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Nasogastric tube insertion in anesthetized, intubated adult patients: A comparison between conventional blind insertion technique and "throat pack *in situ*" technique

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ABSTRACT

Background: Correct placement of nasogastric tube (NGT) placement often becomes difficult in anesthetized, intubated adult patients due to lack of cooperation from patient and the propensity of the tube to travel the same course of path. Preexisting throat pack is supposed to resist the normal passage of the NGT as per common belief. Only one study has evaluated this in pediatric population and the result is encouraging. **Aims and Objectives:** Hence, the present study has been carried out in adult population to compare the success rate of correct placement of NGT in anesthetized intubated adult patients with the pharyngeal (throat) pack in its position in comparison with no throat pack. This is to examine the effect of preexisting throat pack whether it assists or resists the normal passage of the NGT. **Materials and Methods:** One hundred and eighty patients were recruited for this interventional and single-blind study. After induction of anesthesia and intubation, the patients were randomized to receive NGT insertion following either blind insertion of the NGT without a pharyngeal pack (group A, n = 90) or receive the NGT placement in the same technique but after placement of a pharyngeal pack. The success rate of correct placement of NGT in the first attempt (primary outcome), the procedure time, and adverse events was recorded. **Results:** Successful insertion of NGT in first attempt was considerably higher in throat pack *in situ* group compared to blind insertion without a throat pack 81 (90%) versus 63 (70%), respectively (P = 0.001). The procedure time for successful placement of NGT was found comparable between the two groups. Significant decrease in coiling is seen in "throat pack *in situ*" group compared with blind insertion technique (P = 0.003). **Conclusion:** In view of considerable higher success rate and reduced adverse events, it can be concluded that the pre-existing appropriately placed throat pack can facilitate the placement of NGT instead of putting any hindrance.

Key words: Anesthesia; Blind insertion; Intubation; Nasogastric tube; Pharyngeal pack; Throat pack; Sore throat

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INTRODUCTION

In many abdominal and thoracic surgeries, insertion of nasogastric tube (NGT) is an essential procedure. Anesthesiologist often has to perform the procedure as a part of their care providing. In comparison with conscious and cooperative patient, insertion of NGT in anesthetized, paralysed, and intubated patient appears more difficult due to absence of propulsive movement of swallowing in the latter. Blind insertion of NGT is often a difficult and challenging job with a failure rate as high as 50% in the first pass.[1] According to some researchers, the most common

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sites for impaction of NGT are in the pyriform sinus and arytenoid cartilages.[2]

Most of the difficulties in NGT insertion are due to anatomic reasons. Esophagus remains in a collapsed state and the NGT starts becoming softer owing to thermoplasticity. Hence, any resistance faced during insertion deviates the NGT toward the path of least resistance – the spacious oropharynx where they usually coil. The distal portion of the NGT with multiple apertures is the weakest part and it susceptible to kink, coil, and knot.[1,3] The kinked or knotted NGT and the rugged wall due to apertures may invite mucosal tear leading to bleeding.[2,4]

Different maneuvers and techniques are evolving day-by-day with an effort to ease the insertion. The quest for best is still on. Broadly, the methods can be classified as "device based" and "manipulation of posture" or maneuvers.[5] Many modifications of blind technique, such as "neck flexion"[1] "neck flexion with lateral pressure" technique,[6] reverse Sellick's manoeuvre,[7] and frozen NGT technique[8] have been used to facilitate NGT insertion with variable success. In the recent past, there is a brief mention that insertion of NGT after placement of throat pack is possible.[9] It is described that the throat pack itself facilitates insertion of NGT by steering it along the correct path by preventing its diversion to wrong route. Recently, only one study has evaluated this technique in pediatric population with success rate as high as 88% with first attempt.[10] However, this technique needs further evaluation as it appears to be a myth breaker. Moreover, both the novel technique and its comparator (conventional blind technique) have been reported with a quite high success rate with first attempt (88% versus 80%, respectively).[10] Besides, this technique has been evaluated only in one study[10] involving pediatric population. These areas have been detected as lacunae in the existing literature. Hence, the present study was designed to evaluate the success rate of "throat pack *in situ*" technique in comparison with blind technique for NGT placement in anesthetized and intubated adult patients. In addition, the procedure time and adverse events were compared.

Aims and objectives

The aims and objective of the present study was to determine the proportion of patients in whom successful NGT insertion had been possible in the first attempt using either the 'throat pack in-situ' technique or conventional blind insertion (with out presence of a throat pack); and to compare the above proportions to determine any difference between the two proportions (Primary outcome). Secondary outcome measures were, to compare the procedure time for correct placement of nasogastric tube and the incidence of adverse events between the two groups.

MATERIALS AND METHODS

This was an interventional and single-blind study. In this experimental clinical study, the success rates of two techniques of NGT placement were compared. The protocol was submitted to the Institute's Ethics Committee (IEC). After obtaining permission from IEC (IPGME and R/IEC/2021/047, dated February 04, 2021), the study protocol was registered with the Clinical Trial Registry of India (CTRI) (Trial Reg. No. CTRI/2021/10/037136, dated October 06, 2021). Then the recruitment was started in a prospective manner and the study spanned over one year approximately (October 2021 to September 2022). The purpose of study, the description of procedure, and possible adverse events was described to the study subjects to obtain their informed consent.

From the literature, it was noted that the conventional "blind technique" had a success rate of 60%. It was assumed that at least 20% increase in success rate using the "Throat pack *in situ*" technique in comparison with the blind technique would be clinically significant. Hence, the effect size is taken as 0.20. A two-tailed hypothesis was presumed. Based on the principles as described in the literature[11,12] and using software the n Master 2.0 (Department of Biostatistics, Christian Medical College, Vellore, 2011), the sample size was calculated with the following assumptions. The power of the present study was set at 80% and 5% alpha (α) error was allowed. Thus, a sample size of 162 for both two arms (i.e., 81 in each arm) was required for the study. Considering the possibility of 10% drop out, a total of 180 patients was recruited for this study.

Patients aged between 18 and 65 years, of either sex, of the American Society of Anesthesiologists (ASA) physical status I or II, aged 18–65 years, posted for elective abdominal surgeries and requiring NGT in the intraoperative period, were included for this study after satisfying the inclusion and exclusion criteria.

Patients with nasal mass, uncontrolled bleeding diatheses, significant deviated nasal septum, esophageal stricture, history of corrosive poisoning, esophageal varices, and those patients who required NGT insertion in the pre-induction phase were excluded from the study population.

The patients and their legal guardian were explained about the proposed procedure and the risk as well as the benefit associated with it in their own language. They were explained their right to put out from the study at any time during the study. After obtaining written informed consent from patient, they were recruited for the study. They were allocated into two groups: Group A (blind insertion technique), and Group B ("throat pack *in situ* technique").

Total 180 patients were randomly divided into two groups using sealed envelope technique.

There were 180 sealed envelopes containing paper with alphabets "A" or "B" written on the paper. After the patient was anesthetized and intubated, an envelope was randomly picked up by the attending nurse on request and opened. The alphabet displayed there indicated about the technique of NGT placement (group allocation) for the patient. The paper slip was discarded each time after use.

Group A: Patients received placement of NGT using blind insertion technique. In this group, after intubation, no pharyngeal pack was applied, and NGT was inserted with head in neutral position, with no external laryngeal manipulation, and without any instrumental aid.

Group B: Patients received placement of NGT after throat pack placement ("throat pack *in situ*" technique). In this group, after the tracheal intubation and before NGT insertion, one pharyngeal pack or the so called "throat pack" was placed with the help of a Magill's forceps or gloved finger. The pharyngeal or throat pack was applied in gentle, non-tight condition which is checked after endotracheal cuff deflation and at 20 cm H_2O of inflation pressure of ventilation to get a "palpable and audible" leak. Then the endotracheal cuff was re-inflated. Then, the NGT was placed with neutral position of head without laryngeal manipulation and without instrumental aid as in the Group A.

For both the groups, an intravenous (iv) line was established with an 18-G or 20-G iv cannula. Iv fluid was started with lactated Ringer's solution for maintaining adequate hydration of the patient. Before induction of anesthesia, the optimum nostril for NGT insertion was selected and marked based on the better fogging procedure on a metal tongue depressor during exhalation. The patients who required pre-induction NGT insertion was excluded. A nasal decongestant nasal drop was instilled into both nostrils. Then, the patient received induction of anesthesia.

Premedication such as inj. midazolam (0.05 mg/kg) and inj. fentanyl (2.0 mg/kg) was administered through iv route. Induction of general anesthesia with propofol 2–3 mg/kg or thiopentone 5–6 mg/kg as per the suitability of clinical condition and muscle relaxation with atracurium was followed by intubation with appropriate sized cuffed endotracheal tube (ETT) made of polyvinyl chloride.

The tip of the NGT was lubricated with 2% lignocaine jelly. The appropriate length of the NGT for insertion was determined by measuring the distance from the ipsilateral nostril to the ipsilateral tragus, and further to the xiphoid process.[13,14]

Study variables were the number of successful placements of NGT in the first attempt (Primary outcome), the procedure time and the number of adverse events such as coiling, kinking, and bleeding.

Correct placement of NGT was confirmed primarily by auscultation of a "whooshing" sound over epigastrium while injecting air into NGT through a 10-ml syringe. Although, we had planned for an additional confirmation by testing the pH of the aspirate using a pH paper, it could not be done due to local unavailability of the kit.

For both the techniques, the "procedure time" (for successful placement of NGT) was defined from the initiation of NGT insertion through the selected nostril up to the time of confirmation of its correct position by auscultation over epigastrium. The procedure time was calculated with a stopwatch.

In case of proper placement with single attempt, it was noted as a "success" and the procedure time was noted. If it did not enter in to the stomach, then it was noted as a "failure" and that also became an outcome of the study. In case of failure, the conducting anesthesiologist was free to apply his/her technique of choice complying with Institution's protocol to insert the NGT for the surgery.

The patient being already anesthetized and remained unaware of the group allocation. However, the performer or the data-keeper was aware of the technique employed; thus, it was a single-blinded study.

Data were decoded, tabulated, processed, enlisted, and analyzed with suitable statistical method after the completion of the study. For statistical analysis, data were entered into a Microsoft Excel spreadsheet and, then, analyzed by SPSS (version 27, SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 9. All continuous data (numerical variables) are presented in the tables as mean with standard deviation. For categorical variables, the data have been presented as number of patients and proportions. t-test for difference in mean involved paired and unpaired samples. Proportions were compared by Chi-square test or Fisher's exact test, as appropriate. $P \leq 0.05$ was taken to be of statistical significance. If the calculated P-value is below this threshold value, then the null hypothesis is rejected in favor of the alternative hypothesis.

RESULTS

There was no loss of patients. Data from all 180 patients, 90 in each group, were available for analysis (Figure 1).

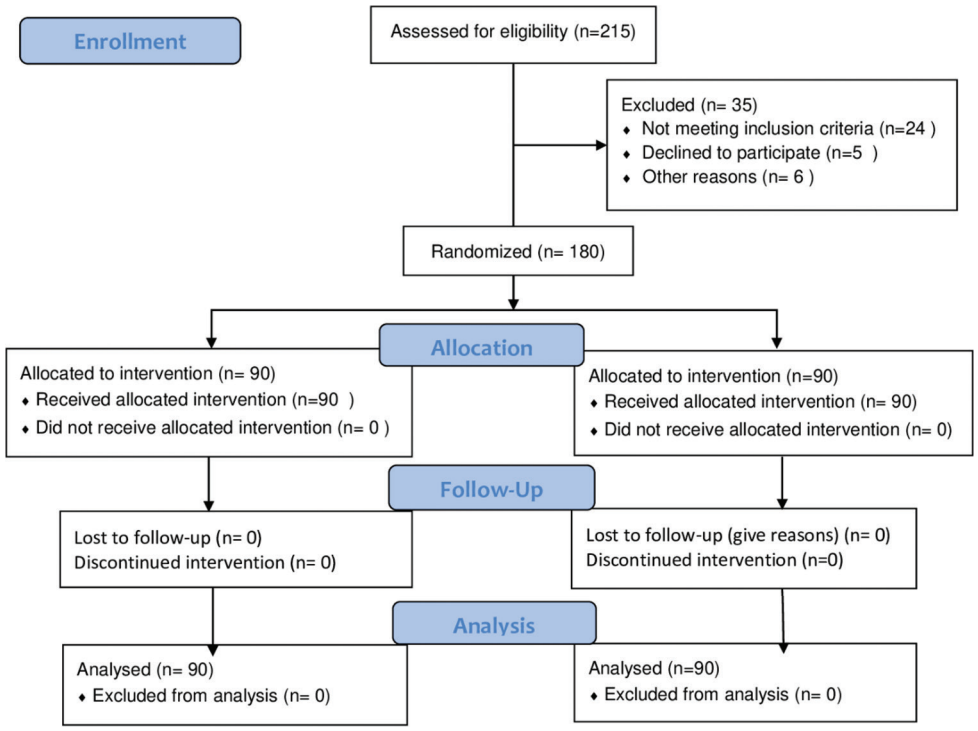

Figure 1: Consort flow diagram. It shows the process of patient selection, randomization, and lost to follow-up

Table 1: Demographic characteristics

Parameters	Blind insertion group (n=90)	Throat pack *in situ* group (n=90)	P-value
Age (years)	42.7±13.4	36.3±12.6	0.037*
Gender (Male/Female)	44/46	42/48	0.765
ASA-PS (1/2)	20/70	28/62	0.178
MP grade (1/2)	14/76	22/68	0.136

Data presented as number patients except the age which is presented as mean±standard deviation. ASA-PS, American Society of Anesthesiologists Physical Status, MP, Mallampati, *Statistically significant

Table 2: Association of age, gender, and Mallampati grade with procedural success

Variable	Successful NG insertion (n=144)	Unsuccessful NG insertion (n=36)	P-value
Age (years)	39.2±13.0	46.5±12.0	0.003*
Gender F/M	76/68	18/18	0.765
Mallampati Grade 1/2	34/110	2/34	0.015*

Age is presented as mean±standard deviation, tested with independent sample t-test; Others are presented as number of patients, tested with Chi-square test. *Statistically significant; total patients=180

There was a difference in mean age between the groups; although the researcher had no control about distribution of patients among the groups due to blind allocation. Comparison of gender, ASA, and Mallampati grade showed no statistically significant difference (Table 1).

When analyzed from a separate angle with data subgrouped according to those having successful (n=144) and unsuccessful (n=36) NGT placement, it was observed that successful NGT insertion on first attempt was observed in lower age group, irrespective of any technique followed. Significantly, higher mean age was seen in patients with unsuccessful NG insertion compared with successful NG insertion (Table 2). There was a significant association between higher Mallampati scale (P=0.015) and the chances of an unsuccessful NG tube insertion. There was no significant association between gender and procedural success rate (P=0.765) (Table 2).

Table 3: Procedure parameters

Variable	Blind insertion group (n=90)	Throat pack *in situ* group (n=90)	P-value
Successful insertion in first attempt	63 (70%)	81 (90%)	0.001*
Time taken for correct placement of NGT (sec)†	25±4.6	23.7±5.7	0.08

Data presented as number of patients (proportion) and analyzed using Chi-square test except that is marked with [†], which is presented as mean±SD and analyzed using Student's t-test; *Statistically significant

Successful insertion of NGT in first attempt was considerably higher in "throat pack *in situ*" group. The procedure time for successful placement of NGT was found comparable between the two groups (Table 3).

Significant decrease in coiling is seen in "throat pack *in situ*" group compared with blind insertion technique (Table 4).

Comparison of mean arterial pressure between the two groups at baseline, pre-insertion, and post-insertion time points was found comparable (Figure 2).

Comparison of heart rate between the two groups at baseline, pre-insertion, and post-insertion time points were found comparable (Figure 3).

DISCUSSION

Conventionally, NGT is inserted before placement of the throat pack (pharyngeal pack) with the belief that the NGT would not enter after the throat pack application. Sometimes, the surgeon requests in the middle of surgery to insert one NGT, while the throat pack has already been placed beforehand. The present study was carried out to compare efficacy between the two techniques of NGT insertion – conventional blind technique without throat pack, and that with preexisting throat pack. This was to ascertain whether the preexisting throat pack can assist or resist the placement of NGT in terms of success rate, procedure time, and adverse events.

Table 4: Adverse events

Adverse events	Blind insertion technique (n=90)	Throat pack *in situ* technique (n=90)	P-value
None	60 (67)	76 (84)	0.003*
Bleeding	3 (3)	5 (6)	
Coiling	27 (30)	8 (9)	
Bleeding and coiling	0	1 (1)	

Data presented as number of patients (proportion) and analyzed using Chi-square test; *Statistically significant

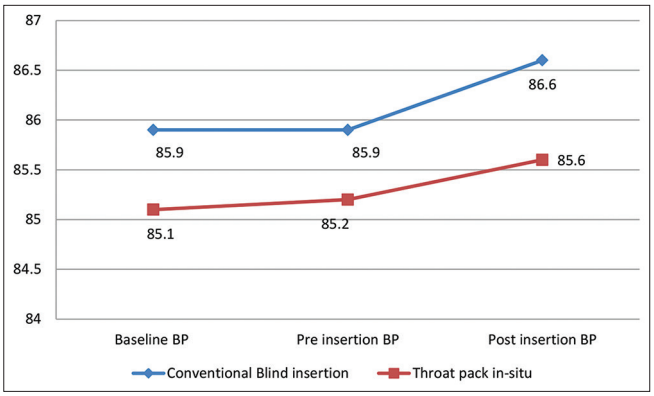

Figure 2: Line diagram showing the trend in MAP

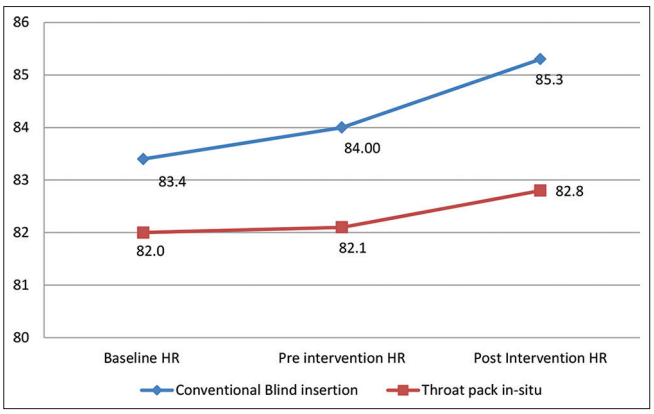

Figure 3: Line diagram showing the trend in heart rate

The present study showed that the incidence of successful placement of NGT in first attempt was 90% (81 out of 90) in "throat pack *in situ*" group, while it was only 70% (63 out of 90) in the conventional "blind insertion" technique (without throat pack). The difference of the incidence between the two groups is statistically significant (P=0.001). It was assumed that proper placement of throat pack before NGT placement actually obliterates the spacious oropharynx, thereby eliminating one less resistant path, that is, oropharynx, where NGT often deviates and coils. Thus, the throat pack reduces the propensity of coiling and helps steering the NGT to its normal intended pathway.

In a correspondence article in 2008, Walker[9] had reported that prior existence of throat pack in intubated patients have facilitated the NGT insertion attempted later on. However, no data was available evaluating this technique. Before designing this study, only one clinical study[10] performed in pediatric population became available.

The present study findings are in line with the observation of Chowdhury et al.,[10] who found that "Throat pack *in situ*" method can be a better alternative to the conventional blind NGT placement (before throat pack application) in pediatric population, where the use of uncuffed ETT with throat pack application is not infrequent. The higher success rate (94%) with blind technique in that previous study[10] may attribute to relatively larger tongue and smaller oropharynx in pediatric population. There might be less hindrance due to microcuff ETT use or in some cases the use of uncuffed tube can lead to less bulging of posterior wall of trachea.

In the present study, the authors are unable to comment about the incidental findings of association of age and Mallampati grade with procedural success, because the study was not designed to test that. However, it could be an area for further exploration with a suitably designed study and can be considered as a future scope of study.

In the present study, the adverse events (bleeding, coiling) were much less with the "throat pack *in situ*" group

compared with the conventional "blind insertion" group. Coiling was found significantly less in "throat pack *in situ*" group compared to blind group (9% vs. 30%) probably due to obliteration of oral cavity with the pack.

Decreased level of consciousness due to disease or administration of anesthesia leads to decrease in muscle tone and glossoptosis.[15] The use of neuromuscular blockers during general anesthesia further relaxes and approximates the soft palate, base of the tongue, epiglottis, and posterior pharyngeal wall. Furthermore, the presence of a ETT can create a hindrance to the natural passage of the NGT.[16] The posterior tracheal wall is deficient of cartilaginous structure and supported with only a thin layer of smooth muscle – the trachealis muscle.[17] The presence of inflated cuff of the ETT can cause a bulging of posterior tracheal wall causing compression of oesophagus.[18,19] Lack of propulsive movement of deglutition also contributes. The patients who were sedated or comatose will not be able to assist the clinician by following the instructions to swallow or changing the posture such as flexion of head. Furthermore, they cannot indicate about the malposition (by coughing when malpositioned in the trachea) during passage of NGT.[20,21] Consequently, the failure rate with blind method of NGT insertion (head in neutral position, no external laryngeal manipulation) is nearly 50% on first attempt.[1] After a failure, subsequent attempts using the same NGT and applying the same technique lead to the same outcome (kinking at the same place) resulting in low success rate due to the "memory effect."[22]

Nowadays, cuffed ETT is generally used for intubation. Question may arise about the justification of using throat pack except the surgeries inside oral cavity, lip and palate, etc. In certain scenarios, the anesthesiologists can rely on a throat pack even after the use of cuffed tube. Those are in following conditions: in case of a leak in the tube's cuff, to prevent microaspirations into trachea, to prevent sipping of blood/secretions, etc., from mouth into the larynx around the cuffed tube, and to keep the cuffed ETT in proper position if the proper sized ETT is not available locally.

The cuffed ETT provides a seal around the trachea and pharyngeal pack is not done routinely. However, in the recent past, some studies[23,24] have investigated the physical and mechanical aspects of ETT cuffs and found that ETTs showed substantial variation in fluid aspiration, relating to cuff material and design. Variability in performance was attributed to the involutional folds that form in the inflated ETT cuff in a random manner.[24] It has been commented that ETT cuffs are not able to completely seal the trachea to prevent aspiration of oropharyngeal secretions.[23] Hence, it was recommended to take other prevention measures as well.[23] A preexisting pack can appear as a friend by assisting NGT placement while reinforcing the seal of tracheal cuff.

The inflated cuff of ETT can put pressure on the esophagus and can cause esophageal compression though the membranous portion of the trachea. This can put hindrance to the passage of NGT into esophagus. In case of difficulty of NGT insertion, sometimes deflation of cuff is required to increase the possibility of success of NGT placement.[19] In that situation, the presence of throat pack will provide some amount of protection from aspiration, as well as prevention of leakage of anesthetic gas mixture. The pharyngeal pack also holds the tube in central position to some extent, thereby reducing undue pressure on soft palate and posterior pharyngeal wall.

Although the present researcher had no control over the age of patients being recruited due to the blind allocation, on analysis, the difference between the mean ages of the two groups become significant.

In the present study, auscultation technique was used to confirm the position of the NGT. The test is done to hear the characteristic "whoosh" sound on auscultation over epigastrium while injecting air using 10 ml syringe through rear end of the NGT. This whoosh test, although not definitive, is a readily available bedside method requiring minimal logistic support. However, a similar gurgling sound may be heard over the epigastrium even if the tube has been incorrectly placed into the tracheobronchial tree, pleural space, or esophagus.[14] In the present study, the chance of NGT to enter tracheobronchial tree is less, as the patients were already intubated with ETT. The operating surgeons also confirmed the placement later on by palpation of stomach.

Other methods to confirm the correct position of NGT are testing the pH of the aspirate with pH paper, capnography, portable X-ray, or USG. Abdominal X-ray has been considered the gold standard for determining the position of NGT.[25] However, it has demerits of radiation exposure and also less feasible due to its cost. Capnography, USG, and electromagnetic tracing have emerged as potential alternatives to radiological examination for confirmation of placement.[25]

Limitations of the study

The present study also bears some limitations. The confirmation of NGT placement was done by auscultation method only and the other methods such as X-ray, capnography, or USG were not done due to feasibility ground. Additional confirmation using pH paper was not done due to local unavailability of the same in this

period. Utilization of combined methods for confirmation of proper placement NGT would give more accurate results. The incidence of sore throat due to throat pack application was also not assessed. Further, study after addressing the aforementioned shortcomings remains to be a future scope.

CONCLUSION

To conclude, pre-existing appropriately placed throat pack may facilitate the NGT insertion instead of putting hindrance.

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