

## Comparison of four techniques of nasogastric tube insertion in anaesthetised, intubated patients: A randomized controlled trial

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### ABSTRACT

**Background and Aims:** Insertion of nasogastric tubes (NGTs) in anaesthetised, intubated patients with a conventional method is sometimes difficult. Different techniques of NGT insertion have been tried with varying degree of success. The aim of this prospective, randomised, open-label study was to evaluate three modified techniques of NGT insertion comparing with the conventional method in respect of success rate, time taken for insertion and the adverse events. **Methods:** In the operation theatre of general surgery, the patients were randomly allocated into four groups: Group C (control group,  $n = 54$ ), Group W (ureteral guide wire group,  $n = 54$ ), Group F (neck flexion with lateral pressure,  $n = 54$ ) and Group R (reverse Sellick's manoeuvre,  $n = 54$ ). The number of attempts for successful NGT insertion, time taken for insertion and adverse events were noted. **Results:** All the three modified techniques were found more successful than the conventional method on the first attempt. The least time taken for insertion was noted in the reverse Sellick's method. However, on intergroup analysis, neck flexion and reverse Sellick's methods were comparable but significantly faster than the other two methods with respect to time taken for insertion. **Conclusion:** Reverse Sellick's manoeuvre, neck flexion with lateral neck pressure and guide wire-assisted techniques are all better alternatives to the conventional method for successful, quick and reliable NGT insertion with permissible adverse events in anaesthetised, intubated adult patients. Further studies after eliminating major limitations of the present study are warranted to establish the superiority of any one of these modified techniques.

**Key words:** Adverse effects, enteral nutrition, instrumentation, intubations, nasogastric tube

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Website: [www.ijaweb.org](http://www.ijaweb.org)

DOI: 10.4103/0019-5049.147157

Quick response code



### INTRODUCTION

Conventional insertion of a nasogastric tube (NGT) in anaesthetised, paralysed, intubated patient is often a difficult and challenging job for the anaesthesiologist with a failure rate as high as 50% in the first pass.<sup>[1]</sup> The distal portion of NGT has multiple apertures (the weakest part) making it susceptible to kink, coil, and knot. Several modifications in the conventional technique include head flexion,<sup>[1]</sup> reverse Sellick manoeuvre,<sup>[2]</sup> use of a split endotracheal tube,<sup>[3]</sup> 'peel-away tube' method,<sup>[4]</sup> 'slipknot to an intubation stylet',<sup>[5]</sup> glidescope,<sup>[6]</sup> Various

forceps and the use of a 'gloved finger to steer' the NGT<sup>[1]</sup> after its impaction in the posterior pharyngeal wall. Ureteral guidewire as a stylet, was found to increase the success rate (66%) of NGT insertion at first attempt than the conventional method (34%)<sup>[7]</sup> and head flexion with lateral pressure has been reported as the easiest method with highest success rate (82%) on the first attempt with shortest insertion time and least complications.<sup>[8]</sup> Reverse Sellick's manoeuvre, that is, a forward displacement of the cricoid cartilage, facilitates the insertion of NGT in about 75–80% of cases by opening the oesophageal inlet more widely.<sup>[2]</sup>

**How to cite this article:** Mandal MC, Dolai S, Ghosh S, Mistri PK, Roy R, Basu SR, *et al.* Comparison of four techniques of nasogastric tube insertion in anaesthetised, intubated patients: A randomized controlled trial. *Indian J Anaesth* 2014;58:714-8.

Several studies have been reported comparing either of these modified techniques with the conventional method. Only one study has evaluated 'head flexion with lateral pressure', 'split-tracheal tube-guided insertion' and 'ureteral guide wire-assisted insertion' techniques.<sup>[8]</sup> However, this reverse Sellick's technique has not been compared with the 'ureteral guide wire-assisted insertion' and 'head flexion with lateral pressure' techniques that also bear high success rate. For several abdominal surgeries, the insertion of NGT is an essential procedure and is often performed by the anaesthesiologist in the operating room. Although an apparently innocuous and simple procedure, NGT insertion is essentially an invasive procedure and often needs repetitive attempts which may result in adverse events such as kinking, knotting, bleeding, false passage; sometimes the attempts end in failure. Existence of many methods with variable reported success rate indicates that the quest for the best is still on. The present study was carried out in an endeavour to evaluate three modified methods of NGT insertion ('reverse Sellick's manoeuvre', 'ureteral guidewire-assisted insertion' and 'neck flexion with lateral neck pressure') in comparison to conventional method with reference to success rate at first attempt (primary outcome), time taken for insertion and adverse events.

## METHODS

The study was conducted after receiving the permission from ethics committee of the institution. The patients scheduled for elective surgery requiring NGT insertion were recruited during preoperative evaluation. Patients aged 20–70 years, American Society of Anesthesiologists (ASA) physical status class I and II with normal airway (Mallampati grade 1 or 2), waiting for operation of gastrointestinal tract, gall bladder and biliary tract were considered for the study. Exclusion criteria were significant deformities of chin, pharynx and/or larynx, base of skull lesion, upper airway lesion, abnormal prothrombin time, activated partial thromboplastin time and platelet disorder, oesophageal stenosis or varices, and the history of radiotherapy in the head and neck region. Informed consent was obtained from each willing patient after discussion of the study procedure and expected complications.

We assumed that a 30% increase in the success rate of NGT insertion with the modified techniques in comparison to the conventional technique would be clinically relevant. Considering an  $\alpha$  value of 0.05 and

power of study ( $1-\beta$ ) at 80%, a minimum sample size of 40 patients was necessary for each group. Expecting some dropout, a total of 216 patients were recruited; 54 in each of the four groups.

Patients were allocated into four groups: Group C (control group), Group F (neck flexion with lateral pressure), Group R (reverse Sellick's manoeuvre) and Group W (ureteral guide wire group), using computer-generated random numbers. Allocation concealment was achieved by placing the randomization sequence for each technique (random numbers) in sequentially numbered sealed opaque envelopes.

After admission of these patients, a preanaesthetic visit was made. Before the induction of anaesthesia, the optimum nostril for NGT insertion was chosen based on the better fogging produced on a metal tongue depressor during exhalation. After premedication with glycopyrrolate (0.01 mg/kg), midazolam (0.03 mg/kg), fentanyl (2  $\mu$ g/kg) and lignocaine (1.5 mg/kg), the patient was induced with propofol (1.5 mg/kg). Intubation was performed with a cuffed endotracheal tube (7–8 mm internal diameter as per patient's size) using atracurium (0.5 mg/kg).

After tracheal intubation, oxymetazoline (0.05%) drops was instilled into both the nostrils. Sterile, lubricated, 14F, 105 cm ROMOLENE® NGT (Romsons International, Agra, Uttar Pradesh, India) was used. The NGT is featured with Luer connector at proximal end, radiopaque line throughout the length, lead markings at the distal end and ball-weighted tip. NGT insertion was always performed by either of two experienced anaesthesiologists. This was done with the aim to reduce skill bias.

In the control group (Group C), a lubricated NGT insertion was performed through the selected nostril, the head being maintained in a neutral position. In guide wire group (Group W), a ureteral guide wire (6F) was introduced within a 14F NGT until the tip of the guide wire reached up to the tip of NGT. The lubricated NGT was then inserted gently through the selected nostril while the head was maintained in a neutral position as in the control group. In the neck flexion with lateral neck pressure group (Group F), a lubricated NGT was inserted through the selected nostril to a depth of 10 cm. Lateral neck pressure was applied at the same side as that of the selected nostril with the neck flexed and the NGT was advanced in a

similar manner to that described for Group C. In the reverse Sellick's manoeuvre group (Group R) anterior displacement (lifting) of the cricoid cartilage was done to facilitate the insertion of NGT.

The time taken for insertion (in seconds) was calculated from the initiation of NGT insertion through nostril up to successful placement of NGT within two attempts. This was measured with a stopwatch. If both attempts were unsuccessful, then the technique was considered as a 'procedure failure'. The correct placement was confirmed with auscultation method. The following data was collected: Number of attempts for successful NGT insertion, procedure time and adverse events during insertion like kinking, knotting, bleeding, etc.

Observed data were entered into Microsoft Excel Workbook. All analyses were conducted using Statistical Package for the Social Sciences (SPSS) for Windows (version 12.0, SPSS Inc., Chicago, IL, USA). Discrete categorical data (ASA physical status classes, Mallampati grades, gender distribution, insertion attempts, and incidences of adverse events) are presented as number of patients (*n*) and were analysed by Pearson Chi-square test and Fisher's exact test as appropriate. Continuous data (age, height, body mass index [BMI] and procedure time) are given as mean  $\pm$  standard deviation and were analysed with

ANOVA test. Results were considered as statistically significant when  $P < 0.05$ .

## RESULTS

This study spanned from September 2009 to June 2010. A total of 216 patients were assessed for eligibility into the study. Five patients in each modified groups (Groups F,R,W) and four patients in the conventional group, altogether 19 patients were excluded from this study on account of patient's refusal at 11<sup>th</sup> h and change in surgical plan. Hence, data from 197 patients were available for analysis. There were no statistically significant differences with regard to age, BMI, height, ASA physical status and Mallampati grade among the four groups [Table 1].

At first attempt, the highest success rate of NGT insertion was obtained in Group R (86%) whereas, at second attempt, it was highest in Group W (22%). Failure was the highest in a conventional group (30%). All the three modified techniques were found more successful than the conventional method on the first attempt ( $P = 0.008$ ). On intergroup analysis of the first attempt, neck flexion and reverse Sellick's technique, but not the guide wire method was found superior to conventional method. On intergroup analysis among the modified techniques, neck flexion technique was found comparable to reverse Sellick's and guide-wire assisted methods [Table 2].

Table 1: Demographic parameters

Parameters	Group C (n=50)	Group F (n=49)	Group R (n=49)	Group W (n=49)	P
Age (years)	40.86 $\pm$ 11.64	42.27 $\pm$ 12.00	43.69 $\pm$ 10.46	44.59 $\pm$ 14.10	0.441
BMI (kg/m <sup>2</sup> )	27.26 $\pm$ 4.16	26.51 $\pm$ 4.25	26.37 $\pm$ 4.52	28.45 $\pm$ 4.72	0.081
Height (cm)	157.74 $\pm$ 3.69	157.73 $\pm$ 3.89	157.88 $\pm$ 3.64	157.69 $\pm$ 3.76	0.995
ASA I/II	29/21	35/14	33/16	34/15	0.502
MP I/II	30/20	34/15	30/19	32/17	0.762
Sex female/male	32/18	37/12	34/15	31/17	0.547

Test done: Chi-square test and ANOVA test. Results were considered significant when  $P < 0.05$ . ASA – American Society of Anesthesiologists; MP – Mallampati; BMI – Body mass index

Table 2: Procedure parameters

Parameters	Group C (n=50) (%)	Group F (n=49) (%)	Group R (n=49) (%)	Group W (n=49) (%)	P (all groups)
1 <sup>st</sup> attempt insertion	28 (56)	37 (75)	42 (86)	32 (65)	0.008*
Intergroup analysis, P values are: *0.041 C versus F; *0.001 C versus R; 0.343 C versus W; 0.201 F versus R; 0.019 W versus R; 0.269 W versus F					
2 <sup>nd</sup> attempt insertion	7 (14)	7 (14)	5 (10)	12 (22)	0.002*
Intergroup analysis, P values are: *0.044 C versus F; 0.001 C versus R; *0.037 C versus W; 0.380 F versus R; 0.063 W versus R; 0.432 W versus F					
Failure	15 (30)	5 (10)	2 (4)	5 (12)	0.001*
Intergroup analysis, P values are: *0.014 C versus F; *0.001 C versus R; *0.014 C versus W; 0.239 F versus R; 0.239 W versus R; 1.00 W versus F					
Procedure time	39.05 $\pm$ 9.63	24.52 $\pm$ 6.65	22.39 $\pm$ 5.05	38.43 $\pm$ 9.22	0.000*
Intergroup analysis, P values are: *0.000 C versus F; *0.000 C versus R; 0.763 C versus W; 0.090 F versus R; *0.000 W versus R; *0.000 W versus F					

Test done: Chi-square test and ANOVA test. \* $P < 0.05$  considered significant

The least procedure time was noted in the reverse Sellick's method. Neck flexion and reverse Sellick's methods were comparable but significantly faster than the other two methods on intergroup comparison. Guide wire-assisted method was comparable with a conventional method regarding longer procedure time[Table 2].

The incidence of coiling, kinking and bleeding were comparable among the four groups. The highest rate of coiling was seen in Group C (32%) while the highest rate of bleeding was found in Group W (28%). Kinking was more in Group R (6%)[Table 3].

## DISCUSSION

Neck flexion, in combination with the curve of the NGT, tends to keep the tube in close proximity to the posterior pharyngeal wall, facilitating its smooth passage into the oesophagus. 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. Reverse Sellick's manoeuvre lifts the cricoid cartilage anteriorly. This anterior displacement helps to open the oesophagus more widely thus easing the passage of NGT.

In the present study a higher success rate for NGT insertion was found in the reverse Sellick's manoeuvre group (86%), followed by neck flexion with lateral neck pressure group (75%) and the ureteral guide wire group (65%), compared to conventional group (56%). The reverse Sellick's manoeuvre group had the highest success rate (86%) among the four groups. The neck flexion with lateral pressure group and guide wire-assisted technique also appears to be an attractive alternative to the conventional method considering the intergroup analysis. The overall success rate of different modified techniques for NGT insertion in the present study is in accordance with the observations of Appukutty and Shroff.<sup>[8]</sup> Considering two attempts, they found 94% success rate with 'neck flexion-lateral pressure' technique, followed by ureteral guide

wire technique (92%) compared to the conventional technique (72%).

In conscious and cooperative patients, NGT insertion is mostly performed with 'push and swallow' technique.<sup>[3]</sup> In anaesthetised, intubated patients, this procedure may require more attempts and at times it may be frustrating one. The impaction of the NGT may occur in the piriform sinus, arytenoids cartilage or the trachea.<sup>[9]</sup> Incidence of coiling, kinking and entanglement also complicates the situation.<sup>[10]</sup> Coiling around the epiglottis in non-intubated patients may present with choking, respiratory distress, tachypnea and cyanosis leading to morbidity. Accidental insertion of NGT into the tracheobronchial tree may invite morbidities like pneumothorax, haemothorax or even death.<sup>[11,12]</sup> Video laryngoscope, an effective device for tracheal intubation, have been used to facilitate NGT insertion and was found to be superior to the blind technique.<sup>[6]</sup> This device may help to diagnose NGT insertion-related complications with more accuracy.

Several methods of insertion have been described with varying degree of success. A common technique in the day-to-day practice involves blind nasal insertion while maintaining external laryngeal manipulation or under direct vision using a laryngoscope followed by instrumentation with Magill's forceps. The NGT have been inserted with reliable and high success rate (94.3% and 98.1% in first and second attempts, respectively) with the assistance of an intubation stylet tied together at the tips by a slipknot.<sup>[5]</sup>

Combination of different methods has also been reported in the literature. For example, outward and rightward pull of cricoid cartilage while maintaining mild flexion of the patient's neck, has been evaluated to be an easy and helpful method for unconscious intubated patients.<sup>[13]</sup> Essentially, the former study has evaluated the combined facilitating effect of reverse Sellick's manoeuvre and neck flexion. Recently, an oesophageal guide wire-assisted insertion while maintaining manual forward laryngeal displacement has been compared with the technique of head flexion while maintaining lateral neck pressure.<sup>[14]</sup> Here the combined facilitating effect of guide wire-assisted insertion and reverse Sellick's manoeuvre might have contributed to the highest success rate (99.2%) with that technique.

Ureteral guide wire may curtail the incidence of kinking by reducing flexibility of NGT. However,

Tables 3: Adverse events

Parameter	Group C (n=50) (%)	Group F (n=49) (%)	Group R (n=49) (%)	Group W (n=49) (%)	P
Coiling	16 (32)	14 (28.57)	15 (30.61)	9 (19.20)	0.419
Kinking	2 (4)	2 (4.08)	3 (6.12)	0 (0)	0.421
Bleeding	12 (24)	6 (12.24)	7 (14.28)	14 (28.57)	0.131

Test done: Chi-square test. \*P < 0.05 considered significant

difficulty may be faced while making the guide-wire free from the NGT and more incidence of bleeding might occur as has been noted in the present study.

pH testing and X-rays are the two first-line tests for confirmation of correct placement of NGT.<sup>[12,15]</sup> Calorimetric carbon dioxide indicator device, endoscopy, ultrasonography, fluoroscopy and magnet tracking are the other reported methods available for confirmation of the right placement.<sup>[16,17]</sup> The 'bubble technique' is also a safe, simple and economical technique for NGT placement confirmation.<sup>[18]</sup> Auscultation method is largely discredited if used on its own. We used this simple test in spite of above limitations owing to feasibility ground. This remains as a major limitation of the present study. We could not incorporate the obese, obstetric, paediatric and emergency patients with a full stomach in the present study. In future, larger studies involving those populations may consolidate the suitability of these modified techniques and may establish the superiority of any one technique in those difficult or special situations.

## CONCLUSION

The present study indicates that reverse Sellick's manoeuvre, neck flexion with lateral neck pressure or guide wire-assisted techniques - all are better alternatives to conventional method for successful, quick and reliable NGT insertion with acceptable adverse events in anaesthetised, intubated adult patients. An extended study after elimination of the major limitations of the present study is warranted to establish the superiority of anyone of these modified techniques.

## ACKNOWLEDGEMENTS

We thank Sabyasachi Das, Professor, Department of Anaesthesiology, North Bengal Medical College, Sushrutanagar for his contribution in design, conduct and approval of final manuscript.

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Source of Support: Nil, Conflict of Interest: None declared