Nasogastric Tube Insertion Using Different Techniques in Anesthetized Patients: A Prospective, Randomized Study

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BACKGROUND: It is often difficult to correctly place nasogastric (NG) tubes under anesthesia. We hypothesized that simple modifications in technique of NG tube insertion will improve the success rate.

METHODS: Two hundred patients were enrolled into the study. The patients were randomized into four groups: control, guidewire, slit endotracheal tube, and neck flexion with lateral neck pressure. The starting point of the procedure was the time when NG tube insertion was begun through the selected nostril. The end point was the time when there was either a successful insertion of the NG tube or a failure after two attempts. The success rate of the technique, duration of insertion procedure, and the occurrence of complications (bleeding, coiling, kinking, and knotting, etc.) were noted. χ^2, analysis of variance, and Student's *t*-test were used to analyze the data.

RESULTS: Success rates were higher in all intervention groups compared with the control group. The time necessary to insert the NG tube was significantly longer in the slit endotracheal tube group. Kinking of the NG tube and bleeding were the most common complications.

CONCLUSION: The success rate of NG tube insertion can be increased by using a ureteral guidewire as stylet, a slit endotracheal tube as an introducer, or head flexion with lateral neck pressure. Head flexion with lateral neck pressure is the easiest technique that has a high success rate and fewest complications.

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The insertion of a nasogastric (NG) tube in anesthetized, paralyzed, and intubated or unconscious patients may be difficult, with reported failure rates of nearly 50% on the first attempt with the head in neutral position.[1–3] After a failure, subsequent attempts are usually unsuccessful due to coiling, kinking, or knotting of the NG tube as it loses stiffness due to warming to body temperature. The memory effect also contributes to subsequent failures; once kinked, the NG tube is subsequently more likely to kink at the same place. The most common sites of impaction of the NG tube are piriform sinuses and the arytenoid cartilage.[4] Maneuvers to keep the NG tube along the lateral or posterior pharyngeal wall during insertion encourages the smooth passage into the esophagus.[1,2,5] Common methods used to facilitate NG tube insertion include the use of a slit endotracheal tube, forward displacement of the larynx and the use of various forceps, the use of an ureteral guidewire as a stylet, head flexion, lateral neck pressure, and the use of a gloved finger to steer the NG tube after impaction.[2,6–8] Neck flexion, in combination with the curve of the NG tube, tends to keep the tube in close proximity to the posterior pharyngeal wall, facilitating its smooth passage into the esophagus.[2] The ureteral guidewire imparts stiffness to the NG tube by acting as a stylet and preventing kinking.

We hypothesized that slight modifications in NG tube insertion technique would improve the rate of successful insertion. We compared three techniques to the common method of NG insertion to determine the success rate, average time for insertion, and incidence of complications, such as bleeding, coiling, knotting, and kinking.

METHODS

Hospital Ethical committee approval was obtained, and a valid written informed consent was obtained from each patient. Patients younger than 20 yr and older than 70 yr were excluded from the study. Two hundred patients were enrolled in the study. All patients received general anesthesia and tracheal intubation for various surgical procedures that required NG tube insertion.

After induction of general anesthesia and tracheal intubation, the patients were randomly allocated into four groups according to a computer-generated randomization order. In the control group (Group C), patients had a lubricated NG tube inserted gently

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through the selected nostril, the head being maintained in the neutral position. The guidewire group (Group W) made use of a ureteral guidewire that was introduced within a 14-F NG tube until the tip of the guidewire was at the tip of the NG tube. Tube insertion was then performed in the same manner as described for the control group. In the slit tracheal tube (TT) group (Group S), the NG tube was inserted through the selected nostril and taken out through the mouth, leaving at least 10 cm of NG tube at the nostril. It was then passed through a longitudinally cut 7.0-mm internal diameter polyvinyl chloride TT, so that the tip of the NG tube was at the level of the Murphy eye of the TT. The TT was lubricated generously and was then inserted blindly into the oral cavity to a depth of 18 cm and the NG tube advanced further. The NG tube was then freed from the cut TT, and the cut TT was removed and the rest of the NG tube passed into the esophagus and was then fixed at the required length by pulling out through the nostril. In the neck flexion with lateral pressure group (Group F), a lubricated NG tube was inserted through the selected nostril to a depth of 10 cm. The patient's neck was flexed, lateral neck pressure was applied, and the NG tube was advanced in a similar manner to that described for Group C.

Preoperatively, the nostril to be used for NG tube insertion was chosen based on two criteria: the amount of fogging produced on a metal tongue depressor during exhalation and the relative size of the nostril. In all patient groups, a 14F, 105-cm NG tube with lead markings at the distal end was used.

NG tube insertion was performed by a group of four third-year anesthesia residents (to avoid operator bias the authors did not perform NG tube insertions). These residents were all judged to be proficient in the techniques described. They were assigned patients according to a computer-generated randomization schedule. The procedure start time was defined when the NG tube insertion was begun through the selected nostril. The procedure end time was defined as the time of successful insertion of NG tube or the time after two failed attempts. The procedure duration was measured with a stopwatch. Successful NG tube insertion was confirmed when the tube passed smoothly and a gurgling sound was heard on auscultation over the epigastrium when injecting 10 cc of air through the NG tube.

If the first attempt failed, the NG tube was withdrawn fully and was cleaned. Lubricating jelly was applied generously, and the procedure was repeated using the same technique. If both attempts at insertion using the selected technique were unsuccessful, then the technique was considered a failure. The NG tube was then inserted with the help of Magill forceps during a direct laryngoscopy.

The following data were collected:

1. Success rate of the selected technique—first, second attempt, and overall.
2. Number of attempts for successful insertion.
3. Duration of insertion using the selected technique.
4. Complications during insertion—kinking, knotting, and bleeding.

An unpublished pilot study of 12 cases per group suggested an approximate 20% improvement (from base rate of 65% to 85%) in success rate using these techniques. Consequently, a power calculation (α = 0.05 and β = 0.2) indicated a minimum of 46 patients for each group using an analysis of variance (ANOVA) test. Continuous data are presented as mean ± SD; categorical data are presented as frequency and percentage. Demographic data were analyzed by Pearson's χ^2 test. The time necessary to insert the NG tube in each group was compared using ANOVA test. The complication rates during insertion of NG tubes in all four groups were compared using ANOVA for multiple variables. A value of $P < 0.05$ was considered statistically significant.

RESULTS

There were no statistically significant differences in the demographic data (age and gender) of the four patient groups. In Group C, successful NG tube insertion was achieved in 36 patients (72%) (Fig. 1) . The success rates of NG insertion were greater in Groups W, S, and F: 46 patients (92%, P = 0.011), 46 patients (92%, P = 0.011), and 47 patients (92%, P = 0.004), respectively. In Group C, 17 patients (34%) had a NG tube placed successfully on the first attempt and 19 patients (38%) on the second attempt (Fig. 1). In Group W, 33 patients (66%) had a NG tube placed successfully on the first attempt and 13 patients (26%) on the second attempt (P = 0.002 compared with Group C). In Group S, 41 patients (82%) had a NG tube placed successfully on the first attempt and five patients (10%) on the second attempt (P = 0.0006 compared with Group C). In Group F, 41 patients (82%) had a NG tube placed successfully on the first attempt and six patients (12%) on the second attempt (P = 0.0006 compared with Group C).

Total NG tube insertion time was 56 ± 36 s in Group C. This time was significantly longer in Group S (98 ± 43 s) and significantly shorter in Group F (31 ± 19 s). Group W time (42 ± 29 s) was not statistically different from Group C.

The most common complication in Group C was kinking of the NG tube, which occurred in 10 patients (20%); knotting occurred in one patient (2%) (Table 1). In Group W, the NG tube became kinked in four patients (8%) (P = NS), and knotting occurred in one patient (2%) (P = NS versus Group C). In Group S, 11 patients (22%) developed bleeding during NG tube insertion, significantly more frequently than in Group C; in one patient, the NG tube could not be freed from the slit TT, and the whole assembly had to be removed (complication classified as "other"). In Group F, four patients (8%) developed kinks during insertion of the NG tube (P = NS versus Group C).

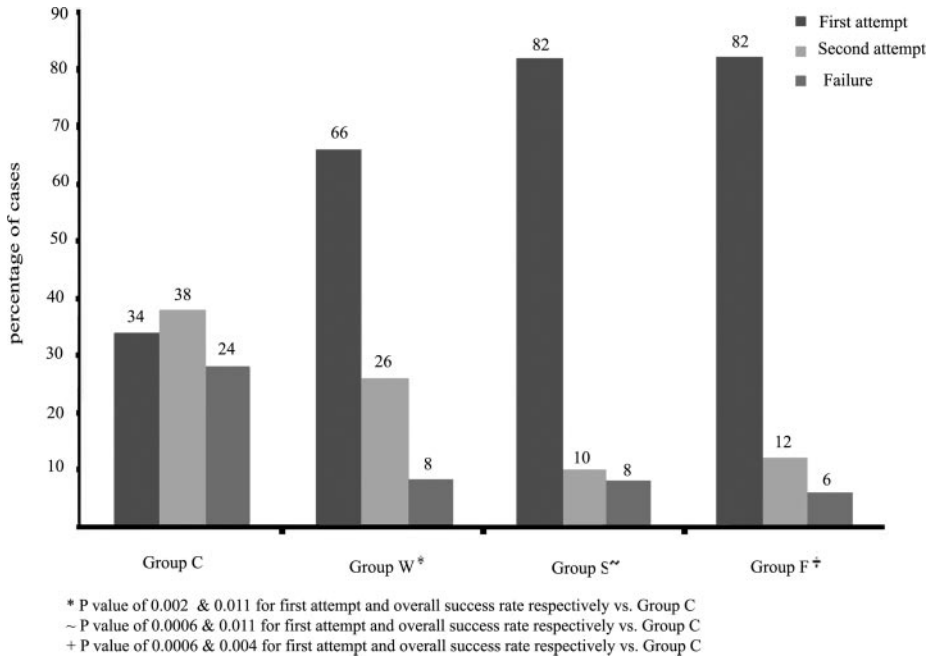

Figure 1. Successful nasogastric tube insertion. Group C = control; Group W = guidewire; Group S = slit tracheal tube; and Group F = neck flexion with lateral pressure.

Table 1. Duration of Nasogastric Tube Insertion (s) and Complications

	Group C (n = 50)	Group W (n = 50)	Group S (n = 50)	Group F (n = 50)
Duration of insertion (s)	56 ± 36	42 ± 29*	98 ± 43†	31 ± 19‡
Complication (number of cases)				
Kinking	10	4	0	4
Knotting	1	1	0	0
Bleeding	0	0	11§	0
Others	0	0	1	0

Group C = control; Group W = guidewire; Group S = slit tracheal tube; Group F = neck flexion with lateral pressure.

* P = 0.166.

† P = 0.0003.

‡ P = 0.001.

§ P = 0.0005 versus control.

†‡§ Significant at $P \leq 0.05$.

DISCUSSION

Insertion of the NG tubes in anesthetized and intubated patients has an average failure rate of nearly 50% on the first attempt with the patient's head in neutral position.[2] The piriform sinuses and arytenoid cartilages are the most common sites of impaction.[4] Maneuvers to avoid impaction on these structures include insertion of the NG tube along the posterior or lateral pharyngeal wall, by head flexion and lateral neck pressure, or by turning the head to one side.[1,5] Other methods to facilitate NG tube insertion include the use of an ureteral guidewire or cooling the NG tube to stiffen it,[9] the use of a slit-TT as a conduit,[7] the use of a guitar wire as a stylet,[10] endoscopic placement, or the use of various endoscopic forceps and lifting the thyroid cartilage.

We observed a success rate of 34% in Group C on the first attempt, which was significantly lower compared with the success rates of the ureteral guidewire (66%), slit endotracheal tube (82%), and head flexion with lateral neck pressure (82%) groups, confirming that the latter procedures increase the success rate. A ureteral guidewire helps to reduce the flexibility of the NG tube, whereas a slit TT, which is resistant to kinking, directs the NG tube into the esophagus. Head flexion and lateral neck pressure help keep the NG tube along the lateral and posterior pharyngeal wall, thereby facilitating passage into the esophagus.

Ratzlaff et al.[11] found that the degree of NG tube flexibility significantly affected the ease with which the NG tube was inserted and also reported that the rigid tubes required fewer insertion attempts. However, as the NG tube rigidity increases, the incidence of trauma also increases, with a subsequent increase in the incidence of bleeding.[10,11] We used an ureteral guidewire (6F) to decrease the flexibility of the NG tube and found that insertion was successful in 92% of patients compared with a 72% success rate in Group C.

In Groups C and W, the time required for insertion was 56 ± 36 s and 42 ± 29 s, respectively; Group S had a longer insertion time. In Group F, the insertion time (31 ± 19 s) was significantly shorter than Group C's insertion time. Among the four groups, the Group F

had the shortest time to insertion whereas the Group S had the longest time. Matsuki and Zsigmond[10] used guitar strings to facilitate NG tube insertion but reported a few cases of bleeding. In our study of 200 patients, 32 (16%) developed complications. The most common complications were kinking of the NG tube, knotting of the NG tube, and bleeding. We observed that of the 32 complications, 18 (56%) were due to kinking, which underscored the importance of reducing flexibility to improve the success of NG tube insertion. Decreased flexibility can be accomplished by using the ureteral guidewire as a stylet. However, bleeding was a frequent complication in the slit TT group: 11 of 50 (22%) patients experienced bleeding. The frequent incidence could be attributed to a technique that involves insertion of an additional TT into the oral cavity in an already intubated patient. This complication was evident in the patient in whom the slit TT could not be withdrawn while keeping the NG tube in place, such that the entire assembly had to be removed with great difficulty.

CONCLUSION

The success rate of NG tube insertion can be increased by using an ureteral guidewire as a stylet, a slit TT as an introducer, or keeping the head flexed while applying lateral neck pressure. The time needed to insert a NG tube was shortest using head flexion with lateral pressure and longest with the use of a slit TT. Kinking was the most frequent complication encountered, and bleeding was the most common when the slit TT was used. Overall, considering the success rate, the duration of insertion, and the complication rate, we conclude that head flexion with lateral neck pressure is the simplest technique that has the highest success rate and lowest incidence of complications. Therefore, we recommend the use of either a head flexion with lateral neck pressure or an ureteral guidewire as a stylet in all NG tube insertions.

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