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A study of nasotracheal intubation using bougie technique and video laryngoscope: an observational study

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ABSTRACT

Introduction: Nasotracheal intubation (NTI) is a widely used technique in maxillofacial and oral cavity surgeries to provide better surgical access. Conventional NTI, while effective, is associated with complications such as nasal bleeding and oral cavity trauma. The bougie-assisted NTI technique, combined with video laryngoscopy, has been proposed to improve the success rate of first-attempt intubations and reduce trauma and other complications.

Objectives: The study aimed to evaluate the effectiveness and safety of the bougie-assisted NTI technique, focusing on the success rates of first and second intubation attempts, time required for intubation, hemodynamic changes, and incidence of complications like nasal bleeding and mucosal injury.

Methodology: This prospective observational study was conducted at Nepal Medical College from February 2024 to July 2024. A total of 36 patients, aged 18 years or older, scheduled for elective maxillofacial and oral cavity surgeries were included. The bougie-assisted technique was adopted under general anesthesia, and video laryngoscopy was employed for visualization. Hemodynamic parameters and complications were recorded at predefined intervals. Data were analyzed using descriptive statistics.

Results: Among 36 patients who underwent nasal intubation, 28 patients (77.8%) were successfully intubated on the first attempt, and 8 patients (22.2%) required a second attempt, There were no cases of esophageal intubation, or oral cavity injury. The incidence and severity of nasopharyngeal trauma was significantly decreased. The heart rate, systolic blood pressure, have no significant change ($p< 0.05$), But the diastolic blood pressure increase in 10,and 15 minutes was significant ($P > 0.05$) in pre-intubation and post-intubation hemodynamic. The aim of the study was bougie-assisted technique would result less hemodynamic change, easy to intubate, less time required to intubate without nasopharyngeal trauma.

Conclusion: Bougie assisted technique for nasotracheal intubation increases the rate of success on first attempt while reducing complications such as nasal or oral trauma and epistaxis. Therefore, we recommend using the bougie assisted technique for nasal intubation.

INTRODUCTION

Nasotracheal intubation (NTI) is used commonly as alternate access for airway management in case of difficult oro-tracheal intubation, maxillofacial surgery, and creates a good working space for oral cavity surgery. The technique of nasal intubation was first explained by Kuhn in 1902, other experts like Macewen,

Rosenberg, Meltzer Auer, and Elsberg contribute popularizing nasal intubation techniques.1 Later on it was introduced in clinical practice by Magill in 1920. This technique was initially used for long-term ventilation in intensive units. Over the time; its use for long-term ventilation has been decreased due to risk of sinusitis. The conventional nasotracheal intubation (NTI) is performed with passing a tracheal tube through the nostrils, has high incidence of nasal bleeding (approximately 54%)2,3 and use of Magill forceps unintentionally cause cuff damage, mucosal injuries, and infections due to disruption of nasal mucosa since the forceps is not sterile or disposable.4-10 It has been reported that use of Magill forceps causes 70% oral cavity trauma,2 to mitigate these complications various modifications have been adopted during conventional NTI technique including; warming tracheal tube,6,7 pre-treatment nostril with vasoconstrictor,8 catheter insertion as guide for NTI,3,11,12 and dilatation of nasal passage but the effectiveness of modification is debated.13,14 Despite these modifications, nasal trauma and tube cuff rupture occur with the Magill forceps.2,4,15,16 However, using the bougie assisted technique instead of conventional NTI, time for intubation significantly decreases, eliminates the use of Magill forceps, reduces the risk of infection, and epistaxis.17 An observational trial was conducted before the research work was finalized to validate the hypothesis by using bougie assisted technique, have higher success rate on first attempt, reduce the need for instrumentation to intubate, and decrease nasal bleeding.

The primary objective of this study was to assess the hemodynamic change during pre-intubation and post intubation, time required for NTI, attempts required for NTI, and evaluate the possibility of intubation without Magill forceps. The secondary objective was to avoid tracheal manipulation during intubation, softening tubes, and reduce complications,11 thus this study was designed to evaluate bougie assisted NTI technique using video laryngoscope.

METHODOLOGY

After obtaining approval from the institutional research committee (IRC) of Nepal Medical College, this observational study was conducted from February 2024 to July 2024, in thirty-six patients. The inclusion criteria for the study were American society of anesthesiology physical status (ASA-PS) I-III undergoing facial, dental, or oral surgery and exclusion criteria were body mass index over 35 kg/m2, hypertension, cardiovascular diseases, conditions unsuitable for nasal intubation, and bleeding disorders. The routine nasal packing was done with nasal decongestant and lubricant was used during intubation to minimize the risk of epistaxis. Pre-operative airway assessment was done using Mallampati score (MPS) and during laryngoscopy Cormack and Lehan Grade (CL) was carried out, then the patients were enrolled after obtaining signed consent and explained about the procedure to reduce anxiety.

In operating room, intravenous line was secured with 18 G cannula, and ringer lactate solution was started, and midazolam hydrochloride 2 mg was administered to alleviate anxiety. Monitors (electrocardiogram, non-invasive blood pressure, and pulse oxymeter) were attached, and baseline vital signs were recorded, flexo-metallic tube 6-6.5 mm ID was chosen for NTI. An elastic gum bougie was kept ready, and glycopyrrolate 0.2 mg was given as an anti-sialagogue to avoid accumulation of secretions, which may complicate intubation by obstructing the laryngeal view and increases risk of aspiration,12 Then the induction of anesthesia was initiated with fentanyl 2 µgm/kg, propofol 2 mg/kg, rocuronium 0.6 mg/kg, and ventilation done with oxygen via a face mask. A bougie was inserted through the nostril to guide tracheal tube, using Seldinger's technique then the video laryngoscope was inserted from right angle of mouth with displacing the tongue towards the left side for direct visualization of vocal cord and pass the tip of bougie with external manipulation, once the tip of bougie was inside the vocal cord, the tube was slide down in the trachea and data were collected to determine the time needed for intubation, hemodynamic changes, number of attempts to intubation, severity of nasal bleeding, abrasions of nasal or oral mucosa without using Magill forceps, the unsuccessful intubation was defined on the basis of number of laryngoscope insertion to attempt intubation. Post-intubation bleeding was graded as 0 no bleeding (no sign of bleeding) 1 mild bleeding (blood in cuff and tube), 2 moderate bleeding (pool of blood in pharynx, no immediate accumulate after swabbing with gauze); and 3 severe bleeding (pool of blood in pharynx with immediate accumulation of blood after swabbing with gauze). 5 The Data were collected to determine the effectiveness of bougie assisted technique for analysis.

RESULTS

The demographic data of bougie assisted NTI technique were recorded. The mean age of the patients was 33.47±1.62 years with 41.7% were male and 58.3% were women, The pre-operative airway assessment using Mallampati score (MPS) for adequate mouth opening, and Cormack and Lehane grade (CLG) for best glottic view were used, Summarized in table 1.

Table 1: Demographic data of patients

Variable		Bougie Technique Group (n=36)
Age in years (Mean ± SD)		33.47±1.62
Gender, n (%) Female	Male	15 (41.7%)
	21 (58.3%)	
Modified Mallampati Grade, n (%) II III	I	15 (41.W7%)
	16 (44.4%)	
	5 (13.9%)	
Cormack and Lehane Grade, n (%) II III	I	16 (44.4%)
	15 (41.7%)	
	5 (13.9%)	
Type of Surgery, n (%) ENT	Maxillofacial	15 (41.7%)
	21 (58.3%)	

The comparison between preintubation and postintubation vital parameters, in different time interval showed significant increase in post induction heart rate (HR) in 10, 15 minutes(P=. There was no significant change in preinduction and postintubation systolic blood pressure (SBP) in 5, 10, and 15 minutes. Whereas, diastolic blood pressure (DBP) significantly increased at 5 minutes, at 10 minutes and 15 minutes (P=0.020, 0.044, 0.001 respectively). SPo2 showed no significant changes in pre induction and postoperative values. But overall change the diastolic pressure has significant change.(Table 3)

Table 2: Vital parameter in time interval (Mins)

Variable Time Interval	HeartRate (beats/min)	P value(Paired `t`test)	Systolic Blood Pressure (mmHg)	P value Paired `t` test	Diastolic Blood Pressure (mmHg)	P value Paired`t` test	SpO2 (%)	P value paired `t` test
Pre-Intubation (0 min) (Mean ± SD)	88.17±9.29		126.25±8.98		70.74±5.34		98.25±1.07	
5 min Post-Intubation (Mean ± SD)	87.42±6.29	0.64	128.64±6.41	0.40	82.83±6.13	0.020	98.36±1.07	0.62
10 min Post-Intubation (Mean ± SD)	8O.42±2.24*	<0.001	128.25±8.9 8	0.11	79.94±4.95	0.044	98.28±1.05	0.91
15 min Post-Intubation (Mean ± SD)	78.11±1.80*	<0.001	125.33±5.40	0.39	77.78±4.24	0.001	98.36±0.99	0.62

Table 3: Overall preintubation and postintubation vitals

Variable	Preintubation vitals Mean±SD	Postintubation vitals Mean±SD	P-value (paired t test)
Heart rate	88.17±9.29	82.86±7.015	=0.9
Sys B.P	126.25±8.98	128.72±7.34	=0.2
Diastolic B.P	70.74±5.34	85.28±4.89	=0.01
Spo2	98.25±1.08	98.39±0.90	>0.71

Out of 36 patients, successful first attempt nasal intubation was performed in 28 patients (77.8%) within 28 ± 1.68 seconds, while second attempt nasal intubation was required in 8 patients (22.2%) with 67 ± 1.68 seconds. Mean of time for intubation was 41.72±10.11 sec.

Table 4: Incidence of Complications

Variable	n = 36 (%)	Time (sec)
Mean time to Intubation		41.72±10.11
First Attempt Success Rate	28(77.8%)	28± 1.68
Second Attempt Success Rate	8 (22.2%)	67 ±1.68
Magill Forceps used	0	

This study evaluated the incidence and severity of nasal bleeding just after intubation, at 5 and 15 minute interval. The incidence of nasal trauma and bleeding was less with bougie assisted technique. Which was scored as no bleeding in 20 patients (55.6%), 14 patients (38.9%) had mild bleeding and 2 patients (5.6%) had moderate bleeding. No other complications were noted.

Table 5: Incidence of Complications

Complication		Number of patients (n=36)%
Nasal bleeding	0 No bleeding (blood absent)	20 (55.6%)
	1 (blood in cuff and tube)	14 (38%)
	2 (pool of blood in the pharynx, no immediate reaccumulation after swabbing with gauze)	2 (5.6%)
	3 (pool of blood in the pharynx with immediate reaccumulation of blood after swabbing with gauze)	0
Mucosal Abrasion, n (%)		0
Mucosal injury, n (%)		0

DISCUSSION

Our results showed, there was no significant increase in heart rate (HR), systolic blood pressure (SBP), but diastolic blood pressure (DBP) significantly increases. Table 3 This finding was similar to study conducted by Smith and collegue[24] proposing the hypertensive response to naso tracheal intubation was significantly greater and more sustained than oral intubation. But interestingly, the tachycardia during nasal intubation was significantly less than that of oral intubation, instead of tachycardia there was bradycardia or no change in heart rate after nasal intubation, this was attributed to baroreceptor reflexes responding to the increase in arterial pressure during the procedure, or it could be because of the nasocardiac reflex. This reflex is similar to the occulocardiac reflex, believed to play development of bradycardia following intranasal instrumentation.[25,26] On other hand, the sympathetic nervous system response after nasal intubation was counterbalanced by increased vagal activity so there was no change in heart rate, but stimulation of sympathetic nervous system causes hypertension, increased intracranial pressure and sometime arrythemias.[25,26] Michal and collegue 2003[18] noted significant rise in HR, SBP, and

DBP, during insertion of the videolaryngoscope, this was due to stress response to laryngoscopy.

In this study, we compare the pre-induction and post induction vital parameters in 10, and 15 minutes interval, showed no significant increase in HR, and SBP, but sustain increase in DBP for more than ten minutes(Table 2). Sundrani and collegue[19] stated that tracheal intubation significant increases mean heart rate, mean arterial pressure from the baseline and post induction vital parameter, and remained elevated for short duration, which was attributed with maintenance and achieving depth of anesthesia by isoflurane. The hypertensive response to nasotracheal intubation has little consequence in young fit individuals, but may have serious effect in the patients suffering from cardiovascular disease.

Regarding the complication related to NTI, epistaxis was commonest complication ranging from 15-80%. To overcome these complication various modifications has been practiced like nasal pack with vasoconstrictor drugs, softening tracheal tubes by immersing in warm sterile water, or by using smaller size NTT.[26,27] Our data showed that bougie assisted technique has better outcome with a drastic decrease in incidence and severity of nasal bleeding by (55.6%), whereas other study stated that the incidence of bleeding was varying from 10% to 80% based on the technique used.[5] Whereas, in our study with use of bleeding severity score we found no active bleeding at 5 minutes was in 20 patients (55.6%), mild bleeding in 14 patients (38.9%), and moderate bleeding in 2 patients (5.6%) with no severe bleeding and nasal mucosal abrasion after intubation as well as no use of Magill forceps.

Notably, in our study time for first attempt intubation was 28 ± 1.68 second in 28 patients with success rates 77.8% and second attempt intubation time was 67 ± 1.68 second in 8 patients with success rate of 28.2% with mean intubation time was 41.72 ± 10.11 sec. The mean intubtion time was higher than other studies; this difference may be because of the learner stage of our residents. The Matthew and collegue 2011[20], stated that use of bougie assisted technique increases success in naso-tracheal intubation with limited glottic view. On another study conducted by Brian and collegue[21], revealed that in bougie assisted technique the rate of successful first attempt intubation was 98%. Whereas, red-rubber catheter assisted intubation technique has longer time for intubation with less traumas and bleeding[12] aligns with similar findings by Enk et al[22] but the use of Magill forceps to manipulate the catheter causes increase in apnea time, risk of forceps trauma, and cuff damage. The studied by Elwood and collegue 2002[12], stated that the bougie assisted technique should be considered due to its advantage of successful NTI and reduce bleeding, the author has stated that the incidence of bleeding at 5 minutes was less by 55%, whereas trauma caused by conventional NTI technique was more so that chances of bleeding, damage to nasal turbinate, bacteremia, or rarely cranial vault penetration.[6,13] Despite increase in intubation times in bougie assisted technique devoid of using Magill forceps decreases complications. The bougie assisted technique has three main advantages. Firstly, it reduces nasal mucosal contact thus decrease the incidence and severity of nasal mucosal trauma, and eliminates the use of Magill forceps. Secondly, as no need to use Magill forceps therefore no risk of cuff damage or oropharyngeal mucosal abrasion,[23] thirdly, when there is less room for oropharyngeal manipulation of tube with Magill forceps, bougie assisted technique is useful, fourthly, in bougie assisted technique success rate of nasal intubation does not change even though the glottis visualization impaired but in the conventional NTI technique epistaxis impaired glottis visualization and impede the intubation.[28] Regarding the surgeon satisfaction in term of bleeding they were excited. Thus a simple modification in technique by using the bougie with video-laryngoscopy prior to passing an tracheal tube through the nares improve the success rate for intubation and decrease in bleeding.

CONCLUSION

This study may have significantly impact on clinical practice in Nepal, as we recommend to use bougie technique in nasotracheal intubation for safe airway management during oral or maxillofacial surgery and airway management, as it reduce nasal trauma and no need of Magill forceps, as well as increased success rates of intubations. Further large-scale study needed to validate the effectiveness of novel approach of nasal intubation.

LIMITATIONS OF THE STUDY

The nasal bleeding is influenced by various factors, such as mean arterial pressure, and nasal cavity anatomy, which were not controlled in this study.

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CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

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