

Original Research Article

A study to assess hearing improvement after fat graft myringoplasty

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ABSTRACT

Background: Tympanic membrane perforations result mainly from infectious and traumatic etiologies. Postoperative outcomes of reconstructive surgeries of hearing mechanism have routinely been assessed by take up rates and air bone gap closure on pure tone testing. The present study was conducted to assess hearing improvement after fat graft myringoplasty.

Methods: The present prospective study was conducted from 1st January 2017 to 30th June 2018. The study population consists of patients of age 18 to 60 years. The subjects with safe or tubotympanic type of chronic suppurative otitis media with small dry central perforation or perforation of the pars tensa less than 3 mm were included in the study. Pure tone audiometry (PTA) was consigned to an audiologist who was blind to the study. Air conduction threshold level was measured at frequencies 0.25 to 8 kHz and bone conduction threshold level was measured at frequencies 0.5 to 4 kHz; average air bone gap of each patient was calculated preoperatively and postoperatively at one and three months at the frequencies 500 Hz, 1000 Hz and 2000 Hz.

Results: Among 30 patients, 15 (50.00%) had pre-operative bone conduction threshold in the range of 0-10 dB HL and rest 15 (50.00%) had between 11-20 dB HL. Majority of them i.e. 20 had post-operative air bone gap in the range of 0-10 dB HL whereas 02 had pre op air bone gap in this range, followed by 07 with air bone gap in the range of 11-20 dB HL as compared to 18 in the pre op and 03 in the range of 21-30 dB HL as compared to 10 in the pre op. Paired t test reveals results are significant.

Conclusions: Postoperative audiometry at the end of 1 month revealed majority i.e. 14 had air bone gap in range of 0-10 dB HL thus showing improvement in hearing. Postoperative audiometry at the end of 3 months revealed maximum number of patients i.e. 20 in the range of 0-10 dB HL which showed further improvement in hearing in the form of decrease in air bone gap.

Keywords: Audiometry, Conduction, Hearing

INTRODUCTION

Perforation of the tympanic membrane is one of the most common clinical presentation in ENT patients. Tympanic membrane perforations result mainly from infectious and traumatic etiologies. Acute otitis media secondary to group A beta-hemolytic streptococcus is associated with high incidence of tympanic membrane perforations and mastoiditis.¹ Blow to the ear, usually a slap results in sudden increase of air pressure that ruptures the tympanic membrane.²⁻⁴ The tympanic membrane has been known

to have an excellent inherent ability to heal spontaneously by itself.^{5,6} In chronic perforations it is found that the stratified squamous epithelium of the outer surface has grown over the edge and meets the mucosal epithelium of the middle ear.⁷⁻⁹ Presently the most commonly used grafting material for repair of tympanic membrane perforations is autologous temporal fascia. It is known that graft material should be immunologically and histologically as close as possible to the host tissue.¹⁰ In a perforation, the use of autologous connective tissue which resembles closely to lamina propria has been

promoted.¹¹ These grafts act as a scaffold upon which tympanic membrane could regenerate.¹²⁻¹⁴ Postoperative outcomes of reconstructive surgeries of hearing mechanism have routinely been assessed by take up rates and air bone gap closure on pure tone testing. Practically more useful speech discrimination scores have been utilized.¹⁵ The present study was conducted to assess hearing improvement after fat graft myringoplasty.

METHODS

The present prospective study was conducted for a period of 18 months i.e. from 1st January 2017 to 30th June 2018. The study was conducted in ENT department of GGS Medical College and Hospital, Faridkot. The study population consists of patients of age 18 to 60 years. The subjects with safe or tubotympanic type of chronic suppurative otitis media with small dry central perforation or Perforation of the pars tensa less than 3 mm were included in the study. Subjects with patients with chronic suppurative otitis media atticofacial disease or with retraction pocket, tubotympanic disease in active stage, focus of infection in nose, ear or throat, marginal localization i.e. involving the annulus or exposing the malleus handle or patients not fit for surgery (old age, bleeding disorders, other co morbidities were not included in the study. The study was approved by the institutional ethical board and a written consent was obtained from them in their vernacular language. Pure tone audiometry (PTA) was consigned to an audiologist who was blind to the study. Air conduction threshold level was measured at frequencies 0.25 to 8 kHz and bone conduction threshold level was measured at frequencies 0.5 to 4 kHz; average air bone gap of each patient was calculated preoperatively and postoperatively at one and three months at the frequencies 500 Hz, 1000 Hz and 2000 Hz. The purpose was also to ascertain the cochlear reserve of the patient. All patients enrolled for the study underwent a series of investigations pre-operatively, with complete blood haemogram, bleeding time and clotting time, renal function tests, blood sugar levels, viral markers and pure tone audiometry. Standard technique was used for operating the patients. Hearing assessment post operatively on pure tone audiometry in terms of the air-bone gap. All the data thus obtained was arranged in a tabulated form and analyzed using SPSS software.

RESULTS

Table 1 illustrates the site of tympanic membrane perforation. According to our observation, from total of 30 patients, 16 (53.33%) had postero-inferior and 12 (40.00%) had antero-inferior quadrant perforation, whereas antero-superior quadrant perforation were seen in 02 (06.67%) patients. Chi square test reveals p value <0.001 which is highly significant. Table 2 shows the size of tympanic membrane perforation. Most of the patients i.e. 23 (76.67%) had size of TM perforation in the range of 2-3 mm, followed by 07 (23.33%) in the

range of 1-2 mm. Chi-square test reveals that there is a statistically significance difference between the size of perforation among participants in the study. Among 30 patients, majority of them i.e. 23 (76.67%) had pre-operative air conduction threshold in the range of 31-40 dB HL and rest 07 (23.33%) had between 21-30 dB HL. There were 60% subjects with postoperative 1 month threshold between 11-20 dB HL and 73.34% with postoperative 3 month threshold between 11-20 dB HL (Table 3).

Table 1: Distribution of patients on the basis of site of tympanic membrane perforation.

Site	No. of patients	Percentage
Postero-inferior	16	53.33
Antero-inferior	12	40.00
Antero-superior	02	06.67
Total	30	100.00

Table 2: Distribution of patients on the basis of size of tympanic membrane perforation.

Size (in mm)	No. of patients	Percentage
1-2	07	23.33
2-3	19	63.34
3-4	04	13.33
4-5	00	00.00
Total	30	100.00

Table 3: Preoperative and post-operative audiometric air conduction threshold.

Air conduction (dB HL)	Preoperative	Post-operative after 1 month	Post-operative after 3 months
0-10	00	00 (00.00%)	00 (00.00%)
11-20	00	00 (00.00%)	01 (03.34)
21-30	07 (23.33%)	21 (70.00%)	24 (80.00%)
31-40	23 (76.67%)	09 (30.00%)	05 (16.66%)
41-50	00	00 (00.00%)	00 (00.00%)
>50	00	00 (00.00%)	00 (00.00%)
Total	30 (100%)	30 (100%)	30 (100%)

Among 30 patients, 15 (50.00%) had pre-operative bone conduction threshold in the range of 0-10 dB HL and rest 15 (50.00%) had between 11-20 dB HL. There were 60% subjects at 1 months and 73.4% subjects at 3 months with postoperative bone conduction threshold at 11-20 dB HL. Table 5 shows that among 30 patients, majority of them i.e. 14 had post-operative air bone gap in the range of 0-

10 dB HL as compared to pre op where only 02 patients had in this range, followed by 11 with air bone gap in the range of 11-20 dB HL as compared to 18 in pre op and 05 in the range of 21-30 dB HL as compared to 10 in the pre op. Paired t test reveals results are significant. Table 6 shows that after 3 months among 30 patients, majority of them i.e. 20 had post-operative air bone gap in the range of 0-10 dB HL whereas 02 had pre op air bone gap in this range, followed by 07 with air bone gap in the range of 11-20 dB HL as compared to 18 in the pre op and 03 in the range of 21-30 dB HL as compared to 10 in the pre op. Paired t test reveals results are significant.

Table 4: Preoperative and post-operative audiometric bone conduction threshold.

Bone conduction (dB HL)	Pre-operative	Post-operative 1 month	Post-operative 3 month
0-10	15(50%)	12 (40.00%)	08 (26.66%)
11-20	15(50%)	18 (60.00%)	22 (73.34%)
21-30	00	00 (00.00%)	00 (00.00%)
31-40	00	00 (00.00%)	00 (00.00%)
41-50	00	00 (00.00%)	00 (00.00%)
>50	00	00 (00.00%)	00 (00.00%)
Total	30 (100%)	30 (100%)	30 (100%)

Table 5: Post-operative air bone conduction gap at 1 month.

AB gap (dB HL)	0-10	11-20	21-30	31-40	41-50	>50
Pre op AB gap (dB HL)	02	18	10	00	00	00
Post op AB gap (dB HL)	14	11	05	00	00	00

Table 6: Post-operative air bone conduction gap at 3 month.

AB gap (dB HL)	0-10	11-20	21-30	31-40	41-50	>50
Pre op AB gap (dB HL)	02	18	10	00	00	00
Post op AB gap (dB HL)	20	07	03	00	00	00

DISCUSSION

Fat graft myringoplasty is a simple, safe and cost-effective procedure. The principal aim of fat graft myringoplasty is the complete closure of the small tympanic membrane perforation. It causes minimal pain

and trauma to the healthy ear drum due to the absence of skin incisions, dissections of meatal flaps and fewer complications with maximum improvement of the air bone gap after the procedure. There is a need to do further research on use of fat as a graft in closure of small central perforation and review of the past research is also essential to develop conceptual model for the same. In our study that out of 30 patients, 16 (53.33%) had postero-inferior and 12 (40.00%) had antero-inferior quadrant perforation, 02 (06.67%) in antero-superior quadrant perforation. Results were in concordant with the study conducted by Saliba et al, on fat graft myringoplasty: a minimally invasive technique and found that among 265 cases with tympanic membrane perforation 90 had postero-inferior quadrant perforation and 72 had antero-inferior quadrant involved.¹⁶ In our study most of the patients i.e. 23 (76.67%) had size of TM perforation in the range of 2-3 mm, followed by 07 (23.33%) in the range of 1-2 mm. There is a general consensus in literature, that smaller the size of the perforation, better suited it is for fat graft myringoplasty with higher closure rates. A small sized perforation is taken as one that is less than 30% of the total surface area of the pars tensa. Thus perforations less than 3 mm diameter are chosen for this study. Studies by Sarker et al in 2011, Bertoli et al in 2007, Khan et al in 2012, Konstantidinis et al in 2009 and 2013, Park et al in Korea in 2001, Kaddour et al in 1992 agree with this generalization.¹⁷⁻²⁴ Similar results were seen in a study conducted by Hegazy et al. He found that the air bone gap of 60 patients was ranging between 10 and 20 dB HL pre-operatively. Majority i.e. 58 (96.66%) patients had AB gap lying between 15-20 dB HL, and only 2 (3.33%) had below 15 dB HL.²⁵ Post-operative air bone gap was found to be in the range of 0-10 dB HL in 20 (66.67%) patients and in the range of 11-20 dB HL in 07 (23.33%) patients. However, 03 (10.00%) of them had the AB gap in the range of 21-30 dB HL. The mean postoperative AB gap after 3 months was found to be 10.19. Similar results were seen in a study conducted by Hegazy et al on 60 patients and found that the air/bone gap of the entire patient group was ranging between 0-10 dB HL. 50 (83.33%) patients had AB gap lying between 1-5 dB HL and 5 (8.33%) between 6-10 dB HL.²⁵ The mean postoperative air bone gap after 3 months was 7.87 dB HL lesser than the mean pre-operative value. Study conducted by Ozgursoy et al and reported a successful closure rate of 82.4% of their perforations, Hegazy et al reported closure of 60 out of 68 perforations (88.2%), Udaipurwala et al reported closure of 20 out of 21 perforations (95.2%), Mitchell et al reported closure of 51 out of 56 ears (91%) of 28 children who had undergone bilateral fat graft myringoplasty, Mitchell et al reported closure in 340 out of a total of 370 ears in children, Chalishazar reported closure in 18 out of 20 ears (90%), Sinha et al reported closure in 23 out of 24 ears (95.8%), Kim et al reported closure in 40 out of 46 ears (87%), Bertoli et al reported closure in 59 out of 73 ears (80.8%), Landsberg et al reported closure in 31 out of 38 ears (81.6%).²⁶⁻³¹

CONCLUSION

In conclusion fat graft myringoplasty with its ease of technique and good graft uptake rate justifies its use in the closure of small dry central tympanic membrane perforations. Postoperative audiometry at the end of 1 month revealed majority i.e. 14 had air bone gap in range of 0-10 dB HL thus showing improvement in hearing. Postoperative audiometry at the end of 3 months revealed maximum number of patients i.e. 20 in the range of 0-10 dB HL which showed further improvement in hearing in the form of decrease in air bone gap.

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REFERENCES

- Segal N, Givon N, Leibovitz E, Yagupsky P, Leiberman A, Dagan R. Acute otitis media caused by streptococcus pyogenes in children. Clin Infect Dis. 2005;41(1):35-41.
- Isak JM, Van EM, Kryzer TC, Cummings RJ. Middle ear injury through the external auditory canal: A review of 44 cases. Ear Nose Throat J. 2006;85(11):722-8.
- Offiah C, Heran M, Graeb D. Lightning strike: a rare cause of bilateral ossicular disruption. Am J Neuroradiol. 2007;28(5):974-5.
- Zoltan TB, Taylor KS, Achar SA. Health issues for surfers. Am Fam Phys. 2005;71(12):2313-7.
- Olsen EG, Stenfors LE. The behaviour of tympanic membrane perforation in tissue culture: a scanning electron microscopic study. J Laryngol Otol. 1993;107:1106-9.
- Goodhill V. Deliberate spontaneous tympanoplasty: roles of annular induction and basement membranes. Ann Otolrhinolaryngol. 1966;75:866-80.
- Yamashita T. Histology of the tympanic perforation and the replacement membrane. Acta Otolaryngol. 1985;100:66-71.
- Bluestone CD. Epidemiology and pathogenesis of chronic suppurative otitis media: implications for prevention and treatment. Int J Pediatr Otorhinolaryngol. 1998;42:207-23.
- Kristen S. Spontaneous healing of traumatic tympanic membrane perforation in man: a century of experience. J laryngol Otol. 1992;106:1037-50.
- Paparella MM, Meyerhoff WL, Morris MS, Da Costa SS. Embryology of the ear. In: Anson BJ, Davies J, Duckert LG eds. Paparella, Otorhinolaryngology. 5th ed. USA: W.B. Saunders Company; 1980:3-25.
- Hicks GW, Wright JW. A review of 925 cases of tympanoplasty using formaldehyde formed fascia grafts. Laryngoscope. 1988;98:150-3.
- Klein JO. Otitis Media. Clin Infect Dis. 1994;41(5):823-33.
- Edelstein DR. Cholesteatoma in the pediatric age group. Ann Otol Rhinol Laryngol. 1988;97(1):23-9.
- Eviatar A. Tragal perichondrium and cartilage in constructive ear surgery. Laryngoscope. 1978;88(11):1-23.
- Committee on hearing and equilibrium. Guidelines for the evaluation of result of treatment of conductive hearing loss. Otolaryngol head neck surg. 1995;113:186-7.
- Saliba I. Hyaluronic acid fat graft myringoplasty: how we do it. Clin Otolaryngol. 2008;33:610-4.
- Dursun E, Dogru S, Gungor A, Cinick H, Poyrazoglu E, Ozdemir T. Comparisons of paper-patch, fat and perichondrium myringoplasty in repair of small tympanic membrane perforations. Head Neck Surg. 2008;138:353-6.
- Saliba I, Froehlich P. Hyaluronic acid fat graft myringoplasty: an office-based technique adapted to children. Arch Otolaryngol Head Neck Surg. 2011;137(12):1203-9.
- Gross CW, Bassila M, Lazar RH, Long TE, Stagner S. Adipose plug myringoplasty: an alternative to formal myringoplasty techniques in children. Otolaryngol Head Neck Surg. 1989;101(6):617-20.
- Lee SH, Jin SM, Lee KC, Kim MG. Paper-patch myringoplasty with CO₂ laser for chronic TM perforation. Eur Arch Oto-Rhino-Laryngol. 2008;265(10):1161-4.
- Singh BJ, Sengupta A, Das SK, Ghosh D, Basak B. A comparative study of different graft materials used in myringoplasty. Indian J Otolaryngol Head Neck Surg. 2009;61(2):131-4.
- Khan MZ, Rabat ZM, Raza M, Umzr AS, Firoz S, Shaikat S. Influence of size of tympanic membrane perforation on outcome of myringoplasty. Pak J Otolaryngol. 2012;28:38-41.
- Sarker MZ, Ahmed M, Patwary K, Islam R, Joarder AH. Factors affecting surgical outcome of myringoplasty. Bangladesh J Otorhinolaryngol. 2011;17(2):82-7.
- Bertoli GA, Barbaro M, Giangrande V, Bava G, Seta ED, Filipo R. Fat graft myringoplasty: an office procedure for the repair of small perforations of the tympanic membrane. Mediterr J Otol. 2007;3:120-5.
- Hegazy HM. Fat graft myringoplasty- a prospective clinical study. Egypt J Ear Nose Throat Allied Sci. 2013;14(2):91-5.
- Kim DK, Park SN, Yeo SW, Kim EH, Kim JE, Kim BY, et al. Clinical efficacy of fat-graft myringoplasty for perforations of different sizes and locations. Acta Oto-Laryngologica. 2011;131(1):22-6.
- Mitchell RB, Pereira KD, Younis RT, Lazar RD. Bilateral fat graft myringoplasty in children. Ear Nose Throat J. 1996;75(10):652-6.
- Mitchell RB, Pereira KD, Lazar RH. Fat graft myringoplasty in children- a safe and successful

- day-stay procedure. *J Laryngol Otol*. 1997;111(2):106-8.
29. Bertoli GA, Barbaro M, Giangande V, Bava G, Seta ED, Filipo R. Fat graft myringoplasty: an office procedure for the repair of small perforations of the tympanic membrane. *Mediterr J Otol*. 2007;3:120-5.
30. Ozgursoy OB, Yorulmaz I. Fat graft myringoplasty: a cost-effective but underused procedure. *J Laryngol Otol*. 2005;119(4):277-9.
31. Landsberg R, Fishman G, DeRowe A, Bero E, Berger G. Fat graft myringoplasty: results of a long-term follow-up. *J Otolaryngol*. 2006;35:44-9.

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