

A Retrospective Analysis to Determine Hearing Results After Stapes Surgery: An Institutional Based Study

Smruti Milan Tripathy^{1*}, Rakhee Panda¹

¹Assistant Professor, Department of Otorhinolaryngology, Saveetha Medical College and Hospital, Chennai, Tamil Nadu, India.

ABSTRACT

Background: Otosclerosis is a disease of the temporal bone that affects the inner and middle ear. Stapes surgery has become the basis of primary treatment of conductive hearing loss in otosclerosis. The present study was conducted to determine hearing results after stapes surgery.

Materials and Methods: This retrospective study was carried out among 200 cases of primary stapes surgery patients. Collection of data from this study was entirely through clinical data found in medical records and therefore no direct patient contact was required. The diagnosis of otosclerosis was based on a clinical history of progressive hearing loss with normal otoscopic findings, an audiogram showing conductive hearing loss and subsequently confirmed by decreased mobility of ossicular chain intra-operatively. Audiological evaluation was carried out using puretone audiometry (PTA) Statistical analysis was performed with IBM SPSS Statistics Version 21. A p value of ≤ 0.05 considered as being statistically significant.

Results: The result of the present study showed that male and females were in equal proportion. 58.57% patients were ≤ 50 years and 41.42% were >50 years. Surgery in left side ear was done in 42.85% patients and right side was done in 57.14% patients. surgery was done in unilateral ear in 17.85% and 82.14% in bilateral ears. The pre-operative ABG level of 30 db or less was found in 30%, while the remaining 70% had levels of more than 30 dB. The pre-operative BC that were 30 dB and less was 37.85% while the rest 62.14% had BC levels of greater than 30 dB. The pre-operative AC levels of 70 dB and

less was found in 52.14% and the remaining cases had 47.85% had pre-operative AC levels greater than 70 dB. Out of the 140 ears that were operated on, 62.14% had excellent post-operative ABG results (post-operative ABG of 10 dB or less), 21.42% had good results (postoperative ABG of 10.1-20 dB) and only 16.42% had poor results (post-operative ABG of >20 dB). In terms of post-operative gain in AC, 65% had achieved a gain of ≥ 20 dB. 60.71% of cases achieved an ideal ABGi of $\geq 70\%$.

Conclusion: This study concluded that stapes surgery provides good results in patients with otosclerosis independent of disease severity or patient profile.


Keywords: Otosclerosis, Stapes Surgery, Hearing Loss.

*Correspondence to:

Dr. Smruti Milan Tripathy,
Assistant Professor,
Department of Otorhinolaryngology,
Saveetha Medical College and Hospital,
Chennai, Tamil Nadu, India.

Article History:

Received: 27-09-2016, Revised: 02-11-2016, Accepted: 23-11-2016

Access this article online	
Website: www.ijmrp.com	Quick Response code 
DOI: 10.21276/ijmrp.2016.2.6.073	

INTRODUCTION

Otosclerosis, also known as otospongiosis, is a primary disease of the otic capsule that leads to stapes ankylosis.¹ Otosclerosis is a common cause of progressive hearing impairment which is characterized by the formation of an abnormal growth of bone on the middle ear ossicles. This disorder affects the stapes footplate and in more advanced stages the cochlear capsule can be affected as well.² Hearing loss is the main symptom. Complaints of continuous tinnitus and eventual vertigo are also observed.^{1,3} A diagnosis of otosclerosis is based generally on a clinical history of progressive hearing loss and audiological findings. Audiological evaluation typically reveals a type As tympanogram which indicates increased stiffness in the mobility of the tympanic

membrane and the middle ear system. Elevated bone conduction thresholds occur, particularly at 2 kHz, which is a hallmark of otosclerosis known as Carhart's notch.⁴ Additional diagnostic assessments include an imaging investigation, which has been demonstrated as essential to confirm the diagnosis of otosclerosis.⁵

Treatment options for otosclerosis include medical treatment, amplification, and surgical intervention.⁶ The description of the surgical treatment of stapes footplate fixation by Shea in 1956,⁷ the technique underwent numerous minor and major changes. The present study was conducted to determine hearing results after stapes surgery.

MATERIALS AND METHODS

This retrospective study was carried out among 200 cases of primary stapes surgery patients. Before the commencement of the study ethical approval was taken from the Ethical Committee of the institution. Collection of data from this study was entirely through clinical data found in medical records and therefore no direct patient contact was required. The diagnosis of otosclerosis was based on a clinical history of progressive hearing loss with normal otoscopic findings, an audiogram showing conductive hearing loss and subsequently confirmed by decreased mobility of ossicular chain intra-operatively. In addition, all patients underwent computed tomography of the temporal bone prior to their operation. Only cases with complete clinical, surgical and demographic data were included for the study. Patients with known congenital malformations, a history of chronic ear infections, previous operation, or sudden sensorineural hearing loss of the affected ear were excluded from the study. For patients in whom both ears met inclusion criteria, each ear was included and analyzed separately. In patients with bilateral disease, the worse ear was operated on first. Patient demographical data was collected. The surgery was done under general anaesthesia, via a transcanal approach. All cases were performed with microscopic approach. The stapes footplate was tested for fixation to confirm the diagnosis of otosclerosis. Audiological evaluation was carried out using puretone audiometry (PTA) which was performed in accordance to the standards set by American Academy of Otolaryngology- Head and Neck Surgery Foundation.⁸ PTA was calculated for air-conduction (AC), bone-conduction (BC), air-bone gap (ABG) using the mean of 0.5, 1.0 and 3.0 kHz thresholds in accordance to the new and revised reporting guidelines from the Committee on Hearing and Equilibrium.⁹ The primary outcomes measured were post-operative ABG levels, improvement in AC thresholds and ABGi. Each of these outcomes was categorized into 'ideal' (defined as ABG closure of ≤ 10 dB, gain in AC ≥ 20 dB and ABGi $\geq 70\%$) and 'not ideal' subgroups. The pre-operative predictors selected in this study: age at surgery (50 years or less/greater than 50 years), sex (male/female), unilateral/bilateral disease, pre-operative ABG (≤ 30 dB/ > 30 dB), AC (≤ 70 dB/ > 70 dB) and BC thresholds (≤ 30 dB/ > 30 dB). The association between these pre-operative predictors and hearing outcomes (ideal versus not ideal) were analyzed using χ^2 test. Mann-Whitney U test was used to analyze the influence of the same pre-operative predictors on ABGi. Statistical analysis was performed with IBM SPSS Statistics Version 21. A p value of ≤ 0.05 considered as being statistically significant.

RESULTS

The result of the present study showed that male and females were in equal proportion. 58.57% patients were ≤ 50 years and 41.42% were > 50 years. Surgery in left side ear was done in 42.85% patients and right side was done in 57.14% patients. surgery was done in unilateral ear in 17.85% and 82.14% in bilateral ears. The pre-operative ABG level of 30 db or less was found in 30%, while the remaining 70% had levels of more than 30 dB. The pre-operative BC that were 30 dB and less was 37.85% while the rest 62.14% had BC levels of greater than 30 dB. The pre-operative AC levels of 70 dB and less was found in 52.14% and the remaining cases had 47.85% had pre-operative AC levels greater than 70 dB. Out of the 140 ears that were operated on,

62.14% had excellent post-operative ABG results (post-operative ABG of 10 dB or less), 21.42% had good results (postoperative ABG of 10.1-20 dB) and only 16.42% had poor results (post-operative ABG of > 20 dB). In terms of post-operative gain in AC, 65% had achieved a gain of ≥ 20 dB. 60.71% of cases achieved an ideal ABGi of $\geq 70\%$.

Table 1: Clinical data of patients

Variables	N (%)
Gender	
Male	70 (50%)
Female	70 (50%)
Age	
≤ 50 years	82 (58.57%)
> 50 years	58 (41.42%)
Surgery side	
Left	60 (42.85%)
Right	80 (57.14%)
Bilaterality of side	
Unilateral	25 (17.85%)
Bilateral	115 (82.14%)

Table 2: Preoperative variables

Variables	N (%)
ABG	
≤ 30 dB	42 (30%)
> 30 dB	98 (70%)
Pre-op BC	
≤ 30 dB	53 (37.85%)
> 30 dB	87 (62.14%)
Pre-op AC	
≤ 70 dB	73 (52.14%)
> 70 dB	67 (47.85%)

Table 3: Table 2: Postoperative variables

Variables	N (%)
ABG	
≤ 10 dB (excellent)	87 (62.14%)
10.1-20 dB (good)	30 (21.42%)
> 20 dB (poor)	23 (16.42%)
Post-op gain in AC	
≤ 20 dB (ideal)	91 (65%)
< 20 dB (not ideal)	49 (35%)
ABGi	
≥ 70 (ideal)	85 (60.71%)
< 70 dB (not ideal)	55 (39.28%)

DISCUSSION

Stapes surgery is the preferred treatment for conductive hearing loss secondary to stapedia otosclerosis.^{9,10} However, many surgeons favor stapedotomy over stapedectomy because theoretically it carries less risk to the inner ear structure.^{11,12} The result of the present study showed that male and females were in equal proportion. 58.57% patients were ≤ 50 years and 41.42% were > 50 years. Surgery in left side ear was done in 42.85% patients and right side was done in 57.14% patients. surgery was done in unilateral ear in 17.85% and 82.14% in bilateral ears. The pre-operative ABG level of 30 db or less was

found in 30%, while the remaining 70% had levels of more than 30 dB. The pre-operative BC that were 30 dB and less was 37.85% while the rest 62.14% had BC levels of greater than 30 dB. The pre-operative AC levels of 70 dB and less was found in 52.14% and the remaining cases had 47.85% had pre-operative AC levels greater than 70 dB. Out of the 140 ears that were operated on, 62.14% had excellent post-operative ABG results (post-operative ABG of 10 dB or less), 21.42% had good results (postoperative ABG of 10.1-20 dB) and only 16.42% had poor results (post-operative ABG of >20 dB). In terms of post-operative gain in AC, 65% had achieved a gain of ≥ 20 dB. 60.71% of cases achieved an ideal ABGi of $\geq 70\%$.

In 2006, Vincent et al.¹³ performed a prospective study in which the results of 3050 stapedotomies were analyzed over a period of 14 years. The mean preoperative and postoperative air-bone gap was 25.6 and 1.7 dB, respectively, and the gap was ≤ 10 dB in 94.2% of cases.

Bittermann et al.¹⁴ and Kisilevsky et al.¹⁵ reported a mean post-operative ABG of 10 dB or less in 72.1% and 75.2% of their patients respectively. However, the mean follow-up time period was 3 months in the study by Bittermann et al.¹⁴ and 16.4 months in Kisilevsky et al.¹⁵

Koopmann et al.¹⁶ who reported a mean ABGi of about 53%. He also encouraged the incorporation of "relative gain" in pre-operative counselling for patient and supported the role of ABGi as such a measure.

This is further supported by Caylakli et al.¹⁷ who reported that patients with the largest pre-operative ABG had the greatest increase in post-operative speech discrimination score.

Marchese et al. reported that older patients in fact had a poorer outcome after stapedotomy.¹⁸

CONCLUSION

This study concluded that stapes surgery provides good results in patients with otosclerosis independent of disease severity or patient profile.

REFERENCES

1. Glasscock ME III, Storper IS, Haynes DS, Bohrer PS. Twenty-five years of experience with stapedectomy. *Laryngoscope* 1995;105; (9 Pt 1):899-904.
2. Cureogle S, Baylan M, Paparell M. Cochlear otosclerosis. *Curr Opin Otolaryngol Head Neck Surg*. 2010;18:357-62.
3. Rondini-Gilli E, Bozorg Grayeli A, Boutin P, et al. [Otosclerosis surgical techniques and results in 150 patients]. *Ann Otolaryngol Chir Cervicofac* 2002;119(4):227-33.
4. Probst R. Audiological evaluation of patients with otosclerosis. In: Arnold W, Hausler R, editors. *Otosclerosis and stapes surgery*. *Adv Otorhinolaryngol*. Vol. 65. Basel: Karger; 2007. pp. 119-26.
5. Abdel-Ghany A, Osman N, Botros S. Correlation between the size, CT density of otosclerotic foci, and audiological tests in cases of otosclerosis. *Int Adv Otol*. 2014;10:156-61.
6. Kisilevsky VE, et al. Hearing results of 1145 stapedotomies evaluated with Amsterdam hearing evaluation plots. *J Laryngol Otol*. 2009;123:730-6.

7. Shea JJ Jr. Fenestration of the oval window. *Ann Otol Rhinol Laryngol* 1958; 67(4):932-51.
8. Committee on Hearing and Equilibrium guidelines for the evaluation of results of treatment of conductive hearing loss. American Academy of Otolaryngology-Head and Neck Surgery Foundation, Inc. *Otolaryngol Head Neck Surg* 1995; 113: 186-7.
9. Merán Gil JL, Masgoret Palau E, Avilés Jurado FJ, Domènech Vadillo E, Flores Martín JC, Figuerola Massana E. Stapedotomy outcomes in the treatment of otosclerosis: Our experience. *Acta Otorrinolaringol Esp*. 2008;59:448-54.
10. Tange RA, Grolman W. Late postoperative hearing results after stapedotomy. *Int Adv Otol*. 2009;5:323-6.
11. Thamjarayakul T, Supiyaphun P, Snidvongs K. Stapes Fixation surgery: Stapedectomy versus stapedotomy. *Asian Biomedicine*. 2010;4:429-34.
12. Baradaranfar MH, Dabirmoghaddam P. The hearing results in otosclerosis after stapedotomy. *Acta Medica Iran*. 2004; 42: 277-80.
13. 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, Suppl 2):S25-S47.
14. Bittermann AJ, Rovers MM, Tange RA, Vincent R, Dreschler WA, et al. Primary stapes surgery in patients with otosclerosis: Prediction of postoperative outcome. *Arch Otolaryngol Head Neck Surg* 2011; 137: 780-4.
15. Kisilevsky VE, Dutt SN, Bailie NA, Halik JJ. Hearing results of 1145 stapedotomies evaluated with Amsterdam hearing evaluation plots. *J Laryngol Otol* 2009; 123: 730-6.
16. Koopmann M, Weiss D, Savvas E, Rudack C, Stenner M. Outcome measures in stapes surgery: Postoperative results are independent from preoperative parameters. *Eur Arch Otorhinolaryngol* 2014; 272: 2175-81.
17. Caylakli F, Yavuz H, Yilmazer C, Yilmaz I, Ozuoluglu LN. Effect of preoperative hearing level on success of stapes surgery. *Otolaryngol Head Neck Surg* 2009; 141: 12-5.
18. Marchese MR, Conti G, Cianfrone F, Scorpecci A, Fetoni AR, et al. Predictive role of audiological and clinical features for functional results after stapedotomy. *Audiol Neurootol* 2009; 14: 279-85.

Source of Support: Nil. **Conflict of Interest:** None Declared.

Copyright: © the author(s) and publisher. IJMRP is an official publication of Ibn Sina Academy of Medieval Medicine & Sciences, registered in 2001 under Indian Trusts Act, 1882. This is an open access article distributed under the terms of the Creative Commons Attribution Non-commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Cite this article as: Smruti Milan Tripathy, Rakhee Panda. A Retrospective Analysis to Determine Hearing Results After Stapes Surgery: An Institutional Based Study. *Int J Med Res Prof*. 2016; 2(6): 337-39. DOI:10.21276/ijmrp.2016.2.6.073