ANOVA (F) parametric test were used. In cases with non-normal distribution, Kruskal-Wallis test were used. Categorical data were analyzed using Pearson Chi-square or Fisher's exact-test ($\chi 2$). All data are expressed as mean ± standard deviation (SD) and median (IQR: Interquartile range) for continuous data and numbers (percentage) for categorical data. P-value less than 0.05 were considered statistically significant.

RESULTS

The CONSORT flowchart of the study is shown in figure 1. The demographic data obtained from the study patients are shown in three groups in table 1. According to the results, 40 (53.3%) subjects were male, and 35 (46.6%) cases were in the 57-70 age range. There was no difference between three types of NG tube insertion in terms of demographic characteristics except for height.

(The mean duration and success rate of NG tube placement in intubated patients are reported in table 2. The mean duration of NG tube insertion in the group C, group B, and group S were 19.68±3.45, 18.43±2.71 and 19.73±5.30 seconds, respectively (p=0.459). The success rate for NG tube placement was 48.0%, 64.0% and 45.8%, in the group C, B, and S, respectively. The introduction of NG tube was not successful for 13 people in the group C on first attempt, and in 10 people (76.9%) the procedure was successful on second attempt. In the group B, 10 people did not experience successful NG tube insertion on first attempt, and for the second time, 7 people (77.8.0%) experienced successful NG tube insertion. In the group S, 13 patients did not experience successful NG tube insertion; for the second time, however, 7 (53.8%) cases experienced successful procedure. The results indicated that in the group B, the success rate of NG tube insertion was more than the other two groups on first attempt. There was no significant

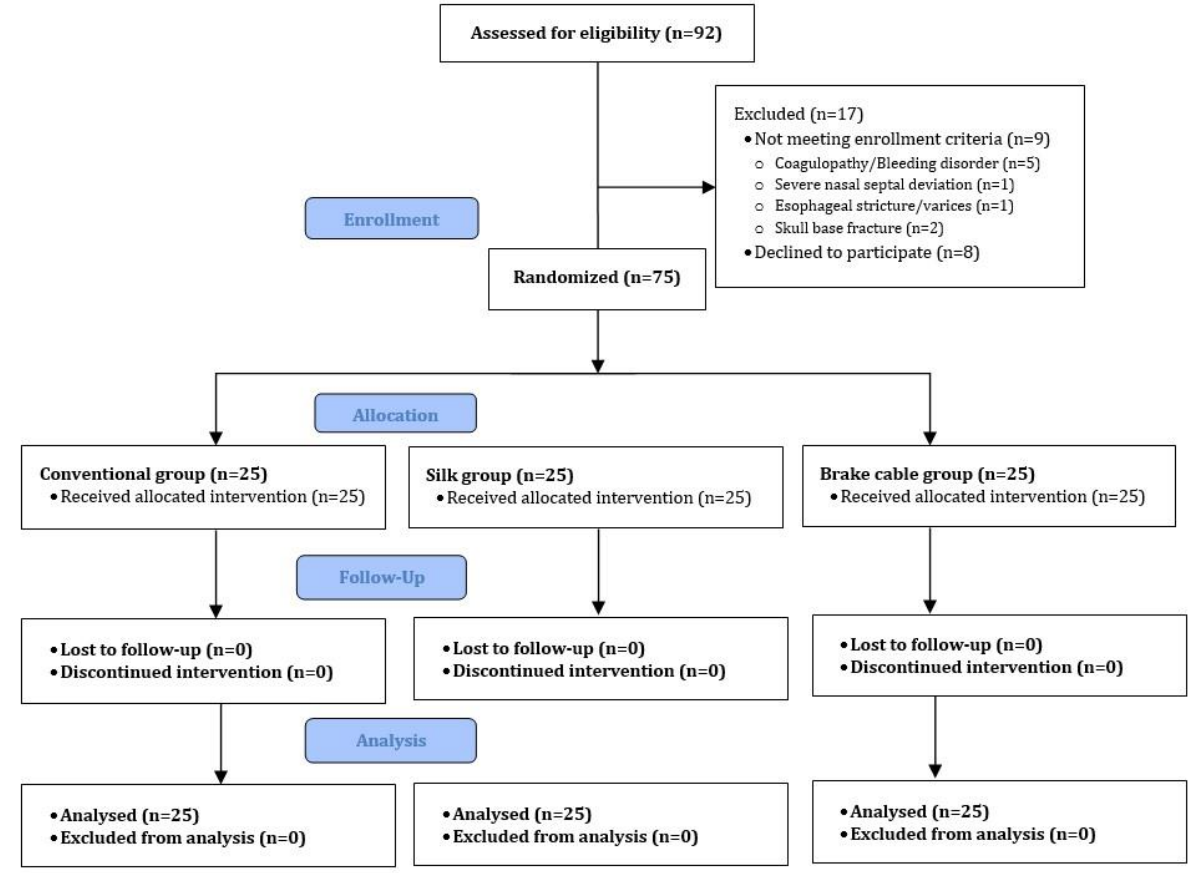

Figure 1: CONSORT flow diagram

difference, however, in the success rate in NG tube insertion on first and second attempts (p=0.376, p=0.353). As can be seen from table 3, only the mean SPO2 after NG insertion was depicted statistically significant between the three study groups (p=0.040).

Mean difference before and after NG tube insertion in all three variables was not significant. Therefore, the effect of NG on changes in these three variables was not evident. There was no significant difference in the incidence of complications, such as arrhythmia, mucosal bleeding, esophageal perforation and kinking and torsion of NG tube in all three groups (Table 4).

The median (IQR: Interquartile range) satisfaction level of residents and emergency medicine

Table 1: Demographic characteristics of the subjects

Characteristics		Group			P-value
		Conventional (n=25)	Brake cable (n=25)	Silk thread (n=25)	
Sex [n(%)]	**Male**	14 (35.0)	11 (27.5)	15 (37.5)	0.498[1]
	Female	11 (31.4)	14 (40.0)	10 (28.6)	
Age (year)	**18-31**	7 (43.8)	3 (18.8)	6 (37.5)	0.396[2]
	31-44	3 (25.0)	4 (33.3)	5 (41.7)	
	44-57	8 (47.1)	3 (17.6)	6 (35.3)	
	57-70	4 (20.0)	10 (50.0)	6 (30.0)	
	> 70	3 (30.0)	5 (50.0)	2 (20.0)	
Weight; mean±SD (Kg)		72.32±10.68	72.08±11.36	76.91±12.06	0.254[3]
Height; mean+SD (meter)		1.67±0.05	1.64±0.05	1.69±0.05	0.004[3*]
BMI; mean±SD		25.91±4.44	26.66±4.13	26.88±4.28	0.731[3]

1: Analysis using by Chi Square Test
2:Analysis using by Fisher Exact Test
3:Analysis using by One-Way Anova
*p-value<0.05

Table 2: The mean duration and success rate of NG tube placement in intubated patients

Variables	Group			P value
	Conventional (n=25)	Brake cable (n=25)	Silk thread (n=25)	
Duration time for NG tube insertion (seconds)	19.68±3.45	18.43±2.71	19.73±5.30	0.459[1]
Success rate in NG tube insertion for first time	12(48%)	16(64%)	11(45.8%)	0.376[2]
Success rate in NG tube insertion for second time	10(76.9%)	7(77.8%)	7(53.8%)	0.353[2]

1: Analysis Using by One Way Anova Test

2: Analysis using by Chi Square Test

Table 3: Average heart rate, blood pressure and arterial oxygen saturation rate in intubated patients in all three groups

Variables	Time point	Group			P-value
		Conventional (n=25)	Brake cable (n=25)	Silk thread (n=25)	
Heart rate	**Before**	89.24±12.01	93.60±60	91.32±14.81	0.628
	After	91.28±12.52	96.16±16	93.20±14.84	0.537
	Mean difference	2.04±1.95	2.56±1.87	1.88±1.57	0.556
Mean arterial pressure	**Before**	132.05±22.94	142.94±33.13	131.53±22.42	0.391
	After	133.27±23.56	145.09±32.81	132.62±22.31	0.291
	Mean difference	1.22±2.55	2.16±2.00	1.08±1.57	0.435
O2 saturation	**Before**	98.2±1.70	96.44±3.20	96.96±2.60	0.106
	After	98.2±1.82	96.16±3.40	96.64±2.68	0.040*
	Mean difference	0.0±0.54	-0.28±0.61	-0.32±0.69	0.188

Test Analysis Using by Kruskal-Wallis test

*p-value<0.05

Table 4: Incidence of complications in intubated patients in all three groups

Variables	Group				P value
	Conventional (n=25)	Brake cable (n=25)	Silk thread (n=25)	Total	
Arrhythmia	0(0.0%)	1(100.0%)	0(0.0%)	1(100.0%)	0.999
Mucosal bleeding	1(14.3%)	5(71.4%)	1(14.3%)	7(100.0%)	0.112
Esophageal perforation	0(0.0%)	1(100.0%)	0(0.0%)	1(100.0%)	0.999
Tilt and torsion of NG tube	9(56.2%)	2(12.5%)	5(31.2%)	16(100.0%)	0.068

Analysis using by Fisher Exact Test

specialists in the first (C), second (B) and third (S) group was 7 (2), 8 (1.5) and, 7 (3) respectively. Using the Kruskal Wallis test, the median satisfaction level did not show a significant difference among the three groups (p=0.118).

Discussion

A percentage of patients referred to the ED due to airway disorder or reduced consciousness may require the establishment of a definite respiratory tract by intubation inside the trachea (18). NG tube placement in these patients is recommended for stomach decompression, reduction of pressure on the lung, proper ventilation and prevention of aspiration of stomach contents (19). NG tube insertion in the unconscious and intubated patients who are under anesthetic drugs is sometimes very difficult and a complicated task. One of the most important reasons for this is the lack of cooperation and inability of the patients to perform swallowing (20). During placement of the nasogastric tube in the emergency room, we always encounter challenges. One of these challenges is the time. Factors contributing to the time include: the type of the tube, occlusion through the insertion pathway, method of tube insertion, personal experience, and so on. Another point is the safety of tubing techniques, especially in patients with suspected cord injury following cervical spine movement, in those with neck trauma or elderly people. Usually, these problematic conditions are not predictable before the NG tube is inserted. In recent studies, the average failure rate for successfully introducing NG tube at the first attempt in the conventional or blind (Group C) method was about 50-66% (21, 22). In this study, a comparison was made between three methods (first group by conventional technique, second group by brake cable, and third group by silk thread and stylet), which caused the least damage to the cervical vertebrae. The results of this study indicated that the subjects were homogeneous in age, sex, weight, height and BMI in all three groups. The mean duration of insertion of NG tube was not significant in all three groups, but the mean duration of NG tube insertion in the group B (Brake cable) was 18.43 ± 2.71 seconds and less than the other two groups. The NG tube insertion at the first

attempt in the group B (brake cable) was associated with the highest success rate. The mean rate, blood pressure, and oxygen saturation rate were not significantly different in all three groups, before and after NG tube placement. Complications such as arrhythmia, mucosal bleeding, esophageal perforation, and kinking and twisting of NG tube were not significantly different in all three groups. The highest average level of satisfaction of residents and emergency medicine specialists was demonstrated in group B (7.37). In recent years, many studies have been conducted on different techniques of NG tube insertion in terms of both time and side effects. Studies on the method of Highway man's hitch and angiography guide wire were published as case studies and, despite the positive results presented; it was not possible to conclude accurately. What makes the present study different from previous studies in this regard is, primarily, the methods used in tube insertion, all of which were performed with minimal cervical spine movement. On the other hand, the study has been designed as a randomized clinical trial in two academic centers by emergency medicine specialists or residents. In several studies, a drop in the cuff pressure of the tracheal tube reduced the pressure on the upper part of the esophagus, immediately before the NG tube insertion, thereby facilitating the entry of the NG tube (23, 24). Some authors believe that the pressure on the lateral neck on the same side and the slow movement of the arytenoid cartilage upwards, make the NG tube easier to pass through the hypopharynx (25). In a 2012 study Yung-fong Tsai and colleagues in Taiwan, 103 patients undergoing gastrointestinal surgery were randomly divided into S (stylet) and control (C) groups. In the S group, NG tube was knotted by a knot called the Highwayman's hitch or Draw hitch to the Rusch stylet and then entered through the nose. In this study, the success rate of NG tube placement was compared with each other in the first attempt, a statistically meaningful difference was noted (98% of group S compared to 52.5% of group C), but there was no significant difference in the complications and duration of insertion of the tubes (26). In another study by Mandal and colleagues on 216 patients, the patients were divided into four groups of 54 (control (C), urinary catheter guide wire(W), neck flexion, and neck compression on the same side (F), and using reverse Selick's maneuver (R). According to the results, the success rate of insertion of NG tube in the first attempt, was higher in all three methods other than conventional method (control group) (27). In another study by Samanta and colleagues in 2013, a NG tube was introduced in a new way. This study was performed on a 48-year-old patient who has been subjected to a myocardial infarction four days earlier. Due to decreased level of consciousness the patient had been intubated. In this patient, six times Residents have been attempting to embed a NG tube that was unsuccessful at each time due to kinking and twisting of the tube. In this study, using a 6 fr angiography catheter that was inserted into the NG tube 12fr, the NG tube was successfully inserted (28).

Limitations

This study has several limitations including a small sample size, and inability to completely blind the study because of different techniques and equipment. We only focused on operator satisfaction with one question, thus creating generalizability challenges. Also, the responses were largely self-reported which could have introduced subjectivity into the study.

CONCLUSIONS

According to the results of our study, Although the time required for initial preparation, as well as the mean time of NG tube insertion was not statistically significant, remarkable success rate of brake cable technique for NG tube insertion on first effort, beside trivial difference with regard to overall procedure duration in the emergency department, make the brake cable method a clinically important technique. Of note, the level of personnel satisfaction regarding the use of brake cable for NG tube insertion has been increased, and the observed complications such as mucous membrane bleeding seems very limited and mild, and not associated with the serious problem or risk for patients.

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AUTHORS' CONTRIBUTION

All the authors met the standards of authorship based on the recommendations of the International Committee of Medical Journal Editors.

CONFLICT OF INTEREST

None declared.

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