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ORIGINAL RESEARCH PERIOPERATIVE MEDICINE

Nasotracheal intubation with the aid of nasopharyngeal airway

Ban Khalid Abd Al-Qader[1], Samar Antoine Abdulahad[2], Husam Mustafa Mohammad[3]

Author affiliations:

1. Ban Khalid Abd Al-Qader, Alwasity Teaching Hospital, Alrusafa Health Directorate, Ministry of Health, Baghdad, Iraq; E-mail: medicalresearch55@yahoo.com
2. Samar Antoine Abdulahad, Alwasity Teaching Hospital, Alrusafa Health Directorate, Ministry of Health, Baghdad, Iraq.
3. Husam Mustafa Mohammad, Alwasity Teaching Hospital, Alrusafa Health Directorate, Ministry of Health, Baghdad, Iraq.

Correspondence: Ban Khalid Abd- Al-Qader; **E-mail:** medicalresearch55@yahoo.com

ABSTRACT

Introduction & objective: Oral and maxillofacial surgeries commonly require nasotracheal intubation (NTI) to overcome difficulty of work in the oropharyngeal space. Several variables affect intubation difficulty and complications and include tube type or design, topical vasoconstrictors, lubricating the endotracheal tube (ETT), selecting smaller diameter ETT, using urethral catheter to assist NTI, using some catheters etc. We aimed to explore the effectiveness of nasopharyngeal airway (NPA) as a factor facilitating the passage of ETT in the nasopharynx and diminishing trauma and bleeding during NTI.

Methodology: One hundred-forty patients undergoing surgery in the oral and maxillofacial area were divided into groups of 70 each; NPA group, in which an NPA was used as an assist device, and non-NPA group with non-NPA use. Before intubation, the more patent nostril was identified, topical nasal vasoconstrictor was used, lubricant jelly applied and thermo softening of the ETT achieved. In NPA group, nasal cavity dilatation was done with an NPA before NTI. The ease of ETT passage and any nasopharyngeal bleeding were assessed by a scale of four grades.

Results: About 95.71% patients had easy (grade 0 or 1) passage of ETT in the NPA group compared to 81.43% in the non-NPA group ($P < 0.0001$, $P = 0.006$), and the remaining grades also showing significant differences between groups. About 98.57% patients had grade 0 to 1 bleeding (no or traces of blood) in the NPA group, compared to 97.14% in the non-NPA group ($P = 0.001$) and the remaining grades also showed significant differences between the groups. NPA minimized difficulties in passage of the ETT and complications.

Conclusion: Application of nasopharyngeal airway in patients undergoing nasotracheal intubation for general anesthesia proved to be effective in increasing nasal cavity space and minimizing difficulties faced in the passage of the endotracheal tube through the nasal passages and diminishing the resulting complications.

Abbreviations: ETT- Endotracheal Tube; NPA- Nasopharyngeal Airway; NTI- Nasotracheal Intubation

Keywords: Endotracheal Tube; Lubricating Gel; Maxillofacial; Nasopharyngeal Airway; Nasotracheal Intubation; Surgery, Oral; Surgery

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1. INTRODUCTION

Oral and maxillofacial surgeries are commonly handicapped by having to work in the small oropharyngeal space, and one way to overcome this difficulty is by nasotracheal intubation (NTI). However, the nasal cavities are much narrower than the oral cavity,

so NTI might cause nasal tissue trauma or epistaxis, leading to difficult airway management or even obstruction.[1-5] The frequency of NTI related epistaxis has been documented in different studies to be 12-66%.[3,6,7]

Several variables and techniques affect intubation difficulty and might diminish complications, including tube type or design and vasoconstrictor application, e.g., epinephrine, phenylephrine, xylometazoline, or oxymetazoline,[8] lubricating the endotracheal tube (ETT) and selecting smaller ETT,[9,10] using urethral catheter to assist NTI,[10] or a red-rubber catheter,[11] or a suction catheter guidance of the ETT,[12] selecting the nostril with more patency,[13] mechanical dilatation with nasopharyngeal airway (NPA) and appropriate manipulation of ETT without exaggerated force to overcome resistance and thermo softening of the tubes.[14,15]

This study was done to explore the effectiveness of NPAs to facilitate the passage of ETT through the nasopharynx, and to minimize trauma and bleeding during NTI.

2. METHODOLOGY

This prospective study was conducted at Al-Wasity Teaching Hospital, from January 2021 to March 2023. We enrolled 140 patients, aged from 18-70 y, ASA physical status I-II, scheduled by the oral and maxillofacial department for elective surgeries with NTI. Ethical committee approval was obtained from Al-Wasity Teaching Hospital, Alrusafa Health Directorate, (#ID: 290 in 2020). Informed written consent was taken from all of the participants.

The sample size of this study was determined by formula: $S = Z^2 \times P \times (1-P)/M^2$ (where S = sample size, Z = Z score, P = population proportion and M = error margin).

We excluded patients having airway difficulty and those with contraindications to NTI such as coagulation disorders, nasal deformity, history of frequent epistaxis, and fracture of skull. Patients underwent random allocation to either NPA group (70 patients), or non-NPA group (70 patients). Before surgery, the anesthesiologist checked the patency of both nostrils, and chose the more patent nostril one for NTI.

2.1. Anesthesia technique

All patients underwent a standardized anesthesia technique. At the day of surgery, an intravenous line was established. Inj glycopyrrolate 0.2 mg, inj midazolam 0.03 mg/kg, and fentanyl 2 µg/kg were injected. Xylometazoline 0.1% solution was instilled inside the chosen nostril to shrink the nasal mucosa. Lignocaine jelly was used to lubricate the nasopharyngeal passage. Oxygenation with face mask was done; then the patients received propofol injection 2-3 mg/kg and vecuronium 0.08 mg/kg were injected IV to establish relaxation.

2.2. NPA group

The patients received a well-lubricated NPA, 8.0 mm/34 Fr for males, and 7.5 mm/32 Fr for females, in the chosen nostril. If this attempt failed, the other nostril was chosen and if it also failed, we excluded the patient from the study. The ETT tip was softened by hot water at 50°C for three min. After four min mask ventilation, the NPA was taken out, and a lubricated ETT of suitable size (No. 7.5 for males and No. 7 for females) was passed through the nose. If passage was difficult, the tube was taken out and passed again with rotation in a counter clockwise direction.

We used four-grade scale to assess degree of ease of ETT passage into the nasopharynx as follows: Grade 0 (no resistance); Grade 1 (slight resistance); Grade 2 (great resistance); and Grade 3 (extreme resistance necessitating change of nostril).

2.3. Non-NPA group

In non-NPA group, the preparation of the patient and the nostrils was done as in the NPA group, except the NPA was not used.

Laryngoscopy was done, and Magill's forceps was used for NTI under direct vision, and the procedure was confirmed by capnography and auscultation to check for similar breath sounds on both sides. During laryngoscopy, the occurrence of nasopharyngeal bleeding with the ETT passage was confirmed and was scaled as follows: Grade 0 (no bleeding); Grade 1 (traces of bleeding); Grade 2 (frank blood in the pharynx); and Grade 3 (bleeding that prevented intubation).

2.4. Statistical analysis

Statistical analysis was done by SPSS for Windows, version 25.0. Armonk, NY, USA. The continuous variables were compared using the unpaired Student's t-test, while the categorical variables were compared using the Chi-square test. In all tests, $P \leq 0.05$ was considered significant.

3. RESULTS

The two groups of patients showed no significant differences in age, sex, body weight, and ASA status (Table 1).

Also, both groups showed no significant difference regarding the nostril choice and the ETT size (Table 2). Forty-seven patients had grade 0 passage of ETT in the NPA group compared to 21 patients in the non-NPA group ($P < 0.0001$). Twenty patients in NPA group had

Table 1: Comparative demographic data of the two groups

Parameters		NPA group (n = 70)	Non-NPA group (n = 70)	Test applied	P-value
Age (y)		39.08 ± 12.07	43.02 ± 13.21	t = 1.84	0.07
Weight (kg)		56.09 ± 7.09	53.51 ± 9.51	t = -1.82	0.07
sex	Male	46 (65.7)	44 (62.85)	χ^2 = 0.18	0.67
	Female	14 (20.0)	16 (22.85)		
ASA status	I	53 (75.7)	50 (71.42)	χ^2 = 0.33	0.57
	II	17 (24.3)	20 (28.57)		

Data presented as mean ± SD, or n (%); ASA = American Society of Anesthesiologists; NPA = Nasopharyngeal airway; P < 0.05 considered as significant

Table 2: The nostril choice and the ETT size

Parameters		NPA group (n = 70)	Non-NPA group (n = 70)	Test applied	P-value
Nostril choice	Right	28 (40)	23 (32.86)	χ^2 = 0.77,	0.38
	Left	42 (60)	47 (67.14)		
ETT size (mm ID)	7.0	17 (24.29)	15 (21.43)	χ^2 = 0.16,	0.69
	7.5	53 (75.71)	55 (78.57)		

ETT = Endotracheal tube; NPA = Nasopharyngeal airway; Data presented as n (%); P < 0.05 considered as significant

Table 3: Patients' grades of passage of endotracheal tube by group

Grades of insertion of ETT	NPA group (n = 70)	Non-NPA group (n = 70)	X^2	P
0	47 (67.14)	21 (30)	19.19	< 0.0001*
1	20 (28.57)	36 (51.43)	7.56	0.006*
2	2 (2.86)	11 (15.71)	6.82	0.009*
3	1 (1.43)	2 (2.86)	0.34	0.56

Data presented as n (%); P < 0.05 considered as significant

Table 4: Patients' grades of bleeding by group

Grades of bleeding	NPA group (n = 70)	Non-NPA group (n = 70)	X^2	P
0	62 (88.57)	46 (65.71)	10.30	0.001*
1	7 (10)	22 (31.43)	9.72	0.001*
2	1 (1.43)	2 (2.86)	0.34	0.56
3	0 (0)	0 (0)	-----	-----

Data presented as n (%); P < 0.05 considered as significant

grade 1 passage (slight resistance) compared to 36 patients in the non-NPA group (P = 0.006). Two patients had Grade 2 passage (great resistance) in NPA group, compared to 11 patients in the non-NPA group (P = 0.009). One patient had Grade 3 passage of ETT (requiring change of nostril side) in the NPA group compared to 2 patients in the non-NPA group (P = 0.56). The overall comparison of all NPA group grades to the non-NPA group grades yielded P of 0.0001 (Table 3).

Sixty-two patients had Grade 0 bleeding in the NPA group, compared to 46 patients in the non-NPA group (P = 0.001). Seven patients had Grade 1 bleeding in the NPA group, compared to 22 patients in the non-NPA group (P = 0.001). One patient had Grade 2 in the NPA group, compared to 2 patients in the non-NPA group (P = 0.56). No patient had Grade 3 bleeding in either the NPA group, or the non-NPA group. The overall comparison of all NPA group grades to the non-NPA group grades yielded P of 0.005 (Table 4).

4. DISCUSSION

Our study showed that NPA made the insertion of ETT easier and the performance of NTI safer with reduced chances of bleeding. Since there were no significant differences among participants in age, sex, and ASA status, these results are mostly attributed to the mechanical dilatation achieved by NPA, which is an approach advocated by some other studies.[14,16]

The difficulty that we faced in ETT passage into the nasopharynx and the bleeding extent and severity were not affected by the choice of nostril or the size of ETT, which is similar to the results found by some other studies.[1,17] However, one study found that the right nostril is easier for NTI when both nostrils are patent, with less epistaxis occurrence and severity, and less time required for intubation.[13]

In our study, the application of NPA improved not just the NTI, but also the mask ventilation and oxygenation during induction of anesthesia, as inappropriate mask ventilation implies hazard of deoxygenation on the patient while anesthetized, especially when difficult mask ventilation is faced.[18]

Our usage of thermo softening showed effectiveness comparable to the results revealed by other studies that revealed that simple thermo softening of the tube effectively reduces ETT impingement and epistaxis during NTI.[15,19,20]

As we stated earlier in the introduction, many other approaches for facilitating NTI are mentioned and used by many other studies. Flexometallic cuffed tube is an example of the many approaches mentioned, where it is non-kinking property makes it safe to use.[21] Also, the silicone-based wire reinforced tracheal tube resulted in less epistaxis rates.[22,23]

Another study advocated usage of nasogastric tube and curved tip suction catheter as a guide.[4] The usage of esophageal stethoscope-obturated ETTs was similar to thermo softening in diminishing epistaxis accompanying NTI, and thermo softened, obturated ETTs showed results better than those of simple thermo softened ETTs in diminishing epistaxis chance.[24] The usage of tubes made of silicone, with a round soft tip, sterile lubrication, and water-soluble jelly can reduce epistaxis or nasal complications.[8,25]

Finally, other tools that can be used during NTI include Magill forceps which have been developed over a century,[11,26] fiberoptic bronchoscope[16] and Parker Flex-Tip tracheal tube.[3]

Taking into consideration the multiple factors and approaches to facilitate NTI that are mentioned, it might be better to conduct multiple studies in different hospitals and different cities with larger sample sizes to enable researchers to better explore the individual role of each approach alone, and the interaction between two or more approaches when applied together in a certain group of patients.

5. CONCLUSION

Application of nasopharyngeal airway in a patient undergoing general anesthesia with nasal endotracheal intubation proved to be effective in increasing nasal cavity space and minimizing difficulties faced in passage of the endotracheal tube and in reducing the associated complications.

6. Data availability

The numerical data generated during this research is available with the authors.

7. Acknowledgement

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8. Conflict of interest

The study utilized the hospital resources only, and no external or industry funding was involved.

9. Authors' contribution

BKAA: Concept, conduction of the study work, methods, data collection, writing and manuscript editing

SAA: Concept, conduction of the study work, writing and manuscript editing _

HMM: Concept, conduction of the study work, writing, investigation, software and manuscript editing

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