A STUDY ON THE RELATIONSHIP OF DEVIATED NASAL SEPTUM WITH MIDDLE EAR PRESSURE AMONG PATIENTS TREATED IN A TERTIARY CARE CENTRE

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ABSTRACT

BACKGROUND

It is a matter of controversy that whether deviated nasal septum is contributing to Eustachian tube dysfunction. In this study, the investigator observed a number of patients with deviated nasal septum (DNS) undergoing surgical correction and was interested to find out whether DNS was contributing to the development of Eustachian tube dysfunction (ETD) in these patients.

Aims of this study- (i) To find the incidence of decrease in the negativity of middle ear pressure (MEP) in patients undergoing septoplasty for deviated nasal septum, and (ii) Among patients undergoing septoplasty, to study the relative proportion of decrease in the negativity of MEP in patients who are also having allergic rhinitis and chronic sinusitis.

Settings & Design- This was a prospective analytical study done in a tertiary care centre in south India.

MATERIALS AND METHODS

This study included adult patients with deviated nasal septum who were posted for septoplasty in a particular unit in ENT Department of this institution during a period of six months, and among them, those who are having a negative middle ear pressure in either ear preoperatively were included in this study. For these patients, tympanometry was repeated six weeks after septoplasty and any change in the middle ear pressure was noted.

RESULTS

The study was done in 61 ears which had negative MEP preoperatively. Six months after septoplasty, a decrease in the negativity of MEP was observed in 27 (44.3%) ears. In patients who were also having allergic rhinitis and chronic sinusitis, a decrease in the negativity of MEP was observed only in 24.1% and 29.4% respectively.

CONCLUSION

The study showed that DNS may be a factor that contributes to ETD, but correction of DNS alone will not improve Eustachian tube function, without treating allergic rhinitis or chronic sinusitis in patients having any of these.

KEYWORDS

Deviated Nasal Septum (DNS), Septoplasty, Eustachian Tube Dysfunction (ETD), Tympanometry, Middle Ear Pressure (MEP).

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BACKGROUND

In the outpatient department, this investigator observed a number of patients with deviated nasal septum (DNS), and on examination, many of them showed retracted tympanic membrane and conductive hearing loss. He was interested to find out whether DNS was contributing to the development of Eustachian tube dysfunction (ETD) in these patients.

Nasal septum separates the two nasal cavities. Its deviation can produce nasal obstruction, headache, epistaxis, hyposmia, external nasal deformity and can lead to paranasal sinus and middle ear problems. When symptomatic it can be corrected by procedures like septoplasty or submucous resection.

The Eustachian tube is a channel connecting the middle ear cavity with the nasopharynx. Its main functions are ventilation of middle ear to equilibrate middle ear pressure with atmospheric pressure, and drainage and clearance of

secretions from the middle ear into the nasopharynx. For normal hearing, it is essential that pressure on the two sides of the tympanic membrane should be equal.

When tube is blocked, first oxygen and later carbon dioxide & nitrogen in the middle ear diffuse into the blood. This results in negative pressure in the middle ear and retraction of tympanic membrane, and later locking of the tube with collection of transudates and later exudates and even haemorrhage. Prolonged tubal block leads to otitis media with effusion, atelectasis, retraction pockets, cholesteatoma and erosion of incudostapedial joint. The common causes for ETD are upper respiratory infections, allergic rhinitis, nasal polyp, deviated nasal septum, hypertrophied adenoids, nasopharyngeal mass, cleft palate, functional, Down's syndrome, etc.

The principle of tympanometry is that when a sound signal of lower frequency like 220Hz is introduced into a sealed external canal, it strikes the tympanic membrane, some of which is absorbed and the rest is reflected. More sound energy is reflected when tympanic membrane is stiff and less when it is compliant. The pressure at which maximum compliance occurs is a measure of middle ear pressure (MEP). The ear canal pressure is swept from +200 daPa to -200 daPa and a pure tone is presented to plot out the admittance as a function of external canal pressure. The peak of the curve corresponds to the situation where the pressure

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difference across it is zero. This curve is the tympanogram. ETD can produce negative MEP which can be measured by tympanometry.

Aims of this study were (i) To find the incidence of decrease in the negativity of middle ear pressure (MEP) in patients undergoing septoplasty for deviated nasal septum, and (ii) Among patients undergoing septoplasty, to study the relative proportion of decrease in the negativity of MEP in patients who are also having allergic rhinitis and chronic sinusitis.

Review of Literature

On review of literature, studies by Duran K et al,¹ Salvinelli F et al² and Abdel-Naby Awad OG et al³ showed that nasal septoplasty significantly improved Eustachian tube function, thereby normalising the MEP. A study by Chmielik M et al⁴ showed that decreased nasal patency had an impact on the function of the middle ear, and the study by Mehrotra N et al⁵ suggested that there was a strong correlation between DNS and middle ear pathology. In a study conducted by Maier W et al,⁶ a tendency towards normalisation of tubal parameters was observed 6 to 8 weeks after surgery; while the study by Kamal NP et al⁷ favoured the observation that surgery for nasal obstruction significantly improved tubal function and middle ear ventilation by 4 weeks postoperatively.

On the contrary, studies by Sahin MI et al,⁸ Eyigör H et al,⁹ Davari R et al¹⁰ and Tan M et al¹¹ showed that septoplasty didn't have considerable effect on Eustachian tube function or MEP; and surgical correction of a nasal septal deviation before ear surgery such as tympanoplasty was not justified.

In the study by Livi W et al,¹² tubal dysfunction was ascertained in 33.3% of the patients with structural nasal obstruction and in 66.6% of the patients with functional nasal obstruction. A study by Filipović SA et al¹³ showed that pathological form of tympanograms was more often present in purely inflammatory changes of nasal cavities than in mechanical nasal obstruction like in DNS. Inflammatory conditions like allergic rhinitis and chronic sinusitis lead to ETD and negative MEP. Studies by Karatzanis AD et al¹⁴ and Rudmik L et al¹⁵ showed that mere correction of DNS didn't have much effect on allergic rhinitis and chronic sinusitis respectively, and thereby on Eustachian tube function and MEP.

Since the results of the studies were highly variable, the present study was intended to find out the relationship between nasal septal deviation and Eustachian tube dysfunction among patients in our setup.

MATERIALS & METHODS

This was a prospective analytical study done in a tertiary care centre in south India. Approval was got from the institutional ethical committee for research works, and informed consent was taken from the participants.

Inclusion Criteria

Patients above the age of 18 years with DNS who were posted for septoplasty in a particular unit in the department of ENT of this institution during a period of 6 months.

Exclusion Criteria

(i) Ears without intact tympanic membrane, and (ii) ears with intact tympanic membrane, but without negative MEP.

One day prior to surgery, in the Audiology section of this institution, tympanometry was done in each ear with intact tympanic membrane, and those who are having a negative MEP in either ear preoperatively were included in the study. Data was collected as per a proforma, which included basic demographic data of the patient, case history, clinical examination and details of the surgery. For these patients, tympanometry was repeated 6 weeks after septoplasty and any change in the MEP was noted. The results were analysed using appropriate statistical methods.

RESULTS

Among the 242 ears in 121 patients who underwent septoplasty, an intact tympanic membrane was seen in 217 ears, out of which 61 had a negative MEP.

Tympanic Membrane	Number of Ears	%
Intact	217	89.7
Perforated	25	10.3
Total	242	100

Table 1. Incidence of Intact Tympanic Membrane among Patients Undergoing Septoplasty

Negative MEP Preoperatively	Number of Ears	%
Present	61	28.1
Absent	156	71.9
Total	217	100

Table 2. Incidence of Negative Middle Ear Pressure among ears with intact Tympanic Membrane

Six months after septoplasty, a decrease in the negativity of MEP was observed in 27 ears. Among the ears studied, the average preoperative MEP was -65.4 daPa which became -42.4 daPa after 6 months. Type C tympanogram was observed in 23 ears preoperatively, which was reduced in 14 ears postoperatively.

Negativity of MEP Postoperatively	Number of Ears	%
Decreased	27	44.3
Not decreased	34	55.7
Total	61	100

Table 3. Decrease in the Negativity of MEP in Patients who had Negative MEP Preoperatively

There were 17 patients with allergic rhinitis. Improvement in MEP was seen in 7 out of 29 ears among them.

Patients with Allergic Rhinitis	Number of Ears	%
Decrease in Negativity of MEP Post-Operatively	7	24.1
No Decrease in Negativity of MEP Post-Operatively	22	75.9
Total	29	100

Table 4. Decrease in the Negativity of MEP in Patients who had Allergic Rhinitis

	No. of Ears with Improvement in MEP	No. of Ears with no Improvement in MEP	Total
Patients with Allergic Rhinitis	7 (24.1%)	22 (75.9%)	29 (100%)
Patients without Allergic Rhinitis	20 (62.5%)	12 (37.5%)	32 (100%)
Table 5. Improvement in MEP in Patients with & without Allergic Rhinitis			

There were 21 patients with chronic sinusitis. Improvement in MEP was seen in 10 out of 34 ears among them.

Patients with Chronic Sinusitis	Number of Ears	%
Decrease in Negativity of MEP Post-Operatively	10	29.4
No Decrease in Negativity of MEP Post-Operatively	24	70.6
Total	34	100
Table 6. Decrease in the Negativity of MEP in Patients who had Chronic Sinusitis		

	No. of Ears with Improvement in MEP	No. of Ears with no Improvement in MEP	Total
Patients with Chronic Sinusitis	10 (29.4%)	24 (70.6%)	34 (100%)
Patients without Chronic Sinusitis	17 (63%)	10 (37%)	27 (100%)
Table 7. Improvement in MEP in Patients with & without Chronic Sinusitis			

DISCUSSION

Among 217 ears with intact tympanic membrane, 61 showed a negative MEP; and among these 61 ears, improvement in the MEP was seen postoperatively in 27 (44.3%) cases. This shows that the degree of ETD was lessened in about half of the cases by undergoing septoplasty, and so DNS may be a factor that contributes to ETD.

Comparing these results with those of the earlier studies, in the study by Duran K et al¹ the middle ear pressure improved by approximately 30% at the side of nasal obstruction and a statistically significant decrease was found at the side of nasal obstruction ($P < 0.05$). In the study by Salvinelli F et al,² results of postoperative tubal function tests were significantly better than preoperative ones (90% versus 46%; $P < 0.001$). In the study by Abdel-Naby Awad OG et al,³ significant improvement in tympanometric values was found ($P < 0.05$) postoperatively. Preoperatively, 93.3% patients had

sensation of ear fullness, but 30 days after surgery, only 66.7% had sensation of ear fullness, with significant improvement ($P < 0.001$).

On the contrary, in the study by Sahin MI et al⁸ middle ear pressures and Eustachian tube function did not differ significantly in the 1st and 3rd postoperative months compared to the preoperative period ($p > 0.05$). According to the study by Eyigör H et al⁹ on comparison of the preoperative and postoperative tympanometry results, no statistically significant difference was observed in middle ear pressures ($p = 0.375$).

In the present study, improvement in MEP was seen only in 24.1% cases with allergic rhinitis, while improvement was there in 62.5% cases without it. The chi-square test showed a value of 9.075 with a p-value of 0.003 which had strong significance. The result is comparable to that of the study by Karatzanis AD et al¹⁴ which showed that improvement after septoplasty was less in patients who were also having allergic rhinitis.

In the present study, improvement in MEP was seen only in 29.4% cases with chronic sinusitis, while improvement was there in 63% cases without it. The chi-square test derived a value of 6.867 with a p-value of 0.009 which was also of high significance. The result is comparable to that of the study by Rudmik L et al¹⁵ which showed that concurrent septoplasty does not appear to affect symptom outcomes in chronic sinusitis.

CONCLUSION

The study showed that about half of the cases showed improvement in MEP after septoplasty, and so DNS may be a factor that contributes to ETD. The study also shows that unless nasal allergy or chronic sinusitis are treated, there won't be much improvement in ETD by doing a septal correction alone in patients having any of these.

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