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Original Research Article

COMPARISON OF DIGITAL ASSISTANCE TECHNIQUE OF NASOGASTRIC TUBE INSERTION VERSUS CONVENTIONAL METHODS IN ANAESTHETIZED, INTUBATED PATIENTS

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ABSTRACT

Background: It is often difficult to correctly place nasogastric (NG) tubes in anesthetized, intubated patients. We hypothesized that simple modifications in technique of NG tube insertion will improve the success rate. **Materials and Methods:** A total of 100 patients, aged 20 to 70 years, undergoing surgeries that require NGT insertions were enrolled into our study. The patients were randomly allocated to the Digit assisted group (Group A) and the Conventional method group (Group B) according to a computerized, random allocation software program. In group A, the NGT was inserted with help of left-hand gloved index finger the patient's head in neutral or slightly flexed position. In group B, the NGT was inserted by conventional method with head with neutral position or slightly flexed position. The success rates of the two methods, the durations of the insertions, the occurrences of complications and stress responses were recorded. **Result:** Successful insertions were recorded for 46/50 patients (94%) in Group A and for 31/50 patients (64%) in Group B. The mean insertion times were 40.4 ±18.7 seconds in Group A and 29.9±19.9 seconds in Group B. There were only 14% complications observed during the application of digital assisted NGT insertion method. The conventional method had higher rate of complications i.e., 38% during the insertion of NGT. **Conclusion:** The Digital assistance method is reliable with a high success rate and less complication rate in anesthetized and intubated patients.

INTRODUCTION

NGT insertion is indicated to decompress stomach in setting of distal obstruction, to prevent aspiration of gastric content, for administration of medication and nutritional support in patients with functional alimentary tract but inability to take orally.[1-8]

In anesthetized and intubated patients, flexible NGT may coil in oral cavity due to inability to swallow and presence of an inflated cuff in the proximal trachea. The most common sites of resistance for passage of orogastric tube and NGT are the arytenoid cartilages and piriform sinuses. The distal 6 cm of the gastric tube with multiple holes are the weak points contributing to coiling in oropharynx. Once the tube is impacted against the pyriform sinuses or arytenoid cartilage, bending of the tube occurs at these weak points, thereby promoting coiling and retarding its entry into the Oesophagus.[9] After each unsuccessful insertion, incidences of mucosal bleeding and hemodynamic complications increases.[10]

Some of the methods often employed for facilitation of NGT insertion mentioned in the literature include the use of intubation stylet, endotracheal tube-assisted technique, endoscopic technique, the use of frozen NGT, use of 'peel-away' split tracheal tube, angiography catheter guided technique, esophageal guidewire-assisted technique, use of video laryngoscopes.[11]

Use of a 'gloved finger to steer' the NGT into oesophagus is one of the methods to overcome its impaction in the posterior pharyngeal wall. The

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fingertip provides the buttress against the holes in the distal part of the gastric tube providing it the requisite sturdiness, preventing its bending and impaction with simultaneous steering into the Oesophagus.[9]

In an unconscious intubated patient insertion of NGT is difficult and challenging, with very high first attempt failure rates.[12] Despite the numerous techniques described in the literature, there is still no consensus regarding a standard approach. In our study, we are describing digitally assisted method of NGT insertion in anaesthetized, intubated patients. This study aims to determine the success rates and time required for inserting refrigerated NGT by digitally assisted method and compare the findings with the conventional methods of NGT insertion. Oral insertion of gloved Index finger will provide an anchor to NGT against the posterior pharyngeal wall and help steer it into the oesophagus. This would help in overall decreasing the incidence of NGT kinking, coiling, or knotting as compared to conventional technique. We hypothesize that use of this technique for NGT insertion could increase the rate of successful insertion compared with the conventional technique in anesthetized and intubated patients and that the occurrence of complication rate through this method will be lesser.

MATERIALS AND METHODS

Study design: A prospective, randomized, double-blind study was conducted approval of Institutional Ethics Committee. The period of study was between April 2021 to May 2022 and compiled in accordance with the consolidated standards of reporting trials CONSORT guidelines.

An informed and written consent was obtained from 100 patients scheduled for general anesthesia for inclusion to this study.

Participants: Patients aged 20-70 years scheduled to receive general anesthesia for elective surgeries that require nasogastric tube were included.

Exclusion criteria:

Patients with predispositions to injury from NGT placement were excluded, including those with head trauma, esophageal varices, alkali ingestion, nasal septal deviation, upper airway anomalies, and coagulopathy.

Patients were randomized prior to administration of general anesthesia into two groups of 50 patients in each group:

Group-A: Nasogastric tube (NGT) insertion by digital assisted method

Group-B: Nasogastric tube (NGT) insertion by conventional method

Interventions: Standard monitoring was used throughout the study. Baseline SBP, DBP, MAP, and HR values were recorded.

Standard general anesthesia was given as per institutional protocols. After premedication and preoxygenation patient induced with intravenous fentanyl at 2 µg/kg (including 50 mcg given during premedication), propofol 1-2.5 mg/kg, rocuronium at 0.6-1.2 mg/kg or vecuronium at 0.1-0.2 mg/kg.

Tracheal intubation was achieved with appropriately sized endotracheal (ETT) cuffed tube under direct laryngoscopy after establishment of suitable depth of anesthesia and adequate muscle relaxation. Anesthesia was maintained with inhalational agent (Sevoflurane) and intermittent dose of vecuronium, fentanyl and midazolam.

NGT sized 16/18 French were refrigerated overnight for insertion to all patients. Lidocaine gel (3 ml of 2%) act as water soluble lubricant and local anesthesia introduced directly into the chosen nasal canal. The procedure start time was recorded as when the NGT inserted into the chosen nostril. The end time was noted as the time after the successful insertion verified by epigastric auscultation or aspiration of gastric contents.

Digital assisted NGT insertion was attempted with head slightly in flex position. In this technique, the gloved left hand's index finger was introduced into the left side of the oral cavity of patient. NGT was pulled towards the lateral pharyngeal wall with the index finger after feeling the tip of NGT in oropharyngeal region. Then, the NGT was pushed from proximal end by the right hand. Simultaneously, the tube was guided along the pharyngeal wall into the oesophagus by left index finger. The patients received the NGT by digital assisted technique were grouped in Group-A.

In contrary to digital assisted group, a group of patients received NGT directly through the selected nostril with the head in neutral and slightly flexed position. A slight lateral neck pressure was applied at the same side as that of the selected nostril. Lateral neck pressure at the same side causes collapse of the ipsilateral piriform sinus and slight medial movement of the ipsilateral arytenoid cartilage, thereby allowing the NGT to enter the hypopharynx in the usual position.10 This conventional technique was applied, and the patients grouped as Group-B.

Failed attempt of NGT insertion was defined by observations as either coiling of NGT in the oropharynx or more than three minutes of procedure, whichever be earlier. The tube was relubricated and reinserted into same nostril and advanced forward by same technique after any unsuccessful attempt. The insertion technique was considered failure after two consecutively unsuccessful trials.

The complications like sign of trauma to oropharyngeal structures and evidence of bleeding were examined by gentle laryngoscopy after any successful or unsuccessful attempts.

During the procedure of both techniques the parameters like number of attempts, insertion time in second, successful rate and complications like coiling, bleeding etc. were recorded.

Outcome measures: Aim of this study was to compare the success rates of digitally assisted nasogastric tube insertion with conventional method and complications associated with it.

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The primary objective was: To determine the time taken and successful insertion of NGT rate in both techniques.

The secondary outcome measures were: To compare the complications associated with the two examined procedures (Digital Assisted Vs. Conventional)

To compare any stress response (hemodynamic changes) in respect to SBP, DBP, MAP and HR between two procedures.

The follow-up period ended with primary and secondary outcome measures.

Sample size: The sample was calculated using G*Power 3.1.9.7. For two tailed t-test statistical analysis with two independent means (two groups), the required sample size was calculated with given α, power and effect size. At effect sized = 0.5, α err probability 0.39 and power (1-β err pro) = 0.95 the required total sample size was 100, 50 in each group with the actual power 0.95 (Figure 1). For Goodness-of-fit tests (Contingency tables) the total sample size was calculated by considering effect size w = 0.3, α err probability 0.05 and power (1-β err pro) = 0.77 and the calculated total sample size was 100 which was fit with our study.

Randomization and blinding: All the patients enrolled into this study were randomly allocated into two groups (Group-A and B) according to a computerized, random-allocation software program10. After randomization in number, double blinded group was formed by not informing the patients and observer according to a computerized, random-allocation software program.

RESULTS

Participant flow: A total of 108 patients scheduled for elective surgeries requiring general anesthesia were assessed for eligibility during preoperative anesthesia consultation. Out of these, 100 were enrolled and 8 excluded as per the exclusion criteria of research methodology.

There was neither loss to follow up or excluded for analysis after the two groups allocated to intervention. [Figure 1] shows the Consolidated Standards of Reporting Trials (CONSORT) diagram of participant flow for this study.

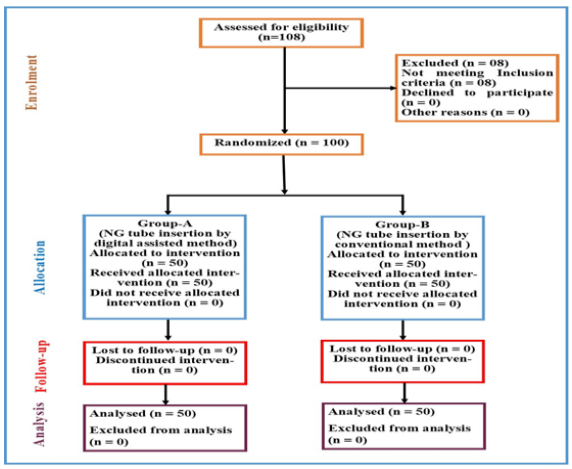

Figure 1: CONSORT diagram showing the flow of patients in the study

Demographic data: The demographic characteristics of patients' data are represented in Table 1 between Group A and Group B.

Primary Objective Outcomes: The outcomes from primary objectives like mean insertion time, no of attempts made and success rate is presented in [Table 2 and Figure 2-4].

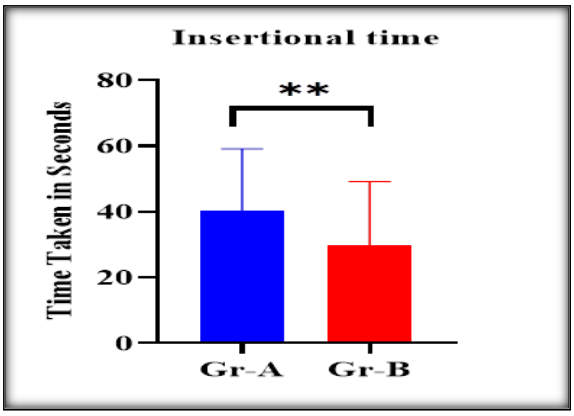

Figure 2: Bar diagram. Unpaired two tailed t-test comparison for mean insertion time among two groups at significance level p<0.05.

No of attempts: The successful placement of NGT was monitored as whether it's happened in 1st attempt or 2nd attempt.

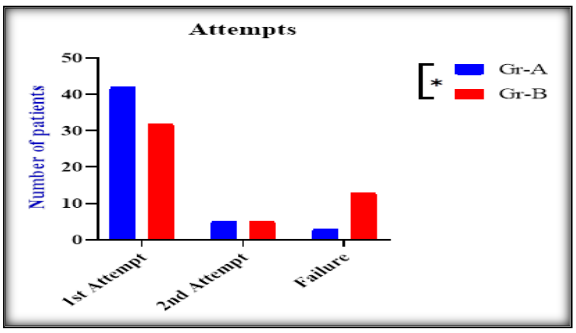

Figure 3: Bar diagram plot. Chi-square test for successful placement of NGT at different attempts among two groups at significance level p<0.05.

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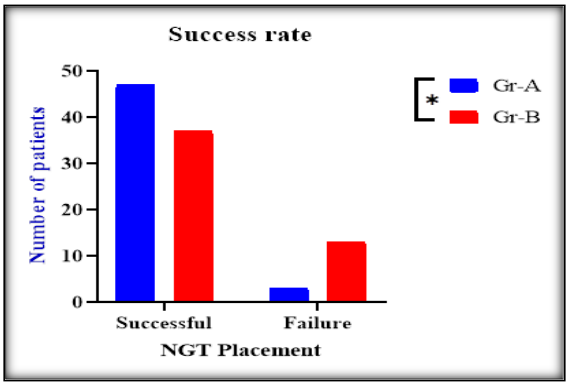

Figure 4: Bar diagram plot. Chi-square test (Fishers Exact Test) for success rate of NGT placement among two groups at significance level p<0.05.

Secondary Objective Outcomes:

Complications: Complications like coiling in 1st or 2nd attempt, only bleeding from nose or oropharyngeal region and coiling cum bleeding were observed during the placement of NGT using both the methods. The observations were represented in percentage as in [Table-3 and Figure 5].

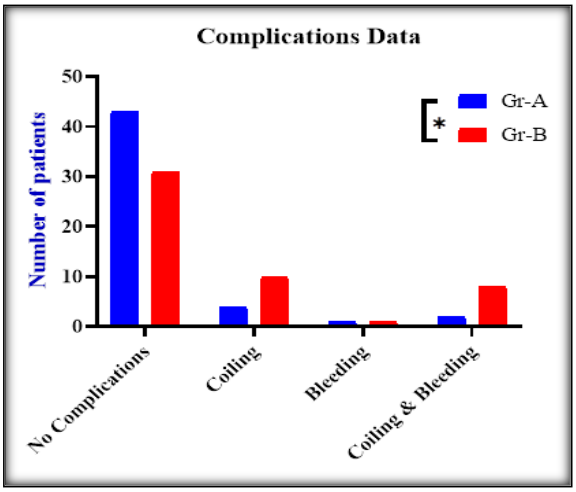

Figure 5: Bar diagram plot. Chi-square test for complications percentage during NGT insertion among two groups of patients at significance level p<0.05.

Stress responses: Pre and post procedure of both methods of NGT insertion, the stress responses were measured considering the hemodynamic parameters like SBP, DBP, MBP and HR measured and recorded in [Table 4]. Simple main effects analysis (column factor) showed that NGT insertion methods did not have a statistically significant effect on SBP, DBP, MBP, HR.

Table 1: Demographic characteristics of patients

Demographic Parameters	Gr-A (n=50)	Gr-B(n=50)	(B - A) ± SEM	95% CI	p-value
Age	53.8 ± 15.8	50.6 ± 14.7	-3.28 ± 3.05	-9.33 to 2.77	0.28
Sex (M: F)	30:20	28:22	-	-	0.839
ASA (I/II/III/IV)	4/22/20/4	4/23/19/4	-	-	0.997
Weight	63.8 ± 12.6	66.08 ± 12.05	2.28 ± 2.46	-2.61 to 7.17	0.36
Height	164.7 ± 7.56	162.7 ± 5.75	-1.94 ± 1.35	-4.61 to 0.74	0.15
BMI	24 ± 3.1	25 ± 3.9	1.4 ± 0.7	-0.037 to 2.8	0.06
Mallampati Score (1/2/3/4)	5/30/15/0	7/29/17/0	-	-	0.79

Table 2: Measurements of parameter of primary objective

Primary Objective	Gr-A (N=50)	Gr-B (N=50)	Difference between means (B -A) ± SEM	95% confidence interval	p-value	Significance level
Mean Insertional Time (sec)	40.4 ± 18.7	29.9 ± 19.3	-10.5 ± 3.8	-18.0 to -2.94	0.007	**
No of Attempts	1st 84%; 2nd 10%; Failure 6%	1st 64%; 2nd 10%; Failure26%	-	-	0.022	*
Success Rate	94%	74%	-	-	0.012	*

Table 3: Complications during insertion of NGT

Complications	Gr-A	Gr-B	P-Value	Significant level
Total (%)	7 (14%)	19 (38%)	0.044	*
Coiling	4 (50)	10 (50)	-	-
Bleeding	1(50)	1 (50)	-	
Coiling cum bleeding	2 (50)	8 (50)	-	-

Table 4: Hemodynamic parameters of patients (Pre and post procedure).

Haemodynamic parameters						
	BL (Pre procedure)	Post Procedure	Mean Diff.	95% CI of diff.	p-value (PreP vs. PostP)	Summary
	SBP					
Gr-A	115±13.2	115±13.4	0.24	-5.03 to 5.51	0.928	Ns
Gr-B	117±12.9	117±13.2	0.02	-5.04 to 5.32	0.957	Ns
	DBP					
Gr-A	72.1±11.1	72.3±11.1	0.2	-4.19 to 4.59	0.928	Ns
Gr-B	74.2±10.5	74.3±10.5	0.06	-4.1 to 4.22	0.977	Ns

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	MBP					
Gr-A	82.0±12.5	82.0±12.4	-0.06	-4.99 to 4.87	0.981	Ns
Gr-B	86.6±13.5	86.6±13.6	0.0	-5.38 to 5.38	0.999	Ns
	HR					
Gr-A	91.7±14.0	93.7±14.2	2.07	-3.55 to -7.69	0.467	Ns
Gr-B	88.3±12.3	88.7±12.4	0.38	-4.53 to 5.29	0.878	Ns

Table 5: Success rates and their comparison with previous published study

Reports	Sample size	Digital assisted (DA)	Conventional Method (CM)	Lifting of the thyroid cartilage (LM)	Guided wire method (GM)	Laryngoscopy Method (LM)	Reverse Sellick maneuver (RSM)
Rahendra et al,[15]	DA-103 RSM-107	90.3%	-		-	-	67.3%
Siddhartha et al,[16]	CM-40 RSM-40	-	77.5%		-	-	92.5%
Illias et al,[13]	CM-50 LM-50	-	88%	92%	-	-	-
Isfahani et al,[17]	DM-38 LM-38	94.7%	-	-	-	78.9%	-
Kavakli et al,[18]	CM-50 LM-50	-	66%	-	-	98%	-
Mahajan et al.[9]	DM-90	83%	-	-	-	-	-
Present Study	DM-50 CM-50	94%	74%	-	-	-	-

Table 6: Number of attempts and success rates in % in respect to our study and previous clinical trials

Reports	No of Attempts	Digital assisted (DA)	Conventional Method (CM)	Lifting of the thyroid cartilage (LM)	Guided wire method (GM)	Laryngoscopy Method (LM)	Reverse Sellick maneuver (RSM)
Rahendra et al,[15]	1st	81.6%	-	-	-	-	60.7%
	2nd	47.4%	-		--	-	16.4%
Siddhartha et al,[16]	1st	-	40%	-	-	-	77%
	2nd		37.5%	-	-	-	15%
Illias et al,[13]	1st	-	82%	88%	-	-	-
	2nd		33%	33%	-	-	-
Isfahani et al,[17]	1st	81.6%	-	-	-	60.5%	-
	2nd	13.2%	-	-	-	18.4%	-
Kavakli et al,[18]	1st	-	54%	-	-	92%	-
	2nd	-	12%	-	-	6%	-
Present Study	1st	84%	64%	-	-	-	-
	2nd	10%	10%	-	--		-

Results of the present study have shown that, the digital assisted method was more successful than the conventional method. In addition, the frequency of the first successful insertion attempt was significantly higher in digital assisted method (Group-A) compared with conventional method (Group-B). Frozen NGT insertion leads to a higher rate of success in the first insertion attempt.[10,12] Hence, frozen NGTs were used in both the methods as mentioned in material and methods of this study. The number of failed attempts using the digital assisted method is much lower than that of the conventional method. The mean insertion time in case of digital assisted method was more than conventional method, but the insertional complications like coiling, bleeding etc were found to have a higher incident in conventional method.

DISCUSSION

Primary outcomes: Direct NGT insertion in anesthetized and intubated patients is difficult. Therefore, many techniques have been suggested to improve the success rate of NGT insertion. There are studies which have compared different methods of NGT insertion in terms of success rates etc.

Success rate: In this study, we compared two methods of NGT insertion methods without using any other instruments i.e., digital assisted method and conventional method. Digital assisted NGT insertion method had high success rate (94%) compared with conventional method (74%) ($p = 0.012$). However, the reported success rates using these methods have differed from study to study (Table 5). These variation in success rates when using the same technique may be based on operator experience and formalization with the procedure.13 The results of previous studies showed a statistically increase in success rate in digital assisted NGT insertion method. The higher success rate in the finger method group is due to NGT fixation and anchoring by the finger when being pushed forward down to the Oesophagus. We postulate that this action prevents the NGT from coiling/kinking inside the pharynx it is pushed by the other hand. Moreover, the finger in touch with the

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NGT also helps to guide it into Oesophagus very much similar to the use of Magill's forceps.

Mahajan and Gupta,[9] reported in their letter to editor about the application of digital assisted technique for insertion of NGT. They used the same technique for NGT insertion in 90 cases over six months duration and reported a success rate of approximately 83%. However, no statistical analysis or comparison to any other technique was done by them. In our study, comprehensive data analysis and comparison with the conventional technique has been conducted and relevant findings have been reported in the study which not only includes the success rates, but also other parameters like complication rate, stress response, time taken, etc.

Its noteworthy to discuss that Isfahani et al,[17] reported a in their study that digital intubation method for NGT insertion was more successful than the video laryngoscope method (success rate: 94.7% vs. 78.9%). Digital method is significantly higher than that of the blind methods. The extent of the patient's mouth opening, the presence or absence of teeth, the length of the neck, lack of mechanical complications in the throat and respiratory tract, the experience and skill of the inserter, and the length of the physician's fingers can be regarded as various factors that affect the quality of performing and success rate of the digital method.[19]

Number of attempts: The high success rate in the finger method group might happen due to NGT fixation by the finger when being pushed forward down to the oesophagus. Generally, the fixed NGT would be hard to kink during its advancement in the first attempt. Table 6 report the comparative success rate in different attempts and state the data from previous studies.

Mean Insertional Time: Hypothetically, if the success rate of NGT insertion in the first attempt by a selected technique is high, then less time is required to rescue failed attempts and the mean time of insertion by this technique will be short. As almost no instruments are required during NGT insertion, time can be saved even after the procedure because there is no need to wash or sterilize any instruments. The shortest mean insertion time was recorded in the conventional method group. The mean time required for a successful insertion was also influenced by operator experience and familiarization with the procedure.

The longer time needed in the digital assisted group might be due the longer time needed to insert the finger into the mouth and fix the tip of the NGT right at the entrance of the oesophagus. During fixation, kinking and coiling could also be immediately felt by the finger at the time of insertion; therefore, there was additional time needed for pulling it slightly and repushing it back.

Secondary outcomes:

Complications: We observed complications like coiling, bleeding from mouth or oropharyngeal region, and coiling cum bleeding due to both NGT insertion methods in 1st and 2nd attempt of insertion. Further, the complications due to digital assisted NGT insertion methods were lower (14% in 1st attempt) than conventional method (38% in 1st attempt) which was statistically significant different between the two groups of patients ($p = 0.044$). Therefore, choosing a technique with a high success rate can decrease the incidence of these complications.[13] Most of the complications related to NGT insertion (kinking and bleeding, pharyngeal wall injury, and stress response) are increased with multiple attempts. The finger method had a lower blood spot complication rate compared with the Reverse Sellick maneuvers. This might be due to the lower rate of NGT coiling or kinking in the finger method.[11] Coiling or kinking of the NGT would result in nasopharyngeal or oropharyngeal lining trauma, characterized by the presence of blood spots.[13,14]

The present study has some limitations. The main limitation of this study; the anesthesiologists who performed the NGT insertion knew the technique used for NGT insertion. To overcome this, NGT insertions were performed by only two anesthesiologists who were blinded to the study methodology to avoid potential investigator evaluation bias. To avoid observer bias and make the study double blinded all data recordings/observations were done by a separate individual who was not aware of the group or aim of the study. And confirming the NG insertion by auscultation method may not have been reliable all the time.

CONCLUSION

Based on the results and discussions, we conclude that higher success rate of NGT insertion in comparison to conventional method. Further it was determined that the insertion time for digital assisted method was more than conventional method still successful placement rate was higher in first attempt of insertion. Moreover, we observed that complications like coiling, bleeding, and coiling cum bleeding due to digital assisted NGT insertion was low in number of cases whereas it was observed one in every three cases due to conventional method of NGT insertion.

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