

Cuff Inflation Technique for Nasotracheal Intubation in Maxillofacial Surgery

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Abstract: Background: Nasal intubation is a commonly used method of intubation for oral & maxillofacial surgeries as it allows better surgical access & isolation for oral procedures. The classical & most common method to guide the endotracheal tube tip into the larynx is through the use of Magill forceps. **Aim: to study:** the use of cuff inflation technique to guide the tip of the endotracheal tube into the larynx instead of use of Magill forceps, in nasotracheal intubation. **Patients & method:** This prospective interventional case series was conducted on 62 patients, all were scheduled for elective maxillofacial surgery under general anesthesia, after preoxygenation and induction of anesthesia, Cormack & Lehane grading was assessed and the tube was introduced through the selected nostril until loss of resistance and the endotracheal tube tip reached the oropharynx, direct laryngoscopy was done and the tube cuff was inflated with 15ml of air to elevate tube tip from the posterior pharyngeal wall to be advanced gently into laryngeal inlet then it was deflated and advanced into the trachea and cuff was reinflated. Patients were classified into 3 grades according to difficulty of intubation (easy, requires external manipulation or tube rotation, requiring Magill forceps for intubation). **Results:** Nasotracheal intubation using cuff inflation technique was successful in 90.3% of the cases without using Magill forceps, 69.3% of cases being easy intubation, 21% of cases required external manipulation of cricoid or tube rotation & only 9.7% of cases required Magill forceps for intubation, the most important predictor for failure of cuff inflation technique was Cormack & Lehane Grading. 91.5% of Grade I patients had easy intubation while none of the grade II patients had easy intubation, 73.3% of grade II patients required manipulation or tube rotation for successful intubation while only 4.3% of grade I patients required manipulation of the tube for successful intubation. **Conclusion:** Cuff inflation technique is associated with a high rate of successful intubation in patients undergoing maxillofacial surgeries with Cormack & Lehane Grading I & II.

Keywords: Cuff inflation technique, nasotracheal intubation, maxillofacial surgery.

INTRODUCTION

Nasal intubation technique was first described in 1902 by Kuhn (Kuhn, F. 1902), It is one of the commonest methods used to facilitate intubation for surgeries of the head and neck region, especially for oral surgery procedures as it allows better isolation and good surgical access for intraoral procedures. (Prasanna, D., & Bhat, S. 2014) Most commonly, this technique is employed in the operating room for dental procedures and intraoral (e.g., mandibular reconstructive procedures or mandibular osteotomies) and oropharyngeal surgeries. (Hall, C. E. J., & Shutt, L. E. 2003) In order to master the nasotracheal intubation procedure, the anesthesiologist must know the anatomy involved, the pathway and procedure of intubation, the pre-anesthetic medication and complications which may be seen at the time of intubation (Prasanna, D., & Bhat, S. 2014).

Choosing the correct nostril for intubation is very important. Anterior rhinoscopy during pre-anesthetic evaluation gives accurate indication of most patent nostril. However, it fails to determine posterior nasal abnormality. Hence anterior rhinoscopy can be used as a provisional method for selection of nostril (Smith, J. E., & Reid, A. P.

1999), Nasal endoscopy is also helpful in choosing the nostril for intubation and assessing intranasal abnormality, Pre-existing nasal pathology and various degree nasal obstructions. Flexible endoscope may be used to perform detailed examination of the entire nasal cavity for the selection of nostril (Bell, C. N. A. *et al.*, 1986).

Cuff inflation technique is a novel technique for NTI; it was first suggested by Gorback for blind nasal intubation in spontaneously breathing patients. (Gorback, M. S. 1987) Chung *et al.* showed that cuff inflation technique significantly increased the correct alignment of the ET with glottis and resulted in successful blind NTI in 84% of patients. (Chung, Y. T. *et al.*, 2003)

During DL guided NTI “cuff inflation,” the operator has to insert the ETT through the nostril first till it lies in the pharynx at this stage the tube has to move along the posterior pharyngeal wall, and it is difficult to facilitate their entry into the laryngeal inlet without use of Magill forceps. Magill forceps may cause damage to the cuff of an ETT or may injure oropharyngeal mucosa. The cuff inflation technique (wherein the cuff of ETT is inflated with 15 mL of air) lifts the ETT tip off the posterior pharyngeal wall and helps the

operator to direct the ETT into the laryngeal inlet. We thus conducted this study to assess the role of a cuff inflation technique in improving oropharyngeal navigation of ET tubes while performing direct laryngoscope-guided NTI.

PATIENTS & METHOD

This prospective, interventional case series was conducted in Ghazi Al-Hariri teaching hospital at the Maxillofacial surgery department from October 2019 to November 2020.

The study was approved by the scientific council of anesthesia & intensive care of the Iraqi board for medical specialties.

The study was conducted on 62 patients, 29 males & 33 females, ASA I or II, after obtaining verbal consent to participate in this study, all these patients were scheduled for elective surgeries under general anesthesia, and required endotracheal intubation as part of their anesthetic management.

Inclusion criteria:

- Age between 18- 65 years.
- ASA I & ASA II.
- Patient undergoing elective maxillofacial surgery who require Nasotracheal intubation.
- Weight between 60-90 Kg.

Exclusion criteria:

- Patient with history of difficult intubation or predicted difficult intubation.
- History of nasal trauma or history of nasal surgery or recurrent epistaxis.
- Coagulopathies.
- Cervical instability.
- Basal skull fractures.
- Nasal polyp or nasal obstruction.
- Cormack & Lehane Grade III or IV (dropped cases).

After IV cannula was inserted , preparation of the nasal cavity with Nasophrine drops (Phenylephrine HCl 0.25%) and Lidocaine spray aerosol 10% , 5 minutes before induction, the patient was positioned supine with the head on a firm pillow 7cm in height, and the standard monitoring protocol was applied (Blood pressure, heart rate, pulse oximetry, capnography), the nostrils were visualized by the anesthesiologist, and the appropriate nostril was selected, and if both nostrils were equally patent, the right nostril was chosen for intubation. Polyvinylchloride preformed north nasal tube were used in this study.

The patients were premedicated with metoclopramide 10mg, ranitidine 150mg & dexamethasone 8mg, patients were preoxygenated with 100% oxygen for 3 minutes.

All patients received IV Fentanyl 1mcg/kg , Propofol 1-2.5mg/kg(sleeping dose), Midazolam 0.02-0.03 mg/kg(1-2mg total), Ketamine 0.1-0.2 mg/kg, followed by IV Rocuronium 0.6mg/kg, then the patients were ventilated with Sevoflurane 2% & 100% oxygen for 3 minutes, A tube size from 6mm to 7.5mm was selected according to the patient's weight , the selected tube was inserted into the nostril while deflated, with the concavity facing caudal, until there was loss of resistance and the tip of the tube reached into the oropharynx, at this point a laryngoscope was introduced to the oral cavity to confirm the tube's location and assess Cormack & Lehane grading, at this point the tracheal tube cuff was inflated using 15ml of air to elevate the tube tip from the posterior pharyngeal wall and the tube was advanced further gently into the laryngeal inlet under direct vision, when the tip of the tube made contact with the vocal cords and resistance was felt, the tube cuff was deflated and advanced into the trachea and the cuff reinflated.

Successful tracheal intubation was confirmed by direct vision, capnography and chest auscultation. If cuff inflation failed to bring the tube into alignment with the laryngeal inlet, external manipulation of the cricoid or tube rotation was done, if both techniques did not bring the tube into alignment with the laryngeal inlet or patient arterial oxygen saturation decreased to less than 90%, the attempt was considered a failure of our technique, and a Magill forceps was used to aid intubation.

Data was analyzed using SPSS software.

RESULTS

There were 62 patients who underwent elective surgery included in this study.

The mean age of patients was 30.4 ± 13.2 years, with minimum age of 18 years and maximum of 65 years old.

For gender characteristics, the males representing 29 (46.8%) of patients and females representing 33 (53.2%) of patients.

The mean age of male patients was 35.5 ± 15.5 years, while the mean age of female patients was 25.8 ± 8.8 years. The difference in mean between

males and females was significantly higher among males (p value = 0.003).

Table 1: Distribution of age across gender						
	Gender	N	Mean	Std. Deviation	Std. Error Mean	P value
Age	Male	29	35.5	15.5	2.8	0.003
	Female	33	25.8	8.8	1.5	

The mean patient's weight was 75.8 ± 10 Kg, with a minimum weight of 60 Kg and a maximum weight of 90 Kg. Mean weight for male patients

was 81.1 ± 6.8 Kg and for female patients, the mean was 71.1 ± 10.2 Kg, this difference in mean was of statistical significance (P value < 0.001).

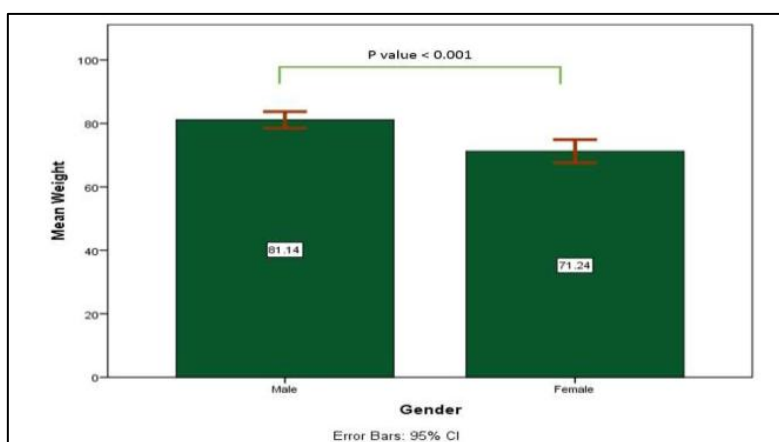


Figure 1: Association between patient's weight and gender.

For the side of the intubation, the majority of patients underwent the intubation in the right nostril 49 (79.0%) of patients, while the left nostril intubation in 13 (21.0%) patients only.

For majority of patients (87.1%), the tube size used either 6.5 or 7, while the tube size of 7.5 used for intubation in 8 patients only (12.9%).

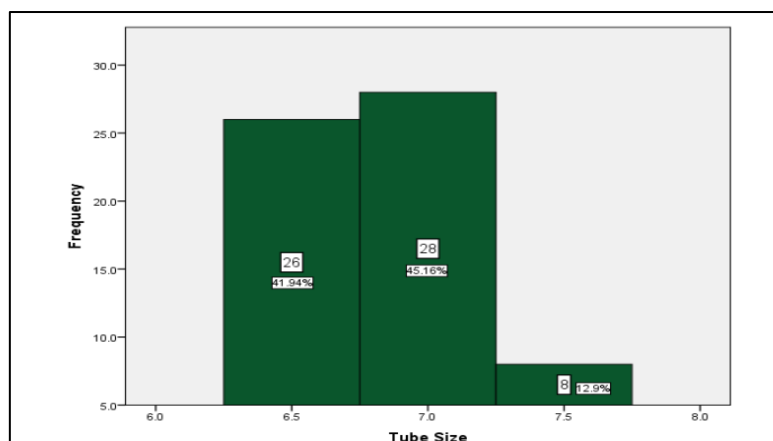


Figure 2: Distribution of tube size used for intubation across patients.

Cormack & Lehane grading (CLG) was assessed for each patient by direct laryngoscopy, 47 (75.8%) of patients were had grade I and 15 (24.2%) patients had grade II. The analysis did not show any significant association between CLG and gender (p value = 0.614).

The mean age of patients with grade I CLG was 27.5 ± 11.4 years, while mean age among patients with grade II was 39.4 ± 14.8 , this difference was

statistically significant (p value = 0.002). There was no association between CLG and weight of patients.

The difficulty of intubation was assessed for each patient, easy intubation was observed in 43 (69.4%) patients, intubation with manipulation was observed in 13 (21.0%) patients, and 6 patients (9.6%) required Magill forceps for intubation.

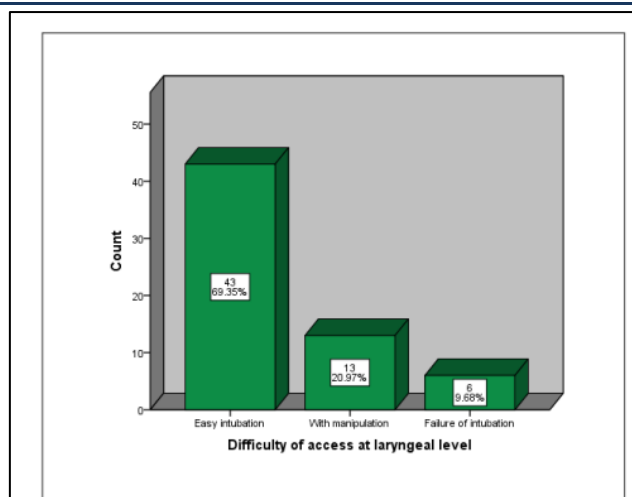


Figure 3: distribution of difficulty of intubation across patients.

The mean age of patients with easy intubation was 28 ± 12 years, with manipulation 33 ± 13 years, and with failure of cuff inflation technique it was 46 ± 15 years.

The mean age was significantly higher among patients with failure of cuff inflation technique than patients with easy intubation (p value = 0.037).

Table 2: Distribution of age across difficulty of intubation groups

		Age			
		SD	Minimum	Maximum	Mean
Difficulty of access at laryngeal level	Easy intubation	12	19	65	28
	With manipulation	13	18	58	33
	Failure of cuff inflation technique	15	19	60	46

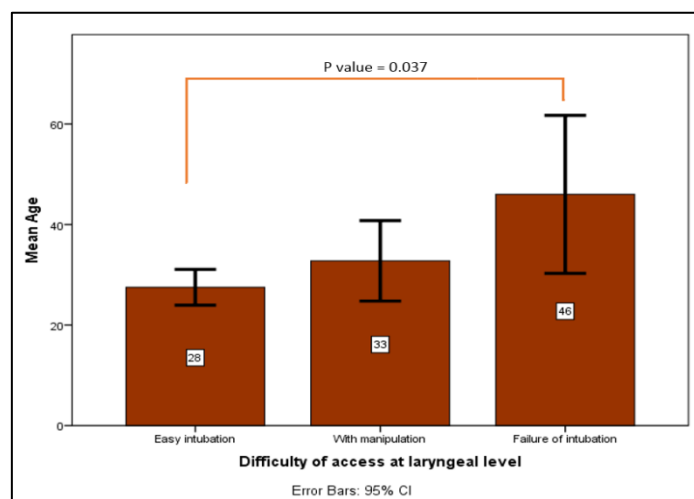


Figure 4: Association between age and difficulty of intubation.

The distribution of gender was equal across the difficulty of intubation groups and no association observed (p-value = 0.818).

Table 3: Association between gender and the difficulty of intubation groups

		Difficulty of access at laryngeal level			Total
		Easy intubation	With manipulation	Failure of intubation	
Male	No.	19	7	3	29
	%	65.5%	24.1%	10.3%	100.0%

Female	No.	24	6	3	33
	%	72.7%	18.2%	9.1%	100.0%
Total	No.	43	13	6	62
	%	69.4%	21.0%	9.7%	100.0%

Also, the distribution of patient's weight was relatively equal across the difficulty of intubation groups and no association observed (p-value = 0.133).

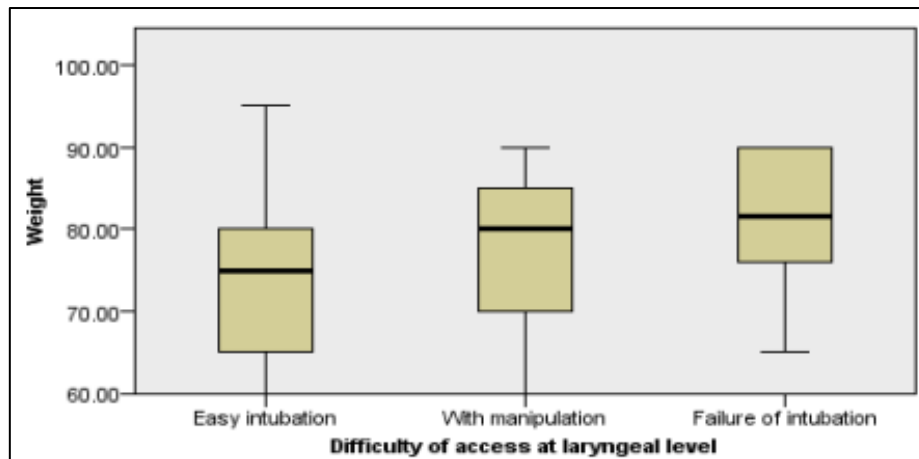


Figure 5: Association between weight and difficulty of intubation by using independent Sample Kruskal Wallis test.

All patients with grade II CLG showed either failure of intubation or intubation with manipulation, while only 4 patients with grade I CLG showed either failure of intubation or

intubation with manipulation. There was strong association between CLG and difficult to intubation (p value < 0.0001).

Table 4: Association between CLG and difficulty to intubate by cuff inflation technique

Table 4: Association between CLG and difficulty to intubate by cuff inflation technique						
			Difficulty of access at laryngeal level			Total
			Easy intubation	With manipulation	Failure of intubation	
Cormack & Lehane	Grade I	No.	43	2	2	47
		%	91.5%	4.25%	4.25%	100.0%
	Grade II	No.	0	11	4	15
		%	0.0%	73.3%	26.7%	100.0%
Total		No.	43	13	6	62
		%	69.4%	21.0%	9.6%	100.0%

DISCUSSION

Nasotracheal intubation is one of the commonest methods used for intubation for oral surgery procedures as it allows better access and isolation for intra oral procedures. (Prasanna, D., & Bhat, S. 2014)

However, it is inherently known to be more traumatic than orotracheal intubation due to the blind passage of the tube through a narrow nasal cavity. (Kumar, R., *et al.*, 2013) In addition to the instrumentation by Magill forceps which is needed to guide the ET tube tip into the laryngeal inlet which may cause damage to the cuff of the ET

tube or may injure oropharyngeal mucosa. (Dorsch, J. A., & Dorsch, S. E. 2008)

Cuff inflation technique does not require the use of Magill forceps & has the advantage of avoiding instrumentation & excessive extension of the neck. (Hall, C. E. J., & Shutt, L. E. 2003)

The technique of blind nasal intubation was first suggested by Gorbach for blind nasal intubation in the late 1980s (Dorsch, J. A., & Dorsch, S. E. 2008), and was first studied clinically by van Elstraete *et al* and Chung *et al* in the early 1990s (Van Elstraete, A. C. *et al.*, 1993). who both tested the ease of insertion of PVC endotracheal tubes

with cuff inflation technique during blind Nasotracheal intubation. Using a similar technique to the above-mentioned studies but with using direct laryngoscopy guided Nasotracheal intubation, we demonstrated that direct laryngoscopy guided cuff inflation technique NTI was successful in 90.3% of cases without using Magill forceps, with 69.4% of cases being straightforward easy intubations, 21% of cases requiring tube manipulation (rotation), and 9.3% of cases requiring Magill forceps manipulation for intubation. Successful intubation was achieved in all cases. The success rate of cuff inflation technique was similar to Rakesh *et al* (91%) and van Elstraete *et al* (95%). The most significant predictor for failure of cuff inflation technique was Cormack & Lehane Grade, as with Cormack & Lehane Grade I, 91.5% of patients had easy intubations, while for Cormack & Lehane Grade II, none of the patients had an easy intubation & all required either manipulation or Magill forceps manipulation. (Grade III & IV were excluded from the study). The only other factor of those studied that was significantly associated with difficulty of intubation was age, as the mean age of patients with easy intubation was 28 ± 12 years, with manipulation 33 ± 13 years, and with failure of intubation it was 46 ± 15 years. The mean of age was significantly higher among patients with failure of intubation than patients with easy intubation. Gender, Weight, tube size and nostril used were not significantly associated with differences in difficulty of intubation.

In our sample, females were slightly over-represented 53.4% to 46.8% males, also female mean age was younger, 25.8 years vs 35.5 years for males, this female to male distribution was similar to Rakesh *et al* (58% to 42%), these differences were likely due to patients undergoing orthognathic cosmetic surgery in our study all being females around age 20.

Right nostril intubation was used in 79% of patients due to right side being used as default, in cases where right nostril passage was difficult, the left nostril was used which occurred in 21% of cases

The following studies' results were found to be in agreement to ours in showing that cuff inflation technique improves rates of successful nasotracheal intubation:

William E. Ackerman *et al*, used cuff inflation technique during direct laryngoscopy NTI, on 25

patients, 23 of which were successfully intubated, & only two patients required use of Magill forceps due to anatomical considerations. (Ackerman, W. E., & Phero, J. C. 1989)

H.K.Badoo *et al*, compared the use of direct laryngoscopy & Glidescope video laryngoscopy, and found that the rate of successful intubation with video laryngoscope using cuff inflation technique was 96%, while it was 84% with Macintosh laryngoscope. (Baddoo, H. K., & Phillips, B. J. 2011)

Xue *et al*, used airway scope and tested cuff inflation technique to complete NTI successfully in more than 20 patients and concluded that cuff inflation is a simple & effective measure to correct lateral & posterior tube tip position during NTI using Airtraq laryngoscope. (Xue, F. S. *et al*, 2010)

Kinna *et al* showed that NTI with cuff inflation with the help of Video Laryngoscope provided a higher rate of 1st trial success for NTI in patients undergoing oral surgery by avoiding Magill forceps, it also concluded that cuff inflation technique avoids the need of Magill forceps, avoids instrumental trauma to upper airway mucosa, avoids ETT cuff damage and decreases intubation time. Hence, it contributes to minimize intubation stress response. (Shah, K. G. *et al*, 2019)

Walls *et al* described a patient with extreme difficulty in using the Glidescope despite Cormack & Lehane Grade I view, this is due to the trachea forming a steep angle posteriorly with the laryngeal inlet causing the ETT tip becoming stuck against the anterior tracheal wall. Successful intubation in this case was achieved by rotating the tube 180 degrees and redirecting the tube posteriorly. (Walls, M. R. M. *et al*, 2010)

Kumar, Rakesh *et al* compared between 3 ET tubes (SWR, WR, PVC tubes) using cuff inflation technique, their study showed that cuff inflation technique consistently improved ET navigation in all 3 tubes with varying stiffness during direct laryngoscopy. With the study showing the SWR tube to be superior to PVC & WR tubes in terms of navigation and nasal injury. (Dorsch, J. A., & Dorsch, S. E. 2008)

CONCLUSION

Cuff inflation technique is associated with a high rate of successful intubation in patients undergoing

maxillofacial surgeries with Cormack & Lehane Grading I & II.

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