Original Article

COMPLICATIONS FOLLOWING NASOTRACHEAL INTUBATION USING CUFFED POLYVINYL CHLORIDE TUBE: A PROSPECTIVE CROSS SECTIONAL STUDY.

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ABSTRACT

BACKGROUND
To examine the complications following nasotracheal intubation by documenting the nasal traumas observed with the use of untreated cuffed polyvinyl chloride tube in unprepared nostrils.

METHODS
Patients who had maxillofacial surgeries under general anesthesia, muscle relaxation and nasotracheal intubation were included in the study. Nasotracheal intubation was carried out after induction of anesthesia was effected with intravenous propofol and suxamethonium by an Anesthetist using well lubricated cuffed polyvinyl chloride tube. Sizes 6.0, 6.5 and 7.0mm were inserted in females while sizes 7.0 and 7.5mm were inserted in males. Occasionally, the natural curve of the tube guides it through the cords without the aid of Magill forceps. Anterior rhinoscopy was performed by otolaryngologist 24 hours after surgery. Results were subjected to statistical analysis.

RESULTS
Sixty four patients were included in the study. They were between the ages of 21 and 63 years (mean 33.2 ± 14.1 years); they were 39 males and 25 females. The most frequently used nasotracheal tube (NT) was size 7.0mm internal diameter. Epistaxis was noticed in 52 (81.2%) patients. There were no statistically significant differences in the incidence of epistaxis observed in males and females, and also between right and left nostrils. A total of 46.8% of nasal trauma were inferior turbinate trauma involving the inferior medial aspect.

CONCLUSION
The use of untreated cuffed polyvinyl chloride tube for nasotracheal intubation in unprepared nostrils is associated with a high incidence of epistaxis and nasal trauma.

Key words: nasotracheal intubation, epistaxis, nasal trauma

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INTRODUCTION

Nasotracheal intubation is a commonly used technique for maxillofacial surgery and its commonest complication is epistaxis.[1,2] Bleeding into the airway from epistaxis may be serious enough to cause aspiration and airway obstruction. Many methods have been suggested to decrease trauma associated with nasotracheal intubation.[1-6]

We therefore examined the complications following nasotracheal intubation and documented the nasal trauma observed with the use of untreated cuffed polyvinyl chloride tube in unprepared nostrils as it is commonly used in our centre. Many centres in Nigeria use this method and there is no data to show to which extent this practice affect the patients.

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Materials and Methods

This is a prospective cross sectional study. Patients who had maxillofacial surgeries under general anesthesia, muscle relaxation and nasotracheal intubation were included in the study. The ethics committee of our institute approved the study and written informed consent was obtained from all the patients. Demographic data were obtained from patients' case file. Data concerning type of operation done, American society of Anesthesiologists (ASA) physical status

classification, size of nasotracheal tube (NT) and intraoperative complications were recorded.

Patients with history of bleeding diathesis or on anticoagulants, and nasal symptoms including breathing difficulties, sinusitis and allergic rhinitis were excluded from the study.

Standard monitoring was carried out with pulse oximetry, electrocardiogram, capnography and noninvasive arterial blood pressure. Patients were preoxygenated for 3minutes and premedication was done with fentanyl 2ug/kg and glyccopyrolate. Induction of anesthesia was effected with thiopentone 5mg/kg and suxamethonium 2mg/kg. Nasotracheal intubation was carried out by a consultant Anesthetist (first author) after the NT (cuffed polyvinyl chloride-Mallinckrodt™) was well lubricated with 2% lidocaine gel. Sizes 6.0, 6.5 and 7.0mm were inserted in females while sizes 7.0 and 7.5mm were inserted in males.

The patient was placed in the "sniffing" position with the neck slightly flexed and the head extended on the neck. After induction of anesthesia, a well-lubricated NT was inserted into the nare and directed (toward the occiput) along the floor of the nasal cavity. The bevel of the tube was oriented toward the septum to avoid injury to the inferior turbinate, and twisting the tube as it advances to help bypass soft tissue obstruction in the nasal cavity. If resistance was encountered that persists despite continued gentle pressure and twisting of the tube, the other nostril was tried. The tube was advanced into the oropharynx.

Direct laryngoscopy was used to visualize the vocal cords and the tip of the NT. With the Magill forceps in the right hand, the NT was grasped proximal to the cuff (to avoid damage to the balloon) and directed toward the larynx. An assistant advances the tube gently while the Anesthetist directs the tip into the larynx and trachea. Occasionally, the natural curve of the NT guides it through the cords without the aid of forceps. The cuff was inflated, and both lungs were auscultated to ensure ventilation. When placement was satisfactory, the tube was secured. Anesthesia was maintained with 1% isoflurane in air-oxygen mixture and pancuronium.

The Anesthetist who performed the intubations estimated the extent of epistaxis and degree of navigability through the nasal passageways. Epistaxis was estimated on a scale of "No epistaxis" indicated no bleeding, "mild epistaxis" represented blood on the nasotracheal tube only, "moderate epistaxis" indicated blood pooling in the pharynx, and "severe epistaxis" represented blood in the pharynx sufficient to impede intubation.[7]

Anterior rhinoscopy was performed by a consultant Otolaryngologist (second author) in the ward 24 hours after surgery. Nasal trauma was defined as mild (pale/engorged), moderate (bruce/crust), and severe (laceration/avulsion).

Statistical analysis was done using the chi square test and p value < 0.05 was considered statistically significant.

Results

Sixty four patients were included in the study. They were between the ages of 21 and 63 years (mean 33.2 ± 14.1 years); they were 39 males and 25 females. Forty three patients were ASA I, 17 ASA II, and 4 ASA III. The mean hemoglobin concentration was 12.8 ±1.5 g/dl.

Nasotracheal intubation was successful in 50 patients at first attempt, 11 at second attempts and 3 at third attempts. Table 1 shows the distribution of NT used according to gender. The right nostril was selected in 37 patients while the left nostril was selected in 27 patients. The most frequently used NT was size 7mm internal diameter (38 patients), 7.5mm was used in 12 patients, 6.5mm in 11 and 6mm in 3 patients. Navigability of NT through the nasal passage way was smooth in 37 patients and impinged in 27 patients. At laryngoscopy, Cormack-Lehane class 1 was observed in 27 patients, class 2 in 31, and class 3 in 6 patients.

Epistaxis was noticed in 52 (81.2%) patients: mild 23 (44.2%), moderate 24 (46.2%), severe 5 (9.6%), and no epistaxis in 12 patients. For patients with moderate to severe epistaxis the airway was suctioned and bleeding stopped. There were no statistically significant differences in the incidence of epistaxis observed in males and females (Table 2), and also between right and left nostrils. But the difference in the incidence of epistaxis observed between NT 6.5mm and 7.0mm used in females was significant ($p<0.05$). Routinely, Magill forceps was used to assist in nasotracheal intubation (93.8%). At the end of operation 14 patients were extubated in the operating room, 21 in the recovery room and 29 in the ward. A prepatency test was not done. On anterior rhinoscopy post operation, 3 cases of septal deviation, 2 turbinate hypertrophy, and one case of right nasal polyp in a retroviral disease patient were discovered. A total of 46.8% of nasal trauma were inferior turbinate trauma involving the inferior medial aspect (Table 3).

Figure 1 shows the types of mandibular surgeries carried out during the period of study. Other surgeries included 8 cases of Benign tumor excisions, 4 Multiple

facial fracture fixation, and 5 Maxillary surgeries.

Discussions

Elimination of epistaxis and nasal damage as a complication of nasotracheal intubation requires multiple methods. Kim et al[1] reported that simple thermosoftening treatment of the NT with warm saline helps to reduce epistaxis and nasal damage when compared to untreated tube. Epistaxis was noticed in 81.2% of our patients and 9.6% was severe. This finding is comparable to that of Lu et al who reported a higher incidence of epistaxis in patients intubated with un-softened endotracheal tube (76.7%) as compared with softened tube (43.8%).[8] There were no statistically significant differences in the incidence of epistaxis observed in males and females and also between right and left nostrils. This is similar to reports by other investigators.[1,9,10]

Anterior rhinoscopy done post operatively revealed abnormal anatomy in some patients. Performing a preliminary bilateral nasendoscopy pre-anesthesia to assess intranasal anatomy and select a more patent nostril can definitely reduce nasal injury compared to random placement of the tube in the nostril. This in addition to simple thermosoftening treatment of NT could reduce significantly the incidence of epistaxis.

The inferior turbinate was the most traumatized (46.8%) in this series, involving the inferior-medial part. This probably buttresses the fact that untreated cuffed polyvinyl chloride tube would usually traverse the lower nasal passageway.[9] The lower pathway may be considered the safer route, in the sense that it is located away from the middle turbinate and cribiform plate of the ethmoid complex.[9] The mucous membrane covering the middle turbinate is thick and vascular, and this may be associated with massive epistaxis, particularly as vessels become entrapped and fail to retract.[11]

Epistaxis was more likely to be reduced if there was smooth navigability of the tube through nasal passageways, and if intubation was performed with the aid of the Magill forceps.[1] In our centre Magill forceps is used routinely to assist in nasotracheal intubation, and in this series navigability was smooth in majority of cases but was not statistically significant. It has been shown that improvement of navigability may be the most effective method of reducing the incidence of epistaxis after nasotracheal intubation.[12] This is because most other methods have their drawbacks. Navigability can be greatly enhanced with fibreoptic scope assisted intubation. This offers inspection of the nostril, allowing the operator to choose the more patent nostril and also serves to guide the tube through the preferred pathway.[9]

It has also been shown that the technique of a red-rubber catheter guided nasotracheal intubation significantly reduces the trauma and severity of bleeding associated with nasotracheal intubation.[5,13,14] The red-rubber catheter is fitted over the end of the nasotracheal tube before its advancement, by placing the end of the endotracheal tube into the flared end of the catheter. This presents a smooth noncutting surface to the nasal mucosa as the tube-catheter combination is advanced. This method is simple and the catheter is readily available and affordable.

It has been previously shown that nasotracheal intubation performed using larger tracheal tubes may be associated with a higher incidence of trauma and bleeding.[15] This was observed in this series when nasotracheal tube 7.0mm internal diameter was used in females.

Of the polyvinyl chloride tubes available, the Portex 'Ivory' cuffed nasotracheal tube is the most malleable for the nasal passage and yet retains the overall curve that is required for ease of laryngeal intubation. This type of material is recommended because it is less traumatic and may decrease the overall incidents of epistaxis.[10] The Mallinckrodt™ nasotracheal tube used in this study has a stiff texture therefore lubrication alone will not soften it unless thermo-softening treatment is applied. Following thermo-softening, if the tube is not used immediately; it may cool back to the ambient temperature of the room and become even stiffer thus can cause epistaxis. In contrast, the Endoflex tube has been shown to offer a smoother nasal intubation without requiring assistance or adjuvant equipment thus superior to conventional endotracheal tubes.[16]

When deliberate attempt is not made to reduce epistaxis and nasal damage; the incidence of epistaxis becomes very high. Simple and efficient methods are available and we advocate their use.

Conclusion

The use of lubricated endotracheal tube and Magill forceps assisted guidance for nasotracheal intubation does not prevent epistaxis. The use of untreated cuffed polyvinyl chloride tube for nasotracheal intubation in unprepared nostrils is associated with a high incidence of epistaxis and nasal trauma. The commonest nasal trauma is inferior turbinate trauma.

Table1. Distribution of Nasotracheal tube sizes

Tube size (ID mm)	Male	Female
6	0	3
6.5	0	12
7.0	28	10
7.5	11	0
Total	39	25

Roman numeric= number of patients

Table 2. Comparing incidence of epistaxis between variables

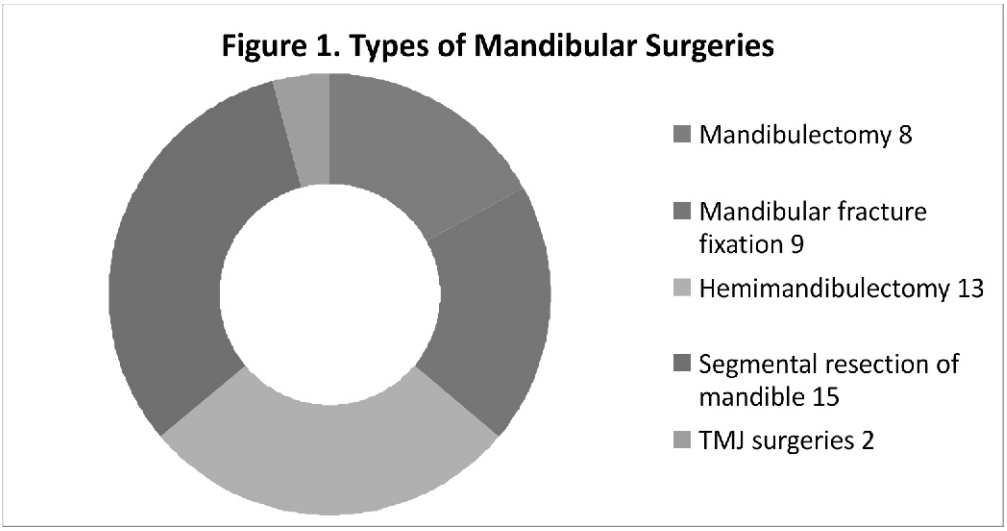
Variables	Incidence of epistaxis	X^2	p value
Sex			
Male	33	0.742	0.889
Female	19		
Nostril selected			
Right	28	1.789	0.181
Left	24		
Trial of intubation			
One attempt	41	0.084	0.771
>One attempt	11		
Navigability			
Smooth	28	1.789	0.181
Impinged	24		
Tube sizes used in females (ID)			
6.5mm	8	4.074	0.044
7.0mm	10		

Roman numeric= number of patients that had epistaxis

Table 3. Nasal trauma in studied population

Nasal trauma	Mild	Moderate	Severe	Total (%)
Inferior turbinate	11	12	6	29 (46.8)
middle turbinate	2	4	0	6 (9.7)
superior turbinate	1	0	0	1 (1.6)
Nasal septum	5	4	0	9 (4.5)
Nasal floor mucosa	5	9	3	17 (27.4)
Total	24	29	9	62 (100)

Roman numeric= number of patients



Roman numeric= number of patients

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