Original Article – Evaluative Study

Evaluation of Nasopharyngeal Airway to Facilitate Nasotracheal Intubation

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Abstract

Background and Aims: Nasotracheal intubation is the most common method of airway management in oral and maxillofacial surgery patients. However, many times, it is associated with bleeding resulting from trauma to nasopharyngeal mucosa. We conducted this study to determine the effectiveness of nasopharyngeal airway (NPA) to easily facilitate the nasopharyngeal insertion and to reduce the trauma during nasotracheal intubation. **Methods:** A total of 120 patients scheduled for elective oral and maxillofacial surgery requiring nasotracheal intubation were randomly divided into two groups of 60 each, after preparation with xylometazoline drops intranasally, lubrication with lignocaine jelly, and thermosoftening of the tip of the endotracheal tube (ETT). In group NPA, dilatation of the nasal cavity was done with NPA before nasotracheal intubation and in Group C, nasotracheal intubation was done without dilatation of the nasal cavity. The smoothness of insertion of ETT was graded on a 4-point rating scale. Assessment of bleeding into nasopharynx was confirmed during laryngoscopy and was also graded with 4-point scale. **Results:** In the NPA group, all the 60 (100%) patients had smooth or relatively smooth (Grade 0 or 1) insertion compared to 51 (85%) patients in the control group ($P < 0.0001$). Eighteen (30%) patients had mild (Grade 1) bleeding and one (1.67%) patient had moderate bleeding (Grade 2) in the control group, whereas only four (6.67%) patients in the NPA group had mild (Grade 1) bleeding ($P = 0.0005$). **Conclusion:** Dilatation of nasal cavity with NPA significantly eases the insertion of ETT into the nasopharynx and also significantly decreases the incidence and severity of trauma and bleeding during nasotracheal intubation.

Keywords: Nasopharyngeal airway, nasotracheal intubation, oral and maxillofacial surgery

Introduction

Nasotracheal intubation is the most common method of airway management in oral and maxillofacial surgery patients as it provides good accessibility for oral surgical procedures. However, the most common complication of nasotracheal intubation is epistaxis, resulting from trauma to nasal and pharyngeal mucosa, nasal septum, and turbinates.[1] The potential for trauma is inherently greater with nasotracheal intubation than with orotracheal intubation because the tube passes through the narrow nasal passages. The incidence of bleeding is variable, ranging from 18% to 77% even in experienced hands.[2] Blood in the airway can make an easy intubation difficult, obscuring the view of the larynx and increasing the potential for aspiration of blood.

Several factors are important for atraumatic nasotracheal intubation, including selection of the most patent nostril, preparation of nasopharynx with vasoconstrictors (oxymetazoline and cocaine),[3,4] progressive dilatation of nasopharyngeal passage with nasopharyngeal airway (NPA),[5] use of an adequate sized endotracheal tube (ETT), lubrication of nasopharynx, lubrication of ETT, warming and softening the tip of ETT before insertion,[6-9] shape of the tracheal tube tip,[9-11] and using appropriate technique without undue force or attempts during the advancement of ETT if resistance is encountered.

This prospective randomized study was conducted to determine the effectiveness of NPA to facilitate the nasopharyngeal

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insertion of ETT and to reduce the trauma and bleeding during nasotracheal intubation.

Methods

The study was conducted at a hospital attached to a medical college. After institutional ethics committee approval, 120 patients of either sex, aged between 18 and 70 years, and belonging to the American Society of Anesthesiologists (ASA) physical status I-II, scheduled for elective oral and maxillofacial surgery requiring nasotracheal intubation, were included in the study. Written and informed consent was obtained from all the patients after explaining about nasopharyngeal intubation. Patients with potentially difficult airway and those with contraindications to nasopharyngeal intubation such as bleeding diathesis, abnormal coagulation status, recurrent epistaxis, fracture base of skull, and nasal deformity were excluded from the study. Patients were randomly allocated to two groups using computer-generated random number table and allocation of the same in sealed envelope technique, control group ($n = 60$) and NPA group ($n = 60$).

During the preoperative anesthesia visit, patency of the nostril was confirmed by comparing the nasal airflow while breathing alternately through the right and left nostrils. The more patent nostril was chosen for nasotracheal intubation or the side was determined by the requirement of surgeon. The anesthetic technique was standardized for all patients. On the day of surgery, after confirmation of adequate nil-by-mouth status, intravenous access was secured with an 18G/20G cannula. All patients were premedicated with injection glycopyrrolate 0.2 mg, injection midazolam 0.03 mg/kg, and injection fentanyl 2 μg/kg intravenously. The appropriate nostril for intubation was prepared with 0.1% xylometazoline drops intranasally for vasoconstriction of nasal mucosa and sniffing of 2 ml 2% lignocaine jelly for the lubrication of nasopharyngeal passage. After preoxygenation with 100% oxygen for 3 min, the patients were induced with injection propofol 2–3 mg/kg. After confirmation of adequate mask ventilation, injection vecuronium 0.08 mg/kg was given for relaxation for intubation and surgery. In patients of NPA group, a well-lubricated NPA of only one size, that is, 7.5 mm/32 Fr for females and 8.0 mm/34 Fr for males, was inserted into the nostril selected for intubation; if it was difficult to insert airway due to anatomical variations, other nostril was selected and if it was difficult to put airway in both nostrils, the patient was excluded from the study, whereas no NPA was used in the control group. The tip of the flexometallic ETT was inserted into hot water at 50°C for about 3 min for softening. After mask ventilation for 4 min, the NPA was removed in the NPA group, and well-lubricated appropriate size flexometallic ETT (no. 7 for females and no. 7.5 for males) was gently inserted into the nasal cavity with the bevel facing toward nasal septum and advanced into the nasopharynx. If resistance was encountered, the tube was withdrawn and reinserted with counterclockwise rotation. Insertion of ETT into the nasopharynx was graded on 4-point rating scale as follows: Grade 0 – smooth insertion without any resistance; Grade 1 – insertion with slight resistance; Grade 2 – insertion with great resistance; and Grade 3 – change of nostril for insertion.

Laryngoscopy was performed, and nasotracheal intubation was done under direct vision using Magill's forceps and confirmed by capnography and auscultation of bilaterally equal breath sounds. The presence of bleeding with the passage of ETT into nasopharynx was confirmed during laryngoscopy and estimated as follows: Grade 0 – no bleeding; Grade 1 – minimal bleeding (only visible traces of blood); Grade 2 – moderate bleeding (pooling of blood in the pharynx); and Grade 3 – severe bleeding (blood in the pharynx sufficient to impede intubation).

Statistics

With the reported incidence of epistaxis of 33%[2] during nasotracheal intubation, we expected the decrease in the incidence of bleeding by 50%. With alpha error of 0.05 and statistical power or beta error level of 80%, the sample size of 58 in each group was required, we included sixty patients in each group to compensate for possible dropouts. Statistical analysis was performed using SPSS for Windows, Version 16.0. Chicago, USA. The quantitative variables were compared using the unpaired Student's t-test. The qualitative variables were compared using the Chi-square test. $P < 0.05$ was considered statistically significant.

Results

The patients in the two groups were comparable with respect to age, sex ratio, weight, and ASA class [Table 1]. There was also no significant difference between the groups in selection of side of the nostril and size of ETT for nasotracheal intubation [Table 2].

Forty-four (73.33%) patients in NPA group had Grade 0 (smooth) insertion of ETT into nasopharynx in comparison to 20 (33.33%) patients in the control group ($P < 0.0001$; $\chi^2 = 19.13$). Sixteen (26.67%) patients in NPA group encountered Grade 1 insertion (slight resistance) as opposed to 31 (51.67%) patients in the control group ($P = 0.0052$; $\chi^2 = 7.81$). Eight (13.33%) patients had Grade 2 insertion (great resistance) and one patient had Grade 3 insertion of ETT (requiring change of nostril side) in the control group. No patient in NPA group had Grade 2 or Grade 3 insertion of ETT into the nasopharynx ($P = 0.0019$; $\chi^2 = 9.65$) [Figure 1].

No bleeding was noted in 56 (93.33%) patients in NPA group as compared to 41 (68.33%) in the control group ($P = 0.0005$; $\chi^2 = 11.98$). Eighteen (30%) patients had mild (Grade 1) bleeding in control group against four (6.67%) patients in NPA group ($P = 0.001$; $\chi^2 = 10.78$). One (1.67%) patient had moderate bleeding (Grade 2) in the control group. No patient in either group had Grade 3 bleeding. The incidence and severity of bleeding was significantly more in the control group as compared to the NPA group [Figure 2].

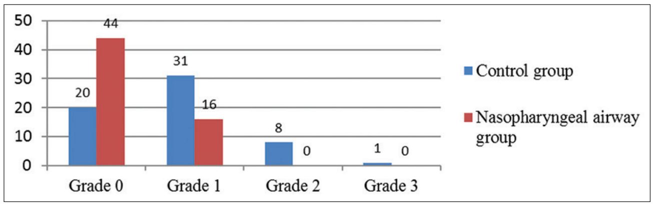

Figure 1: Comparison of grades of insertion of endotracheal tube between the groups

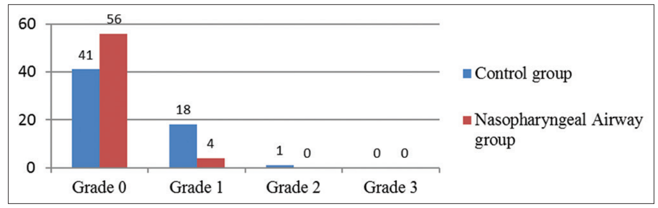

Figure 2: Comparison of grades of bleeding between the groups

Table 1: Patient characteristics

Parameters	Control group (*n*=60)	NPA group (*n*=60)	*P*
Age (years), mean±SD	42.56±15.37	38.01±14.62	*t*=1.66, *P*=0.099, NS
Weight (kg), mean±SD	52.74±9.56	54.46±8.32	*t*=1.05, *P*=0.295, NS
Gender, *n* (%)			
Male distribution	48 (80)	51 (85)	χ^2=0.51, *P*=0.47, NS
Female distribution	12 (20)	9 (15)	
ASA status, *n* (%)			
I	44 (73.33)	48 (80)	χ^2=0.74, *P*=0.38, NS
II	16 (26.67)	12 (20)	

SD=Standard deviation; ASA=American Society of Anesthesiologists; NPA=Nasopharyngeal airway; NS=Not significant

Table 2: Characteristics of nasotracheal intubation

Parameters	Control group, *n* (%)	NPA group, *n* (%)	*P*
Nostril side, *n* (%)			
Right	20 (33.33)	15 (25)	χ^2=0.99, *P*=0.31, NS
Left	40 (66.67)	35 (75)	
ETT size (mm), *n* (%)		/	
7.0	12 (20)	9 (15)	χ^2=0.51, *P*=0.47, NS
7.5	48 (80)	51 (85)	

ETT=Endotracheal tube; NPA=Nasopharyngeal airway; NS=Not significant

Discussion

The results of our study show that the patients in NPA group comparatively had significantly smooth insertion of ETT through the nasopharynx (73.3% vs. 33.3%; $P < 0.0001$) and also significantly decreased incidence and severity of bleeding (6.7% vs. 31.7%; $P = 0.0005$) associated with nasotracheal intubation. Difficulty in insertion of ETT into the nasopharynx and incidence and severity of bleeding were not affected by the selection of nostril side ($P = 0.31$) or the size of ETT ($P = 0.47$) for nasotracheal intubation, as noted in previous studies.[12,13]

The most common complication of nasotracheal intubation is trauma to nasal mucosa and turbinates resulting in bleeding into the nasopharynx. However, the trauma to nasal mucosa is inevitable when a large diameter ETT is passed through the narrow nasal passages.[2] Epistaxis or bleeding is most likely to occur if the transit of the ETT through the nasal passage is difficult. Therefore, strategies to ensure smooth transit of the tube through the nasal passageways are essential to reduce the incidence of epistaxis.[12] One of the ways to facilitate the transit of the ETT through the nasal passage is to dilate the nasal passage with a soft NPA before intubation. The soft and flexible NPA has the unique ability to traverse the nasopharynx and dilate the nasopharyngeal passage atraumatically, thus facilitating the passage of the ETT during nasotracheal intubation.[14]

Mechanical dilatation of nasal cavity using incrementally sized NPA s prior to nasotracheal intubation has been advocated by Kay *et al*.[5] However, Adamson has shown that repeated passage of the NPA and nasotracheal tube over relatively friable nasal mucosa accounted for increased hemorrhage in the dilated group.[15] Enk *et al*. reported the “pathfinder” technique using the Wendl tube to facilitate nasopharyngeal passage of the ETT and reduce nasopharyngeal bleeding and postoperative nasal pain.[16] However, there is a potential risk of losing the Wendl tube if the ETT is advanced blindly.

Considering these facts, we preferred to dilate the nasal passage with the 32/34 Fr NPA that was left in place for 4 min during the induction of anesthesia. Using the NPA also improved the mask ventilation and oxygenation during induction of anesthesia as failed mask ventilation poses an increased risk of deoxygenation to the patient under general anesthesia, particularly in situations of difficult mask ventilation. No patient was excluded from our study in view of unable to negotiate the airway in either nostril.

Preformed nasal tubes or flexometallic reinforced tubes can be used for nasotracheal intubation. We routinely use a wire reinforced flexometallic tube for nasotracheal intubation as it provides an advantage of nonkinkability under drapes and due to flexibility, it passes through the preferred lower nasal pathway more frequently causing significantly less epistaxis than the preformed tracheal tube.[17] Kihara and Komatsuzaki also reported that the frequency (32% vs. 80%; $P < 0.001$) and severity of epistaxis were less with the silicone-based wire reinforced tracheal tube with a hemispherical bevel than the polyvinyl chloride-based tracheal tube.[18]

Before intubation, we inserted the tip of ETT into hot water at 50°C for softening as previous studies have shown that simple thermosoftening of the nasotracheal tube before intubation helps to reduce the nasal damage and severity of epistaxis.[6-9]

Several other techniques have been suggested to facilitate the navigation of ETT through the nasal cavity and to reduce the bleeding. The use of nasogastric tube[19] and curved tip suction catheter[20] as a guide; styletted tracheal tube with a posterior facing bevel;[21] obturating the ETT with an inflated esophageal stethoscope;[8] the bubble-tip (Airguide) tracheal tube system;[22] inserting the ETT into the proximal end of a red rubber catheter;[23] inspection of the nasopharynx with the fiberoptic bronchoscope (FOB) prior to FOB-guided nasotracheal intubation; and[24] using the Magill tipped ETT[9] and Parker Flex-Tip tracheal tube[10,11] in the place of conventional murphy tipped ETT, have been shown to increase the success rate of nasal passage and reduce the incidence and severity of epistaxis.

A limitation of this study is that the anesthesiologists who performed the nasotracheal intubation were not blinded to the control and study groups. However, we do not believe that this limitation influenced our results.

Conclusion

On the basis of findings of the present study, a simple technique of dilatation of the nasal cavity with the NPA during induction of anesthesia seems to facilitate the nasopharyngeal passage of the ETT and decreases the incidence and severity of trauma and bleeding during nasotracheal intubation.

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Conflicts of interest

There are no conflicts of interest.

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