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Role of eustachian tube dysfunction in adult's middle ear diseases

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Abstract
Introduction: Eustachian tube dysfunction (ETD) is linked to multiple middle ear complications and is a main factor in the development of chronic otitis media. It also contributes to problems after surgery for otitis media with tympanic membrane perforation. Accurate identification of eustachian tube dysfunction is crucial for understanding the development of chronic otitis media. The present study seeks to assess the eustachian tube function in people suffering from middle ear problems.
Material and Methods: A total of eighty cases and eighty control individuals who were age and gender matched were chosen from the age range of twenty-two to fifty years old. Both the pre- and post-operative histories were documented, and a comprehensive ear examination and tympanometry were performed. The Valsalva test, nasopharyngoscopy, and pneumatic otoscopy were used in order to assess the functionality of the auditory tubes. The Williams test was used to evaluate the intact tympanic membrane, whereas the Toynbee test was used to evaluate the perforated tympanic membrane.
Results: Postoperative assessment of eustachian tube function by Toynbee's test for 19 cases with failed tympanoplasty showed normal ET function in 5 cases, 8 cases had partial and 6 cases had gross ET dysfunction. Postoperative assessment ET function by William's test showed 4 cases among 19 cases had partial ET dysfunction and 01 cases had gross ET dysfunction.
Conclusion: Eustachian tube function is essential for middle ear surgery success. In most remaining CP patients, ET dysfunction was partial or extensive. Before surgery, tubal dysfunction patients should be assessed for underlying reasons and treated to improve tympanoplasty success.

Keywords: Eustachian tube, tympanic membrane, Toynbee's test, chronic otitis media

Introduction
The Eustachian tube is an active organ that, together with other structures, has a crucial role in the physiological processes of the middle ear, such as ventilation, protection, and evacuation. ET dysfunction refers to a lack of ability to dilate properly, leading to ear problems that might arise from mechanical or functional reasons or occlusion [3]. The condition may be attributable to a variety of reasons, including anatomical blockage of the Eustachian tube or failure of its motility. Anatomical factors, functional obstructions, infections, and allergies have been associated with dysfunction of the Eustachian tube (ET). However, there is no consensus on the specific mechanism of this dysfunction or the precise location of the blockage [4]. Thus, it is advisable to impartially assess the ET function before surgery in order to anticipate the results of the procedure. Understanding the specific kind of dysfunction is crucial, as it determines the appropriate therapy approach for individuals with ET dysfunction.
The majority of examinations into auditory tube dysfunction are unable to distinguish whether it is a functional or mechanical type, which is necessary for managing complications. Functional dysfunction arises from innate weakness in the muscles of the tubes, whereas mechanical dysfunction is caused by blockages in the nasal and paranasal sinuses [5]. There are many therapeutic methods that may be used to assess the function of the eustachian tube, including the Valsalva manoeuvre, Politzer's test, Toynbee test, pneumatic autoscopy, and eustachian tube catheterization [6]. The proper functioning of the eustachian tube is crucial in tympanoplasty, as shown by studies that have examined patients with and without normal tubal function [7]. The successful result of tympanoplasty relies on the accurate identification and treatment of eustachian tube dysfunction prior to the surgical

procedure. The current research aims to evaluate the eustachian tube function in individuals with middle ear disorders.

Materials and Methods

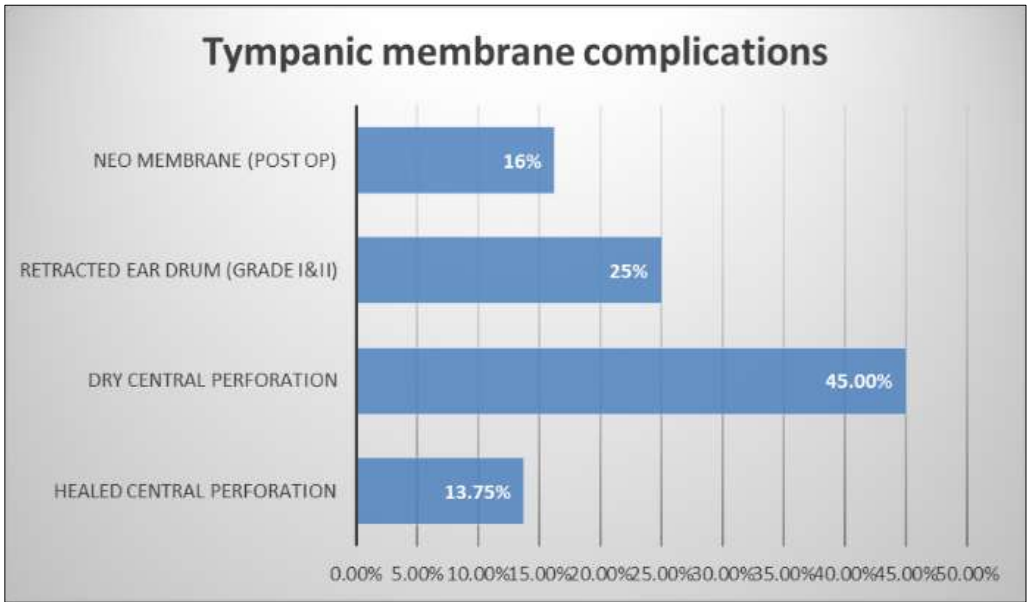
The present study was conducted from January to December 2014 at the Prathima Institute of Medical Sciences in Karimnagar, in the Department of ENT. Eighty patients were recruited and admitted to the Department of ENT with main symptoms of chronic otitis media and middle ear infection. The equal number of age and gender-matched healthy participants with normal tympanic membranes were enlisted. Cases with grade 1 and grade 2 tympanic membrane retraction pars tensa, as well as type 1 tympanoplasty and myringoplasty done three months before to the study, were included. The patients ranged in age from 21 to 50. Cases with middle-year illnesses, UPTI, grade 3 and 4 retracted pars tensa of the tympanic membrane, and ear discharge were excluded. The institutional ethics committee examined and approved the study methods, and the research participants gave written informed consent.

Along with a comprehensive clinical examination and hemogram, each patient had a complete clinical history taken. A comprehensive tympanometry test, as well as pre- and post-surgical histories, were taken. The auditory tubes were examined using pneumatic otoscopy, nasopharyngoscopy, and valsalva testing. The Toynsbee test was used to ascertain if the tympanic membrane was perforated, whereas the Williams test was employed to ascertain whether it was intact. SPSS was used to evaluate the obtained data. The frequency and percentage of the categorical data were examined using descriptive statistics.

Results

Table 1: Age wise distribution of study participants

Demographic data	Cases (n=80)		Control subjects (n=80)	
	Frequency	Percentage	Frequency	Percentage
Age (in years)				
21-30	19	23.75%	20	25%
31-40	38	47.5%	35	43.75%
41-50	23	28.75%	25	31.25%
Gender				
Male	51	63.75%	48	60%
Female	29	36.25%	32	40%



Graph 1: Complication associated with tympanic membrane in study participants

Table 2: Status of eustachian tube function in cases with CSOM

Eustachian tube function	Post-operative residual CP		Non operated dry CP	
	Frequency	Percentage	Frequency	Percentage
Normal	02	2.5%	34	42.5%
Partial dysfunction	03	3.75%	26	32.5%
Gross dysfunction	02	2.5%	18	22.5%

Table 3: Details of auditory tube function in Retracted Tympanic membrane, Healed Central perforation, Post op patients

Ear drum function	Controls (n=80)	Cases (n=80)			
		Dry CP (n=36)	Healed CP (n=11)	Retracted ED (n=20)	Post op with neo membrane (n=13)
Normal function	80 (100%)	04	08	05	10
Partial dysfunction		30	02	12	02
Gross dysfunction		02	01	03	01

Table 4: Comparison of Eustachian tube function in between different conditions

Comparison	Normal ET function	ET dysfunction
Recurrent CSOM	03	08
Retracted ED	18	02
Healed central perforation	09	02

Discussion

Majority participants were between age group 31-40 years (47.5% in cases & 43.75% in controls), followed by 41-50 (28.75% in cases & 31.25% in controls) and 21-30 years (23.75%% in cases & 25% in controls). Male (63.75% in cases & 60% in controls) participants were common than females (Table 1). Postoperative neo membrane was observed in 16% of cases, grade 1 & 2 retracted ear drum was observed in 25% of cases, dry central perforation in 45% and healed central perforation in 13.75% of cases (Figure 1). The postoperative assessment of eustachian tube function by Toynbee's test showed residual CP 2.5%, 3.75%, 2.5% and in non-operated dry CP 42.5%, 32.5% and 22.5% of cases had normal, partial and gross dysfunction respectively (Table 2).

The eustachian tube was normal in al control subjects. The dry CP cases showed normal ET function in 4 cases, partial dysfunction in 30 cases, gross dysfunction in 2 cases. Healed CP showed normal function, partial, gross dysfunction in 8, 2, 1 case respectively. In Retracted ED cases showed Normal in 5 cases, partial in 12 and gross dysfunction in 03 cases. In post-operative neo membrane 10 cases have normal function, 2 has partial and 1 has gross dysfunction (Table 3).

The data indicate that the function of the eustachian tube is always a factor in determining the successful outcome of surgical procedures [8, 9]. According to the findings of a study conducted by Saravanan V and colleagues, out of seven instances in which tympanoplasty was unsuccessful, one case had normal ET function, three cases had moderate ET dysfunction, and three cases had extensive ET dysfunction [10]. Anirban Biswas *et al*., conducted a research in which they found that out of 34 patients, 6 cases had partial ET dysfunction and 2 cases had extensive ET dysfunction [11]. An aberrant IA was also seen in patients who had a greater degree of ET dysfunction, which was grade 2A or above on the DSVE. This indicates that the likelihood of middle ear pressure dysfunction occurring rises in tandem with the severity of the ET dysfunction, demonstrating a high degree of agreement between the two diagnostic modalities [12, 13]. Slow motion endoscopy was shown to be a potentially effective method for examining the pathophysiology of ET dysfunction, according to the findings of a research that was conducted by Poe *et al.* [14]. Furthermore, histopathological examinations have shown that the length of the ET in dysfunctional specimens is shorter than the length of the ET in age-matched controls, which may provide an explanation for tubal dysfunction [15]. The present study had limitations in terms of low sample size with restricted number of clinical parameters and without follow up. Further large scale studies are required with long term follow up assessment.

Conclusion

The data imply that eustachian tube function is always necessary for middle ear surgery. Most residual CP patients had reduced ET function. Impedance audiometry is a straightforward, non-invasive way to assess the Eustachian tube for tubal dysfunction. Before surgery, tubal dysfunction patients should be assessed for underlying reasons and treated to improve tympanoplasty success.

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