ASSOCIATION BETWEEN DEVIATED NASAL SEPTUM AND FUNCTION OF EUSTACHIAN TUBE AMONG PATIENTS ATTENDING A TERTIARY CARE CENTER

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ABSTRACT

Deviated nasal septum is the most common cause of severe and chronic nose blockage. The eustachian tube (ET) is a tube that connects the middle ear cavity and the nasopharynx and provides middle ear ventilation. The relationship between DNS and ETF is controversial in medical literature. This study tried to find the association between deviated nasal septum and function of eustachian tube. This study was conducted in Nepal Medical College Teaching Hospital, Otorhinolarynology Department from November 2022 to October 2023 after acquiring ethical clearance from Institutional Review Committee. All the patients presenting to the outpatient clinic over the age of 19 with deviated nasal septum (DNS) were included. Statistical analysis was done using SPSS. A p-value of < 0.05 was considered statistically significant. Our study had 71 males (54.6%) and 59 females (45.4%) with mean age 37.2±15.9 years. Of 130 patients, 56 (43.1%) had DNS to right side while 74 (56.9%) to left. All patients had moderate DNS. Age group, gender, and laterality of DNS of the patient did not show any significant association with ETDQ7 score, tympanograms and middle ear pressures on either side. Moderate DNS did not affect ETF in a significant way.

KEYWORDS

Nasal septum, Eustachian tube, association

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INTRODUCTION

The nasal septum is a cartilaginous structure that plays a major role in supporting and shaping the nose.[1,2] It separates the two nasal cavities and divides the intranasal airflow passage in two. This division is usually asymmetric resulting into deviated nasal septum (DNS). It's the most common factor causing severe and prolonged nose blockage.[2-4] Estimated prevalence of deviated nasal septum (DNS) is believed to be around 22.83% in the adult population.[2] Nasal obstruction compromises sinus drainage and alters the airflow passageways and resistance.[2] Many etiologies have been discussed for DNS: trauma, growth, ossification and congenital malformations. DNS can be diagnosed clinically by anterior rhinoscopy and nasal endoscopy.

The eustachian tube (ET) is a tube that connects the middle ear cavity with the nasopharynx and provides ventilation to the middle ear. The physiologic pressure depends on the air transition through the ET and gas diffusion between the middle ear mucosa and systemic circulation. A functional ET is crucial for balancing the middle ear pressure.[5-7]

ET functions can be tested using different techniques. Sonotubometry is one example. It is based on sound waves passing through the ET being measured.[8] The manometric test is another option, although it has drawbacks, such as a lack of assessment of ET functions when the tympanic membrane is intact.[9] Because it is simple to conduct, tympanometry is the most frequently used technique for the clinical evaluation of ET functioning and middle ear ventilation.

However, due to the complexity of the functional anatomy and physiology of the ET, there is still no diagnostic "gold standard" for obstructive Eustachian tube dysfunction (ETD). McCoul *et al*[10] has developed the Eustachian Tube Dysfunction Questionnaire (ETDQ-7), which is validated, organ-specific tool for the assessment of symptoms in ETD. Its usefulness has been shown in recent studies.[11-13] Although DNS is fairly common, it is relatively poorly discussed in the medical literature and therefore lacks any validated measuring instrument to quantitatively assess it. Regarding middle ear pressure, DNS is thought to cause a decline in the middle ear ventilation according to certain authors. The aim of this study is to evaluate the relationship between DNS and ETD-related symptoms using the ETDQ-7 as an assessment method and tympanometry results.

MATERIALS AND METHODS

This study was conducted in Nepal Medical College Teaching Hospital, Otorhinolarynology Department from November 2022 to October 2023. Permission for the study was obtained from the Institutional Review Committee (IRC) of Nepal Medical College Teaching Hospital. Purposive sampling was done. Sample size was calculated using the following formula:

z = reliability coefficient

= 1.96 at 95% confidence interval

p = prevalence of DNS (23% = 0.23)

q = (1-P) = 77% = 0.77

d = absolute error (7.5% = 0.075)

$$n = \frac{z^2 P(1-p)}{d^2}$$

$$= \frac{(1.96)2\ (0.23)(0.77)}{(0.075)^2}$$

= 120.95 (Minimum sample size was 121)

All patients fulfilling the inclusion criteria were included in the study. All the patients presenting to the outpatient clinic with nasal and ear complaints over the age of 19 with deviated nasal septum (DNS) were included. The age limit was set to be above 19 years to avoid any Eustachian tube growth adverse issues commonly seen in the pediatric population. Patients with previous nasal or ear surgery, nasal polypi, tumors, recent rhinitis or sinusitis, tympanic membrane perforation on otoscopy, chronic hearing disorder like chronic otitis media, otosclerosis, tympanosclerosis or recent middle ear infection were excluded.

Patients attending the Otorhinolaryngology out-patient department who met the inclusion criteria and gave written informed consent were recruited for the study. Patients were asked first about the side of the symptoms and then assessed for their complaints through the ETDQ-7 questionnaire. Assessing the side of septal deviation came next. Only patients with one-sided deviation were kept for the study and were documented as right or left DNS. DNS was graded as suggested by Salihoglu *et al*.[14] Grade 1 was mild DNS with 0–33% deflection from midline toward lateral wall, Grade 2 was moderate DNS with 34–66% deflection from midline toward the lateral wall, and Grade 3 was severe DNS with 67–100% deflection from the midline toward the lateral wall on clinical examination. The ETDQ-7 questionnaire comprising 7 items with a scale of graduated responses ranging from '1' to '7' allowing quantitative measurement of subjective complaints was then filled starting from '1' for 'no symptoms' and increasing upto '7' indicating the maximum severity of the discomfort. It included 7 components: (1) pressure in the ears (2) pain in the ears (3) feeling the ears are under water (4) ear symptoms when the patient

has a cold or sinusitis (5) cracking or popping sounds (6) ringing in the ears (7) feeling that hearing is muffled. A total score of less than 14.5 was considered as normal. Tympanometry was then done which rendered specific graphs for ear pathologies. Type A was considered normal and an abnormal tympanogram was considered consistent with ETD. Likewise, the middle ear pressure was also obtained. Values ranging from -100 daPa to +100 daPa were considered normal and an abnormal middle ear pressure on tympanometry was considered consistent with ETD. Using SPSS-16, statistical significance was considered for a p value of < 0.05. Descriptive statistics was calculated such as frequency, mean and standard deviation and association was analysed using appropriate statistical tests.

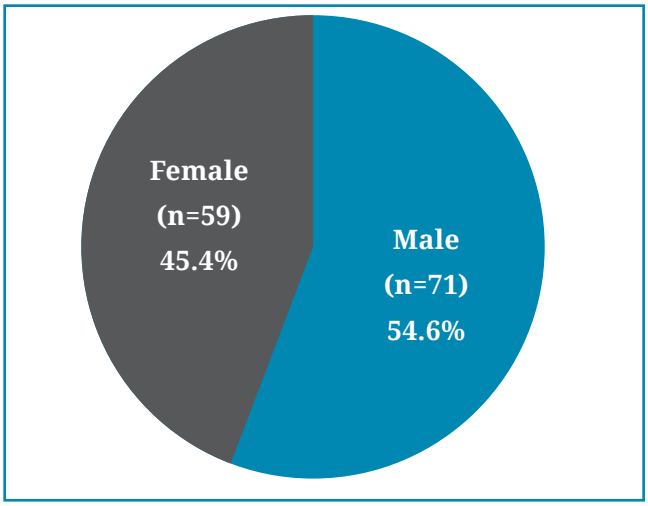

Fig. 1: Gender distribution of patients (total N=130)

RESULTS

A total of 130 patients were included in our study which included 71 males (54.6%) and 59 females (45.4%). The age ranged from 20 to 94 years with a mean age of 37.2±15.9 years. On the basis of the mean age, two age groups were made; one less than 40 years and the other 40 years and above. The more common age group was <40 years with 82 patients (63.1%).

Of 130 patients, 56 (43.1%) had deviated nasal septum to right side while 74 (56.9%) had deviation on the left side. All patients had moderate DNS not affecting more than 66% of nasal passage. The most common presenting symptoms were aural fullness, decreased hearing and tinnitus with 28 (21.5%), 24 (18.5%) and 23 (17.7%) patients, respectively. Nasal symptoms as presenting complaints were seen in 23 (17.7%) patients.

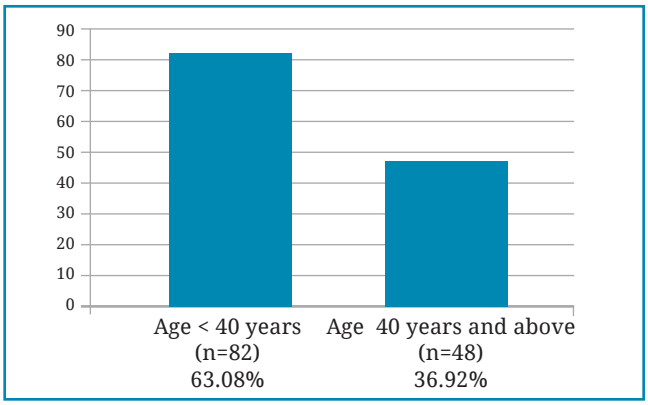

Fig. 2: Age distribution of patients (total N=130)

Age group of the patient did not show any significant association with ETDQ7 score, tympanograms and middle ear pressures on either sides (Table 1).

Table 1: Association of age with ETDQ7, tympanogram and middle ear pressure

AGE GROUP	ETDQ-7		RIGHT				LEFT			
			Tympanogram		ME pressure		Tympanogram		ME pressure	
	Normal <14.5	Abnormal 14.5 or above	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
<40 years	59	23	54	28	53	29	59	23	55	27
40 years+	35	13	32	16	31	17	32	16	31	17
P-value	0.90		0.92		0.99		0.52		0.77	

Table 2: Association of gender with ETDQ7, tympanogram and middle ear pressure

GENDER	ETDQ-7		RIGHT				LEFT			
			Tympanogram		ME pressure		Tympanogram		ME pressure	
	Normal <14.5	Abnormal 14.5 or above	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
Male	51	20	47	24	46	25	47	24	43	28
Female	43	16	39	20	38	21	44	15	43	16
P-value	0.89		0.99		0.96		0.29		0.13	

Table 3: Association of side of DNS with ETDQ7, tympanogram and middle ear pressure

SIDE of DNS	ETDQ-7		RIGHT				LEFT			
			Tympanogram		ME pressure		Tympanogram		ME pressure	
	Normal <14.5	Abnormal 14.5 or above	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
Right	43	13	42	14	41	15	40	16	39	17
Left	51	23	44	30	43	31	51	23	47	27
P-value	0.32		0.06		0.07		0.75		0.46	

Gender and laterality of DNS did not show any significant association with ETDQ7 score, tympanograms and middle ear pressures on either sides (Table 2 and 3).

DISCUSSION

The relationship between DNS and ET functions remains controversial till date. The information about whether DNS affects ET functions is limited. It is known that diseases or changes in the nasopharyngeal region due to conditions formed by DNS affects ETF.[15,16] However, the extent of this effect is still a topic of discussion. The relation between isolated mild to moderate DNS and ETF is still not extensively studied. Some studies have given an indirect indication that DNS doesnot significantly affect ETF by trying to compare the role of septoplasty prior to tympanoplasty.[17,18] DNS is thought to affect ETF by affecting air flow parameters.[19]

The prevalence of nasal septal deviation reaches pretty high in adults. However, only a minority of affected individuals suffer from nasal obstruction.

In our study, we tried to see if there was any relation between mild to moderate DNS not causing significant nasal obstruction with ET functions. Majority of patients had aural symptoms with mild nasal obstruction and all had moderate DNS affecting not more than 66% of the nasal passage.

In this study, there was no significant association between age group of DNS patients and abnormal ETDQ-7 score. Age group showed no significant association with abnormal tympanogram on right side or left side. Age group also showed no significant association with abnormal middle ear pressure on right side or left side. Our findings were similar to those of Akiyildiz *et al.*[19] who stated no difference regarding age. This also suggests that chronicity of DNS has no role to play in the functions of the ET with the passage of time.

Gender of the patient did not show any significant association with ETDQ7 score, right and left tympanograms and right and left middle ear pressures. This was also similar to study by Akiyildiz *et al*[19] who stated no difference regarding gender.[19] However, literature has some studies showing males having higher ETD score.[5,20] Female predominance was also seen in a study.[21]

Laterality of DNS also did not show any significant association with ETDQ-7 score, right and left tympanograms and right and left middle ear pressures. This probably supports clinical study by Bonding *et al.*[22] and the experimental study by Buchman *et al.*[15] who show that middle ear pressure changes only when double-sided total nasal obstruction occurs. Our findings also support a study by Lechoslow[23] in a group of 104 children where he found that DNS has no influence on the development of auditory tube dysfunction.

In addition to DNS, the existence of paranasal and pharyngeal diseases, such as allergic rhinitis, concha hypertrophy and adenoid hypertrophy, should also be taken into consideration in studies that evaluate the effects of DNS on ET functions. When these diseases are present, DNS can further disrupt the functions of ET. In our study, we aimed to see the effects of only moderate DNS on ET by excluding patients with additional pathologies. Our findings also hint towards the fact that we might find significant association between DNS and ET functions only in severe DNS patients. This also indirectly suggest that the widely established norm that ET dysfunction and hypoventilation in the middle ear reduce the success percentage of middle ear operations and hence the necessity for septum to be addressed surgically simultaneously might be considered only for severe DNS rather than mild or moderate DNS. However, this is beyond the scope of our study and a larger study focussing on the surgical aspect would be required to come to any definitive conclusion. Single institutional study, small sample size and non inclusion of severe DNS patients could be the possible limitations of our study.

In conclusion, moderate DNS did not affect ETF in a significant way. Age, gender and laterality of DNS of the patient did not show any significant association with ETDQ-7 score, tympanograms and middle ear pressures.

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