# Nasogastric Tube Insertion in Anaesthetised and Intubated Adult Patients: A Comparison Between the Digital Assistance Technique and Conventional Blind Technique

ORIGINAL ARTICLE

**Sudipta Banerjee[1], Tapobrata Mitra[2], Sanjay Maitra[3], Swapnadeep Sengupta[4]**

## ABSTRACT

**Background and Aims:** Nasogastric tube (NGT) insertion can be challenging in an anaesthetised patient, with the conventional method bearing a failure rate of about 50%; hence, several different techniques including a novel digital assistance technique has been tried over years. **Objectives:** To compare the success rates, procedure time and incidence of adverse events for NGT insertion, among the conventional and digital assistance technique in anaesthetised, intubated adult patients. **Materials and methods:** 80 patients, aged 18 years and above, of either sex, posted for elective surgeries, requiring nasogastric tube intraoperatively, were randomly, divided into two equal groups. After doing endotracheal intubation, NGT were inserted in patients of Group A by conventional method, and that of Group B by digital assistance technique. The procedure time was calculated from insertion of the tip of the NGT into nostril till the confirmation of its position. Number of attempts and total procedure time were recorded upto 5 times, in both the groups. **Results:** In the first attempt, successful NGT placement and procedure times in Group A was in 19 patients (47.5%) and $68 \pm 16.4$ seconds respectively while that in Group B was in 32 patients (80%) and $69 \pm 13.7$ seconds respectively (p value 0.026). Adverse events occurred in 35% in Group A and 15% in Group B (p value 0.069). **Conclusion:** The digital assistance technique appears to be a better alternative to the conventional blind technique in adult patients with better success rate, less procedure time and lesser adverse events.

**KEY WORDS:** Nasogastric Tube, Conventional Method, Digital Assistance Technique, General Anaesthesia.

## Introduction

Nasogastric tube (NGT) insertion is essential for several surgical procedures where decompression of the stomach becomes necessary. Anaesthesiologists are often required to perform this procedure in the operating room (OR), specially in an anaesthetised patient. Although apparently a simple procedure, the successful placement of NGT in an unconscious and paralyzed patient may often be challenging[1]. The main reason for that being, the distal portion of the NGT, having multiple apertures, is the weakest part of the tube and, hence, susceptible to kink, coil or knot, anywhere during its insertion route[1]. Therefore, placement of NGT blindly through the nasal route with the head in a neutral position without external laryngeal manipulation (the conventional method) bears a failure rate of around 50%[2,3].

[1]Department of Anaesthesiology and Critical Care, N.R.S. Medical College and Hospital, Kolkata, West Bengal, India, [2]Associate Professor, Department of Anaesthesiology and Critical Care, Murshidabad Medical College and Hospital, Berhampore, West Bengal, India, [3]Associate Professor, Department of Surgery N.R.S. Medical College and Hospital, Kolkata, Kolkata, West Bengal, India, [4]Assistant Professor, Department of Anaesthesiology and Critical Care, Calcutta National Medical College and Hospital, Kolkata, West Bengal, India

**Address for correspondence:**
 Sudipta Banerjee, Department of Anaesthesiology and Critical Care, N.R.S. Medical College and Hospital, Kolkata, West Bengal, India. E-mail: avisudprime@gmail.com

To overcome the difficulties of conventional blind technique as mentioned above, different techniques, such as 'head flexion'[2], 'neck flexion with lateral pressure'[4], 'reverse Sellick's manoeuvre'[5] or 'Frozen NGT' methods[6], have been adopted at different times, all of which have achieved a success rate of above 80%. Several other methods for NGT placement are also mentioned in the literature such as 'slipknot to intubation stylet'[7], the 'slit-tracheal tube'-guided insertion[4], 'ureteral guidewire-assisted technique'[4] etc.

The placement of NGT is also, often, facilitated with the use of visual aids, like GlideScope[8–10], 'King Vision' video laryngoscope[11] or Endoscopic Technique[12], all of which were found to increase the success rate of NGT placement in lesser time.

However, this flood of literature with so many methods with improvisation or modification of previous techniques clearly suggest that no one method is universally acceptable with the best possible success and thus, the quest for the best is still on in this arena. In the year 2005 Mahajan Gupta R[13] mentioned a novel digital assistance technique, in which the gloved finger had been introduced in left side of the oral cavity of the patient to aid pulling down of the NGT toward the lateral pharyngeal wall once it was negotiated into the oropharynx with simultaneous pushing to the proximal end by right hand, thus, guiding the tube along the lateral pharyngeal wall into the oesophagus. This technique promises a high success rate of introduction of the NGT, though adequate research into the procedure is still awaiting.

Hence, the present study was designed to evaluate (to measure and compare) the success rates, procedure time for nasogastric tube (NGT) insertion and incidence of adverse events, if any, among the 'digital assistance' technique and conventional blind technique in anaesthetised, intubated adult patients.

## Materials and methods

After receiving the Institutional Ethics Committee clearance, this single-blinded, interventional study was conducted among 80 patients of American Society of Anesthesiologists (ASA) physical status I or II, aged 18 years and above, of either sex, posted for elective surgeries and requiring nasogastric tube intraoperatively. Patients with nasal mass, uncontrolled bleeding diatheses, significant deviated nasal septum, cleft lip, cleft palate, oesophageal stricture or history of corrosive poisoning were excluded from this study, which was conducted in the general surgery operating theatre of the N.R.S. Medical College & Hospital for a period of over 18 months approximately (march 2020 to august 2021). After obtaining written informed consent from the patients, they were equally allocated into two groups: Group A (conventional), Group B ('digital assistance technique') by opening 80 sealed envelopes with alphabets 'A' or 'B' written inside them. Group A (n=40) consisted of patients undergoing NGT insertion according to conventional blind technique whereas patients in Group B (n=40) underwent insertion of NGT by digital assistance technique.

After the patients entered the operating room, general anaesthesia with endotracheal intubation were performed with the conventional technique. Once intubated, the appropriate length of the NGT placement to reach the stomach was initially determined by measuring the total distance from the ipsilateral nostril to ipsilateral tragus and then to the mid-point between umbilicus and xiphoid process. The same brand of Nasogastric tube (Size 16-18-French Gauge) was used in order to avoid the variability in the stiffness of NGT between the two groups.

For patient in Group A, the NGT was inserted nasally, after lubricating the tip with 2% lignocaine jelly, with the head in neutral position and without any additional maneuver, The tube being held in such a way to maintain its curvature while inserted into the nose. It was then gently advanced and if resistance was felt during first attempt, the NGT was withdrawn and reinserted. After completion of NGT insertion, a finger was swapped within the oral cavity to detect coiling of the tube and in case it was found to be coiling inside the mouth, it was withdrawn to nasal cavity under gentle laryngoscopy. The next insertion was considered as second attempt.

In case of Group B, the head of the patient was first placed in neutral position. Next, the NGT was introduced through the left nostril, whereas, the gloved index finger of the left hand being introduced in the left side of the oral cavity of the patient. Once the gastric tube was negotiated into the oropharynx, it was pulled toward lateral pharyngeal wall with the index finger, virtually grasping NGT in between the index finger and lateral pharyngeal wall. Along with, the tube was pushed to the proximal end by the right hand and the left index finger simultaneously held

and guided the tube along the lateral pharyngeal wall into the oesophagus[12].

The time taken for insertion, in both the groups, was defined from the initiation of NGT insertion through the selected nostril up to the time of successful insertion of the NGT, no matter how many attempts were required and was calculated with a stopwatch. Correct NGT placement confirmed with the auscultation method, the characteristic 'whooshing' sound being looked for as a confirmatory sign while air was injected into the NGT with a 10-ml syringe (Whoosh test). If the first attempt was a failure, then multiple attempts were made to complete the procedure. However, number of attempts and total procedure time were recorded upto 5 times and it was been decided that after trying 5 attempts, the anaesthesiologist was free to take method of his/her choice to complete the procedure. Successful insertion of NGT placement within 1st attempt was considered as success rate.

For statistical analysis data were entered into a Microsoft Excel spreadsheet and then analyzed by SPSS (version 24.0; SPSS Inc., Chicago, IL, USA). All continuous data (numerical variables) are presented in the tables as mean with standard deviation. For categorical variables the data has been presented as number of patients and proportions. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples. Paired t-tests were a form of blocking and had greater power than unpaired tests. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate. A p-value $\leq 0.05$ was taken to be of statistical significance. The sample size for this study is calculated assuming that there will be 30% increase in the success rate of NGT insertion in first attempt using the digital assistance technique in comparison with the conventional blind technique, as evident from previous studies. Hence the effect size was determined for this study as 0.30. Setting the power (1- beta) of the study at 80% (thus permitting the beta error to 20%), and allowing alpha error as 5% and with the effect size of 0.30, the calculated sample size became 36 for each group. Considering a dropout of 10% the final sample size became 40 for each group.

## Results

Table 1 shows that there was no considerable difference between the groups in respect to age, weight, height, BMI, ASA physical status, MP Grade and gender distribution (P > 0.05). So, the two groups were comparable in terms of demographic parameters.

**Table 1: Demographic parameters**

| Parameters | | Group A (n=40) | Group B (n=40) | p-value |
|---|---|---|---|---|
| Age (years) (mean ± SD) | | 43.1±14.1 | 42.8±11.8 | 0.918 |
| Weight (kg) (mean ± SD) | | 57.1±8.8 | 57.3±9.1 | 0.881 |
| Height (cm) (mean ± SD) | | 161.4±8.2 | 162.7±10.5 | 0.525 |
| BMI (kg/m2) (mean ± SD) | | 21.6±1.9 | 21.7±1.8 | 0.867 |
| Sex | Male | 15/40 | 19/40 | |
| | Female | 25/40 | 21/40 | 0.498 |
| ASA | 1 | 34/40 | 32/40 | |
| | 2 | 6/40 | 8/40 | 0.770 |
| MP Grade | 1 | 23/40 | 22/40 | |
| | 2 | 14/40 | 10/40 | |
| | 3 | 3/40 | 8/40 | 0.268 |

Table 2 denotes thathigher number of successful placements of NGT in first attempt (32 out of 40) was possible in Group B (digital technique) compared with group A (conventional method) where it was 19 out of 40.

**Table 2: Success rate of NGT placement**

| Attempts | Group A (n=40) | Group B (n=40) | p-value |
|---|---|---|---|
| 1st | 19 (47.5%) | 32 (80%) | |
| 2nd | 18 (45%) | 8 (20.0%) | 0.006 |
| 3rd | 3 (7.5%) | 0 (0.0%) | |

Table 3 shows that lesser time for placement of NGT was observed in digital technique (Group B) compared to conventional method (Group A) with a statistically significant (P-value 0.026) difference between the groups.

**Table 3: Procedure times of NGT placement**

| Procedure times | Group A (n=40) | Group B (n=40) | p-value |
|---|---|---|---|
| Procedure time (seconds) (mean±SD) | 61.8±16.4 | 59.1±13.7 | 0.026 |

Table 4 shows that mean Heart Rate in both the groups were comparable before and after the procedure.

| Table 4: Heart Rate (HR) before and after procedure | | | |
|---|---|---|---|
| Heart rate (bpm) | Group A (n=40) | Group B (n=40) | p - value (Intergroup) |
| Before (mean±SD) | 74.3±8.7 | 70.8±8.9 | 0.041 |
| After (mean±SD) | 82.5±9.7 | 75.8±9.9 | 0.003 |

Table 5 shows that MAP in both the groupswere equally comparable before and after the procedure.

| Table 5: Mean Arterial Pressure before and after procedure | | | |
|---|---|---|---|
| MAP (mm of Hg) | Group A (n=40) | Group B (n=40) | p-value (Inter-group) |
| Before (mean±SD) | 91.0±6.2 | 87.5±8.1 | 0.035 |
| After (mean±SD) | 98.7±8.7 | 91.8±9.1 | 0.001 |

Table 6 shows that the incidents of adverse events like bleeding, coiling, kinking and knotting were more in Group A than Group B.

| Table 6: Adverse events | | | |
|---|---|---|---|
| Adverse Events | Group A (n=40) | Group B (n=40) | p- value |
| Bleeding | 7 (17.5%) | 3 (7.5%) | 0.311 |
| Coiling | 14 (35.0%) | 6 (15.0%) | 0.069 |
| Kinking | 6 (16.0%) | 5 (10.0%) | 0.737 |
| Knotting | 2 (5.0%) | 1 (2.5%) | 0.581 |
| Uneventful | 19 (47.5%) | 32 (80.0%) | 0.006* |

## Discussion

Nasogastric tube insertion, though appears to be a simple and easy procedure, can actually be challenging at times, specially when performed in an anaesthetised and paralyzed patient. In view of the significant failure rate, which may count upto around 50%[2,3], of the conventional technique, several different techniques have been experimented, tried and executed with varied success. However, all of them have their own limitations and none had proved to be 100% successful. A new technique, first described by Mahajan Gupta R[13] in 2005, used digital assistance to guide the NGT into the oesophagus. As the procedure seemed to be quite acceptable and successful, this study was made to compare it with the conventional technique in order to evaluate the success rates and procedure time for nasogastric tube (NGT) insertion and incidence of adverse events among the two.

In this single blinded randomised study, 80 adult patients were divided in two equal groups, Group A undergoing NGT insertion according to conventional method and Group B undergoing insertion of NGT by 'digital assistance' technique, had a comparable demographic profile.

The success rate of NGT insertion on 1st attempt was the primary outcome of this study. In this aspect, the present study found that successful NGT placements were possible in 32 out of 40 (80%) patients in Group B compared with 19 out of 40 (47.5%) patients in Group A. The difference was significant with a p-value of 0.006, clearly denoting that the success rate in 'digital assistance' technique were higher than the 'conventional blind' technique.

The success rate of that 'digital assistance technique' was comparable with other techniques considered superior to the conventional one. Mandal MC, et al.[14] found the success rates of NGT insertion in two attempts by conventional method, 'frozen' NGT and Reverse Sellick's Maneuver to be 69%, 84% and 95% respectively. Siddhartha BSV, et al.[15] found the success rate of NGT insertion to be 75% and 83% by conventional method and Reverse Sellick's Maneuver respectively. 'Neck flexion with Lateral Pressure' (success rate 94%)[16], Reverse Sellick's maneuver (success rate 83-96%)[14,15,17]. Also, the success rate of this novel technique is in accordance with Frozen NGT insertion method (success rate 84-88%)[6,14].

The other outcomes of measurement were comparison of number of attempts needed to complete the procedure by using same technique and comparison of overall procedure time (from the starting of the procedure to confirmation of the NGT in the stomach as described in methodology) and incidence of adverse events.

The overall procedure time taken to complete the NGT by digital assistance technique is shorter than the conventional blind technique as described in

Table 3. This was possibly due to the chances of first attempted success rate, which was more in digital assistance technique. The difference was significant with the p value of 0.026 as shown in the Table 3.

In that present study changes of heart rate and changes of MAP were also recorded and it was found that changes of heart rate and blood pressure was less with digital assistance technique.

Overall, the incidence of adverse events (bleeding, knotting, coiling and kinking) were also less in the digital assistance group compared with the conventional group, among which coiling was found to be highest adverse event in both groups (35%in group A vs 15% in group B) probably due to base of the tongue and inflated cuff tube. It had been observed that by using digital assistance technique chances of completing the procedure without any adverse event was more as shown in Table 6.

However, this study bears the limitation in the fact that the confirmation of correct placement of NGT was done by simple auscultation method instead of X-ray or other newer techniques such as capnography, electromagnetic tracing[18], USG or additional confirmation methods like using pH paper owing to feasibility ground. The difficulties that arose while using digital assistance technique in first attempt were mainly due to endotracheal tube cuff itself[19], insertion of obese anaesthesiologist digit in patient mouth and failure to detect the tip of the NGT in small mouth opening.

Thus, to conclude, the digital assistance technique of nasogastric tube insertion appeared superior to the conventional blind technique in respect with first attempt success rate, procedure time and lesser adverse event. Considering better success rate and lesser adverse events, the digital assistance technique appears better alternative to the conventional blind technique in adult patients with less overall procedure time.

## References

1. Mandal M, Bagchi D, Sarkar S, Chakrabarti P, Pal S. Nasogastric tube placement- a simple yet difficult procedure- a review. Journal of Evolution of Medical and Dental Sciences. 2017;6(31):2572–2576. Available from: https://dx.doi.org/10.14260/jemds/2017/556.
2. Mahajan R, Gupta R, Sharma A. Role of Neck Flexion in Facilitating Nasogastric Tube Insertion. Anesthesiology. 2005;103(2):446–447. Available from: https://dx.doi.org/10.1097/00000542-200508000-00034.
3. Bong CL, Macachor JD, Hwang NC. Insertion of the Nasogastric Tube Made Easy. Anesthesiology. 2004;101(1):266–266. Available from: https://dx.doi.org/10.1097/00000542-200407000-00058.
4. Appukutty J, Shroff PP. Nasogastric Tube Insertion Using Different Techniques in Anesthetized Patients: A Prospective, Randomized Study. Anesthesia Analgesia. 2009;109(3):832–835. Available from: https://dx.doi.org/10.1213/ane.0b013e3181af5e1f.
5. Parris WCV. Reverse Sellick Maneuver. Anesthesia Analgesia. 1989;68(3):423–423. Available from: https://dx.doi.org/10.1213/00000539-198903000-00061.
6. Chun DH, Kim NY, Shin YS, Kim SH. A Randomized, Clinical Trial of Frozen Versus Standard Nasogastric Tube Placement. World Journal of Surgery. 2009;33(9):1789–1792. Available from: https://dx.doi.org/10.1007/s00268-009-0144-x.
7. Tsai YF, Luo CF, Illias A, Lin CC, Yu HP. Nasogastric tube insertion in anesthetized and intubated patients: a new and reliable method. BMC Gastroenterology. 2012;12(1):99–99. Available from: https://dx.doi.org/10.1186/1471-230x-12-99.
8. Moharari RS, Fallah AH, Khajavi MR, Khashayar P, Lakeh MM, Najafi A. The GlideScope Facilitates Nasogastric Tube Insertion: A Randomized Clinical Trial. Anesthesia &amp; Analgesia. 2010;110(1):115–118. Available from: https://dx.doi.org/10.1213/ane.0b013e3181be0e43.
9. Kim HJ, Park SI, Cho SY, Cho MJ. The GlideScope with modified Magill forceps facilitates nasogastric tube insertion in anesthetized patients: A randomized clinical study. Journal of International Medical Research. 2018;46(8):3124–3130. Available from: https://dx.doi.org/10.1177/0300060518772719.
10. Hunter CW, Cohen S. A New Use for the GlideScope. Anesthesia &amp; Analgesia. 2006;103(2):509–509. Available from: https://dx.doi.org/10.1213/01.ane.0000227427.99390.24.
11. Okabe T, Goto G, Hori Y, Sakamoto A. Gastric tube insertion under direct vision using the King Vision$^{TM}$ video laryngoscope: a randomized, prospective, clinical trial. BMC Anesthesiology. 2014;14(1):82–82. Available from: https://dx.doi.org/10.1186/1471-2253-14-82.
12. Boston AG. A Novel Endoscopic Technique for Failed Nasogastric Tube Placement. Otolaryngology–Head and Neck Surgery. 2015;153(4):685–687. Available from: https://dx.doi.org/10.1177/0194599815588914.
13. Mahajan R, Gupta R. Another method to assist nasogastric tube insertion. Canadian Journal of Anesthesia/Journal canadien d'anesthésie. 2005;52(6):652–653. Available from: https://dx.doi.org/10.1007/bf03015781.
14. Mandal M, Karmakar A, Basu S. Nasogastric tube insertion in anaesthetised, intubated adult patients: A comparison between three techniques. Indian Journal of Anaesthesia. 2018;62(8):609–609. Available from: https://dx.doi.org/10.4103/ija.ija_342_18.

15. Siddhartha BV, Sharma NA, Kamble S, Shankaranarayana P. Nasogastric tube insertion in anesthetized intubated patients undergoing laparoscopic hysterectomies: A comparative study of three techniques. Anesthesia: Essays and Researches. 2017;11(3):550–550. Available from: https://dx.doi.org/10.4103/aer.aer_41_17.

16. Mandal M, Dolai S, Ghosh S, Mistri P, Roy R, Basu S, et al. Comparison of four techniques of nasogastric tube insertion in anaesthetised, intubated patients: A randomized controlled trial. Indian Journal of Anaesthesia. 2014;58(6):714–714. Available from: https://dx.doi.org/10.4103/0019-5049.147157.

17. Kavakli AS, Ozturk NK, Karaveli A, Onuk AA, Ozyurek L, Inanoglu K. Comparison of different methods of nasogastric tube insertion in anesthetized and intubated patients. Brazilian Journal of Anesthesiology (English Edition). 2017;67(6):578–583. Available from: https://dx.doi.org/10.1016/j.bjane.2016.08.002.

18. Smithard D, Barrett NA, Hargroves D, Elliot S. Electromagnetic Sensor-Guided Enteral Access Systems: A Literature Review. Dysphagia. 2015;30(3):275–285. Available from: https://dx.doi.org/10.1007/s00455-015-9607-4.

19. Mariyaselvam MZ, Marsh LL, Bamford S, Smith A, Wise MP, Williams DW. Endotracheal tubes and fluid aspiration: an in vitro evaluation of new cuff technologies. BMC Anesthesiology. 2017;17(1):36–36. Available from: https://dx.doi.org/10.1186/s12871-017-0328-0.