

Common Nasal Anomalies and Its Implications on Intubation in Head and Neck Surgeries

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Abstract: Nasotracheal intubation used to be the preferred route for prolonged intubation in critical care units. Nasotracheal intubation may sometimes cause nasal trauma. The study included one hundred and nine (109) adult patients, were scheduled for elective head and neck surgeries with general anaesthesia, requiring nasotracheal intubation. All the patients compiled the criteria of American *Society of Anesthesiologists* (ASA) physical status I and II were included in this study. The incidence of complicated laryngoscopy was assumed as 8%, confidence levels at 99% and an error of 3%, the total sample size were One hundred and three (103) patients. Observation, recorded bleeding 63.11% (65-patients) of the time with the literature stating epistaxis rates from 17-77%. The study found there was a significant relationship of soft tissue profile and number of intubation attempts. In this study a concave profile was more likely to have multiple attempts, there was a significant relationship between moderate and severe bleeding and number of intubation attempts and in 04.85% (05-patients) of those patients with severe bleeding there were multiple intubation attempts. Thyromental distance and Mallampati score did not seem to have a significant relationship with either the number of intubation attempts or severity of bleeding. This may demonstrate that multiple attempts led to an increase in bleeding due to increased trauma or that bleeding from the nose into the oropharynx and hypo-pharynx contributed to a difficult view of the larynx for passing the tube between the cords. The clinical relevance from this study to create an algorithm or define a set of factors to alert anesthetists to aware of knowledge about the common nasal anomalies for the difficult nasotracheal (NT) intubation.

Keywords: Nasotracheal Intubation, Dental Surgeries, Oral Surgeries, Nasal Anomalies

1. Introduction

Nasotracheal intubation (NTI) is one of the most common methods used to incite anaesthesia for emergency surgeries in the head and neck region, when orotracheal intubation is not feasible. Nasotracheal intubation used to be the preferred route for prolonged intubation in critical care units. Nasotracheal intubation may sometimes cause nasal trauma [1]. The most frequent complication is epistaxis, which may be occasionally troublesome, even with vasoconstrictors, with a smaller, softened and well-lubricated tube with careful manipulations. More seriously, there have been reports of partial and even total avulsions of middle and inferior

turbinate's [2, 3, 4, 5]. More rarely, an amputated turbinate may obstruct the nasotracheal tube, further endangered the patient safety [6].

In nasotracheal intubation, there are two basic anatomical pathways in the nostril, through which the endotracheal tube might pass [7]. The upper pathway lies between the inferior turbinate and middle turbinate. Lower pathway lies along the floor of the nose and is more secure. The lower pathway is a preferred pathway. Intranasal abnormalities are seen in two-third of oral surgery patients [8]. Anatomical variations like nasal-concha, bulla-ethmoidalis, nasal-septal deviations, nasal-spur and nasal-polyps, are common unilateral obstructions may affects the intubation [9]. The knowledge

about the common anatomical nasal anomalies is more helpful to understand the nasal variations. The preanaesthetic diagnostic evaluations are more helpful to prevent the complications.

2. Materials and Methods

One hundred and nine (109) adult patients were scheduled for elective head and neck surgeries with general anaesthesia, requiring nasotracheal intubation. All the patients compiled

the criteria of American *Society of Anesthesiologists* (ASA) physical status I and II were included in this study. The study considered all the aspects of human care compiled with the ethical guidelines and technical requirements were approved by the Institutional Human Ethics Committee (IHEC) and Institutional Review Board (IRB), National Medical College and Teaching Hospital. The incidence of complicated laryngoscopy was assumed as 8%, [10] confidence levels at 99% and an error of 3%, the total sample size were One hundred and three (103) patients (Table-1).

Table 1. Pre-Anesthetic Classification of patients under Modified Mallampati class (MMC) [11].

MODIFIED MALLAMPATI CLASSIFICATION			
CLASS	DESCRIPTION	NUMBER OF SUBJECTS (n=103)	PERCENTAGE OF SUBJECTS (%)
0	Ability to see any part of the epiglottis upon mouth opening and tongue protrusion	02	01.94
I	Soft palate, fauces, uvula, pillars visible	58	56.31
II	Soft palate, fauces, uvula visible	22	21.35
III	Soft palate, base of uvula visible	13	12.62
IV	Soft palate not visible at all	08	07.76

In the operating room, the patient was placed in the supine position with standard monitors applied (electrocardiogram, noninvasive blood pressure, pulse oximetry, capnography and temperature). General anesthesia was induced with proper ventilatory support. An appropriate sized endotracheal tube (ET) was selected for the patient, using the formula, ((Age of patient in years/4)+4) = diameter of endotracheal tube in millimeters". The chosen endotracheal tube was lubricated and inserted into the right naris at room temperature. If the endotracheal tube met resistance a second tube, one half sizes smaller, was taken and introduced. This procedure was repeated as required until a tube could be gently passed into the nasopharynx. During this procedure, the laryngeal inlet was visualized through direct laryngoscopy (DL) and the endotracheal tube was placed in the appropriate position using the forceps. The ET tube was secured in a standard manner. The study ended after successful intubation of endotracheal tube, it was confirmed by the assessment of chest movement, auscultation and capnography.

To achieve the successful intubation, the posterior oropharynx was visualized with DL, before the chosen endotracheal tube (ET) tube was passed through the vocal cords. The epistaxis was rated as no, mild, moderate and severe. "No epistaxis" indicated with no bleeding, "mild epistaxis" represented as evidence of blood in the endotracheal tube (ET) tube, "moderate epistaxis" indicated the endotracheal tube (ET) tube is splashed obviously with the blood, and "severe epistaxis" represented with a active

bleeding or accumulation of blood in the posterior oropharynx, was sufficient to impede the intubation.

The number of intubation attempts, amount of epistaxis and number of times a new tube was chosen were recorded. Student's t-test, used to analyze the significant differences between easy and difficult laryngoscopy and the number of intubation attempts in relations to the Soft tissue, Cricoid pressure, Epistaxis and preferential Naris.

3. Observations

The significant airway differences between single attempt and multiple attempts laryngoscopy were assessed by: (1) Modified Mallampati class (MMC) [11]; of oropharyngeal view (Table-2); (2) Inter-incisor distance (IID), with the mouth fully opened; (3) Thyromental distance (TMD); (4) Sternomental distance (SMD) obtained by measuring the straight distance from thyroid notch and sternal notch, with the head in extension; (5) Range of head and neck movements described by Wilson *et al* [12]; (6) Mandibular protrusion limitation; (a). the lower incisors can be brought in front of the upper incisors or (b). the lower incisors can be advanced only to the level of upper incisors or (c). cannot reach the level of the upper incisors; (7) Ratio of height (cms) and Thyromental distance (TMD) (cms) [RHTMD ratio]; (8) Dentition: Loose, missing, protruding teeth or edentulous were noted.

Table 2. Modified Mallampati classification differences between Easy and Difficult Laryngoscopy.

MODIFIED MALLAMPATI CLASSIFICATION DIFFERENCES BETWEEN EASY AND DIFFICULT LARYNGOSCOPY			
CLASS	DESCRIPTIONS	LARYNGOSCOPY (n = 103)	
		Single Intubation (n = 82)	Multiple Intubation (n = 21)
0	Ability to see any part of the epiglottis upon mouth opening and tongue protrusion	02 (01.94%)	0 (0%)
I	Soft palate, fauces, uvula, pillars visible	52 (50.48%)	06 (05.82%)
II	Soft palate, fauces, uvula visible	15 (14.56%)	07 (06.79%)
III	Soft palate, base of uvula visible	08 (07.76%)	05 (04.85%)
IV	Soft palate not visible at all	05 (04.85%)	03 (02.91%)

The present study demonstrates that, TMD in the multiple attempts laryngoscopy group was significantly shorter (5.8+1.0) to compare with the single attempt (6.3+0.9) laryngoscopy group. In this study the RH-Ratio of height (cm) and TMD- Thyromental distance (cm) - (RHTMD), was significantly higher in patients in the multiple attempts laryngoscopy group (28.5+5.3) compared with that in the single attempt laryngoscopy group (22.6+3.2). Sternomental

distance (SMD) is an indicator of head and neck mobility [13]. There was a statistically significant difference between SMD in the single attempt and multiple attempts laryngoscopy groups (14.3+1.2 cm and 13.5+2.3 cm, respectively). The other parameters like Inter-incisor distance (IID) < 3.5 cms, Range of head and neck movement < 80° and Dentition were noticed in negligible, but, in statistical significant ratio (Table-3).

Table 3. Significant Airway differences between Easy and Difficult Laryngoscopy.

SIGNIFICANT AIRWAY DIFFERENCES BETWEEN EASY AND DIFFICULT LARYNGOSCOPY				
S. NO	DESCRIPTIONS	LARYNGOSCOPY (n = 103)		
		Single Intubation (n = 82)	Multiple Intubation (n = 21)	P- Value
1	Inter-incisor distance (IID) < 3.5 cms	03 (03.65%)	03 (14.28%)	0.000
2	Thyromental distance (TMD)	6.3+0.9	5.8+1.0	0.001
3	Sternomental distance (SMD)	14.3+1.2	13.5+2.3	0.008
4	Range of head and neck movement <80°	04 (04.87%)	02 (09.52%)	0.000
5	Mandibular protrusion limitation	02 (02.43%)	01 (04.76%)	0.000
6	RH-Ratio of height (cm) and TMD- Thyromental distance (cm)-(RHTMD)	22.6+3.2	28.5+5.3	0.000
7	Dentition	00 (0%)	01 (04.76%)	0.097

Values are mean+SD and numbers (percent)

Current study observed that there was a significant association between the soft tissue profile and the number of intubation attempts made for the secure airway. Patients required single intubation attempt had the highest convex soft tissue profile as 95.18% and a concave soft tissue profile were recorded as lowest ratio like 21.42% in the presented cases. However, for the patients required multiple intubation attempts, the highest ratio of 78.57% had the convex soft tissue profile and the lowest ratio like 04.81% were recorded with concave soft tissue profile (p= 0.0284), (Table-4). The study recorded that, for the patients who were intubated on the first attempt 96% received no Cricoid pressure. However for those who required multiple intubation attempts, 21.42% of patients received the application of Cricoid pressure (p=0.0038), (Table-4). On epistaxis, the patients intubated successfully on the first attempt like 97.36% had no bleeding

and 96% had mild bleeding. However, the patients needed multiple intubation attempts 29.41% demonstrated severe bleeding (p=0.0022). Further analysis revealed that the number of intubation attempts held no statistically significant relationships to any other categorical variables tested. In conclusion, 08.69% of those patients had moderate epistaxis on multiple intubation attempts, while only 02.63% of patients presents with the absence of epistaxis in multiple attempts. (P=0.0048), (Table-4). Where single intubation attempt was made the right naris was used 89.41% of the time, however for those requiring multiple intubation attempts 77.77% of the successful intubations took place via the left naris (p=0.0002). As a result patients for whom the left naris was used for intubation had higher odds of having multiple intubation attempts compared to patients who were intubated through the right naris, (Table-4).

Table 4. Anatomical Variations induce the number of Intubation attempts.

ANATOMICAL VARIATIONS INDUCE THE NUMBER OF INTUBATION ATTEMPTS						
S. NO	Major Variable factors	Sub factors	Frequency	Single Intubation	Multiple Intubation	P-Value
1	Soft tissue	Concave	14 (13.59%)	03 (21.42%)	11 (78.57%)	0.0284
		Convex	83 (80.58%)	79 (95.18%)	04 (04.81%)	
		Straight	05 (04.85%)	04 (80.00%)	01 (20.00%)	
2	Cricoid pressure	Used	28 (27.18%)	22 (78.57%)	06 (21.42%)	0.0038
		Not used	75 (72.81%)	72 (96.00%)	03 (04.00%)	
3	Epistaxis	No Bleeding	38 (36.89%)	37 (97.36%)	01 (02.63%)	0.0022
		Mild Bleeding	25 (24.27%)	24 (96.00%)	01 (04.00%)	
		Moderate Bleeding	23 (22.33%)	21 (91.30%)	02 (08.69%)	
		Severe Bleeding	17 (16.50%)	12 (70.58%)	05 (29.41%)	
4	Preferential Naris	Right	85 (82.52%)	76 (89.41%)	09 (10.58%)	0.0002
		Left	18 (17.47%)	04 (22.22%)	14 (77.77%)	

4. Discussion

The current bleeding rates were consistent with the current

literature findings for nasotracheal (NT) intubation and epistaxis, recorded bleeding 63.11% (65-patients) of the time with the literature stating epistaxis rates from 17-77% [14, 15]. The study found that, there was a significant relationship

of soft tissue profile and number of intubation attempts. In this study, a concave profile was more likely to have multiple attempts, there was a significant relationship between moderate and severe bleeding and number of intubation attempts and in 04.85% (05-patients) of those patients with severe bleeding there were multiple intubation attempts. The fact that a concave profile had a significant relationship with the number of intubation attempts differs from most studies concerning oral intubations. Thyromental distance and Mallampati score did not seem to have a significant relationship with either the number of intubation attempts or severity of bleeding. Interestingly these two assessments, along with soft tissue profile and maximum opening continue as the gold standards for assessing airways. This may demonstrate that multiple attempts led to an increase in bleeding due to increased trauma or that bleeding from the nose into the oropharynx and hypo-pharynx contributed to a difficult view of the larynx for passing the tube between the cords. The present study encountered multiple intubation attempts. As mentioned before, multiple intubations attempts are already a known issue for causing epistaxis. Future studies should further understand if the multiple intubation attempts were with the same tube. Also there was a significant relationship of which naris was used for intubation. Using the left naris for intubation was statistically significant possibly due to the type of nasotracheal (NT) tube used. The tubes used were Mallinckrodt and designed to be introduced into the right side. It was controlled by using Parker tubes right versus left would not have been a factor [16]. This was the first study of its nature in terms of looking at nasotracheal intubation. Compared to other studies, it had an appropriate sample size but did not have inter/intra rater reliability that the other studies had. The unique to this study was successful in finding the parameters, which appeared to be correlated with multiple attempts.

5. Conclusion

The clinical relevance from this study to create an algorithm or define a set of factors to alert anesthetists to aware of knowledge about the common nasal anomalies for the difficult nasotracheal (NT) intubation. Ultimately it would allow an anesthesiologist to decide what is best for the patient and decide against using a nasotracheal (NT) tube. Future considerations for this study would include increasing the sample size to strengthen the conclusion of this study. Further studies might better understand the relationship of cricoid pressure and if it contributed to multiple intubation attempts or if the act of providing cricoid pressure caused multiple attempts. Additionally, using radiographic imaging such as cephalometric radiograph or orthopantogram may better allow us to accurately understand the skeletal relationships of patients versus a subjective assessment of a patient's soft tissue profile. It would also be helpful to understand how bleeding in the posterior oropharynx impeded the view of the vocal cords and contributed to a difficult intubation.

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