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Comparison of the epistaxis tendency betweeen right and left nostrils in nasotracheal intubation

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Abstract

Nasotracheal intubation is a commonly employed technique during oral and maxillofacial surgeries under general anesthesia. Selecting the nostril with better patency may help minimize complications such as epistaxis. This study aimed to evaluate whether choosing the more patent nostril for nasotracheal intubation reduces the frequency and severity of epistaxis. A retrospective analysis was conducted at the Faculty of Dentistry, Akdeniz University, involving 171 patients who underwent maxillofacial procedures under general anesthesia. Participants were grouped according to the side of intubation: right nostril (Group R, n=92) and left nostril (Group L, n=79). All intubations were carried out by two experienced anesthesiologists using direct laryngoscopy. The intubation duration (from mouth opening to circuit connection) and the presence and severity of epistaxis were documented. Epistaxis was graded as none, mild (blood staining on the tube), or severe (visible blood pooling in the pharynx). Epistaxis occurred in 44.4% of all patients. Group L exhibited a significantly higher incidence and severity of epistaxis compared to Group R. Additionally, the mean intubation time was notably longer in Group L. The findings suggest that nasotracheal intubation via the right nostril may be associated with a reduced risk and severity of epistaxis, as well as shorter intubation times. These results highlight the potential benefits of right nostril selection in routine clinical practice when both nasal passages are deemed unobstructed.

Keywords: Direct laryngoscopy, epistaxis, maxillofacial surgery, nasotracheal intubation, nostril

Introduction

Nasotracheal intubation is commonly preferred in oral, dental, and maxillofacial surgeries that require surgical access to the oral cavity. First described in the early 20th century by Kuhn [1] and subsequently refined by pioneers such as Macewen [2,3], Rosenberg [4], Meltzer and Auer [5], and Elsberg [6], this technique remains a standard approach for airway management in head and neck procedures.

Despite its widespread use, nasotracheal intubation is associated with several complications, the most common of which is epistaxis. The reported incidence of epistaxis ranges from approximately 10% to 70% in the absence of nasal endoscopy [7,8], and may remain as high as 44.4% even under direct endoscopic visualization [9]. Various strategies have been proposed to minimize this complication, including local vasoconstrictor application [10], thermal softening of the tube [11], and the use of guiding airways [12]; however, none has demonstrated universal effectiveness [13]. There remains no consensus on whether intubation through the right or left nostril is superior. Despite growing interest and several recent publications, the evidence regarding the preferred nostril for intubation remains inconclusive [9,14–18]. Some authors advocate for the right nostril, citing reduced epistaxis and shorter intubation times [9,14,15], whereas others suggest that the left nostril may result in fewer mucosal injuries due to the angulation of the tube tip [19,20]. Additionally, several studies have reported no significant difference between nostrils with respect to bleeding risk [11,16,18].

Identifying the more patent nostril may facilitate tube passage and reduce trauma. Objective methods such as rhinomanometry have been used to assess nasal patency [21–23]; however, these are impractical for routine clinical use. Consequently, simpler techniques have been proposed, including exhaled breath condensation on a spatula [24], inspection of septal deviation

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[24], palpation of airflow [13], and direct questioning during preanesthetic assessment [13,15]. Flexible fiberoptic nasal endoscopy can also be performed to directly evaluate the nasal anatomy, but this method requires specialized equipment and expertise [25].

Therefore, the aim of this study was to compare the incidence and severity of epistaxis between the right and left nostrils during nasotracheal intubation, and to evaluate whether selecting the more patent nostril prior to intubation reduces the risk of epistaxis in patients undergoing maxillofacial surgery under general anesthesia.

Material and Methods

This retrospective observational study was conducted at the Faculty of Dentistry, Akdeniz University. Ethical approval was obtained from the Clinical Research Ethics Committee of Akdeniz University Faculty of Medicine on March 22, 2023 (protocol number KAEK-253). Medical records of 171 patients aged 18 to 65 years who underwent elective oral and maxillofacial surgery requiring nasotracheal intubation between January and December 2022 were reviewed. Only patients classified as American Society of Anesthesiologists (ASA) physical status I or II were included. Exclusion criteria comprised a history of difficult intubation, clinical features suggesting a potentially difficult airway, previous nasal surgery or trauma, recurrent epistaxis, or complete nasal obstruction. Surgical procedures included mandibular fracture fixation, orthognathic surgery, and surgical extraction of impacted teeth.During nostril selection for intubation, the occlusion test (temporary occlusion of each nostril to assess airflow) and spatula test (observation of vapor condensation on a metal spatula placed under each nostril) were performed. Subsequently, the nasal cavity and nostril anatomy of the patients were evaluated on panoramic radiographs. Based on the results of these tests, the more open side was chosen for intubation. Patients were then divided into two groups according to the side of intubation: Group R (right nostril, n=92) and Group L (left nostril, n=79). All patients underwent standardized general anesthesia without premedication. Monitoring included electrocardiography, pulse oximetry, non-invasive blood pressure measurement, and end-tidal carbon dioxide. Anesthesia was induced with propofol (1–2 mg/kg) and fentanyl (1–2 µg/kg), followed by rocuronium (0.6 mg/kg) for neuromuscular blockade. All patients were ventilated with a mask with 75% oxygen until muscle relaxation was achieved. Nasotracheal intubation was performed using a Macintosh laryngoscope. After laryngoscopy was performed, tube rotation, cuff inflation and Backwards, Upwards, Rightwards, Pressure (BURP) maneuvers were applied to direct the tube towards the glottis. When necessary, Magill forceps were used. In all patients, nasotracheal intubation was successfully achieved on the first attempt. All procedures were performed by two anesthesiologists with over five years of clinical experience, both of whom were right-handed. Spiral-reinforced nasotracheal tubes were used, with inner diameters of 6.5 mm for female patients and 7.0 mm for male patients. Epistaxis was evaluated by direct laryngoscopy immediately after tube passage through the nasal cavity and following successful placement. Bleeding was classified as none, mild (blood staining on the tube), or severe (visible blood accumulation in the posterior pharynx). Intubation time was defined as the interval from the first contact of the nasotracheal tube with the selected nostril to connection of the tube to the anesthesia circuit.

Statistical Analysis

The required sample size was calculated using G*Power 3.1.9 software, referencing the epistaxis rates reported by Sanuki et al. [9]. According to that study, the incidence of epistaxis was 44.4% in the left nostril and 11.1% in the right. These values yielded an effect size of w=0.277. To achieve a statistical power of 95% with an alpha level of 0.05, the minimum number of patients required was calculated to be 170. Descriptive statistics were presented as frequency and percentage for categorical variables, mean ± standard deviation (SD) for continuous variables with normal distribution, and median with interquartile range (IQR) for non-normally distributed variables. The Shapiro-Wilk test was used to assess normality. Comparisons between categorical variables were performed using either Pearson's Chi-square test or Fisher's exact test, depending on expected cell counts. For continuous variables, the Mann-Whitney U test was used when normality was not met, while the independent samples t-test was used when distribution was normal. In comparisons involving more than two groups, the Kruskal-Wallis test was applied for non-parametric data, followed by Bonferroni correction in post-hoc analysis. For parametric data, one-way ANOVA was used, and the Tukey HSD test was applied for pairwise comparisons. Correlations between continuous variables were evaluated using Pearson's or Spearman's correlation tests, depending on distribution. All statistical analyses were carried out using SPSS version 23.0 (IBM Corp., Armonk, NY, USA), with a significance level set at $p<0.05$.

Result

Between January and December 2022, the records of 171 patients who underwent nasotracheal intubation for oral and maxillofacial surgical procedures were reviewed and included in the study. According to the intubation side, patients belonged to either Group R (right nostril, n=92) or Group L (left nostril, n=79). No statistically significant differences were found between the two groups in terms of baseline characteristics, including age, sex, height, weight, and ASA physical status classification (Table 1). Epistaxis was observed in 29 of 92 patients (31.5%) in Group R and in 47 of 79 patients (59.5%) in Group L, yielding an overall incidence of 44.4% (Table 2). Both the frequency and severity of bleeding were significantly higher in Group L compared to Group R ($p<0.05$). Intubation time was also analyzed. While no significant relationship was found between intubation duration and Mallampati classification, the mean intubation time was significantly longer in Group L than in Group R ($p<0.05$) (Table 3).

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Table 1. Demographic characteristics by groups

Variables (n=171)	Direction of intubation		p
	Right (n=92)	Left (n=79)	
Age (year)	35 (24-49.5)	37 (25-47)	0.791µ
Height (cm)	169 (163.5-177.5)	168 (162-176)	0.603µ
Body weight (kg)	71.63±13.04	71.51±15.06	0.954ł
Gender			0.428*
Female	41 (44.6)	40 (50.6)	
Male	51 (55.4)	39 (49.4)	
ASA Classification			0.883*
1	65 (70.7)	55 (69.6)	
2	27 (29.3)	24 (30.4)	

µ: Mann Whitney U test, Med (IQR), ł: Independent Samples T test, median±SD, *: Pearson chi square test, n (%), ASA: American society of anesthesiologist

Table 2. Frequency and severity of epistaxis

Variables (n=171)	Direction of intubation		Total	p
	Right (n=92)	Left (n=79)		
Epistaxis			76 (44.4%)	**<0.001**
No bleeding	63 (68.5%)a	32 (40.5%)b	95 (56.6%)	
Mild	26 (28.3%)a	36 (45.6%)b		
Severe	3 (3.3%)a	11 (13.9%)b		

µ: Mann Whitney U test, Med (IQR), ł: Independent Samples T test, median±SD, *: Pearson chi square test, n (%), ASA: American society of anesthesiologist

Table 3. Duration of intubation according to mallampati score and direction of intubation

Variables (n=171)	Duration of intubation	p	p1-2	p1-3	p1-4	p2-3	p2-4	p3-4
Mallampati		0.444ǩ	-	-	-	-	-	-
1	31 (23-43)							
2	32.5 (22-41)							
3	39.5 (25-47.5)							
4	36 (31-47)							
Direction of intubation		**0.002µ**						
Right	29(21-40)							
Left	37 (27-46)							

ǩ: Kruskal-Wallis H Test, Med(IQR), µ: Mann Whitney U test, Med(IQR)

Discussion

In this study, nasotracheal intubation via the right nostril was associated with a significantly lower incidence and severity of epistaxis, as well as shorter intubation durations, compared to intubation through the left nostril. These findings suggest that even when the more patent nostril is selected, anatomical and procedural factors may favor the right side.

Several recent meta-analyses have supported the preference for right nostril intubation. Hung et al. [26] reported that right-sided intubation reduces the risk of severe epistaxis. Similarly, Tan et al. [27] concluded that intubation through the right nostril results in less bleeding and requires less time, particularly when both nostrils are equally patent. In these two meta-analyses, even though the methods of the studies reviewed were different from ours, the conclusion recommended using the right side for nasal intubation. One explanation for these results may lie in anatomical asymmetries. The right nasal passage often provides a straighter route to the oropharynx, resulting in less mucosal trauma and easier navigation of the tube. This anatomical alignment may also facilitate more effective tube advancement, particularly when standard maneuvers such as BURP or Magill forceps are used. Some studies have contradicted these findings. Coe et al. [28] and Chi et al. [16] reported no significant differences in

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epistaxis rates based on nostril side. However, in those studies, nostril selection was often based solely on subjective patient input, and nasal anatomical variations may not have been fully accounted for. Additionally, Chi et al. evaluated 405 patients using radiographic imaging to determine nasal anatomy, and performed nasotracheal intubation even in cases where septal deviation was observed on the selected side. This methodological choice may have influenced their results and contributed to the lack of significant difference in epistaxis incidence between nostrils [16].

Other factors may also explain discrepancies across studies. In their study of 86 participants who reported breathing equally well through both nostrils, Kim et al. found that the incidence of epistaxis did not significantly differ between right and left nostril intubation [17]. In the study conducted by Kim et al, unlike our study, they utilized Ring-Adair-Elwyn (RAE) tubes specifically designed for head and neck surgeries, and the intubation tube was softened with heat. Furthermore, patients were administered a nasal vasoconstrictor. Due to these factors, it's conceivable that they reported a lower overall rate of epistaxis. Ahmed-Nusrath et al also demonstrated a similar frequency of epistaxis in both nostrils [29]. In contrast to our study, Ahmed Nusrath and colleagues included patients who could breathe equally through both nostrils and employed a heat-softened intubation tube. Despite these differences, the overall epistaxis rate in their study was comparable to ours (45.5% vs. 44.4%). In another randomized controlled study conducted by Wang et al [30], they found no significant difference between the frequency and severity of epistaxis resulting from intubation applied to both nostrils. In Wang and colleagues' study, unlike ours, patients who reported equal airflow from both nostrils were included. Before intubation, a topical vasoconstrictor drug was applied, and the intubation was performed using an RAE intubation tube with a video rigid stylet. The reasons for the lower total epistaxis rate (30%) in their study compared to ours (44.4%) could be the use of the topical vasoconstrictor and the faster intubation facilitated by the video rigid stylet. One reason our results might differ from these studies could be the varying experience levels of the individuals performing the intubation. Conversely, earlier studies have indicated that inserting the tube through the left nostril may reduce trauma to the nasal turbinates, which is often associated with the beveled tip of standard endotracheal tubes [19, 20, 31]. However, since these studies are relatively older and have been reported as case reports, we believe they are not sufficient to conclusively state that using the left side for nasal intubation results in fewer instances of epistaxis. In addition, the shorter intubation time in intubations performed from the right side also explains the less epistaxis. Our findings align with those of Boku et al., who demonstrated that prolonged passage of the tube through the nasal cavity correlates with an increased incidence of epistaxis [15]. Arslan and Türkyılmaz reported that nasotracheal intubation was completed in a shorter time when performed through the right nostril compared to the left. However, this study did not identify any difference in the frequency of epistaxis between the right and left sides [14]. Several factors may account for the shorter intubation time observed with right-sided nasal intubation. One explanation is that the tube naturally follows the contour of the right pharyngeal wall, allowing better visualization of its tip and facilitating alignment with the glottis using maneuvers such as Magill forceps assistance [15, 32]. In addition, multiplanar imaging analyses have shown that the anatomical configuration between the right nasal passage and the posterior nasopharynx may facilitate smoother tube advancement during intubation [33]. According to the study by Wang et al., the choice of nostril had no notable effect on the time required for nasotracheal intubation [30]. This outcome might be attributed to the use of a videolaryngoscope during the intubation in the study.

Conventional tracheal tubes are generally designed to accommodate insertion from the right side, particularly when using a left-hand laryngoscope technique [34]. When inserted via the right nostril, the tube's bevel orientation results in a sharper distal profile, which may enhance its alignment and passage through the glottis [32]. Insertion via the left side often alters the tube's angulation, making the tip appear blunter in relation to the glottis and possibly obstructing the visual field during placement [34]. Based on these two studies, we can explain the higher incidence of epistaxis on the left side in our study, despite choosing the more open nostril. Additionally, since anesthetists are more inclined to intubate from the right side, we believe that the increased need for maneuvers and the prolonged intubation time when intubating from the left side may contribute to greater nasal trauma and bleeding.

This study is subject to certain limitations, including its retrospective design and the fact that it was conducted in a single-center setting. Spiral-reinforced intubation tubes from different brands were used. If intubation tubes from the same brand had been used, our results might have been different. As it is a retrospective study, we do not know whether adjunctive maneuvers were used during intubation. The patients were not evaluated for epistaxis after extubation. Despite selecting the more patent nostril based on combined tests and imaging, our findings still showed a significant difference in outcomes favoring the right side. This suggests that nostril patency alone may not predict the most favorable intubation path. Structural characteristics, tube behavior, and procedural ergonomics likely play key roles. Since each study is conducted under different conditions, it's not entirely accurate to compare them directly.

Conclusion

In conclusion, our findings indicate that nasotracheal intubation via the right nostril is associated with a lower incidence and severity of epistaxis, as well as shorter intubation durations, compared to the left nostril. Even when nostril selection was guided by preoperative patency assessments, right-sided intubation appeared to offer procedural advantages. These results may be attributed to anatomical factors, tube design, and operator ergonomics that favor the right-sided approach. Given the clinical variability among patients and the influence of operator technique, nostril selection should continue to be individualized. Nevertheless, in the absence of specific nasal contraindications, the right nostril may be preferred for routine nasotracheal intubation. Future prospective and multicenter studies are needed to establish evidence-based guidelines for nostril selection and to further explore the factors influencing epistaxis risk in nasal intubation.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
This retrospective observational study was conducted at the Faculty of Dentistry, Akdeniz University. Ethical approval was obtained from the Clinical Research Ethics Committee of Akdeniz University Faculty of Medicine on March 22, 2023 (protocol number KAEK-253).

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