Original Research Article

DOI: http://dx.doi.org/10.18203/issn.2454-5929.ijohns20180699

Study of pathology of ossicles in non-cholesteatomatous chronic suppurative otitis media, its repair and outcome

C. R. Vijay Bharath Reddy, M. Santhosh Reddy*

Department of ENT, Malla Reddy Institute of Medical Sciences, Suraram, Hyderabad, Telangana, India

Received: 20 November 2017 **Accepted:** 25 December 2017

*Correspondence: Dr. M. Santhosh Reddy,

E-mail: srmunugala@hotmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. 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.

ABSTRACT

Background: If the ears have perforation of long standing durations, even without cholesteatomas, they remain infected. Three times as many operations were performed in the United States in 1978 for this disease as were performed for cholesteatoma. The objective of the study was to study of pathology of ossicles in non-cholesteatomatous chronic suppurative otitis media, its repair and outcome.

Methods: This is a clinical study of patients presented to outpatient, department of Vijayanagar Institute of Medical Sciences, Bellary during the period of November 2004 to November 2005 with non-cholesteatomatous chronic suppurative otitis media. This study is aimed to study the various ossicular abnormalities encountered in non-cholesteatomatous chronic suppurative otitis media and their reconstruction techniques.

Results: 12 ears (40%) had central and 18 ears (60%) had subtotal perforation. The average hearing loss in patients with isolated erosion of lenticular process of incus was 50.72±6.95 dB. In our study, autologous incus was used for ossicular reconstruction in 14 (46.67%) patients and homologous septal cartilage in 10 (33.33%) cases. Twenty-nine of the 30 cases underwent myringostapediopexy (type IIIb tympanoplasty) with the ossicular graft as short columella between the tympanic membrane graft and the stapes superstructure.

Conclusions: Excellent results were noted only with the autologous incus graft. 28.57% of the total patients with autologous incus graft showed excellent post-operative results. Good results were found for autologous incus, homologous septal cartilage and teflon PORP, with percentage of 28.57, 50 and 25% respectively.

Keywords: Pathology, CSOM, Cartilage, PORP

INTRODUCTION

"Chronic suppurative otitis media" prevalence varies in different parts of the world. It varies from one percent in some parts of the world to more than forty percent in other parts of the world. This variation is due to depending upon the whether the part of the globe is a developed country or the developing country. Many factors have been outlined as risk factors for "Chronic suppurative otitis media". These include younger age, people living in overcrowded dwellings, lack of proper housing conditions, lack of proper hygiene, malnutrition,

exposure to indoor or outdoor pollution, dysfunction of Eustachian tube etc.¹

If the ears have perforation of long standing durations, even without cholesteatomas, they remain infected. Three times as many operations were performed in the United States in 1978 for this disease as were performed for cholesteatoma.² Paparella and Kim reported that of 375 primary tympano-mastoid operations for chronic mastoidits, two-thirds were performed in ears with granulation tissue and without cholesteatoma.³

Ossiculoplasty represents the reconstruction of the ossicular chain in such a manner that it will transmit sound vibrations from the tympanic membrane to the oral window. The aim of ossiculoplasty is to restore the ossicular chain as near to normal as possible or to achieve continuity and transmission in an entirely different way after abandonment of natural system. In the last three decades, various ossiculoplasty methods have evolved and good results were achieved. Nevertheless ossicular reconstruction continues to be a process in evolution.⁴

This is a clinical study of patients presented to outpatient, department of Vijayanagar Institute of Medical Sciences, Bellary during the period of November 2004 to November 2005 with non-cholesteatomatous chronic suppurative otitis media. This study is aimed to study the various ossicular abnormalities encountered in non-cholesteatomatous chronic suppurative otitis media and their reconstruction techniques.

METHODS

This study study of pathology of ossicles in non-cholesteatomatous chronic suppurative otitis media, its repair and outcome was carried out at the Department of ENT, VIMS, Bellary.

The source of data for our study were the patients admitted in the department of ENT and operated for correction of hearing disability due to Noncholesteatomatous chronic suppurative otitis media, and also patients referred from other departments of combined hospitals of VIMS, Bellary. This study is a prospective study, conducted for a period of 1 year from 1st November 2004 to 31st October 2005. The study was carried out on 30 cases (with unilateral ear problems, bilateral ear disorder patients were excluded from study). The complete data was collected in a specially designed case regarding form (CRF), from the patients by taking history of illness and by doing detailed clinical examination and relevant investigations. Finally, after diagnosis and after unsuccessful medical line of management, the patient was selected for surgery depending on inclusion/exclusion criteria.

For the present study, patients are selected with the following inclusion/exclusion criteria:

Inclusion criteria

Inclusion criteria were irrespective of age and sex; irrespective of socioeconomic status; cases of chronic suppurative otitis media with central perforation of tympanic membrane; cases of chronic suppurative otitis media with conductive hearing loss.

Exclusion criteria

Exclusion criteria were cases of chronic suppurative otitis media with attic or marginal perforation and/or retraction

packet; cases of chronic suppurative otitis media with sensori-neural hearing loss; cases of chronic suppurative otitis media with cholesteatoma; cases with bilateral ear disease.

Follow up

All the cases in our study were admitted in our hospital for an average duration of 7 days. The initial follow up was weekly for a period of 21 days (3 weeks). Subsequently the patients were required to come at the end of 3 months and months from the date of surgery and at every 6 months thereon. Of the 30 cases operated, all the patients attended the follow up on the stipulated dates for the minimum period of 6 months post operatively, and the follow up range was from 6 months to 24 months.

The data collected was transferred into a master chart which was then subjected for statistical analysis. The various statistical parameters applied in the study include:

1. Standard deviation: it is defined as root-meansquare-deviation. The standard deviation is the most frequently used measure of deviation.

$$SD = \sqrt{\mathbb{E}(X-X)^2/(n-1)}$$

2. Mean value: the mean is the average value, or the sum of all (Σ) of the observed values (X_1) divided by the total number of observations (N_1) .

Mean =
$$X = \mathcal{E}(X-X_1)/(N_1)$$

3. Standard error: Instead of means, sometime we may have to test the significance of difference between two proportions or ratios have occurred y chance. In this case we calculate the standard error of difference between two proportions.

Standard error =
$$\sigma/\sqrt{N} = \sqrt{\sigma^2/N}$$

- 4. Confidence interval: used as test to see whether a mean or proportion differ significantly from a fixed value. The most common situation for this is testing to see whether a risk ratio or an odd ratio differs significantly from the ratio of 1.0 (which means no difference)
- 5. P value: before doing any calculations to test the null hypothesis, the investigator must establish a criterion called the alpha level, which is the maximum probability of making a false positive error that the investigator is willing to accept. The level of alpha is usually set at p=0.05. This says that investigator willing to run a 5% risk of being in error when asserting that the treatment and control groups truly differ. It is used to perform tests of significance.

In our study ears, we have analyzed the age distribution, sex distribution, relationship between ossicular pathology and type of perforation of tympanic membrane and the hearing loss in relation to ossicular pathology and the site of perforation of tympanic membrane. Finally, the ears subjected to various types of tympanoplasty, have been studied to ascertain hearing gain, in relation to various reconstructive procedures adopted.

RESULTS

12 ears (40%) had central perforation (other than subtotal perforation) and 18 ears (60%) had subtotal perforation (Table 1).

The hearing loss in relation to ossicular pathology, have been summarized. In ears with single or multiple ossicular involvements, the average hearing loss was noted to be between 39.40 to 60 dB. The average hearing loss in patients with isolated erosion of lenticular process of incus was 50.72 dB with a Standard Deviation of 6.95 and 95% confidence interval of 44.29 to 57.15 (Table 2).

Table 1: Type of perforation.

Sl. no.	Type of perforation	Number	Percentage (%)
1	Central (other than subtotal)	12	40
2	Sub total	18	60
	Total	30	100

Table 2: Hearing loss in response to ossicular pathology.

Sl. No.	Ossicular defects	Types of perforation	Number (%)	Mean±SD AC	Mean±SD BC
1.	Isolated erosion of lenticular process	CP	03(23.33)	50.72±6.95	13.07±6.32
1.	of incus	STP	04		
2.	Isolated erosion of long process of	CP	03(26.68)	50.10 ± 15.48	16.16 ±3.83
	incus	STP	05		
3.	Isolated absence of incus	CP	02(13.33)	59.58±1.77	17.62±2.63
		STP	02		
4	Erosion of malleus handle and long process of incus	CP	02(13.33)	39.38±5.15	14.43±1.88
4.		STP	02		
5.	Erosion of malleus handle and	CP	00(10)	53.73±7.05	17.53±1.86
5.	absence of incus	STP	03		
6.	Absence of incus and stapes super structure	CP	01(3.33)	60.00±-	20±-
		STP	00		
7	Ossicular chain fixation	CP	01(10)	49.54±5.99	9.67±8.73
7.		STP	02		

In our study, Autologous incus was used for ossicular reconstruction in 14 (46.67%) out of 30 patients. Homologous septal cartilage was used for ossicular reconstruction in 10 (33.33%) of the cases (Table 3).

Table 3: Different graft materials used and no of patients.

Sl.	Graft material	Patients	Patients		
No.	Graft material	Number	%		
1	Autologous Incus	14	46.67		
2	Homologous septal cartilage	10	33.33		
3	Teflon PORP	04	13.33		
4	Homologous incus	02	06.67		
	Total	30	100		

Twenty-nine of the 30 cases underwent myringostapediopexy (type IIIb tympanoplasty) with the ossicular graft as short columella between the tympanic membrane graft and the stapes superstructure. Only one case had absence of the stapes superstructure and had to undergo myringoplatinopexy (type IIIc tympanoplasty) using the homologous septal cartilage graft as long columella between the tympanic membrane graft and the stapes footplate (Table 4).

The 14 patients who underwent surgery with autologous incus as the graft material had mean pre-operative Air bone gap of 35.03 dB with standard deviation of 10.88. Post-operatively their mean Air-Bone gap was 18.65 dB with standard deviation of 11.83. This is highly significant statistically with a p<0.001. The statistical significant of pre-operative and post-operative gap is calculated for each material using student's test (Table 5).

DISCUSSION

Whatever the type of perforation of ear may be, it has been found usually that the incus gets commonly affected. In the present study, 90% of the cases have shown some kind of pathology. 23% of the cases have shown that the lenticular process got involved but it was isolated.

23% of the cases also have shown that the handle of malleus was affected. Usually there is resorption of the handle of the malleus. This is more commonly seen in cases of the central perforation than the perforation of the posterior type. This is due to complete exposure of

"handle of malleus" in central type of perforation than the posterior type of perforation. Complete exposure leads to improper supply of blood which leads to necrosis. Stapes was involved only in 1 case (3%).

Table 4: Average percentage of hearing gain in response to different graft material and different ossiculoplasty surgeries done.

		Patients		Gain
Pathology of ossicles	Type of ossicular reconstruction	Number	%	%
Isolated erosion of	Myringostapediopexy (tympanic membrane to stapes	4	13.33	37.62
lenticular process of incus	superstructure) short columella	3	10	28.41
	Myringostapediopexy (tympanic membrane to stapes superstructure) short columella	4	13.33	33.74
Isolated erosion of long		1	03.33	20.00
process of incus		2	06.67	32.30
		1	03.33	17.70
	W	2	6.67	28.26
Isolated absence of incus	Myringostapediopexy (tympanic membrane to stapes superstructure) short columella	1	03.33	27.03
		1	03.33	28.07
Erosion of malleus handle	Myringostapediopexy (tympanic membrane to stapes	3	10	36.52
and long process of incus	superstructure) short columella	1	03.33	34.12
T	Myringostapediopexy (tympanic membrane to stapes superstructure) short columella	1	03.33	32.65
Erosion of malleus handle		1	03.33	18.02
and absence of incus		1	03.33	27.33
Absence of incus and stapes and superstructure	Myringostapediopexy (tympanic membrane to stapes superstructure) short columella	1	03.33	30.91
Ossicular chain fixation	Myringostapediopexy (tympanic membrane to stapes superstructure) short columella	3	10	34.17

Table 5: Pre-operative and post-operative air-bone gap for different graft material used.

Graft material used	Number	Pre-operative A-B gap Mean±SD value (dB)	Post-operative A-B gap Mean±SD value (dB)	P value	Statistical significance
Autologous incus	14	35.08±10.88	18.65±11.83	t=16.69 P<0.001	Highly significant
Homologous septal cartilage	10	34.25±7.66	18.56±7.51	t=12.96 P<0.001	Highly significant
Teflon porp	04	36.28±8.08	22.25±9.28	t=10.63 P<0.01	Significant
Homologous incus	02	45.40±3.68	30.25±5.30	t=13.17 P<0.05	Significant

Austin explained the pathogenesis of necrosis. According to him, the vessels of the mucosa develop thrombotic disease. These vessels supply blood to the incus. Secondary squamous epithelium in growth occurs which results in the destruction of the arch of the stapes and the handle of the malleus. This destruction is due to the enzymes which are osteolytic.

In ears with single or multiple ossicular involvements, the average hearing loss was noted to be between 39.40 to 59.60 dB. It was 50.72 ± 6.95 in patients having isolated erosion of lenticular process of incus. It was 50.10 ± 15.48 in patients having isolated erosion of long process of incus.

Chronic form of disease of ear has perforation with ossicular interruption and 60% of them need surgery. Austin indicated that the typical hearing loss in worse at the lower frequencies and averages 38 dB. If the perforation is larger in size, then it will cause worse hearing loss. But the difference is not stable and can vary. In case the tympanic membrane is completely lost along with ossicles, then in that case, the contour of the hearing loss is the same as the previous group but more severe, averaging 50 dB.

Twenty nine of the 30 cases underwent myringostapediopexy (type IIIb tympanoplasty) with the ossicular graft as short columella between the tympanic membrane graft and the stapes superstructure. Only one case had absence of the stapes of superstructure and had to undergo myringoplatinopexy (type IIIc tympanoplasty) using the homologous septal cartilage graft as long columella between the tympanic membrane graft and the stapes footplate.

The results of tympanoplasty are frequently reported in terms of closure of air-bone gap. The prerequisites for success in tympanoplasty are that firstly the tympanic membrane must be intact and mobile post operatively. Secondly, there must be an efficient sound conducting mechanics. Smyth and Patterson concluded that for significant benefit to be achieved the postoperative air conduction (AC) average over the speech frequencies (0.5, 1.2 and 4 KHz) must be less than 30 db or the interaural difference reduced to less than 15 db. This figure of 15 db corresponds to the cross attenuation effect of the skull.⁸

In our study, the 14 patients who underwent surgery with autologous incus as the graft material had mean preoperative air-bone gap of 35.03 dB with standard deviation of 10.88. Postoperatively their mean Air-Bone gap was 18.65 dB with standard deviation of 11.83. This is highly significant statistically (p<0.001)

In our study, 29 cases had an intact stapes. This group underwent myringostapediopexy. In this group 16 patients (55.17%) showed satisfactory results at 6 month post-operative follow-up (air-bone gap of 0-20 dB). Only 1 case had an absent stapes superstructure with only a mobile footplate. This patient underwent myringoplatinopexy. This patient had a postoperative air-bone gap of 30.90 dB.

The hearing results after ossicular reconstruction in other studies are: when the titanium prosthesis was used, as in studied by Hillman (45.3%).¹⁰ When the hydroxyapatite prosthesis was used as in studies by Grote (68%).⁹ and Shambaugh III (64.8%), and when plastipore prosthesis was used, as in studies done by Hillman (60%).¹⁰

CONCLUSION

Excellent results (post-operative Air-Bone gap between 0 to 10 dB) were noted only with the autologous incus graft. 28.57% of the total patients with autologous incus graft showed excellent post-operative results.

Good results (postoperative air-bone gap between 10 to 20 dB) were found for autologous incus, Homologous septal cartilage and teflon PORP, with percentage of 28.57, 50 and 25 respectively.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

REFERENCES

- 1. Report of a WHO/CIBA Foundation workshop: Prevention of hearing impairment from chronic otitis media. London (U.K): 1996.
- Ruben RJ. The disease in society: evaluation of chronic otitis media in general and cholesteatoma in particular. In Sade. J, editor: Cholesteatoma and mastoid surgery. Amsterdam: Kugler publishing; 1982.
- 3. Paparella MM, Kim CS: Mastoidectomy update. Laryngoscope. 1977;87:1977.
- 4. Celik O, Gok U, Yalcin S, Susaman N, Kaygusuz I, Karl>dag T, Çetinkaya T. Results of ossiculoplasty in chronic otitis media without cholesteatoma: Turkish Arch Otolaryngol. 2001;39(4):259-62.
- Austin DF. Ossicular reconstruction. Otolaryngol Clin North Am. 1972;5:145-60.
- Austin DF. Sound conduction of the diseased ear. J Laryngol Otol. 1978;92:367-93.
- 7. Austin DF. Acoustic mechanisms in middle ear sound transfer, Ossiculoplasty. Otolaryngologic Clin North Am. 1994;27(4):641-53.
- 8. Toner JG, Smyth GDL, Kerr AG: Realities in Ossiculoplasty. J Laryngol Otol. 1991;105(7):529-33.
- Grote JJ. Biocompatible materials in chronic ear surgery. In Brackmann DE, Shelton C, Arriaga MA, editors: Otologic Surgery. Philadelphia: WB Saunders; 2001: 185-200.
- 10. Hillman TA, Shelton C: Ossicular chain reconstruction: titanium versus Plastipore. Laryngoscope. 2003;113:1731.

Cite this article as: Reddy CRVB, Reddy MS. Study of pathology of ossicles in non-cholesteatomatous chronic suppurative otitis media, its repair and outcome. Int J Otorhinolaryngol Head Neck Surg 2018;4:462-6.