

# Evaluation of Eustachian Tube Function by Tympanometry in Patients of Deviated Nasal Septum and Sinonasal Polyposis

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**Abstract:** *Objective:* To study the effect of deviated nasal septum (DNS) and sinonasal polyposis (SNP) on eustachian tube(ET) function & whether the function would improve on septal correction and removal of polyp.

*Patients and Method:* A prospective study of 45 subjects of DNS and 25 subjects of SNP. A detail history was taken including symptomatology, predisposing factors, treatment received. Thorough ENT examination was done after meeting all the inclusion and exclusion criteria, otomicroscopy nasal endoscopy and PTA was done whenever indicated. Tympanometry was performed in all cases using impedance audiometer prior to septal correction and removal of polyp and repeated 4 to 6 weeks after surgery. Tympanogram was classified as described by Jerger in 1975, in clinical experience with impedance audiometry. Any improvement in tubal function was noted. In cases where tubal dysfunction persisted, otomicroscopy and nasal endoscopy was performed again to plan the further line of management.

*Result:* Normal eustachian tube function was achieved in 75.55% after septal correction and 74% after polypectomy which was 51.11% and 56% respectively before surgery.

*Conclusion:* This study suggest that chronic nasal obstruction due to deviated nasal septum and sinonasal polyposis is a frequent cause of ET dysfunction. Surgical correction significantly improve tubal function and middle ear ventilation.

**Keywords:** Eustachian tube function, tympanometry, deviated nasal septum, sinonasal polyposis.

## INTRODUCTION

Otologists generally acknowledge the involvement of middle ear in sinonasal disease. Sinonasal disease is believed to involve eustachian tube leading to various middle ear pathology. Several studies had related nasal septal deviation to eustachian tube dysfunction [1]. Mohsen Rajati attributed inflammation (either due to allergy or infection) associated with polyposis for ET dysfunction [2].

The middle ear is a gas filled biological gas pocket. All biological gas pockets face two special problems, the need to overcome shrinkage or reduced pressure because of net loss of gases in to the surrounding circulation and need to keep the sac clean. In the middle ear these two problems have been overcome by ventilation and mucociliary transport through the Eustachian tube [3].

The eustachian tube, middle ear and mastoid air cells constitute a continuous air space contained in bone lined by epithelium and in continuity with the atmosphere of the nose and nasopharynx [4]. Because of this continuity disease can spread from nose and nasopharynx to middle ear via eustachian tube.

This study was undertaken to know the effect of deviated nasal septum and sinonasal polyposis (SNP)

on eustachian tube function & whether the function would improve on correction of septal deviation and removal of polyp. Among various methods available. The impedance audiometer is most useful tool to determine eustachian tube function. It not only measures anatomical patency of eustachian tube (ET) but also its functional integrity. Tympanometry was performed in patients having deviated nasal septum and sinonasal polyposis (SNP), which was repeated 4 to 6 weeks after surgery.

## PATIENTS AND METHODS

The present study was hospital based, prospective study. The protocol for this study was approved by college ethics committee and informed consent was obtained from all the patients. 45 patients of deviated nasal septum & 25 patient of sinonasal polyposis were subjected for the present study. 51(72.85%) patients were male & 19(27.15%) were female aged between seventeen to forty five year. A detail history was taken including symptomatology, predisposing factors and treatment received. Thorough ear nose and throat examination was done.

## INCLUSION CRITERIA

- 1) Patients having deviated nasal septum with intact drum.
- 2) Patients having ethmoidal and antrochoanal polyp with intact drum.

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## EXCLUSION CRITERIA

- 1) Patients of sinonasal disease having perforation of ear drum.
- 2) Patients of sinonasal disease having aural cholesteatoma.

Fourty patients (57.14%) had no otological complaints while 30 patients (42.86%) had ear symptoms in form of earache, muffled hearing and deafness.

Otomicroscopy, nasal endoscopy and pure tone audiometry was done whenever indicated. Tympanometry was performed in all cases using Impedance audiometer (MAICO MI 24) prior to septal correction and removal of polyp. Tympanogram was obtained and classified as described by Jerger [5] in 1975, in clinical experience with Impedance audiometry.

All the forty five patients of DNS underwent septal correction surgery. Cauterization of inferior turbinate was also done in patient having inferior turbinate hypertrophy refractory to medical line of treatment. Polypectomy/FESS was done in twenty five patients (18 patients of AC polyp and 7 patients of ethmoidal polypi) and intranasal steroids was given in ethmoidal polyposis patients postoperatively for 6 weeks.

Tympanometry was repeated after four to six weeks .Any improvement in the tubal function was noted by observing the tympanograms obtained. In cases where tubal dysfunction persisted had severe retraction of tympanic membrane, otomicroscopy and nasal endoscopy was performed again to plan the further line of management.

## RESULT

Fourty five cases of deviated nasal septum were studied. In 24(53.33%) cases, deviated nasal septum was associated with hypertrophy of inferior turbinate. On otoscopic examination, normal tympanic membrane on both sides was seen in 15(33.33%) patients (30 ears), normal tympanic membrane on one side was seen in 18 (40%) ears and the other side had retraction of ear drum. Retracted tympanic membrane on both sides was seen in 12(26.66%) patients (24 ears).

Thus out of ninety ears examined retracted tympanic membrane was present in 42(46.66%) ears. Unilateral retraction was present on side of deviation in

73.33% cases while it was contralateral in remaining 26.66% cases.

In 45 subjects (90 ears) of DNS abnormal tympanogram suggestive of eustachian tube dysfunction was obtained in 68.88% (31/45) patients. Bilateral ET dysfunction was present in 41.93% (13/31) patients and unilateral dysfunction in 58.06% (18/31) patients. So abnormal tympanogram was observed in 48.88% (44/90) ears. In 75% (33/44) ears type C tympanogram was obtained and in remaining 25% (11/44) ears type B tympanogram was obtained.

In 28.88% (13/45) cases tympanogram was abnormal on both sides and in 40% (18/45) cases it was abnormal on one side. Normal tympanogram was found in 51.11% (46/90) ears.

Tympanometry was repeated six weeks after septal correction. Normal tympanogram was seen in 75.55% (68/90) ears.

### Tympanometry Findings before and after Septal Correction are Depicted in Table 1

Present study comprises of 25 cases (50 ears) of polyposis. In 56% (14/25) patients tympanic membrane was retracted. Retraction on both sides was present in 36% (9/25) and unilateral retraction in 20% (5/25) patients. In remaining 11(44%) patients tympanic membrane was normal on both sides.

**Table 1: Pre-op and Post-op Tympanograms in Patients of DNS (n= 90 ears)**

Tympanogram	Pre-op	Post-op
A	46(51.11%)	68(75.55%)
B	11(12.22%)	04(4.44%)
C	33(36.66%)	18(20.00%)

Preoperative tympanometry was done in 25 cases (50 ears). Abnormal tympanogram was obtained in 44% (22/50) ears. It was bilateral in 8 cases and unilateral in 6 cases. In remaining 56% (28/50) ears normal tympanogram was seen. Tympanometry was repeated six week after surgery, normal tympanogram was seen in 74% (37/50) ears.

### Tympanometry Findings before and after Polypectomy are Depicted in Table 2

So normal Eustachian tube function was achieved in 75.55% after septal correction and 74% after

polypectomy which was 51.11% and 56% respectively before surgery.

**Table 2: Pre-op and Post-op Tympanograms in Patients of Sinonasal Polyposis (n=50)**

Tympanogram	Pre-op	Post-op
A	28(56%)	37(74%)
B	03(06%)	02(04%)
C	19(38%)	11(22%)

## DISCUSSION

The eustachian tube is frequently involved in the pathological processes of the nasal, paranasal and nasopharyngeal cavities. Nasal obstruction can alter eustachian tube function. It is important to know the impact of nasal disease on ET function. The effect of nasal obstruction due to deviated nasal septum and sinonasal polyposis was studied in seventy patients (140 ears). Abnormal tympanogram (type B and C curve) suggestive of eustachian tube dysfunction was found in 48.88% ears having DNS and 44% ears having polyposis.

Our finding are comparable with the study by De Soto and colleagues [6]. They observed eustachian tube dysfunction in seventy one percent of their patients. 69% unilateral and 31% had bilateral dysfunction. They measured ET tube patency as registered by external auditory canal manometry during Tonybee or Valsalva manoeuvres. However they have not studied eustachian tube function after septal correction and hence improvement after septal correction was not noted in their study. In present study, tympanometry was repeated six weeks after septal correction. Tympanometry was performed in 90 ears (forty five patients). Preoperatively eustachian tube function was affected in 48.88% ears and it was normal in 51.11 % ears. After septal correction tympanometry showed definite improvement in eustachian tube function and normal tympanogram was observed in 75.55% ears ( $p < 0.001$ ).

P. Deron and P.A.R Clement [7] in their study entitled "septal surgery and tubal function early and late result" found significant improvement in the passing opening pressure of eustachian tube in patients having DNS. In their study DNS patients did not have any ear disease. 8 cases (16 ears) were studied preoperatively and 43.75% patients had patent eustachian tube while in early post operative period 81.25% had normal

eustachian tube function (ETF) in late post operative period 68.75% had normal ETF.

The concept of a relationship between nasal septal deviation and eustachian tube dysfunction is supported by these studies and could explain the pathogenic effect on middle ear. The most reasonable mechanism is air flow turbulence in the nasopharynx. It is supported that turbulent air flow in the post nasal space has drying effect on the mucosa film [8]. This drying effect could increase the viscosity of mucosa at the tubal orifice, increase the surface tension and impede tubal opening. Another possible mechanism is direct inflammation at the tubal orifice from the constant drying effect of turbulent air flow on the mucous membrane.

Mohsen Rajati MD, Mehdi Bakhshaei *et al.* [2] studied 42 cases of sinonasal polyposis with 24 healthy control and 24 patients of nasal obstruction without polyp. Type B tympanogram ( $p < 0.025$ ) showed significant difference in three groups. In present study pre-operatively ET function was affected in 44% ears and it was normal in 56% ears. After surgery tympanometry showed significant improvement in eustachian tube function and normal tympanogram was seen in 74% ears ( $p = 0.020$ ). Yeolekar *et al.* [9] in their study entitled "otitis media: does onus lie on sinonasal pathology" studied effect of polypectomy on middle ear disease. They found 76.92% improvement in middle ear disease in form of dry ear or closure of perforation. ET dysfunction in polyposis could be either because of mechanical obstruction at pharyngeal end of eustachian tube or inflammation due to allergy or infection associated with polyposis.

## CONCLUSION

This data suggest that chronic nasal obstruction due to deviated nasal septum and sinonasal polyposis is a frequent cause of ET dysfunction. Surgical correction significantly improve tubal function and middle ear ventilation atleast six weeks from the surgical procedure. In the present study ET dysfunction was observed in 48.88% ears in cases of DNS and 44% ears in sinonasal polyposis preoperatively and after surgical correction ET dysfunction was present in 24.44% and 26% ears respectively. Though the present study does not have large number of patients, evidence is provided that the correction of nasal septal deviation and removal of polyp is valid consideration in taking care of ET dysfunction leading to middle ear disease.

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