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ORIGINAL ARTICLE – OPEN ACCESS

The Relationship Between Nasal Obstruction Symptom Evaluation (NOSE) Scores and the Size and Location of Nasal Septal Perforations

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ABSTRACT

Objective: Nasal septum perforation (NSP) is defined as a communication between the nasal passages due to a full layer defect of the septum. The condition has a broad spectrum of potential symptoms, such as scabbing inside the nose, dryness, epistaxis, and breathing difficulty. The aim of this study was to evaluate the symptomatology of NSP and the relationship between the subcomponents of the Nasal Obstruction Symptom Evaluation (NOSE) scale assessment of quality of life and the size and localization of NSP.

Materials and Methods: This prospective study included patients who presented at the otolaryngology policlinics of 2 hospitals and were diagnosed with NSP. The NSPs were grouped according to the length of the long axis, that is, small: 1–10 mm, medium: 11–20 mm, or large: 21–30 mm, and the localization was categorized as anterior, middle, or posterior. A Turkish version of the NOSE scale has been validated as a reliable tool.

Results: A total of 61 patients, 31 (50.8%) females and 30 (49.2%) males, were evaluated. The mean NOSE score was 59.50±20.58. No significant difference was seen in the NOSE score based on the size of the perforation; however analysis of variance revealed a significant difference according to the localization of the perforation in the scale items of NOSE-2 (p=0.007), NOSE-3 (p=0.048), NOSE-4 (p=0.011), and the total NOSE score (p=0.015) (p<0.05).

Conclusion: The results of the NOSE scale analysis indicated that the NSP patients experienced a high level of symptoms, regardless the size and localization of the perforation. The NOSE scale is easy to administer and provides useful information, particularly when the subcomponents are evaluated.

Keywords: Nasal obstruction, nasal septal perforation, nasal septum deviation, nasal surgical procedures, NOSE scale

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INTRODUCTION

Nasal septum perforation (NSP) describes a connection between the nasal passages due to a full layer defect in the mucosa, cartilage, or bony portion of the septum (1, 2). A wide range of potential symptoms includes scabbing inside the nose, dryness, epistaxis, a whistling sound, impaired sense of smell, and breathing difficulty (3, 4). The symptoms may vary according to the size and localization of the NSP (5, 6). The Nasal Obstruction Symptom Evaluation scale (NOSE) is a subjective test widely used to evaluate nasal obstruction (7, 8). The objective of this study was to evaluate the symptomatology of NSP and the relationship between the subcomponents of the NOSE scale and the size and localization of NSP.

MATERIALS and METHODS

Ethical Considerations

Approval for the study was granted by the Kütahya Health Sciences University Rectorate Ethics Committee (no: 2020/11-18). Informed consent was obtained from all of the study participants. The principles of the Declaration of Helsinki were observed throughout the research.

Study Design

This observational, cross-sectional study included patients who presented at the otorhinolaryngology polyclinics of 2 hospitals between January 1, 2020 and January 12, 2021 and were diagnosed with NSP based on anterior rhinoscopy and endoscopic nasal examination.

Each patient's age and history of nasal surgery and trauma, use of nasal sprays, substance abuse, occupational exposure to hazards, nose bleeds and cauterization, granulomatous disease, and nasal foreign bodies was recorded. The size of the NSP was measured using a paper ruler during a 30° nasal endoscopy (Fig. 1). The NSPs were grouped according to the length of the long axis, namely, small: 1–10 mm, medium: 11–20 mm, or large: 21–30

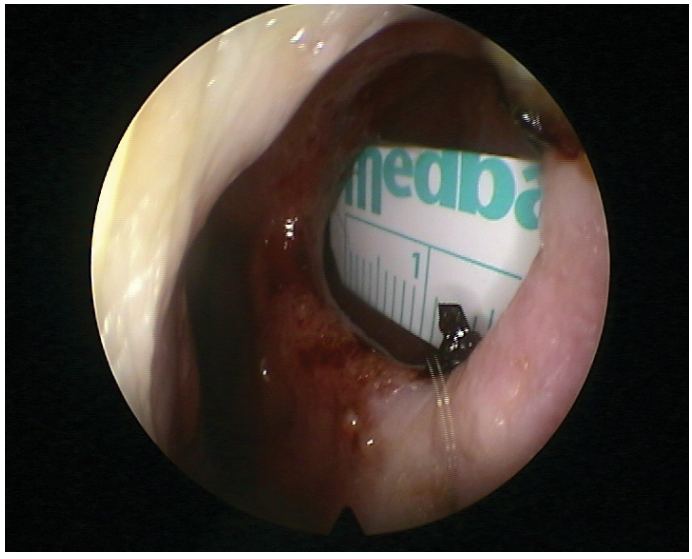

Figure 1. Endoscopic view of a medium-sized nasal septal perforation

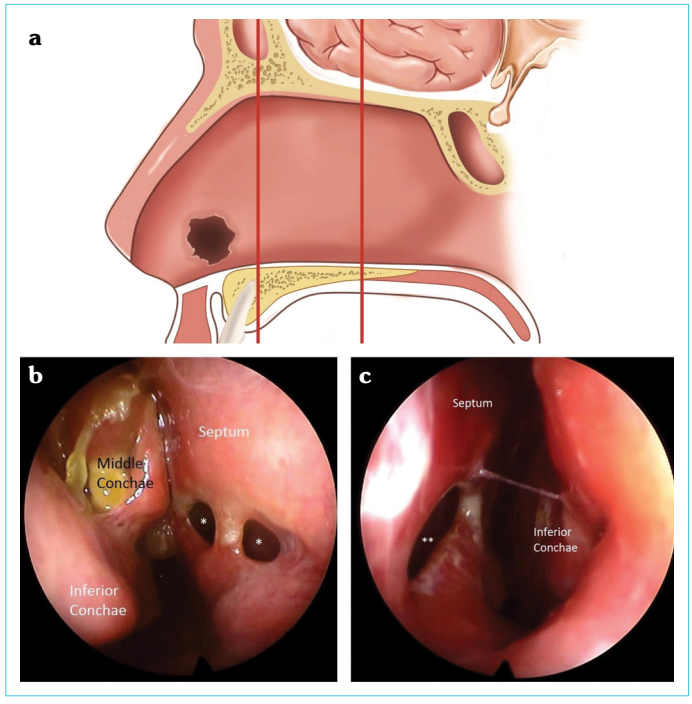

Figure 2. (a) Perforations were grouped according to the localization as anterior, middle, or posterior; (b) View from the right nasal passage of 2 small, middle-located perforations between the anterior border of the middle conchae and the inferior conchae observed after septoplasty and endoscopic sinus surgery; (c) View from the left nasal passage of an anterior perforation in which the anterior border begins before the anterior border of the inferior conchae

mm. The perforations were grouped according to the localization as anterior, middle, or posterior (Fig. 2). The anterior or middle classification was made using the anterior of the inferior conchae as the limit, and the middle or posterior group divider was the anterior of the middle conchae. The anterior edge of the perforation was used to define the localization.

All of the study participants were informed about the NOSE scale, a brief and easy-to-use instrument used to evaluate symptoms experienced in the previous month. The Turkish version of the NOSE scale has been found to be a valid and reliable instrument (7). The complete scale is presented in the Appendix 1. Five items are scored with 0–4 points. The total score of 0–20 is then multiplied by 5 to provide a maximum final score of 100. The study exclusion criteria included the presence of acute infection and purulent secretion in the nose, chronic rhinosinusitis with or without nasal polyps, residual septum deviation or the presence of concha hypertrophy, or tumors. Of the patients who met these criteria, 4 were excluded from the study since they did not wish to complete the NOSE scale. The total NOSE scores and the values of the individual scale items were compared according to the size and localization of the NSP.

Statistical Analysis

The results are presented as the number, percentage, mean, and SD. Analysis of variance (ANOVA) testing was used to compare the differences in NOSE score according to the size and localization of the NSP. The Bonferroni test was used as a post hoc test. $P<0.05$ was considered to represent a significant difference in the results. After using the Kolmogorov-Smirnov test to assess the normality of the distribution, an independent t-test was used to compare subgroups according to the localization of the NSP. Pearson's correlation was used to assess the strength of the linear relationship between the size of the septal perforation and the NOSE scores. The statistical analyses were performed using SPSS Statistics for Windows, Version 17.0 software (SPSS Inc., Chicago, IL, USA).

RESULTS

A group of 61 patients, comprised of 31 (50.8%) females and 30 (49.2%) males with a mean age of 43.73 years (range: 15–76 years), was evaluated. Analysis of the etiology of the NSPs revealed iatrogenic causes in 48 (78.6%) patients (nasal surgery including septoplasty [n=41], functional endoscopic sinus surgery [n=1], sinonasal tumor surgery [n=3], and hypophysectomy [n=3]), trauma-related causes in 6 (9.8%) cases (digital trauma in 6 patients with mental disorders and septal hematoma after trauma in 3 patients), cauterization performed to control epistaxis in 2 (3.3%) patients, granulomatous disease (granulomatosis with polyangiitis) in 1 (1.6%) case, and chromium exposure in 1 (1.6%) case. Idiopathic causes were determined in 3 (4.9%) cases.

The size of the perforation was classified as small in 28 (45.9%) patients, medium in 23 (37.7%), and large in 10 (16.4%) patients. The localization of the perforation was classified as anterior in 36 (59%) patients, middle in 15 (24.6%) patients, and posterior in 10 (16.4%) patients (Table 1). The mean score of each NOSE scale item according to perforation size is shown in Table 2, and according to localization in Table 3. The mean raw total NOSE score of the study group was 11.90±4.05 and the mean final NOSE score was 59.50±20.58.

ANOVA revealed no significant differences in the NOSE scale scores according to the size of the perforation: NOSE-1 (p=0.176), NOSE-2 (p=0.77), NOSE-3 (p=0.28), NOSE-4 (p=0.10), NOSE-5 (p=0.82), and total NOSE (p=0.89).

Table 1. Demographic data, perforation size, and localization

Characteristics	n	%
Age (years)		
Median (range)	42.0 (15–76)	
Sex		
Male	30	49.2
Female	31	50.8
Total	61	100
Perforation size		
Small	28	45.9
Medium	23	37.7
Large	10	16.4
Perforation localization		
Anterior	36	59
Middle	15	24.6
Posterior	10	16.4

ANOVA indicated that the localization of the perforation, however, did yield a statistically significant difference in a number of the NOSE scale scores: NOSE-2 (p=0.007), NOSE-3 (p=0.048), NOSE-4 (p=0.011) and total NOSE (p=0.015) (Table 3).

Independent t-test evaluation of the localization of the perforation indicated that the NOSE-2 (p=0.04), NOSE-4 (p=0.02), and total NOSE (p=0.02) results were statistically significant (p<0.05) in a comparison of anterior and posterior localizations. The NOSE-2, NOSE-4, and total NOSE scores of those with an anterior perforation were statistically significantly higher than those of patients with a posterior perforation. Additionally, the NOSE-2 (p=0.005), NOSE-3 (p=0.03), NOSE-4 (p=0.004), and total NOSE (p=0.01) scores of those with a middle perforation were significantly higher than those of the participants with a posteriorly located perforation. No significant differences were observed in the scores when anterior and middle localizations were compared.

The Pearson correlation between the size of the septal perforation and the NOSE-1 and NOSE-3 scores was 0.175 and 0.134, respectively (negligible correlation) (p>0.01), and the NOSE-2, NOSE-4, NOSE-5, and total NOSE score correlation was 0.268, 0.134, 0.282, and 0.257, respectively (weak correlation) (p>0.01).

DISCUSSION

The effects of an NSP must be considered within a broad spectrum. While dryness, scabbing, epistaxis, and whistling are predominant symptoms in some patients, nasal obstruction is more common in others (1–3). Some patients can remain unaware of a perforation for many years and do not experience nasal obstruction (4). Analysis of the lowest and highest NOSE scores seen in this study demonstrated that while the perforations were close in size, the degree of obstruction varied. It is worth noting that if there is a dominant obstruction on one side, this may indicate the need to correct the deviation and repair the perforation at the same time (5).

Table 2. Nasal Obstruction Symptom Evaluation scale scores according to perforation size

	NOSE scores according to perforation size			
	Small (n=28)	Medium (n=23)	Large (n=10)	p
NOSE-1	2.03±0.74	2.00±0.67	2.50±0.84	0.17
NOSE-2	1.92±0.97	2.08±0.84	2.70±0.82	0.77
NOSE-3	2.46±0.88	2.39±0.78	2.90±0.99	0.28
NOSE-4	2.28±1.04	2.56±1.03	3.10±0.87	0.10
NOSE-5	2.42±1.06	2.69±0.70	3.20±0.91	0.82
NOSE total	11.14±4.27	11.73±3.58	14.40±3.83	0.89
NOSE value	55.71±21.37	58.69±17.91	72.00±19.17	0.89

Analysis of variance; p<0.05; NOSE: Nasal Obstruction Symptom Evaluation

Table 3. Nasal Obstruction Symptom Evaluation scale scores according to perforation localization

	NOSE scores according to perforation localization			
	Anterior (n=36)	Middle (n=15)	Posterior (n=10)	p
NOSE-1	2.19±0.64	2.24±0.86	1.60±0.69	0.67
NOSE-2&	2.22±0.86	2.40±0.91	1.30±0.82	0.007*
NOSE-3&	2.50±0.73	2.86±0.99	2.00±0.94	0.048*
NOSE-4&	2.58±0.99	2.93±0.96	1.70±0.94	0.011*
NOSE-5	2.74±0.94	2.80±0.86	2.10±0.99	0.125
NOSE total&	12.25±3.70	13.24±3.96	8.70±4.13	0.015*
NOSE value	61.25±18.53	66.00±19.83	43.50±20.68	0.015*

Analysis of variance; p<0.05; &: NOSE-2 (p=0.04), NOSE-4 (p=0.02), and total NOSE (p=0.02) values in the comparisons of anterior and posterior localizations were statistically significant (p<0.05). The NOSE-2 (p=0.005), NOSE-3 (p=0.03), NOSE-4 (p=0.004), and total NOSE (p=0.01) scores for perforations with a middle localization were significantly higher than those of perforations with a posterior localization (p<0.05); NOSE: Nasal Obstruction Symptom Evaluation; *: P<0.05

The NOSE scale, which is often used to assess nasal obstruction before and after nasal surgery, were first used to evaluate nasal obstruction in patients with nasal septal deformities in 2004 (7, 8). The scale is a subjective test to help evaluate respiration and nasal congestion levels, nasal blockage, and nasal obstruction at rest, during exercise, and during sleep. The scale is brief and easy to administer. Several studies have evaluated the total NOSE scores in healthy individuals and the measured values in asymptomatic and postoperative patients (7–10).

Karahatay et al. (7) reported a mean NOSE score of 10.97±10.75 in healthy subjects and 65.67±16.77 in patients who had been admitted for surgery due to nasal septal deviation. In addition, Rhee et al. (9) reported values of 15±17 in a healthy control group and 65±22 in patients who were to undergo surgery. In the current study, which evaluated the NOSE scores of patients with NSP, the mean final NOSE score was 59.50±20.58. A NOSE score in the range of 15–25 was only determined in 5 (8.19%) patients. These

values indicate that NSP often results in nasal obstruction. The cause of obstruction in NSP is thought to be impaired laminar airflow and altered mucosal functions due to dryness (11). Previous studies have recorded varying measurements of nasal obstruction in patients with NSP. Although some research has shown that an anterior localization or large perforation created a nasal obstruction that lead to impaired laminar flow within the nose, other studies have reported that size and localization had no effect (12–15). NSPs in 3 locations and 3 size classes were evaluated in the present study to examine the effect of these variables on NOSE scale and subcomponent values.

To the best of our knowledge, this is the first study to have examined the relationship between anatomical properties (i.e., size and localization) of NSPs and the subcomponents of the NOSE scale. Giacomini et al. (16) examined the subcomponents of the NOSE scores of 14 patients with large NSPs and reported the highest scores in the NOSE-2 item. Research on the effect of NSP size on nasal obstruction have produced varying results. Some researchers have highlighted the importance of considering localization and size together. In a study where the symptoms of patients with NSP were evaluated with the Sino-Nasal Outcome Test-22 (SNOT-22), it was observed that the perforation size was larger in asymptomatic patients than in symptomatic patients, though not at a level that was statistically significant (4). It was reported in another study that used the SNOT-22 and radiological measurement of the size of NSPs that the SNOT-22 values did not correlate with the size or location of the NSPs (17).

While small perforations often lead to complaints of whistling sounds during respiration, the turbulent flow that occurs in larger perforations is thought to cause dryness in the nasal mucosa as a result of impairment in the balance between temperature and humidity, resulting in changes to the respiratory epithelium (2, 3). This can cause dryness, an impaired sense of smell, and a feeling of obstruction. In the present study, NSPs were evaluated according to 3 size categories of small, medium, and large, but no significant differences were seen in the comparisons based on size. The highest NOSE scores were seen in the group with a large perforation, particularly the NOSE-4 and NOSE-5 items, which asked about sleeping difficulty and breathing during exercise or exertion, but these high scores were not statistically significant. While greater changes in airflow with increased perforation size were expected to lead to significant differences, such as in the results for NOSE-2, which evaluates nasal obstruction, we found no significant differences. This may be because the NOSE scale lacks the sensitivity to sufficiently measure the effect of size. In our study, the NOSE scores were high, independent of perforation size, and showed that NSP can cause obstruction. No significant differences were seen in the comparisons between small and medium perforations or medium and large perforations. Cannon et al. (5) concluded that larger perforations had a greater impact on modelling that was independent of localization. The authors also determined that large anterior and small posterior perforations led to greater changes in airflow.

Evaluation of the effect of the localization indicated that the NOSE scores increased as the site of the perforation approached the anterior part of the nasal septum. We observed that the NOSE-2 and NOSE-4 scores were different in the anterior-posterior comparison, and significant differences were determined between the NOSE-2, NOSE-3, and NOSE-4 in the middle-posterior comparison.

It is also relevant to note that several classifications have been used to determine localization (18). Grützenmacher et al. (12) reported that localization was unimportant with respect to nasal obstruction. In the nasal airflow modelling study conducted by Lindemann et al. (13), which used an anterocaudal-anterocranial differentiation, the poorest scores were seen in NSPs with an anterocaudal localization. In the current study, significant differences were determined between the NOSE-2, NOSE-4, and total NOSE parameters in a comparison of anterior and posterior perforations. Differences were also identified in the NOSE-2, NOSE-3, NOSE-4, and total NOSE scores in a comparisons of middle and posterior perforations. In NSPs with anterior and posterior localizations, the highest scores were seen in the NOSE-5 item. This is likely due to congestion caused by increased air demand and resistance during exercise. By comparison, the highest scores for NSPs with a middle localization were recorded on the NOSE-4 item. Higher NOSE scores in the anterior section reflect greater airflow resistance, in contrast to the posterior section, where laminar flow becomes stronger as a result of striking the posterior edge of the perforation, resulting in airflow impairment (12). As the posterior edge of the perforation approaches the posterior of the nasal septum and the distance to the choanae becomes shorter, it causes less obstruction.

Beckmann et al. (19) had supporting results. A posterior septectomy that reduced wall shear stress and heat flux in the posterior borders of the NSP relieved patient symptoms. Impaired laminar flow that affected broad segments of the nasal passage was associated with differences between middle and posterior localizations. The highest total NOSE scores recorded in this study were seen in NSPs with a middle localization, but the difference was not statistically significant. There were also no significant differences seen in the NOSE-1 scores based on size and localization. NSPs can create various challenges, especially when breathing through the nose becomes difficult during exertion and sleep. The development of more specific scales could be useful to assess NSPs and their related symptoms, such as dryness, scabbing, whistling sounds, and impaired sense of smell.

This study has certain limitations. First, because some patients only learned that there was a perforation during a rhinologic examination, nasal obstructions were determined coincidentally without the patients having a prior complaint. Second, the number of patients was insufficient for separate evaluations of small, medium, and large NSPs in each localization.

CONCLUSION

The results of the present study, which used the NOSE scale to evaluate nasal obstructions, demonstrated that patients with NSPs with an anterior or middle localization were more symptomatic. In addition, the NOSE scale was insufficiently sensitive for patients to evaluate the size of their NSP. Patients with an NSP, regardless of location or size, had higher NOSE scores than those of healthy individuals reported in other studies, and it was concluded that NSP can be an important cause of obstruction. Future studies with a larger study group of NSP patients and objective tests in addition to the NOSE scale may offer valuable additional information.

Ethics Committee Approval: The Kütahya Health Sciences University Rectorate Ethics Committee granted approval for this study (date: 14.07.2020, number: 2020/11-18).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – MCG; Design – MCG; Supervision – HT; Resource – MCG; Data Collection and/or Processing – MCG, HT; Analysis and/or Interpretation – MCG, HT; Literature Search – MCG; Writing – MCG; Critical Reviews – HT.

Conflict of Interest: The authors have no conflict of interest to declare.

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Appendix 1. The Nasal Obstruction Symptom Evaluation (NOSE) scale, validated for Turkish population, consists of 5 items, each scored with 0–4 points to evaluate patient symptoms in the previous month (7)

Over the past month, how much of a problem were the following conditions for you?
Son bir aydır aşağıdaki şikayetler sizin için hangi düzeydeydi?

Please circle the most appropriate response
Lütfen size göre en doğru seçeneği işaretleyin

		Not a problem *Sorun değil*	**Very mild problem** *Çok hafif*	**Moderate problem** *Orta dereceli*	**Fairly bad problem** *Kötü*	**Severe problem** *Çok kötü*
NOSE-1	Nasal congestion or stuffiness *Burunda şişkinlik veya dolgunluk*	0	1	2	3	4
NOSE-2	Nasal blockage or obstruction *Burun tıkanıklığı*	0	1	2	3	4
NOSE-3	Trouble breathing through my nose *Burundan nefes almada güçlük*	0	1	2	3	4
NOSE-4	Trouble sleeping *Uyumada güçlük*	0	1	2	3	4
NOSE-5	Unable to get enough air through my nose during exercise or exertion *Eforla yeterli nefes alamamak*	0	1	2	3	4