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Original Article

Anaesthesia Section

Comparison between the Reverse Sellick's and SORT Manoeuvres of Nasogastric Tube Insertion in Anaesthetised, Intubated, Adult Patients- A Randomised Clinical Study

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ABSTRACT

Introduction: In the perioperative period and critical care unit, Nasogastric Tube (NGT) placement is a simple procedure which turns in to a difficult one in anaesthetised, intubated patient. The SORT manoeuvre (a combination of Sniffing position, Orientation of nasogastric tube, Rotating the patient's head to the contralateral side and Twisting movements of operator's hand) has been studied sparingly. Reverse Sellick's manoeuvre is a commonly applied method for NGT placement where cricoid cartilage is lifted by the performer with non dominant hand during placement of NGT.

Aim: To ascertain the success rate of SORT manoeuvre in comparison with the reverse Sellick's manoeuvre for NGT placement in anaesthetised and intubated adults.

Materials and Methods: This single-blinded, randomised study was conducted in N.R.S. Medical College and Hospital (tertiary care centre), Kolkata, West Bengal, India, from March 2020 to August 2021. Total 102 adults patients, scheduled for abdominal surgeries under general anaesthesia with intubation, were included. The patients received NGT placement either by applying reverse Sellick's manoeuvre (group A, n=51) or using SORT manoeuvre (group B, n=51), following a random allocation method. The number and percentage of patients having successful NGT placement within first attempt in each group was recorded. The time to perform the procedure and any incidence of adverse event were recorded. Quantitative variables were compared using Independent t-test between the two groups. Qualitative variables were compared using Chi-square test/Fisher's exact test, as appropriate. A p-value ≤0.05 was considered statistically significant.

Results: Successful placement of NGT within single attempt was feasible in 48 (94.1%) patients using the SORT manoeuvre in contrast with 38 (74.5%) applying the reverse Sellick's manoeuvre (p-value=0.006). Longer procedure time was observed with the SORT manoeuvre compared to the reverse Sellick's manoeuvre (22.3±4.4 vs 20.1±3.8 seconds), respectively; p-value=0.008). Use of SORT manoeuvre in comparison with reverse Sellick's manoeuvre resulted in apparently lower incidence of adverse events (coiling 1.96% vs 19.6%; kinking 1.96% vs 3.92%, respectively); however, found statistically not significant (p-value=0.305). However, overall incidence of adverse events was considerably more in reverse Sellick's manoeuvre compared with the SORT manoeuvre (25.5% and 5.8%, respectively, p-value=0.006).

Conclusion: The SORT manoeuvre appears to be advantageous over the reverse Sellick's manoeuvre for NGT placement in adult patients undergoing surgery under general anaesthesia with intubation, in terms of higher success rate and lower incidence of adverse events.

Keywords: Cricoid cartilage, Nasopharynx, Oesophagus, Pharynx, Whooshing sound

INTRODUCTION

Placement of Nasogastric Tube (NGT) is an essential instrumentation for several abdominal as well as thoracic surgeries. It is as such a simple procedure and usually executed by the anaesthesiologists. However, correct placement of this tube often becomes difficult in adult patients, while they are in the intubated state under general anaesthesia. The distal part of the tube having several holes in the wall, is vulnerable to kink, coil or form a knot, mostly in the pharynx or oesophagus when it faces slight resistance during its natural path [1]. Conventional method of NGT placement is placement of the tube blindly through the nasal route, keeping the position of the head as neutral- i.e., neither flexed nor extended. Also, external laryngeal manipulation and any change of head position are not allowed during this classic conventional method which has a failure rate of around 50% [2].

To overcome the difficulties and to increase the success rate of above mentioned blind method, clinicians have adopted different techniques such as 'head flexion', 'neck flexion with lateral pressure', 'reverse Sellick's manoeuvre' (anterior lifting of the cricoids cartilage), or 'frozen NGT' methods (a silicone NGT is filled up with distilled water and subsequently freezing it) [2-5]. All of which achieved a success rate of above 80%. Several other methods for NGT placement are mentioned in the literature [3,6-10]. The use of Glide Scope and 'King Vision' video laryngoscope was also found to facilitate NGT placement in lesser time [11,12]. The flood of literature with so many methods, modification of previous technique, frequent arrival of new technique i.e., all indicate that no one method is universally acceptable with high success rate and the quest for the best is still on in this arena.

The reverse Sellick's manoeuvre was first described by Parris WC, in the year of 1989. It is the forward or anterior displacement of the cricoid cartilage using the fingers. It facilitates the insertion of NGT by opening the oesophagus more widely and its success rate is about 75-80% [4]. Although, a higher success rate of about 94% has been reported by other researchers [13]. In the year of 2016, Najafi M and Golzari SEJ, introduced a novel technique for nasogastric tube insertion [14]. It is the SORT manoeuvre. The word SORT is the acronym for the following steps of the manoeuvre i.e., sniffing position, orientation of the nasogastric tube, rotation of the head to the contralateral side of insertion with external pressure at the pyriform fossa and at last twisting motion of the NGT while gently pushing it into the oesophagus. The placement of NGT is facilitated by using of visual aids.

Although, the technique SORT manoeuvre has been mentioned in that article, its success rate has not been assessed [14]. At the time of framing the present study, no data was available regarding the success rate of this particular manoeuvre. An article depicting the manoeuvre, a case report describing its use and one review article was the only literature available at that time. Thus, a lacuna was identified in the existing literature [14-16].

Hence, the present study was designed to evaluate (to determine and compare) the success rates, procedure time for NGT insertion and incidence of adverse events (coiling, kinking and bleeding), if any, among the SORT manoeuvre and the reverse Sellick's manoeuvre. The primary objective was comparison of the success rate of patients in whom successful nasogastric tube insertion could be possible using either the SORT manoeuvre or the reverse Sellick's manoeuvre at a single attempt. Other outcome measures were to compare the procedure time and the incidences of adverse events between the two groups.

MATERIALS AND METHODS

This randomised clinical study was conducted in the N.R.S. Medical College and Hospital, Kolkata, West Bengal, India, from March 2020 to August 2021. The Institutional Ethical Committee had approved the study (No. NMC/436, dated 27.01.2020). An informed consent was taken from every patient. They were also given the option to opt-out from the study at any time.

Sample size calculation: From the literature, it was noted that the reverse Sellick's manoeuvre had a success rate of 75% [4]. It was assumed that at least 20% increase in success rate using the SORT manoeuvre (as compared with reverse Sellick's manoeuvre) would be clinically significant. Hence, the effect size was 0.20. Setting the confidence level at 95% (α=0.05) and the power (1-β) of the study at 80%, a sample size of 46 per group was obtained. The formula of comparing two proportions as mentioned in the article of Das S et al., was followed [17]. Expecting a 10% dropout, a total of 102 patients were enrolled for this study.

Total 110 patients were screened in the preanaesthesia clinic for recruitment in the current study. However, three of them did not turn up for surgery. Five patients changed their mind and refused to participate in the study. Thus, finally 102 patients were subjected for random allocation. The data from all 102 patients were available for analysis.

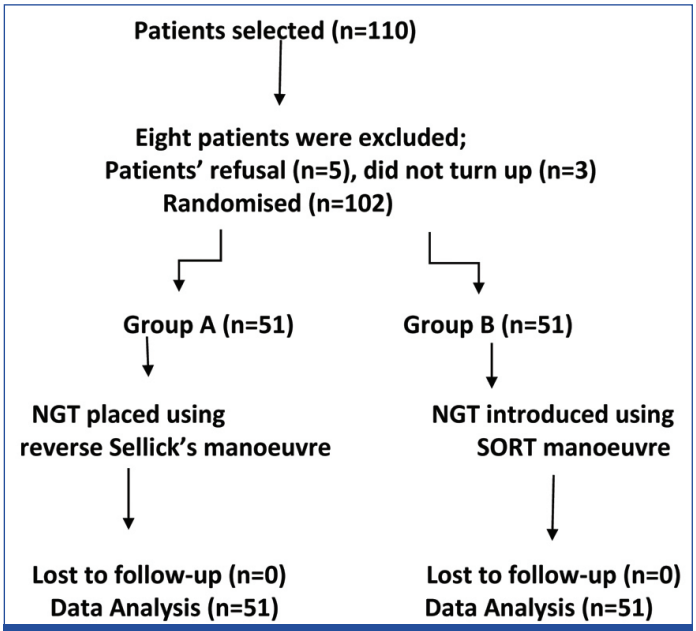
Inclusion criteria: All adult patients (18 years and above), scheduled for abdominal surgeries under general anaesthesia with intubation and subsequent requirement of placement of NGT were included in the study.

Exclusion criteria: Any structural abnormalities in the nasal or oropharyngeal area such as cleft palate, considerable deviated nasal septum and patients with nasal or oropharyngeal masses, patients with oesophageal stricture or other pathologies, those with considerable injuries involving the head and neck region over head or neck and those with suffering from thrombocytopaenia or coagulopathies were excluded from the study.

Study Procedure

Once the patient was received in the operation room, the preanaesthesia check-up report was verified. An intravenous access was established with an 18 G cannula. Continuous monitoring was done using Electrocardiogram (ECG), End-tidal carbon dioxide ($EtCO_2$) and SpO_2 while continual monitoring was done with measurement of Non Invasive Blood Pressure (NIBP). Before induction of general anaesthesia, the optimum nostril for NGT placement was selected based on the better fogging procedure on a metal tongue depressor during exhalation. Premedication was done, as appropriate for each patient, using fentanyl (2 mcg/kg), glycopyrrolate (4 mcg/kg), and ondansetron (0.1 mg/kg). Propofol (2 mg/kg) or thiopentone (3-4 mg/kg) was the induction agent depending on the patient's variables. Depolarising muscle relaxant, succinylcholine (2 mg/kg) was used for intubation by laryngoscope. Endotracheal tube of appropriate size was used depending on patient variables. Muscle relaxation was maintained with atracurium.

After induction of anaesthesia and intubation, the patients were randomly into two groups with 'sealed envelope' technique, to receive placement of NGT using either reverse. Reverse Sellick's manoeuvre (group A; n=51) or using the 'SORT' manoeuvre (group B; n=51). There were 102 sealed envelopes each containing a piece of paper marked with numbers ranging from 1-102. The envelopes were placed in a container and then reshuffled. After induction of anaesthesia, one envelope picked up at random and opened to find the number. On getting an 'even' number, the reverse Sellick's manoeuvre was followed and in case of finding an 'odd' number the SORT manoeuvre was used. The used envelope with the paper slip was then discarded. Thus, the issue of 'selection bias' was averted to some extent. The procedure of NGT placement was performed by a single anaesthesiologist who remain fully aware of the particular technique being used . Owing to the anaesthetised state, the patients remain unaware (blind) about the technique followed. Thus, the interobserver variability was minimised and the study was single-blinded [Table/Fig-1].



[Table/Fig-1]: Flow diagram showing patient selection, randomisation and lost to follow-up.

In both the groups, prior to NGT insertion, the cuff of the endotracheal tube was deflated and the tip of the NGT was lubricated with 2% lignocaine jelly. The length of the NGT to be inserted was determined by measuring the distance from the ipsilateral nostril to the ipsilateral tragus and further to the xiphoid process [7]. Once the NGT was successfully placed, the cuff of the endotracheal tube was reinflated.

Confirmation of correct position of NGT was done primarily by auscultation of a 'whooshing' sound over epigastrium while injecting air into NGT through a 10 mL syringe. The procedure time for successful placement of NGT was recorded from the moment of insertion of NGT into nostril till the confirmation of its correct position by auscultation over epigastrium. A case was termed 'successful' if the NGT can be properly placed in the first attempt. Any adverse event occurring during the procedure was recorded.

Group A (Reverse Sellick's manoeuvre)

After intubation with appropriate size endotracheal tube, the patient's head was kept in neutral position. Then anterior displacement or lifting of cricoid cartilage by using fingers of non dominant hand of anaesthetist was done and then NGT was inserted through the patient's nostril by the dominant hand of anaesthetist. After

placement, the correct position of tube was verified by pushing 10 mL of air into the tube, and finding a 'whoosh' sound on auscultation. If the tube was found to be correctly placed in the 'first attempt', the case was taken as 'successful'.

Group B (SORT manoeuvre)

The patient's head was placed as 'sniffing the morning air' position with the lower cervical spine flexed and atlanto-occipital joint extended. The curvature of the NGT was oriented to align with the anatomy, leading from the nose to the oesophagus. Then the patient's head then rotated contralateral to the side of insertion and external pressure was applied at the pyriform fossa to obliterate the fossa. At last, the NGT was gently pushed into the oesophagus with a twisting motion [14]. The confirmation of correct placement and consideration of 'successful' placement was ascertained in the same way that was done in group A.

The following study variables were noted-

- The number of cases with successful NGT placement in the first attempt
- The time taken for the procedure
- Any adverse events (coiling, kinking, bleeding) occurring during the procedure.

STATISTICAL ANALYSIS

The data entry was done using MS excel spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0. Categorical variables were presented as number of patients and proportion (%) and continuous variables were presented as mean±Standard Deviation (SD). Data was found having normal distribution with the use of Kolmogorov-Smirnov test. Quantitative variables were compared using Independent t-test between the two groups. Qualitative variables were compared using Chi-square test/Fisher's exact test, as appropriate. A p-value of ≤0.05 was considered statistically significant.

RESULTS

The demographic data were found to be comparable between the two groups [Table/Fig-2]. The success rate was found considerably high using the SORT manoeuvre [Table/Fig-3]. The procedure time was found considerably longer using the SORT manoeuvre [Table/Fig-4].

Parameters	Reverse Sellick's manoeuvre (n=51)	SORT manoeuvre (n=51)	p-value
Age (years), Mean±SD	42.14±13.55	44.29±13.82	0.428 (Student's t-test)
Weight (kg), Mean±SD	53.43±10.59	52.76±8.09	0.722 (Student's t-test)
Gender			
Male	22	27	0.322 (Chi-square test)
Female	29	24	
American Society of Anaesthesiologists-Physical status (I /II)	39/12	35/16	0.375 (Chi-square test)
Mallampati grade (1&2/3&4) '†'	47/4	48/3	0.695 (Chi-square test)

[Table/Fig-2]: Demographic parameters.
A p-value ≤0.05 was considered as significant; Grade 1: Visualisation on the soft palate, fauces, uvula and both anterior posterior pillars; Grade 2; Visualisation of the soft palate, fauces and uvula; Grade 3; Visualisation of the soft palate and the base of the uvula; Grade 4; The soft palate is not visible at all

Parameters	Reverse Sellick's manoeuvre (n, %)	SORT manoeuvre (n, %)	p-value
Success in first attempt	38 (74.5%)	48 (94.1)	Chi-square value=7.4127 p-value=0.0064
Second attempt	13 (25.5%)	2 (3.9%)	
Third attempt	0	1 (1.9%)	

[Table/Fig-3]: Success rate of NGT placement.

Procedure time (seconds)	Reverse Sellick's manoeuvre (n=51)	SORT manoeuvre (n=51)	p-value (Chi-square test)
Mean±SD	20.1±3.8	22.3±4.4	0.008
Minimum-Maximum (Median)	15-30 (20)	14-35 (22)	

[Table/Fig-4]: Procedure time.
A p-value ≤0.05 denotes statistical significance

Considering all types of adverse events, the overall incidence of adverse events was found to be more in reverse Sellick's manoeuvre compared with the SORT manoeuvre (25.5% and 5.8%, respectively) [Table/Fig-5]. The vital parameters (heart rate and mean arterial pressure) were comparable between the groups at all time points of measurements [Table/Fig-6].

Parameters	Reverse Sellick's manoeuvre (n, %)	SORT manoeuvre (n, %)	p-value
Adverse events			
Yes	13 (25.5%)	3 (5.8%)	χ^2=7.4128; p-value=0.006
No	38 (74.5%)	48 (94.1%)	
Specific types			
Bleeding	1 (1.96%)	1 (1.96%)	χ^2=2.3745; p-value=0.305
Coiling	10 (19.61%)	1 (1.96%)	
Kinking	2 (3.92%)	1 (1.96%)	

[Table/Fig-5]: Adverse events recorded.
A p-value ≤0.05 denotes statistical significance

Parameters	Reverse Sellick's manoeuvre (Mean±SD)	SORT manoeuvre (Mean±SD)	p-value (Student's t-test)
Heart rate (beats per minutes)			
Baseline	94.7±13.5	95.0±12.4	0.897
Before intubation	89.8±12.9	90.4±12.6	0.847
Postintubation	107.7±14.8	106.6±13.1	0.682
Post NGT insertion	97.7±13.2	97.9±9.9	0.926
Mean arterial pressure (mmHg)			
Baseline	93.88±6.37	95±9.20	0.478
Before intubation	87.29±5.65	87.94±6.48	0.592
Postintubation	101.69±9.16	99.96±10.33	0.374
Post NGT insertion	96.14±7.39	95.65±5.95	0.713

[Table/Fig-6]: Heart rate and mean arterial pressure at different time points.
A p-value ≤0.05 considered as statistical significant

DISCUSSION

In the present study, two methods of NGT placement i.e., the SORT manoeuvre and the reverse Sellick's manoeuvre were compared in terms of success rate, procedure time and adverse events. The present study found that the success rate for placement of NGT was higher using the SORT manoeuvre compared with the reverse Sellick's manoeuvre (94.1% vs 74.5% respectively). At the time of framing the current study design, no data was available regarding the success rate of SORT manoeuvre. However, at the time of reporting the present study, the observations of two reports have become available [18,19]. Sanaie S et al., found around 90% success rate in the first attempt using the SORT manoeuvre as compared to 17% using the 'neck flexion with lateral presure' technique [18]. Dhakal SD et al., found 94% success rate in the first attempt using SORT maneuver in comparison with 77% using conventional blind method [19].

In the present study, time taken for placement of NGT using the SORT manoeuvre was found to be significantly higher compared with that applying reverse Sellick's manoeuvre (about 22 seconds vs 20 seconds, respectively). Dhakal SD et al., also reported longer procedure time for SORT manoeuvre in comparison with blind method, the median time 25 seconds and 22 seconds,

respectively [19]. The comparatively longer procedure time during SORT manoeuvre might be due to its four step manipulations.

The increased success rate of SORT manoeuvre can be due to the combined effect of four separate manipulations. Placing the patient in sniffing position, the arytenoid cartilage is shifted away from oesophagus. The rotation of head to contralateral side (during SORT manoeuvre) obliterates the ipsilateral pyriform sinus. Twisting component is applied for 'back and forth' movement to reduce resistance during deep insertion though a collapsible structure, the oesophagus [18]. Thus, the components help steering the NGT in to its intended course in a smoother way. The SORT manoeuvre tries to negotiate the NGT along the path of least resistance, thereby reducing injury.

In the present study, coiling of NGT has occurred more in reverse Sellick's manoeuvre group compared with SORT manoeuvre group. Lifting of the cricoid cartilage with reverse Sellick's manoeuvre not only make oesophagus more widely open but also increase the space around pyriform sinuses. The former can increase the success rate of proper NGT placement while the later may be the potential cause for impaction of NGT into the pyriform sinuses. The overall proportion of adverse events was higher in the revere Sellick's manoeuvre group, compared with the SORT manoeuvre (25.5% vs 5.8%, respectively) considering summation of coiling, kinking and bleeding episodes in the two groups. In a recent study, the incidence of adverse events during SORT manoeuvre is reported as high as 31% [16]. The difference in the incidence of adverse events between reverse Sellick's manoeuvre and SORT manoeuvre could easily be explained due to the higher incidence of coiling in the reverse Sellick's group. Although, the SORT manoeuvre includes four step method, the use of 'to-and-fro' as well as rotational movement during insertion provided a better scope for negotiation of the tube through a new passage that avoided coiling and kinking. In other words, application of undue force was strictly prohibited while performing the SORT manoeuvre. This had been emphasised repeatedly by Najafi M and Golzari SEJ, the pioneer of this novel method [14]. The essence of SORT manoeuvre is to minimise injury at the cost of lengthened procedure time. The use of polyurethane tubes could have reduced the mucosal injury. However, it should be kept in mind that such soft tube with increased flexibility can lead to more frequent coiling and kinking of the NGT [15,20].

In the present study, some practical problems were faced in the SORT manoeuvre group during lateral rotation of the head. The endotracheal tube is usually fixed at the angle of mouth on right side. The problem arises, if the clinician chooses to insert the NGT through the right nostril. When there is a need for rotation of the head towards left (contralateral rotation of head, a part of SORT manoeuvre), the movement become cumbersome with the fixed endotracheal tube along with the attached ventilator circuit. Extra care is warranted to ensure maintaining proper position of the endotracheal tube, keeping in mind about the significant dragging of the endotracheal tub. Since, the cuff of the endotracheal tube was deflated prior to insertion there is a risk of extubation at this stage while contralateral rotation of head is performed. During this lateral rotation of head, the endotracheal tube and the ventilator circuit hanging in front can also create a hindrance to the path of vision while performing NGT placement. This may be solved by keeping the endotracheal tube detached from the ventilator circuit during NGT insertion. The detachment of endotracheal tube from the circuit may not safe for frail patients as the procedure time may vary at times even for this simple procedure.

The auscultation method for confirmation of proper placement of NGT may not differentiate from artifacts such as the transmitted sound from lungs, oesophagus, duodenum or proximal jejunum in case of improper placement [21-23]. X-ray is considered as the golden test for confirmation of proper placement of NGT [22,24]. The use of pH paper for detection of gastric secretion, combination of pH testing along with the use of biochemical markers such as bilirubin, trypsin and pepsin and electromagnetic tracing [25,26]. All might be useful for confirmation of NGT position. Colorimetric CO_2 detection and capnography is useful to detect improper placement of NGT in the lungs [27].

Limitation(s)

In the present study, the confirmation of NGT placement was done by detecting a 'whoose' sound at epigastrium on auscultation while pushing 10 mL of air rapidly through NGT. This is simply for logistic reason. This auscultation method is simple and can be done easily at bedside without any advanced gadget. The radiological confirmation of NGT tip location was not possible in the operation theatre set up on regular basis. Also, the polyurethane made NGT could not be used owing to local unavailability due to logistic reasons.

CONCLUSION(S)

To conclude, a considerable higher success rate for nasogastric tube placement can be achieved using the SORT manoeuvre as compared with the reverse Sellick's manoeuvre in adult anaesthetised patients in the operation theatre set up. The procedure time appears to be longer using SORT manoeuvre. The incidence of adverse events is found to be lesser during SORT manoeuvre for insertion. The overall benefits to the patients may be considered greater with SORT manoeuvre in comparison with reverse Sellick's manoeuvre. The SORT manoeuvre can be a better alternative to reverse Sellick's manoeuvre for nasogastric tube placement in anaesthetised, intubated adult patients.

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