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Nasogastric tube insertion in anesthetized, intubated adult patients: A comparison between combined lateral position with throat pack *in situ* and lateral position alone

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ABSTRACT

Background: Although the proper placement of nasogastric tube (NGT) is usually a simple procedure, it may be challenging one in case of its placement in anesthetized intubated patients. At times, it may be tiresome even for the expert anesthesiologist. Different techniques have varying success rates. Many novel techniques are entering the avenue to be tested. Combinations of different techniques are showing improved success rates over individual techniques. **Aims and Objectives:** This interventional study primarily aimed at comparing the success rates of proper placement of NGT in the first attempt between the "combined lateral position with throat pack *in situ*" and "lateral position alone." **Materials and Methods:** The present study was performed on 180 adults (≥18 years), posted for abdominal surgeries requiring NGT insertion. Patients received NGT placement using the "combined lateral position with throat pack *in situ*" technique (Group A, n = 80) or lateral position alone (Group B, n = 80). The proportion of patients in whom correct placement of NGT was possible in the first attempt using either of the techniques (primary outcome), the procedure time for successful placement of NGT, and the incidence of adverse events were compared between the groups. **Results:** Correct placement of NGT in the first attempt was possible in considerably higher proportions of patients using the combined technique over lateral position alone (87.5% vs. 68.75%, P = 0.007). The procedure time was comparable in both groups (23.7 ± 6.6 vs. 25.2 ± 5.2, combined vs. lateral position alone, P = 0.093). Coiling was found to be considerably reduced in the combined method compared with the "lateral position alone" (8.75% vs. 17.5%, *P* = 0.03). **Conclusion:** Combined lateral position with throat pack *in situ* technique can be a better alternative to "lateral position alone" for NGT insertion in anesthetized, intubated adult patients.

Key words: Anesthetized; Intubation; Lateral position; Nasogastric tube; Reverse Sellick's maneuver; Throat pack

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INTRODUCTION

The placement of nasogastric tube (NGT) is relatively a simple procedure. However, repeated failure in proper placement of NGT can occur in anesthetized and intubated patients owing to the absence of coordinated swallowing effort, which helps the progress of the NGT.[1] The pyriform sinus and arytenoid cartilage are the most common sites for impaction.[2] Unconscious patients often exhibit glossoptosis owing to decreased tone of the tongue. The backward displaced tongue blocks the pharyngeal passage.[3] The lateral decubitus position of the interspace between the posterior

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lateral pharyngeal wall and the tongue increases, which can facilitate NGT insertion.[3]

A successful NGT insertion is possible with the following prerequisites, first, by avoiding the NGT into the common impaction sites and keeping the NGT close to the posterior lateral pharyngeal wall into the more widely opened esophagus and second, by enhancing the stiffness of the tube[4] or using a stylet[5] to prevent kinking. Researchers have performed much work to improve the success rate of NGT placement. Some researchers have utilized different instrumental help such as the opening of the upper esophagus by inflating air through a face piece[6] while others relied on different maneuvers to facilitate the NGT insertion such as the reverse Sellick's maneuver,[7,8] use of gloved fingers to manipulate the NGT after impaction,[9,10] neck flexion with lateral pressure,[7,11] and head rotation.[12-14]

NGT placement in the lateral position is not new. As early as in the year 2004, Bong et al.,[15] evaluated NGT insertion in a lateral position over a neutral position and found the former to be more effective (80% vs. 40%, respectively). In the recent past, Zhao et al.[3] found the success rate of the lateral decubitus position to be 89% over the neutral position (66%). Thus, variation of success rate has been observed in the literature. Hence, there is a scope for further evaluation.

Combinations of different methods are being evaluated with the hope that it would increase the success rate of NGT placement further.[16] The lateral decubitus position has not been evaluated as a part of any combination method. In recent years, a prior application of a throat pack has been found to increase the success rate of NGT placement instead of the common belief of hindrance.[17] Hence, the present study will be designed to determine the success rate of correct NGT placement using a combined method, that is, NGT placement in lateral position with throat pack *in situ* in comparison with NGT placement in lateral position alone.

Aims and objectives

The aims and objectives of the present study were to determine the proportion of patients in whom successful NGT was possible in the first attempt using either the "combined lateral position with throat pack *in situ*" or "lateral position alone" and subsequently to compare the said proportions to determine any difference between the success rates (primary outcome). Other outcome measures were to compare the procedure time for successful placement of NGT within the first attempt and the incidence of adverse events, if any, between the two groups.

MATERIALS AND METHODS

This was an experimental, single-blind study. In this interventional study, the success rates of two techniques for NGT insertion were compared. The study protocol was placed before the Institute's Ethics Committee (IEC). After approval from IEC (IPGME&R/IEC/2023/245, dated April 18, 2023) and permission from West Bengal University of Health Sciences, the study protocol was registered prospectively with the Clinical Trial Registry of India (CTRI) with trial registration number: CTRI/2023/05/052290 dated May 04, 2023. Thereafter, the recruitment was started in a prospective manner and the study spanned over 12 months approximately (June 2023–May 2024).

Sample size

The previous study[15] reports that lateral decubitus can achieve an 80% success rate of NGT placement in the first attempt. We assumed that the combined technique of "lateral position with throat pack *in situ*" would achieve a clinically important difference of at least 15% (effect size) in the success rate of proper placement of NGT compared to "lateral position alone". Setting the power of study at 80% and allowing 5% alpha error, the sample size was calculated to be 72 for each group. The sample size calculation was done based on the methods as described in the literature.[18] For both groups, about 144 patients were taken following 1:1 group allocation. Apprehending the possibility of dropout (around 10%), the sample size was hiked to the extent of 160.

Patients aged 18 years and above, of either sex, conforming to the American Society of Anesthesiologists (ASA) physical status I or II, posted for abdominal surgeries requiring NGT insertion, in the general surgery operating room were selected based on inclusion and exclusion criteria. Patients with anatomical or structural abnormalities such as gross deviated nasal septum, abnormalities involving lip and palate or with oral, nasal, pharyngeal, or esophageal masses were excluded from the study. Patients with significant injuries involving the head and neck or those with thrombocytopenia or any coagulopathies were excluded.

Pre-anesthetic evaluation was done on the day before surgery. Standard baseline investigations were considered as per Institutional protocol. A nasal patency test was done preoperatively to find the more patent nostril and to rule out any gross nasal deformities such as a spur or significant deviated nasal septum. The patients and their legal guardians were briefed about the aim of the study, a description of the NGT insertion procedure, and probable adverse events in their mother language to obtain informed

consent. They were given the option to opt out from the study at any time. The patients who had given written, informed consent were included in the study.

The group allocation was performed after induction of anesthesia and intubation. It was executed every time by opening the sequentially numbered sealed opaque envelopes. There were 160 sealed envelopes each containing one piece of paper marked either "A" or "B" (80 papers marked as "A" and another 80 papers marked as "B"). After the tracheal intubation, an envelope was randomly selected and opened. The alphabet displayed ("A" or "B") corresponded to the group allocation of the patient.

Group A (n=80): Patients undergoing NGT insertion using the technique of combined lateral position with throat pack *in situ*.

Group B (n=80): Patients undergoing NGT insertion using lateral position alone technique.

On receiving the patients in the operating room, an 18-G cannula was used to establish intravenous access for every patient. Monitoring of patients within the operating room was done continuously using electrocardiogram leads, blood pressure cuff, end-tidal carbon dioxide monitor, and oxygen saturation probe. Before induction of anesthesia, the optimum nostril for NGT insertion was chosen based on the better fogging procedure on a metal tongue depressor during exhalation. Pre-medication was given, as appropriate for each patient, using fentanyl (2 mcg/kg), glycopyrrolate (4 mcg/kg), and ondansetron (0.1 mg/kg). Propofol (2 mg/kg) or thiopentone (3–4 mg/kg) was the induction agent depending on the patient's clinical conditions. Depolarizing muscle relaxant, succinylcholine (2 mg/kg) was used for intubation by laryngoscope. The appropriate size of the endotracheal tube was selected according to the patient's demography. Muscle relaxation was maintained with atracurium (0.1 mg/kg).

In both groups, before NGT insertion, the cuff of the endotracheal tube was deflated and the tip of the NGT was lubricated with 2% lidocaine jelly. The length of NGT insertion was determined by measuring the combined distance from the ipsilateral nostril to tragus and from tragus to the xiphoid process.[19] Once the NGT was successfully placed, the cuff of the endotracheal tube was re-inflated.

In Group "A" (the technique of combined lateral position with throat pack *in situ*): After intubation with an appropriate size endotracheal tube, the patient's head was kept in the neutral position. The pharyngeal pack or the "throat pack" was placed with the help of Magill's forceps or gloved finger. Patients were placed in the lateral decubitus position, ensuring that the patient's head, neck, and trunk were at the same level. The selected nostril was facing upward. The NGT was gently inserted approximately 10–15 cm into the nostril. A small amount of resistance if felt, the body was then further tilted to the prone decubitus position by 20–30°. In this position, the tongue moved laterally and forward due to gravity and the interspace was exposed between the tongue and posterior lateral pharyngeal wall, which facilitated the NGT placement. Then, NGT was inserted through the patient's nostril by the dominant hand of the anesthesiologist.

In Group "B" (lateral position alone): Patients were placed in the lateral decubitus position, ensuring that the patient's head, neck, and trunk were at the same level. The selected nostril was facing upward. The NGT was gently inserted approximately 10–15 cm into the nostril. A small amount of resistance if felt, the body was further tilted to prone decubitus position by 20–30°. In this position, the tongue moved laterally and forward due to gravity, and the interspace was exposed between the tongue and the posterior lateral pharyngeal wall, which facilitated the NGT placement. Then, NGT was inserted through the patient's nostril by the dominant hand of the anesthesiologist.

In both groups, the correct placement of NGT was verified by pushing 10 mL of air rapidly through the tube, and auscultation was done for a "whoosh" sound over the epigastrium.[19]

It was not possible to conceal the specific technique of NGT placement to the anesthesiologist who was performing the procedure. One senior anesthesiologist did all the procedures to minimize interpersonal variability of efficiency. Only the anesthetized patient was unaware of the particular method employed for the NGT placement. One dedicated anesthesiologist acted as an observer and data-keeper who cannot be blinded as the procedure was obvious. Thus, the study was a single-blind design.

The proportions of patients having successful insertion of NGT using either of these methods were compared. The patients receiving NGT placement with lateral position alone acted as comparators for the study group, combined technique of "lateral position with throat pack *in situ*." The case was considered "successful" if the NGT was found to be correctly inserted in the first attempt. The proportion of patients having successful placement of NGT in a single attempt was considered to be a successful insertion (primary outcome). Secondary outcome measures were the procedure time and any adverse events occurring during the procedure. The procedure time for the successful placement of NGT was recorded from the moment of

insertion of NGT into the nostril till the confirmation of its correct position by auscultation method ("whoosh test").[19]

Statistical analysis

Data were decoded, tabulated, processed, enlisted, and analyzed with suitable statistical methods after the completion of the study. For statistical analysis, data were entered into a Microsoft Excel spreadsheet, and then, it was analyzed by the Statistical Package for the Social Sciences (SPSS) (version 27; SPSS Inc., Chicago, IL, USA) and JASP version 0.17.2.1. All continuous data (numerical variables) were presented in the tables as mean with standard deviation and analyzed using a t-test. For categorical variables, the data were presented as the number of patients and proportions and analyzed using the Chi-square test or Fisher's exact test, as appropriate. Once a t-value was determined, the P-value was found using a table of values from Student's t-distribution. A P≤0.05 was taken to be of statistical significance. If the calculated P-value was below this threshold value, then the null hypothesis was rejected in favor of the alternative hypothesis.

RESULTS

From the above data, it is inferred that the two groups are comparable in terms of demographic and clinical parameters (Table 1).

Considerably higher proportions of patients had successful insertion of NGT in the first attempt when "combined lateral position with throat pack *in situ*" was applied. The combined technique achieved about an 18% success rate over lateral position alone (Table 2). Although apparently a shorter procedure time was noted with combined technique over lateral position alone, it was comparable when analyzed (Table 2).

Considerably higher adverse events were observed with the use of lateral position alone over the combined method. Among the adverse events, coiling was found in higher proportions of patients in both groups (Table 3).

Table 1: Demographic parameters

Parameters	Group A (n=80)	Group B (n=80)	P-value
Age (years)*	46.9±15.0	49.0±15.0	0.375
Gender (M/F)	26/54	34/46	0.253
ASA (I/II/III)	31/40/9	35/43/2	0.090
MMP Grade 1/2/3	31/49/0	37/40/3	0.109

Group A: Combined lateral position with throat pack *in situ*, Group B: Lateral position alone, ASA=American Society of Anesthesiologists; MMP=Modified Mallampati. Data are presented as the number of patients and are analyzed with Chi-square test except marked (*) which is presented as mean±standard deviation where Student's t-test has been applied for P-value

Mean arterial pressures in both groups were found to be comparable at every time point of observation. Heart rates in both groups were found to be comparable at every time point of observation (Table 4).

DISCUSSION

The present study finds that the successful placement of NGT using combined lateral position with throat pack *in situ* has approximately 18% more success rate than placement of NGT using lateral position alone. The difference in the incidence between the two groups is statistically significant (P=0.007). This is in line with observations of Bong et al.,[15] who found a higher success rate of NGT placement in lateral position over neutral position (80% vs. 40%, respectively). Similarly, Zhao et al.,[3] also found a higher success rate of NGT placement in lateral decubitus position over neutral position (89% vs. 66%, respectively).

Table 2: Procedural outcome

Parameters	Group A (n=80)	Group B (n=80)	P-value
Successful insertion in the first attempt	70 (87.5%)	55 (68.75%)	0.007*
Failure	10 (12.5%)	25 (31.25%)	
Procedure time #	23.7±6.6	25.2±5.2	0.093

Group A: Combined lateral position with throat pack *in situ*, Group B: Lateral position alone. (*): Statistically Significant, Data are presented as the number of patients (proportion) and are analyzed using Chi-square test except marked [#], which is presented as mean±SD and analyzed using Student's t-test

Table 3: Adverse events

Parameters	Group A (n=80) (%)	Group B (n=80) (%)	P-value
Kinking	2 (2.5)	6 (7.5)	0.03*
Coiling	7 (8.75)	14 (17.5)	
Bleeding	1 (1.25)	5 (6.25)	

Group A: Combined lateral position with throat pack *in situ*; Group B: Lateral position alone; (*): Statistically Significant. Data are presented as the number of patients (proportion) and are analyzed using the Chi-square test

Table 4: Mean arterial pressures and heart rate at various time points

Parameters	Group A (n=80)	Group B (n=80)	P-value
Mean arterial pressure			
Baseline	79.6±9.4	80.9±11.0	0.45
Pre-insertion	79.6±9.4	80.9±11.0	0.45
Post-insertion	82.8±9.2	85.3±10.7	0.11
Heart rate			
Baseline	78.4±15.1	80.0±16.3	0.55
Pre-insertion	78.5±15.0	80.2±16.3	0.49
Post-insertion	84.5±15.9	87.4±15.3	0.24

Continuous data, presented as mean±standard deviation. Analyzed using Student's "t"-test. Group A: Combined lateral position with throat pack *in situ*; Group B: Lateral position alone; (*): Statistically Significant

Previous studies[3,15] depict that using lateral position alone in adult intubated patients can achieve a success rate for NGT insertion of around 80–89% in the first attempt. In the present study, a lesser success rate (68.75%) was observed. Smaller sample size leading to heterogeneity, different materials of nasogastric tube leading to variation in the flexibility or rigidity, and the anatomical variation in the sample population – all can be attributed to this deviation in the magnitude of the benefit achieved. However, the trend is the same.

Contrary to the common belief that throat pack may cause hindrance to NGT placement, the present study observes the beneficial role of throat pack in this regard. That the throat pack does not put a hindrance to NGT insertion and rather can facilitate the said procedure by reducing the incidence of coiling has already been observed by other researchers in the recent past.[20,21] This novel concept of the application of the throat pack in facilitating NGT insertion – a myth breaker – was first mentioned in the year 2008 by Walker [22] who observed that prior application of throat pack has actually facilitated the later placement of NGT using blind insertion method. However, Walker only described the method and mentioned the probable reason without any clinical investigation. Subsequently, some studies[17,20,21] have evaluated and confirmed the beneficial role of prior throat packs for increasing the success rate of NGT placement.

Combinations of different methods are being evaluated with the hope that it would increase the success rate of NGT placement further.[16] The lateral decubitus position has not been evaluated as a part of any combination method. Hence, the present study was designed to evaluate the combined effect of lateral position with throat pack *in situ* over lateral position alone.

In a study of upper airway morphology using magnetic resonance imaging analysis, Litman et al.,[23] demonstrated that placement of a sedated, spontaneously breathing child in the lateral position enlarges the upper airway. Isono et al.,[24] studied this phenomenon of change in airway dimension with altered body posture in paralyzed adult patients. They explained that gravity causes the narrowing of the upper airway by surrounding anatomical structures in the supine position compared with the lateral position. The oropharynx is the region between the hard palate and epiglottis, which is divided into retropalatal and retroglossal regions. The oropharyngeal airway and specifically the retropalatal and retro-glossal regions of the oropharynx seem to be the most affected part of the upper airway when evaluated with respect to head rotation, head extension, jaw protrusion, and altered body position.[25-27] The cross-sectional area and volume of the oropharynx increase as a response to head rotation, head extension, lateral recumbent position, and jaw protrusion.[25-27] In the lateral recumbent position, the lateral dimension of the retropalatal region decreases,[25] which is beneficial but the cross-sectional area in the retroglossal region increases,[25] which is therefore problematic, as it increases the chance of coiling of NGT. Walker,[22] hypothesized that prior application of a throat pack can obliterate the oropharyngeal space thereby facilitating the passage of NGT toward its normal path.

The present researchers are of the notion that the throat pack obliterates the spacious oropharynx. Hence, one less resistant path, that is, the oropharynx is obliterated, where NGT often deviates and coils. Therefore, the throat pack reduces the tendency of coiling and facilitates NGT to its normal intended pathway.

In the present study, the adverse events (bleeding, coiling, and kinking) occurred much less in the combined "lateral position with throat pack *in situ*" group compared with "lateral position alone" group. The *P*-value (0.03) indicates that adverse events in combined methods are considerably less than that of lateral position alone, probably due to the obliteration of the oral cavity with the pack. In other words, the present researchers wish to opine that, the application of a prior throat pack not only facilitates NGT to its intended path but also reduces the chances of adverse events to occur such as kinking, coiling, and bleeding during the procedure.

When compared, the mean procedure time (in seconds) between "combined lateral position with throat pack *in situ*" and "lateral position alone" is comparable. Even though the mean procedure time is not statistically significant, the present researchers like to infer that ease of insertion is satisfactory in the former technique. Furthermore, there has been no significant difference noted in hemodynamic variations in both groups.

Limitations of the present study

Confirmation of the correct placement of NGT was done by auscultation for a "whoosh" sound over the epigastrium.[19] Transmitted sound over the epigastrium can still be heard if the NGT is in the trachea, esophagus, duodenum, or proximal jejunum.[19] X-ray is the gold-standard test and ultrasonography is non-invasive bedside test that is devoid of radiation exposure.[28] However, these could not be used owing to lack of resources. Confirmation using pH paper could not be done due to local unavailability at the time of this study. Life-threatening complications such as esophageal perforation, piriform fossa penetration, and pneumothorax have not occurred, but the present researchers do not rule out the possibility of such adverse

scenarios. The mean procedure time did not include the time taken to insert the throat pack. The application of throat pack and associated complications such as sore throat were also not evaluated. Hence, there is further scope of study addressing the aforementioned shortcomings.

CONCLUSION

The "combined lateral position with throat pack *in situ*" can be a better alternative to "lateral position alone" for NGT insertion in anesthetized, intubated adult patients.

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Authors Contributions:
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