

Effect of minimal cuff inflation with thermo softening of the endotracheal tube to minimize the trauma during naso tracheal intubation – observational study

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Abstract

Introduction and Objective: Several techniques and modifications have been put forward to decrease the decrease nasopharyngeal trauma and epistaxis. This study evaluated the effect on partial inflation of the thermo softened endotracheal tube cuff to reduce bleeding.

Materials and Method: This observational study was done at IRT Perunthurai Medical college Hospital after the institutional ethical committee approval between April 2013 and August 2013 at the main operating theater complex. 20 patients who were scheduled for open reduction and internal fixation of mandible that required nasal intubation were chosen following a formal written informed consent. Nasal pharyngeal anatomy was screened by an ENT surgeon and noted accordingly as a part of pre-anaesthetic assessment for adequate nasal patency. In the operating room after nasal decongestion and lubrication appropriate thermo softened tube is introduced in the preferred nostril with the cuff inflated with a minimal volume of air not exceeding 2 milliliters. Ease of passage of the endotracheal tube, degree of bleeding during laryngoscopy and post-operative nasal pain were observed by the anaesthesiologist who performed the laryngoscopy and Magill forceps assisted nasotracheal intubation.

Results: When observed the bleeding ranged from a thin to a thick streak which indicated that there is definitive reduction in the amount of trauma induced by the passage of the inflated thermo softened endotracheal tube with minimal cuff inflation.

Conclusion: Partial inflation of the cuff in a thermo softened tube was found to be very effective in reducing the nasopharyngeal trauma thereby significantly decreased the incidence of epistaxis and its related complications.

Keywords: Nasotracheal tube, Thermo softening, Nasal turbine, Epistaxis, Nasopharynx.

Introduction

Nasotracheal intubation is commonly performed for oromaxillofacial surgeries. Nasotracheal intubation is known to cause mucosal trauma as well as concha damage that will result in bleeding, epistaxis, bacteremia, sinusitis and rarely retropharyngeal perforation.⁽¹⁾ Nasal intubation is preferred often for better surgical access in the oral cavity, to assess the facial symmetry and dental occlusion in jaw fractures.^(2,3,4) Nasal mucosal damage that occurs during nasotracheal intubation is caused by the rigid tip of the ET tube and also due to sharp edged Murphy eye. Trauma and subsequent fracture of turbinates have also been reported.^(2,3,4) Bleeding during nasotracheal intubation can be mild to severe or may be torrential and at times life threatening.⁽⁵⁾

Since the passage of the endotracheal tube invariably traumatizes the nasal passage, innumerable research and studies were done to reduce the incidence of nasal mucosal trauma by modifying the endotracheal tube and the techniques in assisted nasotracheal tube insertion.⁽⁶⁾ The conventional poly vinyl chloride tubes in body temperatures are subject to thermo softening. This could make the PVC tube soft, flexible and can reduce the nasal mucosal trauma.^(6,7,8) Thermo softening can reduce the incidence of mucosal abrasion, however the contribution of trauma with the serrated edges of the cuff is likely and therefore a minimal inflation of the cuff to obliterate the serrations will reduce the mucosal injury further more. This study observed the effect of such

modification in reducing mucosal damage and the resultant complications.^(6,7,8,9)

Aim

To determine the effect of the partially inflated cuff of the thermo softened endotracheal tube in reducing the nasopharyngeal trauma and epistaxis.

Materials and Method

After obtaining the institutional ethical committee approval this observational study was done at IRT Perunthurai Medical College Hospital between April 2013 and August 2013. A formal written informed consent obtained after a detailed explanation. 20 patients who were admitted with fracture mandible that required Open Reduction and Internal Fixation of the mandible were chosen for the study.

Selection criteria

- Age group 25 – 50 years
- ASA I, ASA II
- Mandible Fractures that requires ORIF
- Weight 45 – 65 Kgs

Exclusion criteria

- ASA III, ASA IV
- Patients unwilling for the study
- Allergic Rhinitis
- Nasal mucosal disease
- Craniofacial anomaly
- Chronic Sinusitis

• Turbinate hypertrophy

All the patients were screened by an ENT surgeon to evaluate nasal anatomy, septal deviation during the pre anaesthetic patient screening which included a meticulous airway assessment. Three sizes of ET tube (6.5, 7.0, 7.5 mm ID) were put in a bottle of sterile saline along with a thermometer and warmed at 95⁰ F for softening of ET tube.^(6,7)

Stages of the procedure^(6,7,8,9,10)

1. Nasal decongestion
2. Standard anaesthetic induction, intubation and maintenance protocols followed
3. Adequate lubrication
4. Thermo softening of ET for at least 5 minutes in a sterile warm saline bottle (at 95⁰ F)⁽⁷⁾
5. Inflation of one to two milliliter of air in the cuff to obliterate the serrated edges of the cuff so that it will create a minimal bulge when the cuff passes through the nares without traumatizing.
6. Deflate the cuff once endotracheal tube reaches the pharynx
7. Laryngoscopy and observation of the degree of bleeding
8. Magill assisted intubation

Observation done

1. Ease of endotracheal tube navigability through the nasopharynx^(9,10,11)
2. Presence of blood/ bleeding in naso pharynx during Laryngoscopy^(9,10,11)
3. Post-operative nasal pain assessed 2 hours after extubation and recovery

Table 1: Category of bleeding^(9,10)

Category	Inference
No epistaxis	No bleeding
Mild	Thin streak to Blood on the ET tube/pharynx

Moderate	Thick streak to minimal Blood pooling on the ET tube/pharynx
Severe	Blood in pharynx that hinders intubation

The degree of bleeding was categorized as nil, mild, moderate and severe (Table 1) and the ease of navigation of the tube through the nasopharynx were recorded.^(9,10,11) The anesthesiologist who performed the intubation observed and graded the category of epistaxis and also the ease of passage through the nasopharynx which was categorized according to the resistance or impingement sensed as easy if passage is smoother, mild when gentle manipulation is required, moderate if manipulation with pressure is needed and graded as difficult if multiple manipulations with pressure is necessary or unable to negotiate.^(9,10,11,12)

Results

When the ease of navigation was observed, seven (35%) patients among the twenty, navigability was smoother with no resistance, eleven (55%) patients had a mild resistance (Table 2) and (Fig. 1).

Table 2: Distribution of Navigability

Category	No of patients
No resistance / Easy	7
Mild resistance	11
Moderate resistance	1
Unable to negotiate	1

One (5%) patient had a moderate resistance and in another patient (5%) tube could not be negotiated as resistance was felt through both nares hence the ETT had to be removed and a smaller tube was renegotiated successfully.

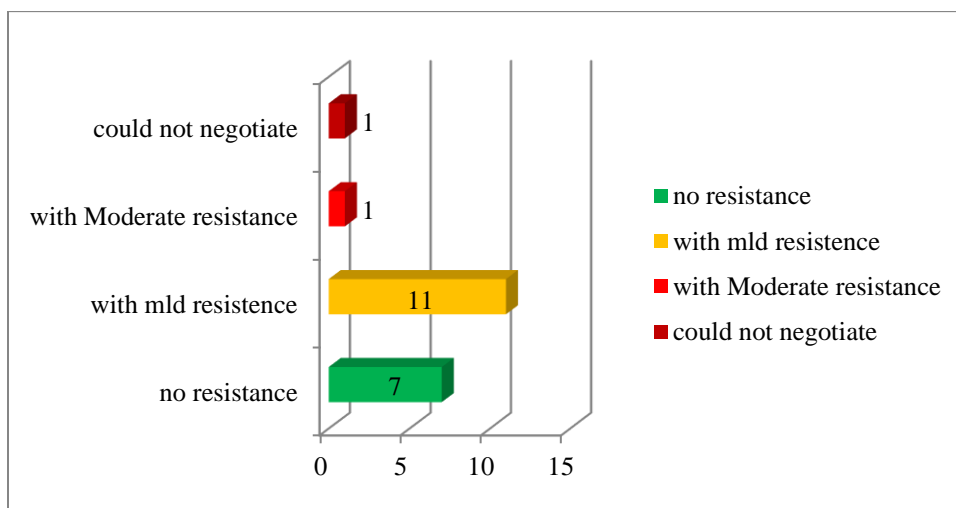


Fig. 1: Navigability of the tube

Patients had just streak of blood ranging from thin to thick streak on the endotracheal tube. Among the 20 patients there was a mild bleed in fifteen (75%) patients and moderate category of bleed in five (25%) patients. No patients had severe bleeding on observation and none of the patient had a clear oropharynx (Table 3).

Table 3: Distribution of Severity in bleeding

Category	Inference
No epistaxis	0
Mild	15
Moderate	5
Severe	0

None of the 20 patients had bleeding that required through suctioning to visualize the vocal cord (Fig. 2).

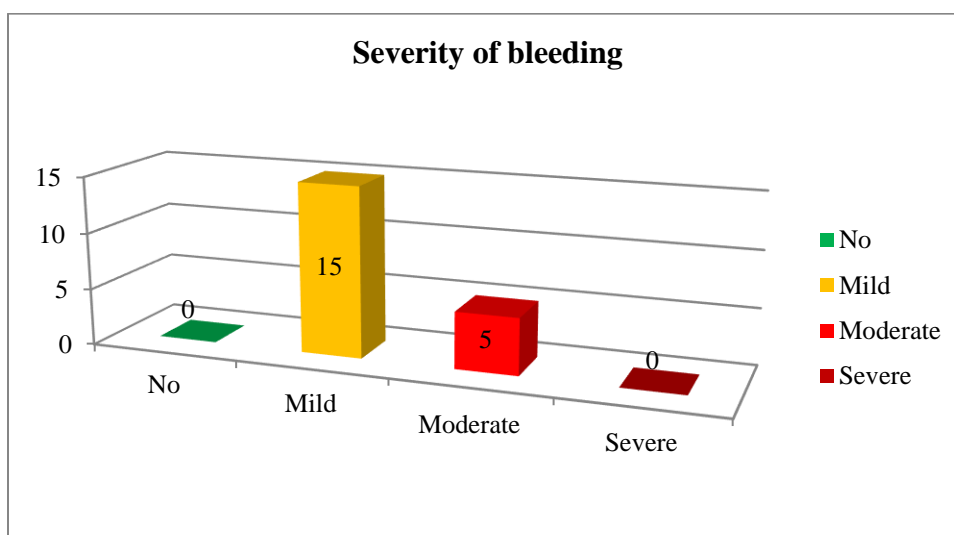


Fig. 2: Severity of bleeding

Only one patient (5%) who had a moderate bleeding had mild pain and nasal stuffiness which was treated symptomatically with nasal decongestant. Among the rest 4 patients (20%) had nasal discomfort for a couple of hours which needed only reassurance and others had no pain or discomfort.

Discussion

Nasal pathway can be divided into upper and lower as the space between middle and inferior nasal turbinates and the space below the inferior turbinate respectively. During nasotracheal intubation the tube can go in the upper as well as lower pathways.

During nasotracheal insertion the endotracheal tube transverses through the nasal cavity, thus traumatizing the path it passes through causing bleeding. Sometimes the bleeding may be torrential.^(2,3)

Epistaxis due to minor abrasions or bruises of the nasal mucosa on various studies ranges from 18% as much as 66% more so in the inferior turbinate mucosa – about 55%. The bleeding can make intubation difficult and also aspirates into the lungs along with debris.^(14,15)

Lot of endotracheal tube modification and manipulations has been described with and without satisfactory results. Uncuffed endotracheal tube after thermo softening will reduce the trauma with a better navigability but the risk of aspiration is high in spite of a good throat pack. Hence a cuffed tube is much preferred especially in the maxillofacial procedures.^(15,16,17)

Many techniques have been proposed to reduce the bleeding and trauma to the nasal passages which includes mechanical, pharmacological or a combination of both.⁽¹⁸⁾ There has been a continuous search for newer technique and modified tubes to reduce the nasopharyngeal trauma during nasal intubation to decrease the bleeding. Many studies have been published regarding the prevention of nasal trauma during intubation e.g. thermo softening, urethral catheter assisted intubation, Parker flex tip tube, covering the tip with finger glove.

In spite of using a nasal decongestant/ vasoconstrictor before the procedure and adequate lubrication of the ET and nares with a jelly, abrasions do occur invariably. Though the tip of the tube is implicated, it is worthwhile to make a note that the deflated cuff of the disposable endotracheal tube will have a few serrated edges. These serrated edges will cause a definitive trauma when it goes through the nasal passage even without obvious resistance. It is the modification aimed at reducing this serration of the tube cuff that will reduce the mucosal trauma and thereby bleeding.

When the idea that of a partially inflated the cuff could reduce the trauma to the nasal passage emerged, it seemed appropriate to assess the efficacy of this modification along with a proven method of thermo softening.

The capacity of cuff with high volumes obviously makes the surface area of the cuff bigger thereby producing longer serrated edges of the deflated cuff. Hence filling of the high volume low pressure cuff with one or two milliliter of air during the nasal passage nearly eliminates the serrations on the cuff thereby reduces the nasal mucosal trauma as well as turbinate trauma.

The thick polyvinyl chloride tube on thermo softening becomes more flexible and soft and can reduce the trauma to the nasopharyngeal pathway. The nasomucosal trauma can be further reduced by removing the serrations of the empty cuff by inflating the cuff with one or two milliliters of air.

When we observed the results of this modification we could make out the difference in the amount of injury inflicted by the passage of the ETT through the nose. Having observed so many dental procedures in over the years, we could clearly make out the difference in the amount of mucosal trauma and the following epistaxis. There was an obvious reduction in the usual bleeding. Bleeding streaks were found in many patients though not as alarming as it is to be in the regular Nasal intubation. Thermo softening of the conventional PVC ET tube along with a minimal cuff convincingly reduces the trauma to the nasal mucosa.

Though there are certain limitations as this is an observational study involving a sample size of a smaller group, the results were encouraging to follow it with an extended study in the future.

Conclusion

Partial inflation of the endo tracheal tube cuff along with thermo softening during Nasotracheal intubation is simple, safe, effective, and also reliable in reducing the mucosal trauma.

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