Correlation of Eustachian Tube Dysfunction with Results of Tympanoplasty in Mucosal Type of Chronic Suppurative Otitis Media

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Received: 28 August 2018 / Accepted: 27 October 2018 / Published online: 2 November 2018
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Abstract To Assess the relation between eustachian tube function and outcome of tympanoplasty in mucosal type of chronic suppurative otitis media, a prospective study was carried out over a period of one and half years (January 2016–July 2017) at a tertiary referral centre (Gujarat Cancer Society Medical College and Research Institute, Ahmedabad). Total 90 Patients of any age and sex and with Mucosal type of chronic suppurative otitis media and Patients with follow up of 12 months were selected. The Eustachian Tube function was assessed preoperatively by pressure swallow equalization test and impedance audiometry. All patients were categorized based on function of eustachian tube. All patients were operated by type 1 tympanoplasty with or without mastoidectomy. We measure the Graft uptake rate after type 1 tympanoplasty (with or without mastoidectomy) in patients with or without eustachian tube dysfunction. Graft uptake rate is higher in patients with normal or mild eustachian dysfunction compared to severe eustachian tube dysfunction. In our study we found 87% success rate in patients with normal Eustachian tube function, 80% in partially impaired Eustachian tube function, and 70% in totally impaired Eustachian tube. So, pre-operative planning in tympanoplasty surgery eustachian tube function assessment is must to increase graft uptake rate by preoperative utilization of decongestant. It is also important to comment outcome of surgery.

Keywords Chronic suppurative otitis media · Eustachian tube function · Tympanoplasty

Introduction

Dysfunction of eustachian Tube place a very important role in the pathogenesis of chronic suppurative otitis media. A properly functioning eustachian tube is an integral part of a normally functioning middle ear and the existence of good tubotympanic mucociliary drainage and constitutes a favourable prognostic factor in the outcome of reconstructive surgery as well as long term prognosis [1]. A pre-operative test of tubal function is important for achieving a satisfactory result of tympanoplasty [2]. Hence, assessment of eustachian tube function is of paramount importance not only before embarking on any surgery for suppurative otitis media, but also for establishing its etiological basis and deciding outcome of surgery.

This study focuses on relation between eustachian tube dysfunction with results of type 1 tympanoplasty.

Materials and Methods

30 patients each with normal to mild, moderate to severe and persistent eustachian tube dysfunction with existing mucosal type of chronic suppurative otitis media were recruited in the study. This is a prospective study carried out over one and half years from 10th January 2016 to 10th July 2017 in Department of E.N.T.& Head and Neck Surgery, a tertiary care hospital. Patients with Chronic suppurative otitis media (Mucosal) type were only included in the study, no limit was considered for the age bar, however the youngest patient recruited in our study was

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11 years. Those subjects who did not turn up for follow up following surgery were excluded.

A detailed history with thorough ENT examination was done in all the patients. In history, symptoms of otorrhoea, impaired hearing, tinnitus, bleeding, pain, cough, rhinorrhoea, sneezing and throat complains were all taken into consideration. Thorough local Examination of the ear was done with otoscopy. Hearing threshold was tested clinically with tuning forks of 256 Hz, 512 Hz, 1024 Hz. Hearing acuity was tested with Pure Tone Audiometry in both the ears. Nose and Throat was also thoroughly examined in all the patients. All patients with chronic suppurative otitis media of squamous type were excluded from the study.

The Eustachian Tube function was assessed preoperatively by pressure swallow equalization test and impedance audiometry. In this study, we had utilized interacoustics impedance audiometer AZ-26 for assessing the functional status of Eustachian tube, in patients with central perforation in mucosal type of chronic otitis media.

All ears were mopped dry as far as possible. The probe tip of appropriate fit was selected and cleaned meticulously prior to surgery. Initially a negative middle ear pressure was created through the air tight probe tip. The patient was instructed to swallow 3–5 times in 10 s (Negative Pressure Equalization Test). The Pressure remaining at the end of all swallow was termed ‘The residual negative pressure’

All patients were categorized based on function of eustachian tube was as follows:

Eustachian tube function	Residual pressure after 3–5 swallow
Normal function	0–50 mm of H ₂ O
Mild dysfunction	50–100 mm of H ₂ O
Moderate dysfunction	100–150 mm of H ₂ O
Severe dysfunction	150–200 mm of H ₂ O

Patients with no or mild dysfunction were subjected directly to surgery. Patients with moderate to severe and persistent Eustachian tube dysfunction were given a course of combination of Tablet Chlorpheniramine malate (4 mg) with Phenylephrine (10 mg) twice a day along with topical nasal Xylometazoline (0.1%) for a period of 7 to 10 days in view of improving the tubal function and reassessed for tubal function after 10 days.

Hence all the patients were categorized into 3 groups according to their tubal dysfunction:

Group A Patients with no or mild Dysfunction

Group B Patients with improved function to no or mild dysfunction from moderate or severe after a course of decongestant

Group C Patients with persistent moderate or severe Dysfunction after a course of decongestant

We have taken 30 patients from each group for this study. All patients were operated by type 1 tympanoplasty with or without mastoidectomy. Out of 90 patients cortical mastoidectomy with type 1 tympanoplasty was done in 63 patients and type 1 tympanoplasty alone was done in 37 patients. Selection of patients for mastoidectomy were done as per Bellucci’s classification to assess middle ear risk index of successful outcome of surgery. Mastoidectomy was done in all cases with a risk index of 2 or more irrespective of severity of Eustachian tube dysfunction. Patients were followed up for 12 months for graft uptake.

Results and Analysis

In our study out of 90 there were 44 males and 46 females. Age of patients we studied varied from minimum of 11 years to maximum of 58 years. Among patients with Normal to mild (p value = 1.0) and persistent (p value = 0.2069) Eustachian tube dysfunction there is no significant statistical difference in rate of graft uptake between patients undergoing tympanoplasty and tympanoplasty with mastoidectomy. However, among patients with moderate to severe dysfunction there is a statistically significant difference between the two groups in terms of graft uptake, with the group undergoing tympanoplasty with Mastoidectomy faring better with a p value of 0.004. In our study we found statistically significant difference between the rate of graft uptake in patients undergoing tympanoplasty with mastoidectomy (83%) as compared to those tympanoplasty without mastoidectomy (56%) with p value of 0.015. Comparing patients with normal to mild dysfunction with moderate to severe and persistent dysfunction a statistically significant difference was found in terms of graft uptake (p value = 0.0489) with normal to mild dysfunction group faring better. SPSS 24.0 was used for statistical testing and Fisher’s exact test was used as a measure of significance (Tables 1, 2, 3, 4, 5).

Discussion

A functioning eustachian tube is essential to have a healthy and functioning tympanic cavity. Precise evaluation of eustachian tube function in the clinical audiological practice aims at safely defining tube status in order to guarantee the success of any type of procedure used to improve the middle ear function.

Unfortunately, however the assessment of eustachian tube function has not been popularized as much as it

Table 1 Graft taken up rate

	Preoperative Eustachian tube function		Surgery done		Graft taken up	
	No. of case	%	Tympanoplasty (no.)	Tympanomastoidectomy (no.)	No. of cases	%
Normal	30	33	12	18	26	87
Abnormal	60	66	15	45	45	75

Table 2 Graft failure rate

	Preoperative Eustachian tube function		Graft failure	
	No. of cases	%	No. of Cases	%
Normal	30	33	4	13
Abnormal	60	66	15	25

Table 3 Group A

Surgery	No. of cases	Graft take up	
		No. of cases	%
Tympanomastoidectomy	18	16	89
Tympanoplasty	12	10	83
Total	30	26	87

Table 4 Group B

Surgery	No. of cases	Graft take up	
		No. of cases	%
Tympanomastoidectomy	18	16	89
Tympanoplasty	12	4	67
Total	30	24	80

Table 5 Group C

Surgery	No. of cases	Graft take up	
		No. of cases	%
Tympanomastoidectomy	27	20	74
Tympanoplasty	3	1	33
Total	30	21	70

warrants. The natural outcome of this has been poor success in spite of competent surgery in well-equipped microsurgical setup.

Though many otologists carry out tests for anatomical patency of eustachian tube, yet this test do not serve the

purpose for which they are undertaken. These techniques merely tell us weather the eustachian tube is anatomically patent or not. The purpose of undertaking the eustachian tube function tests is to assess its physiological profile.it is the physiological functioning and not the anatomical

patency of tube that is required for maintaining the normal function of middle ear. The modern impedance audiometer offers us facility of ascertaining physiological function of the eustachian tube even in the presence of tympanic membrane perforation.

In pre-operative planning in tympanoplasty surgery eustachian tube function assessment is must to increase graft uptake rate by preoperative utilization of decongestant. It is also important to comment outcome of surgery.

SATO et al. [3] stated that the percentage of unsuccessful outcomes increased with the grade of tubal dysfunction, indicating that tubal function is closely associated with the outcome of ear surgery. Thus, it was revealed that the preoperative tubal function test including positive pressure test and clearance test are useful for predicting the prognosis of ear surgery.

Anirban Biswas [4] conducted study on 'Eustachian tube function test: a new dimension in management of Chronic suppurative otitis media'. and concluded that impaired tubal function is the major cause of persistent/recurrent otorrhea and important contributing factor for failure of tympanoplasty. The result of tympanoplasty were significantly poor in ears having poor tubal function.

Jong Woo Chung et al. [5] stated that Eustachian tube function measured by a modified pressure equilibration test using an inflation-deflation manometric method was a good indicator of middle ear aeration and was predictive of better postoperative hearing.

El-Guindy et al. [6] stated that success rate of graft taken up in patients with normal tubal function was 95% and success rate in patients with tubal dysfunction present but could be corrected was 90% and success rate in patients with poor tubal function was 68% while, in present study we have success rate of 87% in Group A, 80% in Group B and 70% in Group C. so it is cleared that success rate is definitely higher in patients with normal Eustachian tube function.

Priya et al. [7] in their study stated that there was strong association between eustachian tube function and graft taken up rate with p value of less than 0.01 (i.e. 0.0005). the results are comparable to this study.

Sen et al. [8] in 1998 assessed ETF by using impedance audiometry. Those with normal Eustachian tube function a graft uptake of 80%, 80% graft uptake in partially impaired Eustachian tube function, and 66% graft uptake in totally impaired Eustachian tube function. In our study we had a similar result showing 87% success rate in patients with normal ETF, 80% in partially impaired ETF, and 70% in totally impaired ET.

Conclusion

In preoperative planning in tympanoplasty surgery eustachian tube function assessment is must to increase graft uptake rate by preoperative utilization of decongestant. It is also important to comment outcome of surgery. Including of cortical mastoidectomy with type 1 tympanoplasty has a favourable outcome in terms of graft uptake.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in this study.

References

1. Gimenez F, Algarra M (1993) The prognostic value of mucociliary clearance in predicting success in tympanoplasty. *J Laryngol Otol* 107:895–897
2. Srivastava Abhinav, Mohan Chander, Sengar Arjun (2014) How relevant is eustachian tube function in surgical outcome of tympanoplasty? *J Evol Med Dent Sci* 3(08):1855–1858. <https://doi.org/10.14260/jemds/2014/2069>
3. Sato H, Nakamura H, Honjo I, Hayashi M (1990) Eustachian tube function in tympanoplasty. *Acta Otolaryngol Suppl* 471:9–12
4. Biswas A (1999) Eustachian tube function test: a new dimension in the management of CSOM. *Indian J Otolaryngol Head Neck Surg* 51(2):14–22
5. Choi SH, Han JH, Chung JW (2009) Pre-operative evaluation of eustachian tube function using a modified pressure equilibration test is predictive of good postoperative hearing and middle ear aeration in type 1 tympanoplasty patients. *Clin Exp Otorhinolaryngol* 2(2):61–65
6. El-Guindy A (1993) Manometric and endoscopic study of tubal function in drum perforation. *Am J Otol* 14(6):580–584
7. Priya K, Karthikeyan P, Coumare VN, Sambandan AP (2012) Evaluation of *Eustachian tube* function in chronic suppurative otitis media (tubotympanic type) with reference to its treatment outcome. *Indian J Otol* 18:179–183
8. Sen S, Guha S, Biswas A, Ghosh LM (1998) A comparative study of methods of evaluation of Eustachian tube functions in chronic otitis media. *Indian J Otol* 4:147–149