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# Comparison of ease of insertion of nasogastric tube in standard sniffing position and in additional flexion of the neck: A randomized control trial

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ABSTRACT

*Background:* Nasogastric tube insertion under anaesthesia have high reported failure rate of almost 50%.Use of front of the neck manipulations and airway instrumentation are not without complications. We hypothesized that flexion of the neck assisted NGT insertion can result in more successful nasogastric intubations over the conventional technique.
*Aims and objectives:* comparison of the ease of insertion, success rate, insertion time, manoeuvres needed and complications of NG Tube placement with the neck in standard sniffing position and in additional neck flexion.
*Methods:* Two hundred patients of ASA physical status I and II undergoing surgery under general anaesthesia and endotracheal intubation were enrolled. After induction of general anaesthesia they were randomized into two groups. Group A: NG tube insertion in the sniffing position. Group B, NG tube insertion with additional flexion of the neck.
The success rate of the technique, duration of insertion, maneuvers used and the occurrence of complications was noted.
*Results:* There was a statistically significant difference in the number of attempts, manoeuvres used, time for insertion and failure rates between the groups p-001.
*Conclusion:* Additional flexion of the neck, results in more successful and faster nasogastric intubation times with lower complication rates as compared to the traditional technique.


## 1. Introduction

Nasogastric tube insertion is often an arduous task in the intubated patient with first attempt failure rates as high as 50% [1]. Furthermore the incidence of complications like bleeding and hemodynamic perturbations increase with each unsuccessful insertion.

The NG tube's multi-apertured distal part often makes it susceptible to kinking, coiling and mucosal tears with resultant bleeding. Impaction at the arytenoids and pyriform fossae is a common occurrence [1]. Thus adopting maneuvers to slide the NG tube along the posterior pharyngeal wall would facilitate a smoother pass into the esophagus [2].

Nasogastric tube insertion during anaesthesia is often difficult. Many techniques have been proposed to aid insertion, including forward displacement of the larynx, use of a split endotracheal tube, and various kinds of forceps. The last few years have witnessed a general upsurgence in instrumental facilitation of nasogastric intubation in routine OT practice. Such techniques include the frequent and firsthand use of guide wire assisted techniques, split endotracheal tubes, different forceps as well as use of videolaryngoscope aided methods [3–6]. Although associated with good success rates,instrumental facilitation of the nasogastric tube placement is accompanied by diverse complications like mucosal tears and bleeding [6,7].

Though positional alterations like, reverse sellicks maneuver and forward displacement of the larynx have been described to aid NG tube insertion, their application and practice has witnessed a tremendous decline. Of these, lifting of the thyroid cartilage cannot be performed in patients with big thyroid and other neck masses.

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Flexion of the neck is one such positional alteration, which by keeping the nasogastric tube along the posterior pharyngeal wall, could facilitate nasogastric tube passage into the esophagus. The major advantage of this technique is simplicity and minimal complications as compared to instrumental facilitation.

The purpose of this article, as a randomized control trial is to evaluate and establish the efficacy and safety of simple neck flexion without any instruments. We hypothesized that this simple positional alteration without using any other instruments may have a high success rate for NG tube placement when performed by senior anesthesiologists.

## 2. Methods

The study was approved by the Institutional ethics committee (No.EC/NIMS/1751/2016) and the Indian Clinical Trial Registry (CTRI/2017/02/007832). Written informed consent was obtained from all the patients. This study has ethics committee approval.

Study Design: This is a prospective, randomized clinical study.

Inclusion criteria: 200 hundred adults of ASA physical status I and II belonging to both the genders, scheduled for surgery under general anaesthesia requiring a nasogastric tube placement were enrolled in the study.

Exclusion criteria: Patients belonging to ASA status III, IV, those with airway distortion or trauma, bleeding diathesis, pregnant patients, at risk of pulmonary aspiration, cervical spine pathology, neck mass, on anticoagulants or aspirin and those with gastro-esophageal reflux disease were excluded from the study. A detailed preoperative assessment was performed with respect to history and patients' demographic data.

Following airway measurements were noted in the preoperative period: thyro mental distance (TMD), Sterno mental distance (SMD), neck circumference (NC), body mass index (BMI) and modified Mallampati grading. Preoperatively, the enrolled patients were randomized using computer-generated randomized numbers into the two groups. The patients were not informed about the group they were enrolled in and the anaesthesiologist was also not informed of the same, until at least 1 minimum alveolar concentration end-tidal concentration of sevoflurane was confirmed after intubation.

Group A (n-100): sniffing position and.

Group B (n-100): flexion of the neck with additional head pillow.

Induction of general anaesthesia and endotracheal intubation with polyvinyl chloride endotracheal tube of size 7.5 mm (for female) or 8.0 mm (for male) internal diameter was carried out as per routine institutional protocol. A standard 14 Fr. NG tube was lubricated at the distal end and passed through the largest patent nostril of the patients in both the groups. A well-lubricated 16-French gastric tube was inserted via one nostril for a premeasured length from the xiphoid process of the patient till the tragus via the nose. In Group A, the NG tube was inserted with the head maintained in the sniffing position. In Group B, procedure was attempted with additional flexion of the neck, obtained by placing an extra pillow under the head. Correct placement of the NG tube in the stomach was verified by auscultation and aspiration of gastric contents.

The start time of the procedure was taken at beginning of NG tube insertion into the chosen nostril and the end time was when successful gastric placement as verified by auscultation and aspiration of the stomach contents.

In the event of failure of the first attempt, the NG tube was completely withdrawn and reinsertion tried with the following manoeuvres used in succession:

1. Jaw lift
2. Laryngeal lift
3. Change of nostril
4. Change in the direction of the NG tube
5. Use of urethral guide wire, or Magill's forceps.

**Data Noted:** The following data were noted in both the groups:

a) Success rate of the technique
b) Duration of insertion
c) Number and type of alternative techniques used.
d) Occurrence of complications (bleeding, coiling)

Criteria to define failure included presence of ≥2 of the following:

a) Not able to insert the tube in 2 attempts,
b) Use of more than one alternative technique such as jaw lift, laryngeal lift, Use of laryngoscope, Magill's forceps
c) Time more than 90 s.

### 2.1. Statistical analysis

Sample Size: The proportion of failure in pilot study with sniffing position was 30%. A sample size of at least 69 per group was calculated to achieve 81% power at a significance level of 0.05 to detect a 20% difference in proportion of failure in between the groups. The sample size was rounded off to 100 per group.

Descriptive statistics: Data was expressed as mean and standard deviation for continuous variables and frequency with percentage for categorical variables.

Analytical statistics: categorical data was compared between the groups using chi square test and continuous data was compared using independent sample test. A two sided p value of <0.05 was considered significant. Statistical package used was SPSS 22.

## 3. Results

All the 200 patients assessed could be enrolled into the study. There were no statistically significant differences in the demographic data between the 2 groups studied (Table 1).

Successful NG tube placement could be achieved in 92% of the patients in group B in less than 2 attempts as opposed to 68% of patients in sniffing position (Table 2). Of these, successful placements were recorded in 76% (70/92) of patients in the first attempt in group B as compared to 63% (43/68) in the first attempt in group A. Multiple attempts of more than 2 times were needed in only 8% patients in group B and in 32% of them in group A.

Successful NG tube placement was possible in less than 90 s in 98% of the patients in Group B as compared to 86% of patients in group A, which achieved statistical significance (p-0.001) (Table 3).

Correct NG tube placement was possible without any additional maneuvers in 60% of the patients in Group B, as compared to only

**Table 1**
Demographic data.

| Variable | Group-A Sniffing position (n-100) | Group B Additional neck flexion (n100) | p |
|---|---|---|---|
| Age(years) | 35.8 ± 11 | 37.6 ± 11.3 | 0.37 |
| Gender M/F | 48/52 | 68/32 | 0.68 |
| Height(cm) | 157.2 ± 9.5 | 155.2 ± 8.9 | 0.29 |
| Weight(kg) | 62.1 ± 16.6 | 58.2 ± 14.1 | 0.21 |
| BMI($kg/m^2$) | 25.1 ± 6.2 | 24.4 ± 6.3 | 0.64 |

Values expressed as mean ± SD or number of patients.

**Table 2**
Success rates of nasogastric tube insertion in both groups.

| Parameter | Group-A Sniffing position (n = 100) | Group-B Additional Flexion position (n = 100) | P value |
|---|---|---|---|
| Attempts 2or less | 68 (68) | 92 (92) | P < 0.001* |
| Attempts >2 | 32 (32) | 8 (8) | |

Values expressed as number of patients and percentage (%).

**Table 3**
Time for successful nasogastric tube placement.

| Parameter | Group-A Sniffing position (n = 100) | Group-B Additional flexion position (n = 100) | P value |
|---|---|---|---|
| Time of insertion >90 s | 14(14) | 2(2) | 0.001* |
| Mean time for insertion(seconds) | 29.9(19.6) | 22.7 (11.4) | 0.013* |

Values expressed as number of patients and percentage (%) and mean ± SD.

30% in group A (p-0.003). The failure rate was only 8%(8/100) in group B, as compared to 32%(32/100) in group A(Table 4).

The overall incidence of complications was significantly less in group B ($p < 0.05$), with coiling in the oral cavity being the commonest complication observed in group B, and kinking of the NG tube being the commonest in Group A. None of the patients in group B had mucosal bleed, which was seen in 2% of patients in group A (Table 5).

## 4. Discussion

In this randomized trial, we found that as compared to traditional sniffing position, in which most of the NG tube insertions are attempted, additional flexion of the neck, results in significantly more successful and faster NG tube placements. Nasogastric intubation in this position also results in a lower rate of commonly observed complications like coiling, kinking, bleeding and mucosal injury.

Most of the prior studies have suggested the use of either additional equipments eg. guidewire alone or various airway maneuvers in combination(combination of neck flexion, reverse sellicks maneuver, laryngeal lift, lateral positioning) to be most effective in successful NG tube placement; resulting however in an often unwarranted upsurgence in their use [7]. The fact that the high success rates of these techniques is often at the cost of increased complications cannot be overlooked [6,8,9]. Appukutty and Shroff [6] have demonstrated that the use of esophageal guide wire to increase the rigidity of the NG tube increased the success rate but only at the cost of higher incidence of complications like mucosal trauma and bleeding.

Our study results conducted in 100 anaesthetized patients reveal that simple additional neck flexion by placing a pillow under the head results in faster and successful NG tube placement rate of as high as 92% of patients without the need for any instrumentation for the purpose. Only 2 patients (2%) in group B mandated the use of urethral catheter and Magill's forceps to facilitate successful nasogastric intubation.

Two prior studies by Appukutty and Shroff [6] and Amina Mohamed Illias et al. [10], using neck flexion with lateral pressure have reported success rates of 92% and 88% respectively. In our study we found a similar success rate with simple neck flexion without any lateral pressure of the neck, achieved by an additional pillow alone to yield good success. When compared with other non instrumental techniques, reverse sellicks maneuver and laryngeal lift though popular have yielded varied success rates ranging from 52% to 92% [7,10,11]. Further studies comparing reverse sellicks maneuver and neck flexion would be necessary to make recommendations regarding the superiority of one over the other. More importantly and of relevance in day to day clinical practice, lateral neck pressure, reverse sellicks and laryngeal lift may not be technically feasible nor without complications in a patient with a large thyroid or other neck masses. Bradycardia due to activation of the carotid sinus reflex has been reported during excessive manipulation of the thyroid cartilage during the laryngeal lift maneuver [10].In this subset of patients, simple neck flexion could be an easy and valuable method to guide NG tube placements without the need for unnecessary instrumentation.

Time for insertion: We found that 98% of the patients could be successfully inserted with the NG tube in less than 90 s with an additional neck flexion, as compared to 86% of patients in the sniffing position Though other studies have found a mean placement time of around 30 s, none of them have actually studied the

**Table 4**
Additional manoeuvres and failure rates.

| Parameter | Group-A Sniffing position (n = 100) | Group-B Additional Flexion position (n = 100) | P value |
|---|---|---|---|
| Change in direction of the Ng tube | 30 | 14 | 0.005* |
| Jaw lift | 57 | 31 | p < 0.001* |
| Laryngeal lift | 38 | 14 | p < 0.001* |
| Manoeuvres | | | |
| 0 | 30 | 60 | 0.003* |
| 1 | 19 | 25 | |
| 2 | 19 | 7 | |
| 3 | 17 | 6 | |
| Use of instruments(urethral catheter/guide wire/Magill's forceps) | 15 | 2 | |
| Failure (Criteria >2) | 32 | 8 | p < 0.001* |

Values expressed as number of patients and percentage (%).

**Table 5**
Complications of NG tube placement.

| Parameter | Group-A Sniffing position (n = 100) | Group-B Additional Flexion position (n = 100) | P value |
|---|---|---|---|
| Coiling in oral cavity | 35(35) | 6(6) | 0.002* |
| Kinking | 38(38) | 3(3) | 0.000* |
| Bleeding | 2(2) | 0(0) | 0.000* |

Values expressed as number of patients and percentage (%).

percentage of patients in whom NG tube could be placed in less than a commonly accepted time frame; hence comparisons cannot be made [6,7]. We chose an average time of 90 s as acceptable based on our own clinical experience and due to the fact that the average time could vary with experience of the anaesthesiologist and familiarity with the selected maneuver.

Complications: In agreement with prior studies on NG tube, coiling in the oral cavity and kinking were the most common complications noticed, though both were significantly less than the control group [6,12].Though few patients required multiple attempts and 2 required instrumental facilitation, none of them had any mucosal injury or bleed.

As elucidated by Ozer and Benumof [2], the pyriform fossae and arytenoids cartilages are the commonest sites of nasogastric tube impaction, resulting in their coiling in the oropharynx. Once impacted in these structures, the distal perforated weak part of the nasogastric tube further facilitates coiling and kinking, thus retarding its esophageal entry. Furthermore, loss of tone and backward displacement of the tongue is a common occurrence in the paralyzed patient. Such glossoptosis, by blocking the pharyngeal passage, hinders the entry of the NG tube into the upper esophagus [13,14].

The technique of neck flexion in facilitating NG tube passage is based on two concepts: Flexion of the neck, maintains the nasogastric tube along the posterior pharyngeal wall, thus preventing impaction at the pyriform fossae and the arytenoids [2,15].Secondly the positional change serves to handle the issue of glossoptosis by increasing the space between tongue and the posterior pharyngeal wall. Both these factors promote the easy entrance of the NG tube into the esophagus as seen in our study.

This article should act as a reminder to encourage the use of this simple maneuver as the elective and first choice in NG tube placements, thus preventing unnecessary manipulations of the thyroid, larynx and instrumentation of the airway with their associated complications. Instrumental techniques should be used only to 'salvage' the occasional extremely difficult NG tube placement, only when other non-instrumental methods have failed.

Conclusion: Additional flexion of the neck, results in more successful and faster nasogastric intubation times with lower complication rates as compared to the traditional technique. Routine, elective adoption of this technique would promote reliable and consistent nasogastric tube placement, avoiding unwarranted front of the neck manipulations and instrumentation of the airway for this purpose in majority of patients.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.tacc.2019.03.002.

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