Section: ENT

Original Research Article

A STUDY ON IMPACT OF NASAL SURGERIES ON THE MIDDLE EAR VENTILATION

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ABSTRACT

Our study included patients with various nasal pathology having negative middle ear pressure who were posted for nasal surgeries. Middle ear pressure measured before surgery, 3 months and 6 months after surgery and changes in middle ear pressure was noted. This study showed that there was an improvement in middle ear pressure of patient who underwent nasal surgery.

Keywords: Deviated Nasal Septum, Sino-nasal polyposis, turbinate hypertrophy, septoplasty, FESS, tympanometry.

INTRODUCTION

Nasal obstruction is a common ENT complaint among all age groups. Most common cause of nasal obstruction are Deviated nasal septum, Turbinate hypertrophy, Nasal polyposis, Chronic rhino sinusitis, Adenoid hypertrophy and Malignancy (in elderly patients).

Nasal obstruction causes mechanical Eustachian tube blockage which can lead to absorption of air inside the middle ear cavity, thus leading to development of negative pressure in the middle air. The physiologic middle ear pressure depends on the air transition through ET and gas diffusion between middle ear mucosa and systemic circulation.[1] ET dysfunction can lead to Secretory Otitis Media, TM retraction or retraction pockets, Atelectasis, Adhesive otitis media, Cholesteatoma. Other common causes for Eustachian tube dysfunction includes Allergic or Vasomotor rhinitis, Upper respiratory tract infection, cleft palate, downs syndrome

Various Eustachian tube function tests include Valsalva test, Politzer test, ET catheterization, Toynbee's test, Tympanometry, Sonotubometry. We used tympanometry in the study because it is easy to perform and widely used in clinical studies for evaluating Eustachian tube function.

Nasal, paranasal and nasopharyngeal pathologies can affect ET function. Insufficient ventilation of ET is the main cause of middle ear inflammatory disease.[1] Such pathologies can result in conductive hearing loss which can be detected by a pure tone audiometry Our study is a prospective study to evaluate the effectiveness of nasal surgeries to improve middle ear ventilation

Objectives

1. To evaluate incidence of eustachian tube obstruction in nasal pathologies
2. To evaluate the effectiveness of nasal surgeries in improving middle ear ventilation

MATERIALS AND METHODS

It is a prospective observational study conducted among patients attending ENT OPD in our institute with age above 3 years having nasal obstruction as symptom. Study duration was 12 months.

These patients underwent diagnostic nasal endoscopy to find the cause for nasal obstruction. Impedance audiogram was done to find the middle ear status and eustachian tube function. After surgery, they were on follow up and impedance was repeated at 3- and 6-months post operatively.

Inclusion Criteria

- Patients of any gender, above 3 years of age.

- Patients with nasal obstruction due to adenoid hypertrophy, DNS, ITH, nasal polyposis, Chronic rhino sinusitis
- Patients willing to participate in the study

Exclusion Criteria

- Patients below 3 years of age
- Patients with sinonasal malignancies
- Revision nasal surgeries
- Patients with history of otorrhea
- Those who are not willing to participate

Sample Size:72

At 5% significance, z=1.96. As per earlier study-conducted to determine effects of septoplasty on middle ear pressure in the dept of ENT in Trivandrum medical college, p=0.577, q=1-p

$n = z^2 pq/d^2 = 1.96x\ 1.96\ x\ 0.577x0.423/(0.12)^2$

$= 0.9376/0.0144 = 65.11$

Adding non response ,10% =65.11x10/100= 6.511

Therefore, n= 65.11+6.511=71.62 ≈ 72

Sampling: consecutive sampling method

Study Tool: Peer reviewed Study proforma.

RESULTS

I. Demographic characteristics of study population

Table 1: Gender distribution of study participants (n=72)

Gender	Frequency	Percent
Male	39	54.32
Female	33	45.8
Total	72	100

Among the participants, 54.32 percentage were male (n=39) and 45.8 % were female (n=33).

Table 2: Age distribution of study participants (n=72)

Age distribution	Frequency	Percent
<37	38	52.8
>/=37	34	47.2
Total	72	100

The mean age of study population was 37.05 with a minimum age of 5 and maximum age of 71. Among the participants, 52.8% were below 37 years of age and 47.2% were above or equal to 37 years of age.

This figure illustrates the distribution of symptoms at initial visit to our OPD. All patients presented with nasal obstruction (100%), 81.1% patients had nasal discharge, 80.6% had PND,79.2% had sneezing, 75% had ear block ,58.35 % had reduced hearing, 45.8% mouth breathing, 55.6 % had snoring, 45.8% smell disturbances 18.1% had ear ache and only 2.8 % had epistaxis. Nasal obstruction was the most common symptom. [Figure 1]

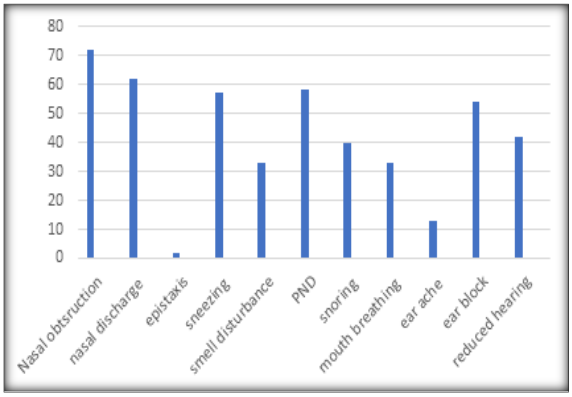

Figure 1: Distribution of patients based on symptoms on initial visit to OPD(n=72)

Table 3: Frequency of various nasal pathology seen in diagnostic nasal endoscopy

Nasal pathology	Frequency	Percentage
Sinonasal polyposis	18	25
Turbinate hypertrophy	28	38.8
DNS	47	65.2
Adenoid hypertrophy	16	22.2

This table shows the frequency of various nasal pathology which was seen individually or in combination, in the diagnostic nasal endoscopy of the study population. Deviated nasal septum was the most common finding (65.2%) followed by turbinate hypertrophy (in 38.8% participants) followed by sinonasal polyposis (25% of participants) and adenoid hypertrophy (22.2%) population.

Table 4: Distribution of study participants based on changes in tympanogram findings of right ear

TYMPANOGRAM	Initial presentation		3 months after surgery		6 months after surgery	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
A	6	8.3	45	62.5	59	81.9
As	4	5.5	20	27.7	10	13.8
B	33	45.8	2	2.7	0	0
C	29	40.2	5	6.7	3	4.1

TOTAL	72	100	72	100	72	100
						p value <0.0001

This table illustrates distribution of tympanogram findings of right ear at three different time points: At initial visit, 3 months after surgery and 6 months after surgery.

Pre operatively, majority of patients (45.8%) had B type curve and 40.2 % had C type curve indicating middle ear effusion or eustachian tube dysfunction while 5.5% had as type curve and 8.3 % had A type curve indicating normal middle ear ventilation. After 3 months of surgery, there was reduction B type curves (2.7%) and C type curve (6.7%) whereas A type curve increased to 62.5 % and As to 27.7% indicating improving middle ear ventilation and drainage.

The changes in tympanogram distribution (initial, 3 months, and 6 months) were analysed using the Chi-square test and found to be statistically significant ($p < 0.0001$).

Table 5: Distribution of study participants based on changes in tympanogram findings of left ear before and after surgery

TYMPANOGRAM	Initial presentation		3 months after surgery		6 months after surgery	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
A	9	12.5	51	70.8	61	84.7
As	10	13.8	12	16.6	7	9.7
B	30	41.6	3	4.2	0	0
C	23	31.9	6	8.3	4	5.5
TOTAL	72	100	72	100	72	100
					P value	*<0.00001*

This table illustrates distribution of tympanogram findings of left ear at same three different time points. A statistically significant improvement was observed following surgery in left ear as well, as indicated by tympanometric findings. At initial visit, only 12.5% had A type tympanogram, which increased markedly to 70.8% at 3 months and 84.7% at 6 months post operatively. Conversely, the proportion of ears with type B and type C tympanograms decreased substantially over time. The changes in tympanogram findings in three time period was analysed using chi square test and p value was found to be <0.00001 which is significant.

DISCUSSION

This study was conducted to find out the effect of nasal surgeries in middle ear pressure.

In our study, 54.32 % of patients were male and 45.8% patients were females. The mean age of the study population was37.05 with a minimum age of 5 years and maximum age of 71.

In a similar study by Prakash P et al, the mean age was 28.44+/-8.23 years with male/female ratio of 7:36.

All patients presented with nasal obstruction, with other common symptoms being- 81.1% patients had nasal discharge, 80.6% had PND,79.2% had sneezing, 75% had ear block ,58.35 had reduced hearing, 45.8% mouth breathing, 55.6 % had snoring, 45.8% smell disturbances 18.1 had ear ache and only 2.8 % had epistaxis. The presence of ear block and reduced hearing suggest strong correlation between nasal pathologies and eustachian tube dysfunction.

Pre operative nasal endoscopy showed presence of deviated nasal septum as the most common nasal pathology (65.2 % of patients). Turbinate hypertrophy was seen in 38.8 % patients, sino-nasal polyposis in 25 % patients and adenoid hypertrophy in 22.2 %. These conditions are known to compromise nasal airway and cause eustachian tube dysfunction by disrupting the normal nasopharyngeal anatomy and pressure regulation.

Pre operatively, B tympanogram was the most common finding in impedance audiometry. 45.8% patients had B tympanogram in right ear and 41.6 % had B curve in left ear. C curve was seen in 40.2 % patients in right ear and 31.9 % in left ear.

After 3 months of surgery, this improved to 62.5 % patients having A type tympanogram in right ear and 70.8 % patients having A type tympanogram in left ear.

After 6 months of surgery, A type tympanogram was seen 81.9 % patients in right ear and 84.7 % patients in left ear indicating a significant improvement in middle ear function following nasal surgery.

Notably, type B cases reduced to 0% confirming resolution of middle ear effusion

The changes in tympanogram distribution (initial, 3 months, and 6 months) were analyzed using the Chi-square test and found to be statistically significant ($p < 0.0001$ in right ear and p value <0.00001 in left ear). Hence, there is a statistically significant association between the time point of measurement (initial, 3 months post-operative, 6 months post-operative) and the type of tympanogram observed in the both ear. This suggests that nasal surgery leads to a significant change in the distribution of tympanogram types over time, indicating an improvement in middle ear ventilation in the study population.

A statistically significant improvement in middle ear ventilation suggests a strong association between nasal surgery and improved middle ear ventilation.

Our studies are consistent with the previous studies. For instance, Bhargava et al reported significant normalisation of tympanograms following

septoplasty in patients with chronic nasal obstruction. Similarly, studies by Subhashini et al and Kariya et al, have emphasized the role of nasal airflow in maintaining eustachian tube patency and middle ear aeration.[7]

The reason for these is that nasal obstruction alters nasopharyngeal pressure dynamics and obliterates eustachian tube orifice. By relieving the obstruction via surgery, normal pressure equilibrium is restored, facilitating middle ear ventilation.

In a study by F salvinelli et al to find the effect of nasal surgery on eustachian tube function, post operative tubal function was noted to be significantly better than pre operative one (90% vs 46%) but they did not obtain a significant change in tympanometric values.[3]

In a similar study by Mesut Kaya et al, there was significant improvement in eustachian tube function. Percentage of functional eustachian tube increased from 40% to 72% in affected side and 58% to 70% in contralateral side.[4]

In another study by Prakash P et al, positive tympanometric peak pressure increased by 37% and 43 % respectively in right and left ear.[6]

These results highlight the importance of evaluating nasal pathology in patients with persistent middle ear dysfunction. Nasal surgeries like septoplasty and FESS should be considered as a part of multidisciplinary approach in managing eustachian tube dysfunction and associated otologic symptoms.

CONCLUSION

This study signifies the positive impact of nasal surgery on middle ear ventilation. The postoperative tympanogram findings demonstrated significant improvement, suggesting that addressing nasal pathology can effectively enhance Eustachian tube function. These results support the role of nasal surgery as an adjunct in the management of middle ear ventilation issues, particularly in patients with concurrent nasal and Eustachian tube dysfunction.

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