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Research Article

Comparison of ease of nasogastric intubation with or without application of Reverse Sellick's manoeuvre using a cold nasogastric tube in anaesthetized, intubated adult patients. A prospective, randomized, open label, parallel assignment study

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ABSTRACT

Background: Insertion of a nasogastric tube (NGT) in anaesthetized and endotracheally intubated patients can be technically difficult because of tube coiling, kinking, and impaction at the upper airway structures. Various techniques have been proposed to improve the success of NGT placement, including cooling the tube to increase its rigidity and the use of Reverse Sellick's manoeuvre to facilitate esophageal entry.

Aim: To determine the success rate of nasogastric intubation with a cold NGT with Reverse Sellick's manoeuvre by a doctor in training in adult human participants with endotracheal tube in-situ.

Methods: This prospective, randomized, open-label trial included 130 adult patients undergoing general anaesthesia who required NGT insertion. Participants were randomly assigned to either the cold NGT group (Group C, n=65) or the cold NGT with Reverse Sellick's manoeuvre group (Group RS, n=65). The primary outcome was successful placement on the first attempt. Secondary outcomes included second-attempt success, overall success rate confirmed by radiography, procedure duration, and insertion-related complications.

Results: The first-attempt success rate was higher in Group RS than in Group C (70.8% vs. 58.5%), although the difference was not statistically significant (p=0.140). Group RS demonstrated significantly greater second-attempt success (84.2% vs. 55.6%; p=0.040) and overall success rates (95.4% vs. 81.5%; p=0.010). The mean insertion time was significantly shorter in Group RS (36.6±17.1 seconds) compared with Group C (47.6±21.5 seconds; p=0.002). In addition, insertion-related complications, particularly kinking and overall adverse events, occurred less frequently in the Reverse Sellick's group.

Conclusion: From a clinical perspective, the combination of improved success rates, reduced procedure time, and lower complication rates makes this technique particularly useful in the operating room setting, where efficiency and patient safety are paramount. Fewer attempts and shorter insertion times may also reduce mucosal injury and bleeding.

Keywords: Nasogastric Tube, Reverse Sellick's Manoeuvre, Intubated Patients, General Anaesthesia.

INTRODUCTION

Nasogastric tube (NGT) insertion is a routine procedure in anaesthetic and critical care practice, which becomes considerably more difficult in anesthetized and endotracheally intubated individuals due to the loss of swallowing reflex, altered upper airway anatomy, presence of an inflated endotracheal tube cuff and relaxation of the pharyngeal musculature. [1,2]

Blind insertion of the NGT is often associated with a high rate of failure, because of frequently encountered resistance at pyriform sinuses and arytenoid cartilages.[3] The inherent flexibility of the NGT makes it prone to kinking, coiling, or even knotting, may necessitate repeated attempts, which increases the risk of mucosal trauma, bleeding, and prolongation of the procedure.

Several techniques have been proposed to improve the ease and success of NGT insertion, like neck flexion with lateral pressure, use of Magill forceps, guidewire-assisted placement, and endotracheal tube-guided methods. [4,5,6,7,8,9,] Increasing the stiffness of the tube, such as cooling or freezing the NGT, have also been shown to facilitate smoother passage by reducing its tendency to coil.[10]

Reverse Sellick's manoeuvre [11] involves anterior displacement of the cricoid cartilage, which in turn elevates the laryngeal structures and widen the esophageal inlet and help the NGT bypass sites of impaction in the hypopharynx and allow easier advancement into the esophagus.

Despite the availability of multiple approaches, no single technique has been universally accepted as the standard method for NGT insertion in anesthetized patients. Furthermore, most studies have assessed these techniques individually, and there is limited evidence regarding the combined use of methods such as cold NGT and Reverse Sellick's manoeuvre, particularly when performed by trainee clinicians.

In this context, the present study was designed to assess whether the addition of Reverse Sellick's manoeuvre improves the success rate of nasogastric intubation using a cold NGT in anesthetized, intubated adult patients.

MATERIAL AND METHODS

This study was designed as a prospective, randomized, open-label, parallel-group clinical trial and was carried out in the operation theatres of a tertiary care teaching hospital over a period of one year, from November 2023 to November 2024. Clearance was obtained from the Institutional Ethics Committee (Roc.No.AS/11/IEC/SVIMS/2017 dated 2-11-2023) and the trial was registered with the Clinical Trials Registry of India (CTRI/2024/06/069364) prior to commencement of the study written informed consent was obtained from all participants or their legally authorized representatives before inclusion in the study, and confidentiality was maintained throughout. Participants were informed of their right to withdraw from the study at any point without affecting their ongoing treatment.

Adult patients aged 18 years and above, belonging to American Society of Anaesthesiologists (ASA) physical status[12] I to IV, who required nasogastric tube (NGT) insertion during elective surgery under general anaesthesia with endotracheal intubation, or intubated patients in the intensive care unit requiring NGT placement as part of routine care, were considered eligible for inclusion. Patients were excluded if they had any contraindications to nasal insertion such as nasal obstruction or mass, history of corrosive ingestion, bleeding disorders, recent radiotherapy to the head and neck region, craniofacial abnormalities, significant deviated nasal septum, esophageal conditions like strictures or varices, suspected base of skull fracture, or if they were pregnant or lactating. Patients who did not require radiographic confirmation as part of routine management or those unwilling to participate were also excluded.

All patients received a standardized anesthetic technique. After establishing intravenous access, general anesthesia was induced, and endotracheal intubation was performed using a Macintosh laryngoscope with a high-volume, low-pressure cuffed endotracheal tube. Prior to NGT insertion, oxymetazoline 0.05% drops were instilled into both nostrils, and the nostril offering least resistance was selected. The appropriate length of the NGT was estimated by measuring the distance from the nostril to the tragus and then to the xiphoid process. A cooled 16 French NGT was adequately lubricated using 2% lignocaine jelly before insertion.

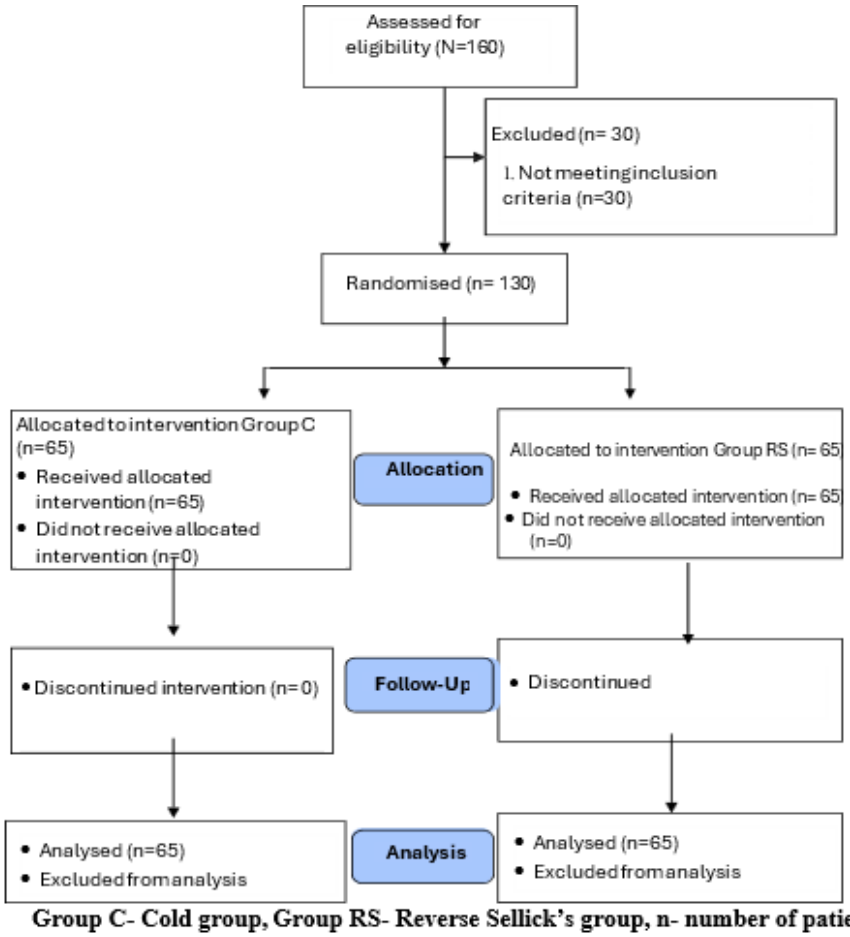
In the control group (Group C), NGT insertion was performed using a tube that had been cooled by placing it in a freezer for 2 hours prior to the procedure. In the intervention group (Group RS), a similarly prepared cold NGT was inserted with the addition of Reverse Sellick's manoeuvre, during advancement of the tube. In both groups, the patient's head was maintained in a neutral position throughout the procedure. If resistance was encountered during insertion, the tube was slightly withdrawn and reattempted. A maximum of two attempts were permitted,

beyond which the procedure was considered unsuccessful.

The primary outcome of the study was to assess the rate of first attempt success rate and overall success rate. First attempt success rate was assessed clinically by using the whoosh test by auscultating over the epigastrium during the air insufflation. Overall success was assessed radiologically by visualization of tube tip below the level of the 12th thoracic vertebra. Secondary outcomes included, time taken for insertion measured with a stopwatch, and the occurrence of complications such as bleeding, kinking, knotting, or malposition. All observations were documented in a predesigned data collection form, verified for accuracy, and entered into a secure database.

A total of 130 patients meeting the eligibility criteria were enrolled in the study. They were randomly assigned into two groups in a 1:1 ratio using a computer-generated randomization sequence. Allocation concealment was achieved through the use of sequentially numbered, opaque, sealed envelopes, which were prepared by an independent investigator not involved in data collection and analysis. Due to the nature of the procedure, blinding of the operator was not feasible, and hence the study was conducted in an open-label manner.

Statistical Analysis: All collected data was double checked to exclude any clerical error. Data collected was evaluated for normality using the Shapiro-wilk test. Continuous variable data was analysed using unpaired students t test and expressed as mean±SD. Categorical variables were expressed as frequencies and percentages and analyzed using the chi-square test or Fisher's exact test as appropriate. A p-value of less than 0.05 was considered statistically significant. Statistical analysis was carried out using Statistical Package for the Social Sciences (SPSS) version 23.



Group C- Cold group, Group RS- Reverse Sellick's group, n- number of patients

Figure1: Consolidated Standards of Reporting Trail (CONSORT) Flow Diagram

RESULTS

A total of 130 patients were enrolled in the study and were randomly allocated into two groups, with 65 patients in each group. All participants completed the study and their data were included in the final analysis.

The demographic characteristics, including age, gender distribution, and ASA physical status, were comparable between the two groups, with no statistically significant difference observed.

Table1: Comparison of demographic data between the study groups

Parameters		Group C (n=65)	Group RS (n=65)	P value
Gender	Male n (%)	24(36.9)	16(24.6)	0.120
	Female n (%)	41(63.1)	49(75.4)	
Age in year (mean±SD)		50.4±14.6	50.4±11.5	0.980
Weight in kg (mean±SD)		57.9±13.6	54.2±12.1	0.100
Height in cms (mean±SD)		156.4±8.1	155.4±8.9	0.500
Body mass index in kg/m^2(mean±SD)		23.70±5.6	22.47±5.0	0.190
ASA-PS grading	I n(%)	17(26.2)	21(32.3)	0.660
	II n(%)	38(58.5)	33(50.8)	
	III n(%)	10(15.4)	11(16.9)	

The primary outcome, namely the first-attempt success rate of nasogastric tube (NGT) insertion, was higher in Group RS compared to Group C. First-attempt success was achieved in 70.8% of patients in Group RS and 58.5% in Group C, but this difference was statistically not significant (p value 0.140).

Table 2: Comparison of primary objectives between the two groups

	GROUP C (%)	GROUP RS (%)	P VALUE
First Attempt Succes	58.5%	70.8%	0.140
Overall Success Rate	81.5%	95.4%	**0.010**

The overall success rate of NGT insertion, confirmed radiographically, was higher in Group RS than in Group C of 84.2% and 55.6% respectively, which was statistically significant **(p=0.010)**.

Table3: Comparison of secondary objectives between the two groups

	Group C (n=65)	Group RS (n=65)	P value
Duration of procedure [Mean duration ±SD (seconds)]	47.6±21.5	36.6±17.1	**0.002***
Bleeding (%)	20%	10.8%	0.140
Knotting (%)	3.1%	0%	0.150
Kinking (%)	38.5%	16.9%	**0.006**
Any Complications (%)	38.5%	16.9%	**0.006**

The mean time required for successful NGT insertion was significantly shorter in Group RS compared to Group C (36.6±17.1 seconds vs 47.6 ± 21.5 seconds) which was also statistically significant **(p=0.002),** indicating that the use of reverse sellick's manoeuvre facilitated faster insertion.

With regard to complications, the incidence of adverse events such as nasal bleeding, kinking, knotting, and malposition was lower in Group RS compared to Group C, which was statistically significant with **(p = 0.006).**

No major complications were observed in either group during the study period.

DISCUSSION

Insertion of a nasogastric tube (NGT) in anesthetized and intubated patients is often technically challenging due to loss of airway reflexes and altered upper airway anatomy under general anaesthesia. The tube

commonly encounters resistance at the level of the piriform sinuses or arytenoid cartilages, leading to repeated attempts, procedural delays, and increased risk of trauma. Various techniques, including external manoeuvres and modification of tube characteristics, have been proposed to improve success rates.

In the present study, we evaluated the effectiveness of combining Reverse Sellick's manoeuvre with a cold NGT. The first-attempt success rate was 70.8% in the RS group and 58.5% in the cold NGT group. While clinically relevant, this difference was not statistically significant (p = 0.140). Similar studies reported varying first-attempt success rates: Singh L.C. et al.[13] (64%), Mandal M. et al.[14](93%), Mandal M.C. et al.[15] (86%), Siddhartha B.V. et al.[1](77%), and Chakraborty D. et al.[16] (74%), with most studies reporting rates between 70% and 80%. Mandal M. et al.[14] and Mandal M.C. et al.[15] observed higher success rates, possibly due to differences in technique and operator experience.

A notable finding in our study was the significantly higher second-attempt success rate in the RS group (84.2%) compared to the cold NGT group (55.6%) (p = 0.040). This suggests that Reverse Sellick's manoeuvre plays a crucial role in facilitating tube passage when initial attempts fail. Similar trends have been reported in earlier studies, although with varying success rates.

The overall success rate was higher in the RS group (95.4%) than in the cold NGT group (81.5%). This aligns with findings from Siddhartha B.V. et al.[1](92.5%), Mandal M.C.etal.[15](96%),Mandal M.etal.[14](84.6%),and Singh L.C.etal.[13](90%). The highest reported overall success rate(100%)was in Chakraborty D.etal.[16] (2022) likely due to all insertions being performed by a single anaesthesiologist, eliminating inter-observer variability.

Procedure time was significantly shorter in the RS group (36.6 ± 17.1 seconds) compared to the cold NGT group (47.6 ± 21.5 seconds). The relatively wide variation in time observed in our study may be explained by the involvement of novice trainees and the use of suboptimal NGTs, many of which had pre-existing bends or larger distal apertures, increasing the likelihood of coiling and kinking. Our procedure time was shorter compared to Singh L.C. et al.[13] (60±23z seconds), and longer with respect to Siddhartha B.V.etal.[1] (13.5±2.57seconds). Other studies reported intermediate times: Mandal M.etal.[14] (31.5±9.5seconds), Mandal M.C. et al.[15] (22.39±5.05 seconds), and Chakraborty D. et al.[16] (20.1±3.8 seconds). Shorter durations, possibly reflecting greater operator expertise and better equipment quality.

With regard to complications, we had considered only kinking as one of the complications, whereas some studies have considered kinking and coiling as separate entities and have recorded them separately. There was a statistical difference in occurrence of kinking between the study groups having p value0.006, with 38.5% (25 out of 65) of patients in Group C experiencing kinking, comparedto16.9%(11outof65) in the RS group. Mandal M. et al.[14] reported the lowest coiling complication rate at 7.9% in the RS group. Our findings align with those of Siddhartha B.V. et al.[1] and Chakraborty D. et al.[16] (17.5%- 19.6%), while Mandal M.C. et al.[15] reported a higher rate of 30.61%.

The improved outcomes observed with Reverse Sellick's manoeuvre can be explained by its effect on airway anatomy. Anterior displacement of the cricoid cartilage helps align the hypopharynx with the esophageal inlet, thereby reducing resistance and facilitating smoother advancement of the tube. Additionally, cooling the NGT increases its stiffness, reducing the likelihood of coiling and aiding successful placement.

Strengths and Limitations of the Study

This study has several strengths, including its randomized design and the use of a standardized protocol, which enhance the reliability of the findings. However, certain limitations should be acknowledged. Being a single-center study, the results may not be widely generalizable. The inability to blind the operator could have introduced bias. Additionally, although radiographic confirmation was used to verify final placement, initial assessment relied partly on clinical methods, which may be less accurate.

CONCLUSION

From a clinical perspective, the combination of improved success rates, reduced procedure time, and lower complication rates makes this technique particularly useful in the operating room setting, where efficiency and patient safety are paramount. Fewer attempts and shorter insertion times may also reduce mucosal injury and bleeding.

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