DOI: https://doi.org/10.53350/pjmhs20231711405

ORIGINAL ARTICLE

Outcome of Stapedotomy in the Treatment of Otosclerosis in a Tertiary Care Hospital: A Retrospective Study

ARIA MASOOM[1], ABDUL MANAN KHAN[2]
[1]*Associate Professor, Department of ENT, Bolan Medical College / Complex Hospital, Quetta*
[2]*Associate professor ENT Bolan Medical College SPH Quetta*
Correspondence to: Abdul Manan Khan, Email: mk1803754@gmail.com

ABSTRACT

Background: Otosclerosis is a major ear disorder that causes conductive hearing loss. Proper treatment is crucial to prevent hearing loss.

Objective: The objective of this study was to determine the outcome of stapedotomy in the treatment of otosclerosis in a tertiary care hospital

Material and Method: This retrospective study was conducted at the Department of ENT, Bolan Medical College / Complex Hospital, Quetta from April 2023 to September 2023 after taking approval from the research committee of the institute. We obtained and examined the clinical records of otosclerosis individuals who had done stapedotomy at the ENT department. A total of 55 Individuals diagnosed with otosclerosis and evaluated on the basis of tone audiogram and tympanometry were included. Pure tone audiometry was performed for each individual just before surgery, on the first day following the procedure, and three months later during the post-operative follow-up. Data on the comparison of the air bone gap (ABG) frequencies 0.5, 1, 3, and 4 KHz before and after surgery has been collected. The difference in pre- and post-operative (at three months' follow-up) ABG was used to compute the postoperative hearing gain. The resulting increase in hearing thresholds was categorized as best (>30dB), better (21-30dB), good (11-20dB), and fair (0-10dB) for the purposes of the analysis.

Results: In the present study a total of 55 individuals were enrolled out of which 31(56%) were male and 24(44%) were female and the age ranged from 18-46 years. It was observed that thirty of the participants (54.4%) had hearing improvements of greater than 30 dB (best), whereas 12 (21.8%), eight recipients (14.5%), and 5 patients (9%) had improvements of 21–30 dB (better), 11–20 dB (good), and 0–10 dB (fair) respectively. Although all the participants presented some improvement, nobody experienced a drop in their hearing. Individuals under 35 years old had a significant improvement in their hearing thresholds when compared to those over 35 (value of p equal to 0.013). Nevertheless, the statistical evaluation revealed that the participants' gender had no significant impact on the improvement in their hearing thresholds (value of p equal to 0.446).

Conclusion: The study concluded that stapedotomy is a choice of therapy for otosclerosis, improved hearing thresholds in individuals with hearing loss.

Keywords: Outcome; Stapedotomy; Treatment; Otosclerosis

INTRODUCTION

Otosclerosis occurs in the foot plate area by abnormal bone resorption and deposition, which fixes the bone and causes conductive hearing loss. The genetic and environmental variables have been involved in the aetiology of otosclerosis. Researchers have examined the relationship between otosclerosis and a number of genetic variations that affect the likelihood of developing the disease. These genetic variants have a major impact on the pathways involved in bone remodeling.[1] The disease has also been associated in large population studies to the bone morphogenetic proteins.[2] Specific genes correlated with otosclerosis include collagen 1A1 (COL1A1), CD46, and CD150.[3] Research has shown that autosomal dominant inheritance can result in uncommon monogenic forms that are caused by mutations in a single gene. As a result, seven gene loci that cause otosclerosis have been found in various families.[4] A distinct pattern of Mendelian inheritance and family segregation is suggested by these results.[5] Additionally, genetic variations in the RELN gene linked to otosclerosis are found via a genome-wise study.[6] Environmental variables, such as viruses (especially measles), fluoride, and hormones (oestrogen), have also been associated with it in addition to hereditary causes. Otosclerosis and a prolonged measles virus infection have been identified in a number of studies.[7] It has been shown that samples of otosclerotic foci contain viral antigen and its antibodies.[8-9] The shift in age from younger to older at the beginning of the disease and the decrease in the incidence of otosclerosis have been linked to the use of the measles vaccination. Fluoride deficiency is thought to be the second most significant environmental factor linked to it the development and individuals treated with it experienced less hearing loss, according to research.[10-11] It has been suggested that fluoride works by inhibiting harmful proteolytic enzymes. Lastly, it has been hypothesized that hormones like estrogen play a part in the pathophysiology of otosclerosis. This theory is likely based on the observation that the condition is more prevalent in women.[12] Stapedotomy or stapedectomy are the recommended and successful treatments for otosclerosis. Stapedotomy is recommended because it lowers the chance of inner ear injury by limiting the vestibule's the entryway. Furthermore, in terms of improving hearing, stapedotomy has better outcomes than stapedectomy.[13] The aim of this study was to explore the outcome of stapedotomy in the treatment of otosclerosis in a tertiary care hospital.

Received on 06-09-2023
Accepted on 29-10-2023

MATERIAL AND METHOD

This retrospective study was conducted at the Department of ENT, Bolan Medical College / Complex Hospital, Quetta from April 2023 to September 2023 after taking approval from the research committee of the institute. We obtained and examined the clinical records of otosclerosis individuals who had done stapedotomy at the ENT department. A total of 55 Individuals diagnosed with otosclerosis and evaluated on the basis of tone audiogram and tympanometry were included. Individuals with tympanosclerotic patches and revision stapedotomies were excluded. Data such as gender, age, type of ear involved, tinnitus presence, and surgical outcome were recorded. Pure tone audiometry was performed for each individual just before surgery, on the first day following the procedure, and three months later during the post-operative follow-up. An expert audiologist conducted the tests in a soundproof chamber, consistently using the same audiometer. Data on the comparison of the air bone gap (ABG) frequencies 0.5, 1, 3, and 4 KHz before and after surgery has been collected. The air conduction and bone conduction thresholds that were noted on the same audiogram were used to compute the ABG. The difference in pre- and post-operative (at three months' follow-up) ABG was used to compute the postoperative hearing gain. The resulting increase in hearing thresholds was categorized as best (>30dB), better (21-

30dB), good (11-20dB), and fair (0-10dB) for the purposes of the analysis.

RESULTS

In the present study a total of 55 individuals were enrolled out of which 31(56%) were male and 24(44%) were female and the age ranged from 18-46 years. The most prevalent comorbidities were preoperative tinnitus 42(76%), history of Otosclerosis in the family 39(70%) and bilateral otosclerosis 33(60%) respectively as presented in table 1 By using pure tone audiometry all patients' hearing improvement at three months after stapedotomy was evaluated. It was observed that thirty of the participants (54.4%) had hearing improvements of greater than 30 dB (best), whereas 12 (21.8%), eight recipients (14.5%), and 5 patients (9%) had improvements of 21–30 dB (better), 11–20 dB (good), and 0–10 dB (fair) respectively as presented in figure 2. Although all the participants presented some improvement, nobody experienced a drop in their hearing. Individuals under 35 years old had a significant improvement in their hearing thresholds when compared to those over 35 (value of p equal to 0.013) as presented in table 2. Nevertheless, the statistical evaluation revealed that the participants' gender had no significant impact on the improvement in their hearing thresholds (value of p equal to 0.446) as presented in table 3.

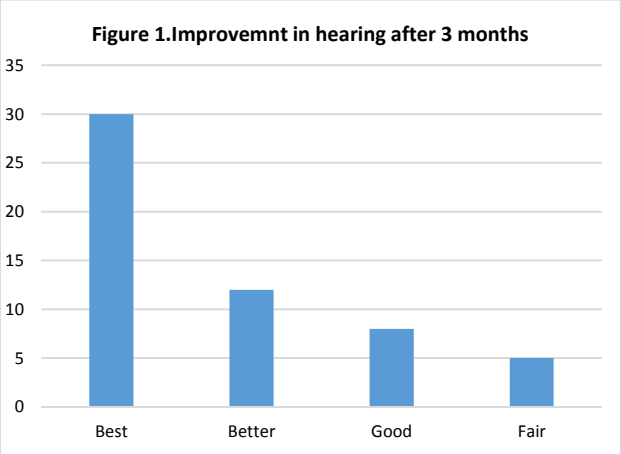

Table 2: Age distribution among individuals in related to post-stapedotomy hearing improvement

Age in years	No patients	Best	Better	Good	Fair	P value
35 or below	33(60%)	19(34.5%)	7(12.7%	7(12.7%	Zero(0)	0.013
Above 35	22(40%)	11(20%)	5(9%)	1(1.8%)	5 (9%)	
Total	55(100%)	30(54.5%)	12(21.5%)	8(14.5%)	5(9%)	

Table 3: Participant distribution by gender with regard to post-stapedotomy hearing improvement

Sex	No patients	Best	Better	Good	Fair	P value
Male	31(56.35%)	18(32.7%)	5(9%)	1(1.85%)	3(4.5%)	0.446
Female	24(43.6%)	12(21.8%)	7(12.7%)	7(12.7%)	2(4.5%)	
Total	55(100%)	30(54.5%)	12(21.5%)	8(14.5%)	5(9%)	

Table 3: Demographic features of the study population

Features	N (%)
Age in years	
Age ranged	18-46 years
Sex	
Male	31(56%)
Female	24(44%)
Comorbidities	
Preoperative tinnitus	42(76%),
history of Otosclerosis	39(70%)
bilateral otosclerosis	33(60%)
Ear involved	
Right	16(29%)
Left	4(7.2%)

DISCUSSION

The significance of stapedotomy in the management of otosclerotic individuals was examined in this retrospective research. Specifically, the demographic information of those individuals who had otosclerosis were collected, compiled, and examined. In order to make comparisons with other comparable research easier, the improvement in hearing following stapedotomy was also evaluated and categorized. There were several notable differences between the previously reported data and the participant's demographic data pattern. For example, individuals that presented to our clinics with otosclerosis showed a trend of male predominance. This pattern is in line with findings from previous research that looked at the same demographic. Male to female patient ratios of 1.22:1 and 1.18:1 have been recorded in research from various parts of Pakistan; these studies included significant patient populations of 200 & 600 patients, respectively.[14-15] In a cohort of thirty individuals, another research from Pakistan revealed a 4:1 male to female ratio.[16] This male-dominated tendency, however, contrasts with previous studies from areas other than Pakistan that found a female-dominated trend among individuals who had otosclerosis. The gender-specific incidence of otosclerosis in Pakistan has been compared to that of different countries in order to clarify this issue. In particular, Finland has the highest recorded female to male ratio of otosclerosis cases (3:1), which is followed by Spain (2.82:1) and Brazil (2.3:1).[17-19] Similar gender-based incidence patterns have been documented for the demographics of Germany, the United Kingdom, and Jordan. Saudi Arabia, Brazil, as well as China.[19-24] This is a crucial finding that can indicate a high correlation between the aetiology of otosclerosis and the ethnicity and demographic group in discussion. In the present study the most prevalent comorbidities were preoperative tinnitus 76%. This finding is similar to the previous studies that revealed that majority of otosclerosis participants experience tinnitus and both hearing and tinnitus can be improved with surgery.[21-23] By using PTA the hearing improvement of the participants at three months after stapedotomy was evaluated. It was observed that thirty of the participants (54.4%) had hearing improvements of greater than 30 dB (best). These findings are in line with previous research, since majority of publications show that stapes surgery has a high success rate. Previously, stapedotomy was reported to have an overall treatment success rate of 89% (defined as air bone gap: ABG ≥ 20). These findings are in line with previous research, since majority of publications show that stapes surgery has a high success rate. Previously, stapedotomy was reported to have an overall treatment success rate of 89% (defined as air bone gap: ABG ≥ 20).[20] In a big cohort, the outcomes of stapedotomy for otosclerosis revealed that in 94.2 percent of individuals, the postoperative ABG closed to 10 dB.[25] A comparison of the pure tone average of air conduction/gap before and after stapes surgery also showed a statistically significant improvement. Along with the high success rate, stapedotomy has been associated with shorter hospital stays and less vertigo (both in terms of severity and duration) than stapedectomy.[26] All things considered, the findings of these (and other) investigations show that stapedotomy is a viable treatment option for otosclerosis.

CONCLUSION

The study concluded that stapedotomy is a choice of therapy for otosclerosis, improved hearing thresholds in individuals with hearing loss. The patient's age significantly influenced their ability to enhance their hearing, while their gender had no discernible impact.

REFERENCES

1 Janssens K, Gershoni-Baruch R, Guañabens N, Migone N, Ralston S, Bonduelle M, et al. Mutations in the gene encoding the latency-associated peptide of TGF-beta1 cause Camurati-Engelmann disease. Nat Genet. 2000;26(3):273–5.

2 Schrauwen I, Thys M, Vanderstraeten K, Fransen E, Dieltjens N, Huyghe JR, et al. Association of bone morphogenetic proteins with otosclerosis. J Bone Miner Res.2008;23(4):507–16.

3 Karosi T, Jókay I, Kónya J, Petkó M, Szabó LZ, Sziklai I. Expression of measles virus receptors in otosclerotic, non-otosclerotic and in normal stapes footplates. Eur Arch OtoRhino-Laryngology. 2007;264:607–13.

4 Thys M, Camp G Van. Genetics of Otosclerosis. Otol Neurol. 2009; 30:1021–32.

5 Schrauwen I, Camp G Van. The etiology of otosclerosis: A combination of genes and environment. Laryngoscope. 2010;120(6):1195–202.

6 Bouzid A, Tekari A, Jbeli F, Chakroun A, Hansdah K, Souissi A, et al. Osteoprotegerin gene polymorphisms and otosclerosis: an additional genetic association study, multilocus interaction and metaanalysis. BMC Med Genet. 2020;21:122.

7 Potocka-Bakłażec M, SakowiczBurkiewicz M, Kuczkowski J, Pawełczyk T, Stankiewicz C, Sierszeń W, et al. Expression of TNF- α, OPG , IL-1β and the presence of the measles virus RNA in the stapes of the patients with otosclerosis. Eur Arch Oto-RhinoLaryngology. 2015;272:1907–12.

8 Karosi T, Jókay I, Kónya J, Petkó M, Szabó LZ, Pytel J, et al. Activated osteoclasts with CD51/61 expression in otosclerosis. Laryngoscope. 2006;116(8):1478–84.

9 Karosi T, Kónya J, Szabó LZ, Sziklai I. Measles virus prevalence in otosclerotic foci. Adv Otorhinolaryngol. 2007;65:93–106.

10 Arnold W, Busch R, Arnold A, Ritscher B, Neiss A, Niedermeyer HP. The influence of measles vaccination on the incidence of otosclerosis in Germany. Eur Arch Oto-RhinoLaryngology. 2007;264:741–8.

11 Daniel HJ. Stapedial otosclerosis and fluorine in the drinking water. Arch Otolaryngol. 1968;90(5):585–9.

12 Bretlau P, Causse J, Causse JB, Hansen HJ, Johnsen NJ, Salomon G. Otospongiosis and sodium fluoride. A blind experimental and clinical evaluation of the effect of sodium fluoride treatment in patients with otospongiosis. Ann Otol Rhinol Laryngol. 1985;94:103–7.

13 Alraqi A, Alshahrani M. The outcome of hearing in stapedotomy versus stapedectomy in non endemic areas. Indian J Otol 2019;5(3):114-6. DOI: 10.4103/indianjotol.INDIANJOTOL_24_19

14 Salahuddin I, Salahuddin A. Experience with stapedectomy in a developing country: A review of 200 cases. ENT-Ear, Nose Throat J. 2002;81(8):548–52.

15 Musani MA, Rauf A, Ahsan M, Khan FA.Frequency and causes of hearing impairment in tertiary care center. J Pakistan Med Assoc. 2011;61(2):141–4.

16 Ahmed S, Raza N, Ali L, Ullah S, Iqbal S. Hearing improvement after stapedotomy using teflon loop prosthesis. J Coll Physicians Surg Pakistan. 2006;16(10):659–61.

17 Ramsay H, Ktirkktiinen J, Palva T. Success in surgery for otosclerosis: Improvement and other indicators. Am J Otolaryngol. 1997;18(1):23–8

18 Gil JLM, Palau EM, Jurado FJA, Vadillo ED, Martín JCF, Massanaa EF. Stapedotomy outcomes in the treatment of otosclerosis: Our experience. Acta Otorrinolaringológica. 2008;59(9):448–54.

19 Dall´Igna C, Teixeira VN, Dall´Igna DP, Petersen L, Rosito S. Results of stapes surgery for otosclerosis with two kinds of prothesis in residency training. Braz J Otorhinolaryngol. 2008;74(6):826–32.

20 Mahafza T, Al-layla A, Tawalbeh M, Abu-yagoub Y, Sulaiman AA. Surgical treatment of otosclerosis: Eight years experience at the Jordan university hospital. Iran J Otorhinolaryngol. 2013;25(4):233–8.

21 Crompton M, Cadge BA, Ziff JL,Andrew J, Nash R, Orl-hns F, et al. The epidemiology of otosclerosis in a British cohort. Otol Neurotol. 2019;40(1):22–30.

22 Menger DJ, Tange RA. The aetiology of otosclerosis : a review of the literature. Clin Otolaryngol Allied Sci. 2003;28(2):112–20.

23 Zhang K, Fang Y, Wang B, Cheng X, Chen B, Shu Y, et al. Frequency-specifichearing results after stapes surgery for Chinese population otosclerosis with different degrees of hearing loss. Acta Otolaryngol. 2020;140(5):356–60.

24 Alzhrani F, Mokhatrish MM, AlMomani MO, Alshehri H, Hagr A, Garadat SN. Effectiveness of stapedotomy in improving hearing sensitivity for 53 otosclerotic patients: retrospective review. Ann Saudi Med. 2017;37(1):49–55.

25 Vincent R, Sperling NM, Oates J, Jindal M. Surgical findings and long-term hearing results in 3,050 stapedotomies for primary otosclerosis: a prospective study with the otology-neurotology database. Otol Neurotol. 2006;27(8):S25–47.

26 Dankuc D, Pejaković N, Komazec Z, Vlaski L. Functional hearing results in patients with otosclerosis before and after stapedotomy. Med Pregl. 2012;65(1-2):54–9.

This article may be cited as: Masoom A, Khan AM: Outcome of Stapedotomy in the Treatment of Otosclerosis in a Tertiary Care Hospital: A Retrospective Study. Pak J Med Health Sci, 2023;17(11):405-407.