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Review on hearing improvement in tympanoplasty using Cartilage graft

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ABSTRACT

Background: Perforations of tympanic membrane is a commonly encountered problem presented to the otorhinolaryngologist. Surgical repair (tympanoplasty) of the perforated tympanic membrane (TM) is indicated to restore hearing ability as well as to prevent recurrent otorrhea. Owing to its stiffness, cartilage is resistant to resorption and retraction. It is less likely to cause an inflammatory reaction or an infection postoperatively. **Material and methods**: Total 112 cases of tympanoplasty with cartilaginous graft were studied in one year time duration. Patients with Tubotympanic disease were included having perforation but non involvement of middle year ossicles. Preoperative and post operative Air Bone Gap is studied and compared to access the efficacy of cartilaginous graft. **Observation & Result**:- Of 112 cases mean age of patients came out as 28.1 years, of them 93% had unilateral disease. Males constitute 62.5% and female were 37.5%. Success rate of tympanoplasty was 92%. Post operative ABG came out 15dB.**Conclusion**: Tympanoplasty is an effective procedure that can lead to improvement in hearing function of patients and prevention of recurrent ear discharge. As cartilage has better structural and tensile quality as compared to other graft also due to its mesodermal origin, tympanoplasty with cartilage graft show lesser incidence of cholesteatoma.

Keywords: Tympanoplasty, Cartilage, Air Bone Gap, Hearing loss etc

Introduction:

Perforations of tympanic membrane is a commonly encountered problem presented to the otorhinolaryngologist[1]. The most common cause for tympanic membrane perforation is infection followed by trauma, or an extruded pressure equalization tube. These perforations may be acute or chronic perforations. In the USA, however, Te et al[2] reported iatrogenic perforations from ventilation tube therapy to be the main indication for tympanoplasty in their study. Tympanic membrane has very good ability to heal on its own, as a result most of the acute perforations heal spontaneously however around 15-20% will become chronic[3,4].

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The aim of tympanoplasty is to close the tympanic membrane perforation, restore hearing and reconstruct a healthy middle ear cavity. In 1952, split thickness graft was used by Wullstein[5] for repair of the tympanic membrane and published the results. Zollner[6] described his experiences with a similar graft.

Tympanoplasty is a successful procedure in 80–90% of normal middle ears, the prognosis becomes poorer in cases with total dysfunction, adhesive processes, infection, wet/ discharging ear, tympanic fibrosis and defect of the entire tympanic membrane. Surgical repair (tympanoplasty) of the perforated tympanic membrane (TM) is indicated to restore hearing ability as well as to prevent recurrent otorrhea[7]. For reconstruction and restoration of tympanic membrane many autogenous, allogeneic and a few xenogenous graft materials have been used for ear drum perforation closure and reconstruction of the middle ear and ear canal[8].

Different TM reconstruction techniques for tympanoplasty using different types of grafts, including temporalis fascia, perichondrium, palisade cartilage and Cartilage Island, have been described[9,10]. Owing to its stiffness, cartilage is resistant to resorption and retraction. The major advantage of cartilage is its stiffness and bradytrophic metabolism, which make it particularly suitable for difficult conditions, such as subtotal perforations, adhesive otitis and reoperation[11]. Cartilages are harvested from tragus, concha were used. Its' rigidity in comparison to temporalis fascia, manages to prevent resorption, retraction, and re-perforation, despite continuous Eustachian tube dysfunction. It is less likely to cause an inflammatory reaction or an infection postoperatively. Many studies have proven that the middle ear tolerates cartilage very well showing long-lasting survival.

Keeping these quality of cartilage into the consideration we conducted this study with aim of finding the result after cartilage tympanoplasty and to compare the hearing outcome after the procedure.

Material and method:

This prospective study was carried out from November 2021 to November 2022. Total 112 patients of tympanic membrane perforation chronic suppurative otitis media, safe type who after thorough clinical, audiological and radiological assessment were selected and admitted in different ENT hospitals of Cuttack and Balasore Odisha. Necessary permission

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and approval from authority prior to starting study was taken. Informed written consents were obtained from the patients according to the protocol approved by the Ethics committee of our institution and patient confidentiality was maintained. These patients undergoing type 1 tympanoplasty were included.

Inclusion Criteria-

1. Tubotympanic type of disease i.e. Pure conductive hearing loss with Adequate cochlear reserve.
2. Age: 10 years- 60 years
3. Adequate cochlear reserve and Patent Eustachian tube

Exclusion Criteria-

1. COM with impending/overt complications like ossicular discontinuity.
2. COM with severe SNHL.
3. Age < 10 years and > 60 years
4. Those who refused to give consent, not given compliance to treatment and follow-up.

Preoperative assessment of all the patients, detailed history was taken including the history of any past surgical history followed by clinical examination. Thereafter, detailed examination of both ears was done. Preoperative audiological evaluation including: pure-tone audiometry (PTA), tympanometry, speech reception threshold, speech discrimination score, and then calculation of mean air-bone gap (ABG) at 500, 1000, and 2000 Hz for both ears.

Post Operative: Patients were instructed for timely follow-up. Monthly visits started at 1month postoperatively; the patients were examined for any late-onset postoperative complications, graft uptake, healing process, or residual perforation. Follow-up Patients were followed up in ENT OPD for aural cleaning, otoscopy and hearing assessment. Tuning fork tests using 256, 512, 1024 tuning forks were used and pure tone audiometry was done at 2 months and 6 months post-operatively. Ear findings and audiometry reports were recorded. At the end of the study, results were analysed statistically

Results:

We studied following parameters : graft take up, change between pre and post-op pure tone audiogram showing improvement in air– bone–gap. If there is no perforation or

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lateralisation, it is labelled as successful graft uptake. At the end of 06 months we found successful graft uptake in 92%.

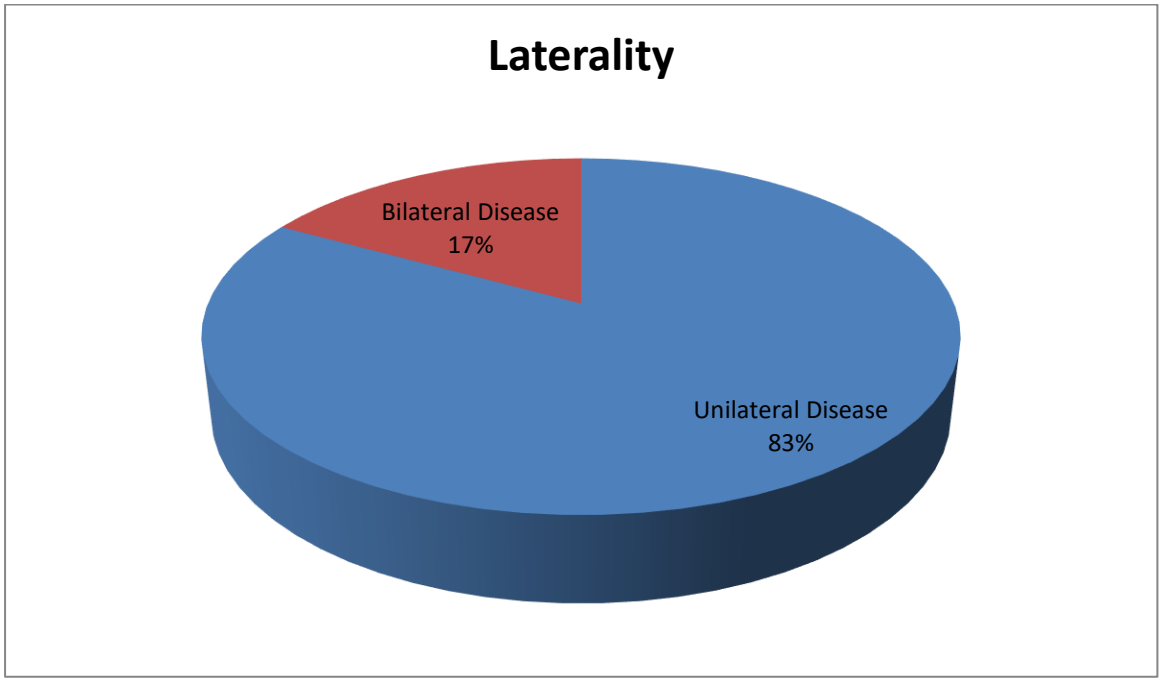
In our study the mean age was 28.1 years (range: 10–60 years) youngest patient included is 10 year of age and oldest one is 58 years of age. Of total 112 tympanoplasty done female were 42 (37.5%) and male were 70 (62.5%).

Table 01: Age wise and sex wise distribution of patients:-

Age group	Male	Female	
10-20	19	11	26.7%
21-30	26	18	39.3%
31-40	14	08	19.6%
41-50	08	04	10.8%
51-60	03	01	3.5%
Total	70	42	100%

Laterality: Out of 112 patients, 93 cases (83%) had unilateral ear disease and 19 cases (17%) had bilateral ear disease.

Graph 01:



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Pre op Hearing Assessment: Out of 112 patients, 78 patients (70%) had mild hearing loss, 30 had moderate (26.5%) and 04 patient (3.5%) had moderately severe hearing loss preoperatively (Table 02).

Table 02:-

Category of hearing loss	Number of Patients	Percentage
Mild Hearing Loss,	78	70%
Moderate Hearing Loss	30	26.5%
Moderately Severe Hearing Loss	04	3.5%
Total	112	100%

Post op Hearing Assessment: Out of 112 patients, 66 patients (59%) had hearing within normal limits, 29 patients (25%) had mild hearing loss and 14 patients (12.5%) had moderate hearing loss and 03 patients (2.5%) had moderately severe hearing loss postoperatively (Table03).

Table 03: Post operative hearing outcome:-

Category of hearing loss	Number of Patients	Percentage
Normal Hearing	66	60
Mild Hearing Loss	29	25
Moderate Hearing Loss	14	12.5
Moderate To Severe Hearing Loss	03	2.5
	112	100

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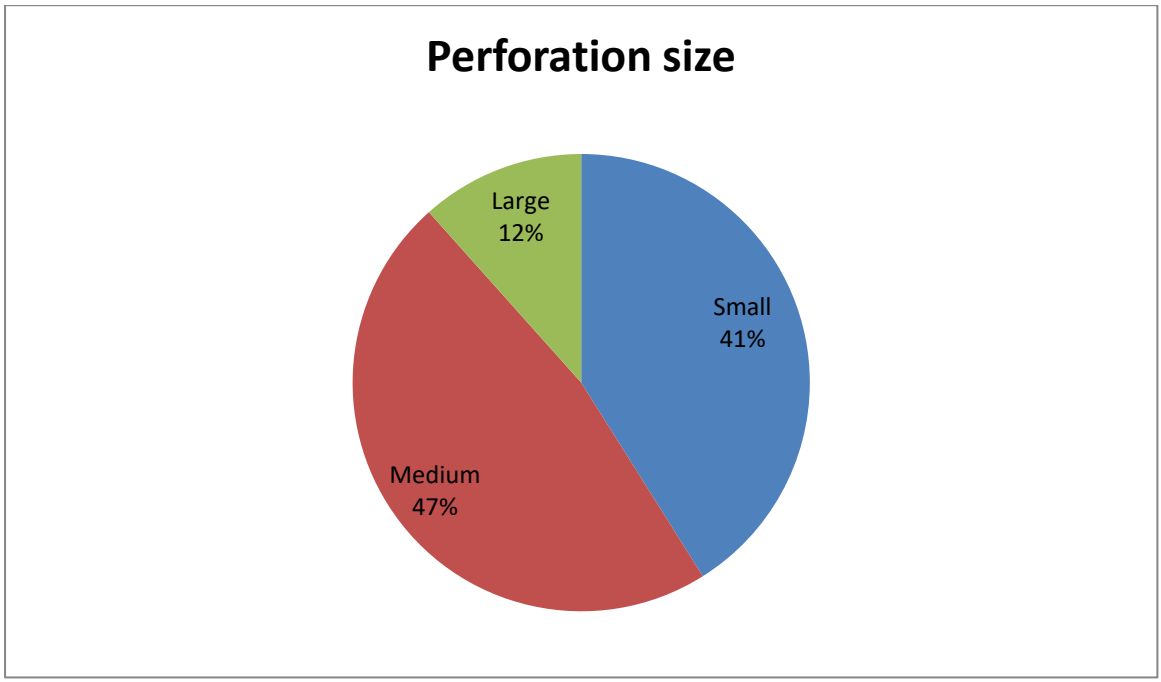
TM perforations were small (<1/3 perforation) in 46 cases (41.0%) medium size in 53 cases (47%) and large ie subtotal or total in 13 cases (11.5%)- Graph 02. There were central perforations in 93 (83%) ears and attic perforation with retraction pockets in 19 (17%) ears.

Graph 02- Distribution of perforation size in tympanic membrane:



The Pre-Operative average air conduction threshold is 47.79 dB and the Postoperative 60th Day average air conduction is 25.71 dB. The difference between the two means is found to be statistically significant.

In our study, the mean preoperative ABG was 33.6±8 dB and the mean postoperative ABG was 14.8±8 dB which has shown a highly significant gain in decreasing ABG postsurgical intervention

Table 04: Subjective improvements in hearing at the end of 06 months

Result	Number of patients	%
Absent	11	9.8%
Present	101	90.2%
Total	112	100%

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Discussion:

The present study was designated to evaluate hearing improvement while using cartilage with as graft material in type 1 tympanoplasty. The hearing improvement in our study was assessed by air bone gap i.e. AB gap pre and post operatively. This was calculated for each patient individually at 2 and 6 months post operatively. In our study postoperative ABG came out to be around 15 dB, similar results were found in study by Bhanu et al[12].

In our study success of cartilage graft in tympanoplasty came out to be 92%. Yung et al[13] has conducted a study in 18 patients, of which cartilage uptake was 80%, Cabra et al[14] has reported cartilage palisade technique and reported a higher morphological success in cartilage (82.3%). Ulka et al[15] has reported 91.3% success rate of graft uptake in cartilage versus fascia 88.2% and hearing gain of 12.3% in cartilage graft. In Turkey, Kazikdas et al[9] compared the use of palisade cartilage with the temporalis fascia tympanoplasty technique for the management of subtotal perforations and reported a better outcome with the palisade cartilage group. Sergi et al[11] reported that tympanoplasty resulted in a 57–97% improvement in patients' hearing function and that myringoplasty can improve hearing independent of the site and size of perforation, and thus concluded that hearing improvement can be used as an indication for myrinoplasty.

Mishra et al[16] reported hearing gain of 10–30 dB in 95% of their cases. Faramarzi et al[17] reported that approximately 24% patients that had ABG within 25 dB before intervention; increasing to 71% post-operatively.

The average air conduction was 23.77 dB (SEM = 2.36) and the average air bone gap was 15.86 dB (SEM = 1.50) when compared with the preoperative average air conduction (which is 47.80 dB) and average air bone gap (which is 30.11 dB). The difference between the two means was found to be statistically significant.

In our study patients had a gain in hearing function of around 89% which is within the range of findings from other published study Olusesi et al and Ogisi et al. in Nigeria reported 88.2% and 77.0% gain respectively in hearing function in type I tympanoplasty.

Conclusion:-

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Tympanoplasty is an effective procedure that can lead to improvement in hearing function of patients and prevention of recurrent ear discharge. Optimal results can be achieved by the use of the appropriate surgical technique. As cartilage has better structural and tensile quality as compared to other graft also due to its mesodermal origin, tympanoplasty with cartilage graft show lesser incidence of cholesteatoma.

References:-

1. Lim DJ. Recent advances in otitis media. Report of the Eighth Research Conference. Ann Otol Rhinol Laryngol 2005; 114:1.
2. Te GO, Rizer FM, Schuring AG. Pediatric tympanoplasty of iatrogenic perforations from ventilation tube therapy. Am J Otol 1998; 19(3): 301–5
3. Acuin J. Chronic suppurative otitis media. Clin Evid 2004; 12:710.
4. Yates PD. Otitis media. In: Lalwani AK, editor. Current diagnosis and treatment in otolaryngology − head and neck surgery. 1st ed. McGraw Hill Companies; 2005. pp. 655–665.
5. Wullstein HL (1952) Funktionelle operationen im mettelohr mit Hilfe des Freien Spaltlappentransplantates. Arch Otorhinolaryngol 161:422–435
6. Zoellner F (1955) The principles of plastic surgery of the sound conducting apparatus. J Laryngol Otol 69:657–659.
7. Neumann A, Kevenhoerster K, Gostian AO. Long-term results of palisade cartilage tympanoplasty. Otol Neurotol 2010;31(6):936-939.
8. Heerman H (1960) Tympanic membrane plastic with temporalis fascia. Hals Naser Ohren 9:136–139
9. Kazikdas KC, Onal K, Boyraz I, Karabulut E. Palisade cartilage tympanoplasty for management of subtotal perforations: a comparison with the temporalis fascia technique. Eur Arch Otorhinolaryngol 2007; 264(9):985–9.
10. Demirpehlivan IA, Onal K, Arslanoglu S, Songu M, Ciger E, Can N. Comparison of different tympanic membrane reconstruction techniques in type I tympanoplasty. Eur Arch Otorhinolaryngol 2011; 268(3):471–4
11. Sergi B, Galli J, De Corso E, Parrilla C, Paludetti G. Overlay versus underlay myringoplasty: report of outcomes considering closure of perforation and hearing function Acta Otorhinolaryngol Ital 2011; 31(6):366–71.

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12. Bhanu Bhardwaj, Jaskaran Singh. Comparative Study of Hearing Improvement of Type 1 Tympanoplasty Using Temporalis Fascia and Conchal Cartilage as Graft Material. Indian J Otolaryngol Head Neck Surg (November 2019) 71(Suppl 2):S1174–S1178;
13. Yung M, Vivekanandan S, Smith P (2011) Randomised study comparing fascia and cartilage grafts in myringoplasty. Ann Otol Rhinol Laryngol 120:535–541
14. Cabra J, Monoux A (2010) Efficacy of cartilage palisade tympanoplasty: randomised controlled trial. Otol Neurotol 31:589–595.
15. Ulka CH (2010) Cartilage tympanoplasty with island technique for reconstruction of tympanic membrane perforation; anatomic and audiologic results. Kulak Burun Bogaz Ihtis Derg 20:7–12
16. Mishra P, Sonkhya N, Mathur N. Prospective study of 100 cases of underlay tympanoplasty with superiorly based circumferential flap for subtotal perforations. Indian J Otolaryngol Head Neck Surg 2007; 59(3):225–8.
17. Faramarzi A, Hashemi SB, Rajaee A. Mucosal pocket" myringoplasty: a modification of underlay technique for anterior or subtotal perforations. Am J Otolaryngol 2012; 33(6):708–13.
18. Ogisi FO, Adobamen P. Type 1 Tympanoplasty in Benin: a 10- year review. Niger Postgrad Med J 2004; 11(2):84–7.