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Original Research Article

Audiometric evaluation of type 1 tympanoplasty for hearing results

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ABSTRACT

Background: To evaluate the graft uptake rate of the type1 tympanoplasty performed by underlay technique using autologous temporalis fascia graft for the last two years and to assess the hearing improvement in the successfully operated cases with respect to age, sex, size and location of perforation.
Methods: This prospective Study included 50 patients, who underwent type1tympanoplasty.All operations are performed using an underlay technique and by postural approach. In all the cases, temporalis fascia is used for the reconstruction of TM. The data of all the patients regarding preoperative disease, perforation size and location, surgical approach, graft material, pre and postoperative clinical and functional (hearing evaluation by pure-tone audiogram) results are analyzed.
Results: Successful closure rate of the TM perforation is 88% and the graft failure rate is 12%. In this study, lowest and highest age of patients at presentation is 13 and 55 years respectively with a mean age of 26.6 years. Most common approaches is post aural. The mean pre and post-operative air conduction threshold in the successful cases are 33.34 dB and 20.20 dB respectively with a mean audiological improvement of around 13 dB. The improvement in the hearing is achieved in only 88% (44 out of 50) among the successful operated type 1 tympanoplasty.
Conclusions: Type 1 tympanoplasty is a safe and effective technique to improve the quality of life of patients. The most common approach is postural. The graft uptake rate is better at three months. The improvement in hearing is noted irrespective of age, sex, size and location of perforation.

Keywords: Type 1 tympanoplasty, Graft uptake rate, PTA, Hearing improvement

INTRODUCTION

In all developing countries the incidence of chronic suppurative otitis media (CSOM) is very high because of poor socioeconomic standard, overcrowding, poor nutrition and lack of health education.[1] Among the two types of chronic suppurative otitis media, tubotympanic disease is characterized by a central perforation of the pars tensa of varying size and shape.

The patients usually present with aural discharge with or without hearing loss. Aural discharge is always mucoid or mucopurulent and varies with upper respiratory tract infection. Discharge is usually intermittent recurring whenever there is an upper respiratory tract infections or water enters in to the ear.[2]

Hearing loss in tubotympanic disease is usually conductive in nature but a few case of sensorineural hearing loss is also found.[3] Hearing loss with intact ossicular chain is approximately 10-30 dB.[4,5] But more when ossicular chain is disrupted.

Type 1 tympanoplasty is the operation which involves eradication of disease from middle ear and visualisation

of ossicular cleft and repair or reconstruction of the tympanic membrane without repair of ossicles.

This study aims to evaluate the surgical and audiological outcome of type 1 tympanoplasty done in the cases of chronic otitis media, mucosal, inactive type, by underlay technique with temporalis fascia graft.

METHODS

This prospective study is carried out in the department of ENT and Head- Neck surgery of MRMC Gulbarga, from November 2013 to November 2015. In this prospective study, 50 patients are considered who underwent type 1 tympanoplasty using underlay technique with temporalis fascia graft. After taking relevant history, clinical examination and investigation, the diagnosis is made and considered for the operation. Hearing assessment done using tuning fork tests and pure tone audiometry. Size of perforation is considered small if it involves one quadrant, medium if it involves two quadrants and large if more than two quadrants. Written consent taken, the operations done by senior residents or consultants either under general or local anaesthesia.

Inclusion criteria

CSOM- Tubotympanic type with dry central perforation for at least 3 months, patients with conductive hearing loss, age 12 years and above, both males and females, hearing loss of less than 35 dB, patients with intact ossicular chain.

Exclusion criteria

All ASOM, otosclerosis, tympanosclerosis, adhesive otitis media, congenital hearing disorder, CSOM with mixed or sensory neural hearing loss (SNHL), hearing loss due to serous otitis media, chronic otitis externa, systemic diseases- diabetes mellitus, tuberculosis, bleeding disorders, clotting disorders, hypertension, ischaemic heart disease, cholesteatoma, intracranial and intratemporal complications of CSOM.

The patients are post operatively followed up at interval of one month and then at period of three months. Result of surgery is regarded as successful if ear is dry and the tympanic membrane intact and mobile at the end of three months follow up. Pure tones audiograms are performed at one and three months and hearing gain of 10 dB and more at the end of three months is considered as improvement in hearing.

Statistics

All the data tabulated and processed using computer software Microsoft office excel 2007 spread sheet. Statistical analysis is performed with the SPSS software, version 16.0 (Statistical Package for the social sciences, SPSS Inc, Chicago, Illinois, USA). Comparisons within each group between pre and postoperative results are made with paired t tests. Anova is used to analyse the difference in hearing improvement between gender, size and site of perforation.

RESULTS

Table 1 show that overall graft uptake rate is 44 out of 50. Graft failure.

Table 2 show that 6 patients, 4 of which are noted in the group of 12-23 years age. Most of the perforations were in inferior part of the pars tensa.

On comparing the preoperative hearing and postoperative hearing results via air bone gap closure, the results obtained at 1 month and 3 month follow up are statistically highly significant ($p < 0.001$).

Table 3 show best result of hearing gain (in speech frequency) has been found in group A followed by group B and C, but the results are not statistically significant ($p > 0.05$).

Table 4 no statistical significance is noted in hearing results in different size of perforation ($p > 0.05$).

Table 5 showing slightly higher hearing improvement in inferio quadrant perforation compared to anterior and posterior.

Table 1: Graft uptake rate.

Tympanic Membrane	No of ear (3 month)	Male	Female	12-23 years	24-34 years	35-45 years	46 & above	Anterior	Posterior	inferior	Mixed locations	Small	Medium	Large
Graft uptake	44	17	27	18	13	11	2	9	11	16	8	36	6	2
Graft failure	06	03	03	4	1	1	0	2	0	0	4	2	2	2
Total	50	20	30	22	14	12	2	11	11	16	12	38	8	4

Table 2: Audiological profile of patient's pre and postop.

Mean HL dB speech freq.	Pre-op mean±SD(dB)	Post-op (1 month) mean±SD(dB)	Paired t test and P value	Post-op (3month) mean±SD(dB)	Paired 't' test and p value
A.C.	33.34±1.977	31.02±2.989	t=1.34 P>0.05	20.20±5.79	t=11.39 P<0.001
B.C.	6.9±2.45	7.1±2.493	t=0.46 P>0.05	7.1±2.49	t=0.0 P>0.05
A-B gap	26.43±2.85	23.92±3.621	t=3.86 P>0.05	13.106±5.75	t=10.84 P<0.001
AC gain		2.314±2.433		13.022±6.207	t=11.39 P<0.001
BC gain		0.2±1.42		0.2±1.429	t=0.0 P>0.05
A-B gap Closure		2.51±2.70		13.022±6.39	t=10.84 P<0.001

Table 3: Showing hearing results vs. age group.

Age group (years)	No. of patient	Gain in AC (dB)	Gain in BC (dB)	A-B gap closure (dB)
12-23 (A)	18	14.46±4.48	0.2±2.1	14.46±3.2
24-34 (B)	13	14.64±5.23	0.2±1.429	14.64±2.1
35-45 (C)	11	12.58±5.03	0.2±1.23	12.58±1.4
46 & above (D)	2	12.1±2.35	0.2±1.16	12.13±1.23
Anova	44	F=2.64	F=0.142	F=2.64
P value		P>0.05	P>0.05	P>0.05

Table 4: Showing hearing results vs. size of perforation.

Size	No. of patients	Gain in AC (dB)	Gain in BC (dB)	A-B gap closure (dB)
Small	36	14.01±4.7	0.2±1.429	14.01±4.7
Medium	6	13.6±6.1	0.2±1.429	13.6±6.1
Large	2	12.5±3.5	0.2±1.429	12.5±3.5
Anova	44	F=2.15	F=0	F=2.151
P value		P>0.05	P>0.05	P>0.05

Table 5: Showing hearing results vs. location of perforation.

Location	No. of patients	Gain in AC (dB)	Gain in BC (dB)	A-Bgap closure (dB)
Anterior	9	11.3±5.11	0.2±1.42	11.3±5.11
Posterior	11	15.89±4.22	0.2±1.42	15.89±4.27
Inferior	16	14.44±4.197	0.2±1.42	14.44±4.199
Mixed locations	8	13.325±5.35	0.2±1.42	13.325±5.32
Anova	44	F=3.12	F=0	F=3.12
P value		P>0.05	P>0.05	P>0.05

DISCUSSION

In this prospective study, 50 (20 males and 30 females) patients are considered. All underwent type 1 tympanoplasty by underlay technique with temporalis fascia graft and were followed up for at least three months postoperatively.

In the study we observed the graft take rate of 88% which was satisfactory comparing to studies done by other authors.[12,13]

While four cases of failure which were in adolescent age can be attributed to high incidence of upper airway infections, poor eustachian tube function and the relative immaturity of the immune system.

Six cases of surgical failure in adult patients with anterior perforations (2 anterior +4 anterior quadrant involvement in mixed locations) in comparison to posterior perforations in this study may have been due to the more limited vascularization of the anterior part of the ear

drum, limited access to this perforation as well as difficulty in graft placement.

The mean pre and post-operative air conduction threshold in the successful cases are 33.34 db and 20.20 db respectively with a mean audiological improvement of around 13 db. Improvement of mean air-bone gap is 13db. Hamans et al found a median hearing gain of 10 db. While Lee et al and Palva and Ramsay stated mean hearing improvement of 8 db in their series, this improvement is similar to our study.

The best mean hearing gain was 14.64 db in age group of 24-34 years, while lesser gains are noted in 38-50 years of age. Indicating that age can be considered as a prognostic factor for attributing the results of type 1 tympanoplasty.

In this study we did not find much difference in pre and post op hearing gain between male and female gender, as well; between size and location of perforation showing that type1tympanoplasty is an operation that can improve hearing in many cases independently of gender and the size and site of the perforation. Patients who undergo type 1 tympanoplasty should be advised whilst been consented that there is a good chance of hearing improvement.

CONCLUSIONS

Type 1 tympanoplasty is a safe and effective technique to achieve intact tympanic membrane and improve hearing in patients of chronic otitis media tubotympanic type.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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