Original Research Article

A study on association of Eustachian tube function with graft uptake in chronic suppurative otitis media (tubotympanic) patients in tertiary level care hospital

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Abstract

Background: Normal Middle Ear functioning relies on Eustachian tube patency and its proper functioning. Eustachian tube has three functions with respect to middle ear (i) Protection from Nasopharyngeal sound pressure and secretions (ii) Drainage into the Nasopharynx of middle ear secretion (iii)Ventilation to equilibrate the air pressure in the middle ear with atmospheric pressure. The aim of our study is to assess the Eustachian tube patency in chronic suppurative otitis media (Tubotympanic type) and to evaluate the treatment outcome of CSOM (tubotympanic type) in relation to Eustachian tube dysfunction. **Materials and Methods:** In our study 50 patients with CSOM (tubotymnpanic type) were subjected to assess ETF by Impedance audiometry and Dye Instillation test. The patients were grouped into normal ETF and Impaired ETF. Patients with dry ear were planned for myringoplasty and with wet ear were planned for cortical mastoidectomy. The patients were followed up at 1 month and 3 months post operatively and then the results were analyzed. Successful outcome defined as healed graft with good middle ear function. Graft failure or perforation secondary to otitis media during follow up is considered as failure. **Results:** In our study done in 50 patients 44 (88%) had normal ETF, 6 (12%) patients had impaired ETF by impedance audiometry. The Dye Instillation test revealed that 6(12%) patients had obstruction, 5 (10%) patients had hypofunction and 39 (78%) patients had normal ETF **Conclusion:** In our study the correlation between ETF and graft uptake was statistically analysed (p value 0.015) and was found to be highly significant. Hence there is a strong association between ETF and graft uptake. The pre operative test of tubal function is therefore of great interest, especially if such provides a possibility of estimating the chance of achieving a satisfactory result of tympanoplasty

Key Words: Eustachian tube function, Impedance audiometry, Dye Instillation test, mucociliary clearance, myringoplasty, cortical mastoidectomy.

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INTRODUCTION

Normal Middle Ear functioning relies on Eustachian tube patency and its proper functioning. Any dysfunction of the Eustachian tube will lead to negative pressure build in the tympanum, which results in retraction, effusion and such complications. Eustachian tube has three functions with respect to middle ear (i) Protection from Nasopharyngeal sound pressure and secretions (ii) Drainage into the Nasopharynx of middle ear secretion (iii) Ventilation to equilibrate the air pressure in the middle ear with atmospheric pressure. Eustachian tube dysfunction has been considered as one of the factors of

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tympanoplasty failure both primarily due to middle ear pressure dynamics and secondarily via recurrent otitis. Hence, assessment of Eustachian tube function is of prime importance before undertaking any surgical procedure for chronic otitis media.[1] CSOM can present with dry and wet ear (discharging ear). It's an accepted fact that an actively draining central perforation is not a contraindication for ear surgery.[2] Besides mechanical factors like gravity and airpressuregradient clearance of secretion from middle ear is influenced by (i) the mucociliary transport mechanism of Eustachian tube (ii) active tubal opening (iii) surface tension factors. Tubotympanic (mucosal) disease of ear – Chronic Suppurative Otitis Media is mainly due to infection from the oropharynx and nasopahrynx and sources like GERD travels via Eustachian tube into the middle ear. Of the various factors that dictate the successful outcome of middle ear pathologies, Eustachian tube is the most important. Impedance audiometry is an essential tool to assess Eustachian tube function in non-intact Tympanic membrane. Dye instillation test demonstrates the efficiency of mucociliary transport mechanism of Eustachian tube. This study is undertaken to assess the Eustachian tube function in patients with Chronic Suppurative Otitis Media (Mucosal) with reference to its treatment outcome.

MATERIAL AND METHDOS

Study Place: Rajiv Gandhi Government General Hospital, Chennai

Study Centre: Institute of OtoRhinoLaryngology

Study Design: Interventional study Ethical Clearance were obtained.

Inclusion Criteria: CSOM (All tubotympanictype)

Exclusion Criteria

- Congenital anomaly
- Atticoantral disease
- Age <12 years
- Serous Otitis Media

Investigations: Plain X-ray both mastoids**,** Pure tone audiometry**,** Impedanceaudiometry**,** Oto-endoscopy**,** Dye instillation test**,** Diagnostic nasal endoscopy.

Data Collection Method: The study was conducted in Rajiv Gandhi Government General Hospital and Madras Medical College in the Upgraded Institute Of Oto-Rhino-Laryngology. The study group comprised of patients who were diagnosed to have CSOM of tubotympanic type. Detailed history and clinical examination as per the proforma were performed. The patients were subjected to a complete otolaryngological examination to rule out any associated pathologies and foci of sepsis, which could influence the result of tympanoplasty. Each patient was subjected to blood investigation, pus culture and sensitivity, plain X-ray both mastoids. Pure tone audiometry, impedance audiometry and Diagnostic nasal endoscopy.

Assessment of Eustachian Tube Function: In our institute the assessment of Eustachian tube function is done at Institute of Speech and Hearing.

Forced Inflation Test: In CSOM patients with non-intact Tympanic membrane the forced inflation test is done to assess Eustachian tube function. The probe of manometer is fitted to test ear and middle ear pressure is raised to 500dPa. This opens the Eustachian tubeand pressure drops. This passive opening of Eustachian tube is called opening pressure. After the pressure is equilibrated the Eustachian tube closes and this is called as closing pressure. If there is no passive opening of Eustachian tube, then the patient asked to swallow 3-5 times. This will open the Eustachian tube and then the pressure drop occurs. This is active opening of the Eustachian tube. This is considered as a positive test. If the Eustachian tube doesn't open even after swallowing, then it is negative. Positive test suggests normal functioning of Eustachian tube and Negative test suggests grossly impaired Eustachian tube function.

Impedance Audiometry: In our institute, we use resonance R36 M to evaluate Eustachian tube function in perforated drum.

Dyeinstillation Test: The mucociliary mechanism of Eustachian tube assessed by dye test. The patients were then subjected to dye instillation test.0.25mL of Methylene blue dye is instilled into the test ear and the test ear was kept upwards for 5-10 minutes. Then by nasal endoscopy the nasopaharyngeal end of Eustachian tube was visualized after spraying 4% xylocaine. The nasopharyngeal end was watched for appearance of dye. At the end of 5 minutes if dye did not appear, tragal pressure was applied at 30seconds interval and a note was made of number of tragal pressures after which dye appeared.

a. Normal function : dye appears in 5 minutes and upto 6 tragalpressures
b. Hypofunction : dye appears after 7 to 20 tragal pressures
c. Obstruction : dye fails to appear even after 20 tragalpressures

Surgical Procedure: After assessment of Eustachian tube function, patients were taken up formyringoplasty or cortical mastoidectomy depending upon the middle ear status. Antibiotics were given for 1 week along with analgesics, antihistamines and multivitamins. Sutures were removed on the 7th Post-operative day.

Post Operative Follow Up: Patients were reviewed 2 weeks after discharge and 2nd and 3rd review on the 1st

and 3rd month post operatively. Patients were evaluated post-operatively using otoscopy.

Outcomes: On the basis of ear findings in post-operative period patients were divided into two outcomes

1. Successful outcome, defined as healed graft with good middle ear function
2. Graft failure or perforation secondary to Otitis media during follow is considered as failure.

Stastical Analysis and Results: Data entered in Microsoft office excel. Analysis was carried out using SPSS for windows version 16. Relevant results tabulated. Chi-square test was used to analyze the variable. P value <0.05 was considered to be statistically significant.

OBSERVATION AND RESULTS

A total of 50 patients were selected for the purpose of this study. The study group included both adult males and females of different ages, different economic status in urban and rural population.

The Eustachian Tube functions were tested by Tympanometry and Dye Instillationtest. The tympanometric studies revealed that,

- 12% patients had severe impairment of Eustachian tube function,
- 88% patients had normal ETF.

The Dye Instillation test was done to study the mucociliary clearance function of the Eustachian Tube.The Dye Instillation test revealed that,

- 12%patients had obstruction
- 10% patients had hypofunction
- 78% patients had normal function

The pneumatisation of mastoid air cell system was assessed by x ray mastoids.

- 30% patients had poor pneumatisation of mastoid air cells
- 70% patients had well pneumatised air cells.

The middle ear status of the patients were assessed by otoscopy and otoendoscopy. It was found that,

- 24% patients had polypoidal, edematous(moist status) middle ear mucosa.
- 76% patients had healthy (dry status) middle ear mucosa.

In our study patients with healthy (dry status) middle ear were taken up for myringoplasty and patients with polypoidal edematous (moist status) middle ear were taken up for cortical mastoidectomy. In our study out of 50 patients,

- Myringoplasty was done for 38 cases
- Cortical mastoidectomy with tympanoplasty was done for 12 cases.
- Out of the 44 patients with normal ETF, corticalmastoidectomy was done for 10 patients and myringoplasty was done for 34 patients.
- Out of the 6 patients with severe impairment of ETF, corticalmastoidectomy was done for 2 patients and myringoplasty was done for 4 patients.

Follow up was done after 1 month and 3 months post operatively. Patients were evaluated post operatively using otoscopy. On the basis of ear findings patients were divided into two outcome groups,

1. Successful outcome defined as healed graft
2. Graft failure or perforation was considered as failure.

In our study 46 patients (92%) had successful outcome with healed graft and 4 patients(8%) had graft failure with perforation. Out of the 4 patients with failed outcome,2 patients had normal ETF and 2 patients had impaired ETF. In our study the pneumatisation of mastoid air cells correlated significantly with the ETF. In our study on 50 patients with CSOM (tubotymopanic type), the preoperative ETF significantly correlated with the outcome after surgery. Patients with normal ETF showed a good graft uptake when compared with those with impaired ETF.

Table 1: Post operative Graft Uptake Status

Post Operative Graft Status	Frequency	Percent (%)
Graft Accepted	46	92
Graft Rejected	4	8
Total	**50**	**100%**

Table 2: Post operative Graft Uptake in Myringoplasty and Cortical Mastoidectomy

Surgery	Post Op Graft Status		
	Graft Accepted	Graft Rejected	Total
Myringoplasty	35(78.3%)	3(75%)	38(78%)
Cortical Mastoidectomy	11(21.7%)	1(25%)	12(22%)
TOTAL	**46(92%)**	**4(8%)**	**50(100%)**

CHISQUARE-0.023 DF-1 P value-0.88

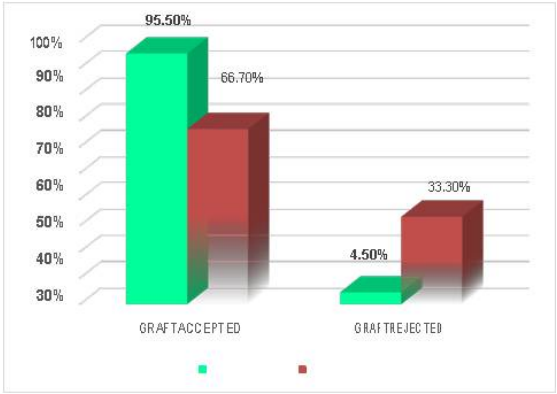

Figure 1: Bar Chart Showing Asociation Between ET Function and Graft Uptake CHISQUARE-5.945 DF-1 Pvalue-0.015(sig)

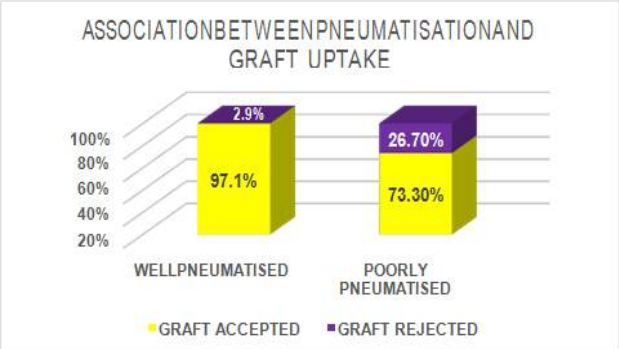

Figure 2: Association between pneumatisation and Graft Uptake
CHISQUARE- 10.15 DF-1 Pvalue-0.001(sig)

Table 3: Post operative Graft uptake in Dry and Wet middle Ear

Middle Ear Status	Post Op Graft Status		
	Graft Accepted	Graft Rejected	Total
Dry	36(94.7%)	2(5.3%)	38(100%)
Wet	10(83.3%)	2(16.7%)	12(100%)
TOTAL	**46(92%)**	**4(8%)**	**50(100%)**

CHISQUARE- 1.611 DF-1 Pvalue-0.204

Table 4: ET Function in Dry and Wet Middle Ear

Middle Ear Status	ET Function		
	ETF NORMAL	ETF POOR	TOTAL
Dry	34(89.5%)	4(10.5%)	38(100%)
Wet	10(83.3%)	2(16.7%)	12(100%)
Total	**44(88%)**	**6(12%)**	**50(100%)**

CHISQUARE- 0.326 DF-1 Pvalue-0.368

DISCUSSION

In this study, the graft uptake in dry ear is 94.7% and in wet ear83.3% which is almost similar to the study conducted by shreyash *et al*, in dry group, complete graft uptake was seen in 90% cases, whereas in wet group, a graft uptake rate of 86.7% was achieved.[3] in this study. Myringoplasty graft uptake is 92% and cortical mastoidectomy graft uptake is 91% which is almost similar to the study conducted by hazem mohammed *et al*[4] in this study, etf is good in dry ear 89.5% and in wet ear 83.3% which is almost similar to masoud nadirpour *et al*[4] in 1963 palva and siedentop *et al* had done quantitative methods for measuring pre op tubal function in csom patients with perforated ear drum. Cohen *et al* in 1979 assessed etf by using impedance audiometry. Those with a normal etf had 95% graft uptake and 69% graft uptake in impaired etf. Sen *et al* in 1998 assessed etf using impedance audiometry. Those with normal etf had 80% graft uptake and 66% graft uptake in impaired etf. Priya *et al* in 2012 assessed etf using impedance audiometry. Those with normal etf had 100% graft uptake and 76% graft uptake in impaired etf. Many authors used single test for assessing etf,but in our study etf is assessed by using impedance audiometry and dye instillation test. Those with normal etf had 95.5% graft uptake and 66.7% graft uptake in impaired etf. In our study there was graft failure in 1 patient with normal etf and well pneumatised mastoids which may be due to defective technique and postop infection. In kurein *et al* in 2009 found no relationship between mastoid pneumatisation and graft uptake. In priya *et al* study there was no relationship between mastoid pneumatisation and graft uptake. In our study there is significant correlation between mastoid pneumatisation and graft uptake. Well pneumatised mastoid have 97.1% graft uptake. In poorly pneumatised mastoid there is 73.3% graft uptake. Many authors used dye instillation test to study etf. The results are: etf obstruction rate was 5.12% in takahasi *et al* study, 32% in sethi *et al* study, 18% in sen *et al* study,23.3% in Roy Chowdhury study, 22.1% in prasad *et al* study, 50% in bhatta *et al* study.in our study using dye instillation test we found 12% with obstructed eustachian tube.

CONCLUSION

A properly functioning eustachian tube is an integral part of a normally functioning middle ear and the existence of good tubotympanicmucociliary drainage contributes for a favorable prognostic factor in the outcome of reconstructive surgery of the middle ear. A functioning Eustachian Tube is an integral part of normal middle ear and is thus an essential requirement for optimum results in tympanoplastic operations.

1. In our study the correlation between ETF and the graft uptake was statistically analyzed(p value 0.015)and was found to be highly significant.Hence there is a strong association between ETF and graft uptake.
2. A pre operative test of tubal function is therefore of great interest,especially if such provides a possibility of estimating the chance of achieving a satisfactory result of tympanoplasty.
3. Impedance audiometry and Dye Instillation test are good important tools for testing ETF pre operatively and correlates well with pneumatisation of mastoid air cells and hence it predicts the operative results
4. Cortical mastoidectomy plays important role in reducing post op failure in CSOM (tubotympanic type) with impaired ETF.
5. Our method of testing ETF is easier than Bluestone 9 step test and it is non invasive than other invasive methods like ET catheterization.
6. Mastoid pneumatisation strongly correlates with ETF and graft uptake.

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