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Research Article

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Implications of Septal Deviation on the Intranasal Schirmer Test

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ABSTRACT

Background: Nasal obstruction is frequently encountered in otorhinolaryngology and can arise from various causes, with septal deviation being the most prevalent anatomical factor contributing to obstruction.

Methods: This prospective comparative study was conducted in the Department of ENT, a tertiary care center in Pipariya, Vadodara, Gujarat. The study was conducted from October 2022 to October 2023. Patients with deviated nasal septum were subjected to intra-nasal Schirmer's test and compared with an equal number of patients with straight septum. The Schirmer's strips were folded to create a 45° angle at a distance of 5 mm. Subsequently, these folded strips were positioned bilaterally on the mucosa of the anterior nasal septum. After a 10-minute interval, the area of moisture absorption was measured in millimeters.

Results: A total of 50 patients with DNS were part of the study and were compared with an equal number of patients with a normal septum. About 66% of the patients who participated in the study were found to be males and 24% were females. Maximum number of patients lie in the age group of 18-30 years. In our present study, a maximum number of patients (20 patients) have borderline (6-10mm) range of nasal moisture, followed by 18 patients having dryness (<6mm) on the side of DNS and the least number of patients (12 patients) have normal (11-15mm or more) nasal moisture. Since the p>0.05 the results for the present study are statistically insignificant.

Conclusion: Our study concluded that the Schirmer test values were less on the deviated side of the septum than the opposite side and people without septal deviation in most patients. This finding supports the negative effect of septal deviation on nasal moisture, although the difference was not statistically significant.

Key-words: Deviated nasal septum, intra-nasal moisture, Nasal blockage, Nasal deformity, Nasal dryness, Schirmer's strip

INTRODUCTION

The nasal septum is a complex structure made of bone and cartilage that divides the nose into two passages [1]. It is common for nasal cavities to be asymmetrical, as some degree of deviation is considered a normal anatomical variation [2]. Nasal septum deviation (NSD) can occur due to developmental factors, leading to a smooth "C-shaped or S-shaped" deformity or as a result of trauma, which typically causes a more irregular and displaced septum [1].

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Nasal obstruction is frequently encountered in otorhinolaryngology and can arise from various causes, with septal deviation being the most prevalent anatomical factor contributing to obstruction. [3,4].

The diversity in nasal septum deviation (NSD) regarding structure, symptoms, and associated conditions has led to the development of various classification systems. One classification system categorizes NSD based on its impact on the inferior turbinate [5]. This system defines three degrees: degree I involves septal deviation without reaching the inferior turbinate, degree II includes deviation reaching the inferior turbinate, and degree III encompasses deviation reaching and compressing the inferior turbinate [5].

Another classification system categorizes NSD based on common deviation patterns such as S-shaped and C-shaped deviations [6]. Mladina's classification system

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proposes a detailed categorization of NSD based on observations from rhinoscopy or cone-beam computed tomography (CBCT) [7]. According to Mladina's system, NSD is classified into seven types: type I involves a vertical ridge that does not reach the nasal dorsum, type II involves a vertical ridge reaching the nasal dorsum, type III involves a deeper vertical ridge, type IV involves both anterior and deeper vertical ridge areas, type V presents as a unilateral horizontal deformity with the contralateral side being flat, type VI involves bilateral septal involvement with dislocation on one side and deviation on the other, and type VII represents a combination of two or more types [7,8].

The nasal airways serve multiple functions, such as olfaction, nasal defense, and providing resistance during expiration to prevent alveolar collapse. In addition to these roles, the nose performs special functions during inspiration and expiration. During inspiration, the nasal airways heat, humidify, and filter the air, often called "air-conditioning" [9-11] essential for optimal alveolar gas exchange. In contrast, during expiration, the nasal passages help retain heat and moisture from the exhaled air, minimizing the loss of these elements during respiration. Furthermore, particles that escape retention in the bronchial airways are deposited within the nasal airways [12,13].

MATERIALS AND METHODS

The present study was conducted in the ENT department of Dhiraj Hospital, Piparia, Vadodara. The study's sample size was 50 patients with deviated nasal septum compared to an equal number of normal septum individuals. The present study was a Prospective Comparison study. The sample size was collected through Computerized Random Allocation, and the data was gathered through predesigned proforma used in the study.

Inclusion Criteria

- Patients with deviated nasal septum
- Age group 18 and above
- Patients giving the consent

Exclusion Criteria

- Patients not giving consent
- Patients with other nasal pathologies except DNS.
- Patients with organic neurological conditions.
- Patients with DNS with a history of using decongestants or any other medications for the same

Informed written consent was taken from the patients. Patients who fit the inclusion criteria underwent intra-nasal Schirmer's test in ENT OPD. A total of 100 patients were evaluated.

Methodology- As per the enclosed proforma detailed history was taken, followed by a thorough ENT and systemic examination and a clinical diagnosis was arrived at in support of the relevant investigations. Intranasal Schirmer's test was performed in all the patients with deviated nasal septum and all the findings were noted. We performed the intranasal Schirmer's test without anesthesia (Schirmer's type 2).

The intranasal Schirmer test was conducted using Whatman no. 41 filter paper strips (Schirmer test paper; Dr. Gerhard Mann Chem.- Pharm Fabrik GmBH, Berlin, Germany), which have 1-mm intervals marked from 1 to 35 mm. The strips were folded at a 45° angle at a distance of 5 mm. These folded strips were placed bilaterally on the mucosa of the anterior nasal septum during anterior rhinoscopic examination. The 5 mm segment of the strip was entirely positioned in contact with the anterior septal mucosa, with the remaining portion extending out of the nostril. After 10 minutes, the area of wetness on the paper was measured in millimetres. Standardized conditions were ensured by conducting the study simultaneously and in the same location for all participants and volunteers. [20]

Table 1: Classification of the Schirmer reading

Classification	Schirmer reading
Normal	11-15mm or more
Borderline	6-10mm
Dryness	<6mm

Statistical Analysis- This study was statistically studied under the Chi-Square test, calculated using the following formula to determine if the difference between observed data and expected data is due to the change or d relationship between the variables t. We used a two-tailed test since the variables considered in this study are independent variables.

$$X^2 = \Sigma [(O_i – E_i)^2 / E_i]$$

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Ethical Approval- This study was conducted for patients who voluntarily presented to Dhiraj Hospital. All the interventions were valid as per international protocols and were done only after the informed consent of patients/guardians/care providers. So, no ethical issue was involved in carrying out this study. The patients did not bear any extra cost as it was a part of normal investigation protocol.

RESULTS

Our present study compared 50 patients with Deviated Nasal Septum to 50 patients with no septal deviation over 1 year. In our present study, the maximum patients (29 patients) with deviated nasal septum lie in the age group of 18-30 years of age followed by 13 patients between 31-50 years and 7 patients between 51-70 years. Only 1 patient was studied in 71-90 years of age group (Table 2). Since the p>0.05, the results for the present study are statistically insignificant.

Table 2: Distribution of nasal moisture in patients with DNS according to age

Schirmer values	Inference	18-30 years	31-50 years	51 and more years
<6mm	Dryness	12	4	3
6-10 mm	Borderline	12	5	2
11-15 mm or more	Normal	5	4	3

In our present study, 66 % of patients with DNS are males, while 24% are females. Since the p>0.05 the results for the present study are statistically insignificant (Table 3).

Table 3: Distribution of nasal moisture in patients with DNS according to gender

Schirmer values	Inference	No. of males	Percentage(%)	No. of females	Percentage(%)
<6mm	Dryness	12	24	6	12
6-10mm	Borderline	10	20	9	18
11-15mm or more	Normal	11	22	2	4

In our present study, the maximum number of patients (20 patients) have borderline (6-10mm) range of nasal moisture, followed by 18 patients having dryness (<6mm) on the side of DNS and the least number of patients (12 patients) have normal (11-15mm or more) nasal moisture (Table 4). In our present study, a maximum number of patients (19 patients) have a borderline (6-10mm) range of nasal moisture, followed by 16 patients having normal (11-15mm or more) on the opposite side of DNS and least number of patients (15 patients) have dryness (<6mm) of nasal moisture. Since the p>0.05, the results for the present study are statistically insignificant (Table 4).

Table 4: Distribution of patients with DNS according to nasal moisture on the side and opposite side of convexity of septum

Schirmer values	Inference	No. of patients	Percentage (%)
Nasal moisture on the side of convexity of septum			
<6mm	Dryness	18	36
6-10mm	Borderline	20	40
11-15mm or more	Normal	12	24
Nasal moisture on the opposite side of convexity of septum			
<6mm	Dryness	15	30
6-10mm	Borderline	19	38
11-15mm or more	Normal	16	32

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In our present study, the maximum number of patients (22 patients) have dryness (<6mm) of nasal moisture, followed by an equal number of patients (14 patients each) having normal (11-15mm or more) and borderline (6-10mm) range of nasal moisture on right side of the nasal cavity without any effect of DNS (Table 5). In our present study, the maximum number of patients (24 patients) have dryness (<6mm) of nasal moisture, followed by 15 patients having normal (11-15mm or more) and 11 patients having borderline (6-10mm) range of nasal moisture on the left side of the nasal cavity without any effect of DNS. Since the p>0.05 the results for the present study are statistically insignificant (Table 5).

Table 5: Distribution of patients without DNS according to nasal moisture in the right and left nasal cavity

Schirmer values	Inference	No. of patients	Percentage (%)
Nasal moisture in the right nasal cavity			
<6mm	Dryness	22	44
6-10mm	Borderline	14	28
11-15mm or more	Normal	14	28
Nasal moisture in the Left nasal cavity			
<6mm	Dryness	24	48
6-10mm	Borderline	11	22
11-15mm or more	Normal	15	30

DISCUSSION

In the present study, we aimed to evaluate the nasal Schirmer test values in patients with nasal septal deviation. We also compared the results to those of the normal population. The cases selected in this study were between 18-72 years of age, the majority of which lied in the age group of 18-30 years, followed by a few patients in 31-50 years age slab and the least number of patients being between 51-70 years. It is known that the lowest temperature and humidity rates are reported in elderly patients compared to younger patients, and the elderly are more sensitive to nasal dryness symptoms [14]. However, age did not significantly affect the nasal moisture of patients with DNS (p>0.05) and was already reduced on the side of convexity.

Here, 66% of patients were males and 24% females amongst the group with septal deviation and the results implicated no gender preponderance with p>0.05. Intranasal secretion test values on the deviated side (same side) are lesser than those on the contralateral side, indicating that the deviated side is drier [15]. However, this is not statistically significant, with the p>0.05 [16]. Laminar airflow acquires turbulence (fluctuating high-frequency velocities) as it passes through the nasal cavity and comes into contact with the nasal mucosa. Nasal septum deviation will cause the formation of local turbulent eddies and high flow velocities in front of the deviation, which will increase blood resistance and cause mechanical damage and dryness of the nasal septal mucosa on the side of the deviation. All of these conditions can cause nasal dryness with low humidity. The lower nasal secretion may explain the low results of the Schirmer test values, although this is not statistically significant [15].

The results of my study correlate with another study, 'The Impact of Septal Deviation on Intranasal Schirmer Test Values' done by Celebi *et al.* [15], which concluded that the Schirmer test values of the deviated sides were less than the values of the contralateral side in the majority of their patients. This finding supported the negative effect of nasal septum deviation on nasal humidification, although the difference did not reach statistical significance.

Deviation of the nasal septum may alter the nasal airflow, resulting in an alteration from the normal laminar airflow to a more turbulent one. This causes dryness of mucosa further leading to recurrent epistaxis [17]. In the nasopharynx, the air temperature is usually between 31 to 34°C, with a relative humidity ranging from 90% to 95%. [3,18] Individuals with nasal septum deviation (NSD) are more susceptible to oxidative stress. [19]

However, there are only a few objective ways of measuring nasal humidity and these tests require special

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equipment and might occasionally cause some discomfort to the patients [20,21]. The aim of this study is thus to evaluate the nasal Schirmer test values in patients who had nasal septal deviation. Ophthalmologists commonly perform Schirmer's test to check for dry eye and not a lot of studies have been performed by otorhinolaryngologists to check for intranasal moisture. Hence, we conducted this study to understand the same better.

CONCLUSIONS

Our study concluded that the Schirmer test values were less on the deviated side of the septum than the opposite side and people without septal deviation in most patients. This finding supports the negative effect of septal deviation on nasal moisture, although the difference was not statistically significant. This research aimed to find the effect of the deviated septum on the nasal cavities' moisture levels, which would further help us guide the required management and benefit the patients symptomatically. Since DNS is a very common pathology, our study signifies dryness of nasal mucosa in such patients. However, not statistically significant, saline nasal drops, paraffin, glycerol, or sorbitol drops can be prescribed alongside medications for symptomatic relief.

CONTRIBUTION OF AUTHORS

Research concept- Prapti Gupta, Lopamudra Ghosh
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Materials- Prapti Gupta, Lopamudra Ghosh
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