

# One Stage Posterior Canal Wall Reconstruction With Conchal Cartilage In Cholesteatoma Surgery

Padam Singh Jamwal\*, Kamal Kishore\*, Manish Sharma, Mohit Goel\*

## Abstract

This study incorporates 352 patients, who underwent canal wall down mastoidectomy followed by canal wall reconstruction using conchal cartilage at SMGS Hospital, Govt medical college, Jammu. Out of 352 patients, 198(56.25%) were males and 154(43.75%) were females with 242(68.75%) cases having bilateral pathology. Posterosuperior pathology was seen in 43.75% patients while 31.25% had attic pathology. Aural polyp was seen in 15.62% and mesotympanic pathology was seen in 9.38%. 87.5% patients had an Air Bone gap of greater than 20dB preoperatively and postoperatively 72.72% had an airbone gap of <20dB. One stage PCW reconstruction in cholesteatoma surgery is a safe procedure for the management of cholesteatoma as a CWD technique is followed which helps in adequate exposure and wide eradication of the disease and when reconstruction of PCW is done a faster healing and lower morbidity is observed as patient is now free from cavity.

## Key Words

Cholesteatoma, Mastoidectomy, Posterior Canal Wall Reconstruction

## Introduction

The main aim of cholesteatoma surgery as given by Parisier in 1989 (1) is elimination of irreversible disease so as to make the ear safe and dry, and restoration of serviceable unaided hearing. However the secondary goal is to maintain a normal anatomical appearance of the ear and to minimize the need for long term care of the operated ear or the concern of getting water into the ear.

The surgery for cholesteatoma removal is of two types: Canal wall up or canal wall down type. Canal wall up technique gives better functional and anatomical results with no cavity problems as stated by Hough in 1983 (2) but the incidence of residual and recurrent disease happens to be high which is unacceptable both to the public and the treating surgeon. Sayeed (2002) (3).

Canal wall down helps in wide exposure and complete

eradication of disease but is associated with poor anatomical and functional results. Moreover, the problem of cavity remains. Smyth in 1985 (4) said that between these extremes are those, who in order to provide better access for the removal of cholesteatoma, temporarily remove the canal wall but later replace or reconstruct it, or having removed it used bone or soft tissue to reduce the size of mastoidectomy cavity. Grote and Van Bitterswijk in 1986 (5) stated that this compromise has been evolved to provide the best aspects of both the techniques.

One stage reconstruction of PCW in cholesteatoma surgery helps in adequate exposure and wide eradication of the disease with better hearing results. Moreover, there is faster healing with no cavity problems and therefore a

From the Department of ENT, SMGS, GMC, Jammu J&K India 180001

Correspondence to : Dr Padam Singh Jamwal, Associate Professor Department of ENT, SMGS, Jammu J&K India 180001

lower morbidity as stated by Sayeed 2002 (3). Several materials have been utilized for PCW reconstruction like autograft cartilage by Whers in 1972 (6), bone pate by Pulec in 1976 (7), autologous mastoid bone by Marquet in 1976 (8), Proplast by Johns in 1981 (9), hydroxyapatite cement by Wiet *et al* in 1993 (10), ionomer cement by Geyer *et al* in 1997 (11), titanium mesh by Zini *et al* in 2002(12) and conchal cartilage perichondrial graft by Sayeed in 2002 (3), but the research for the suitable reconstruction material is still on. Our study was aimed to assess the feasibility safety, mechanical survival, extrusion rate, functional integrity and function results by using conchal cartilage for PCW reconstruction in a single stage cholesteatoma surgery.

The present study "one stage posterior canal wall reconstruction with cartilage in cholesteatoma surgery" was done to assess the feasibility, safety, mechanical survival, extrusion rate, functional integrity and functional results in this single stage reconstructive procedure.

#### **Material and Methods**

From 1998-2010,352 cases including 198 males and 154 females underwent canal wall down mastoidectomy followed by canal wall reconstruction using conchal cartilage at SMGS Hospital, Govt medical college, Jammu. Age of the patients ranged from 11-56 years.

All the patients underwent canal wall down mastoidectomy via a postaural incision. Tympanomeatal flap was elevated and middle ear entered. The incudostapedial joint was disarticulated to avoid trauma to inner ear. In most cases (except those with postaural fistula) an anterior posterior approach was done and all cholesteatoma and granulation tissue was removed. The middle ear, attic, aditus and antrum were made disease free. A reconstruction of ossicles was done as required depending upon the type of ossicular erosion. A composite cartilage perichondrium graft was harvested from concha for reconstruction of tympanic membrane. The posterior meatal wall was built with conchal cartilage with concavity towards the canal side. To anchor the cartilaginous wall securely, the lower cut in the cartilage was fashioned to fit the contour of the lowered canal wall. If needed, it was supported with pieces of gelfoam placed on mastoid side. A small gap underneath the upper part of the cartilaginous plate was left to act as an aditus to the mastoid cavity. Cartilage was placed slightly posterior to the original position of the posterior bony canal to widen the

reconstructed canal. Perichondrial graft was placed beneath the tympanic membrane remnant and draped over the reconstructed ossicles and then over the canal wall side of reconstructing cartilage. Meatal skin flap was reapplied over the reconstructed meatal wall. Postaural incision was closed in layers and medicated ribbon gauze were kept in the external auditory canal. Patients were kept under follow-up, weekly follow-up for one month followed by monthly till three months, then three monthly thereafter.

The taken-up reconstructed external auditory canal (EAC) was labeled as sufficiently wide when healing of the cartilage took place at the same level as that of facial ridge. If the cartilage was taken-up posterior to the ridge, the canal was labeled as extremely wide. In the case when cartilage had fallen anterior to the ridge, reducing the size of the canal, the canal was recorded to as narrow.

Failure of uptake of reconstructed canal wall was divided into medial failure when the medial most part of the cartilage failed to taken-up and attic and mastoid antrum at this level communicate with external auditory canal. Lateral failure was when mastoid antrum communicated with the external auditory canal at the lateral portion of the ridge while medial part of the cartilage was well taken-up. Total failure was when throughout the length of the facial ridge, the mastoid antrum communicated with external auditory canal and middle ear.

#### **Results**

Out of 352 patients, 198(56.25%) were males and 154(43.75%) were females. The most commonly affected age group was between 15-25 years for both the sexes. In the present study 242(68.75%) cases had bilateral pathology. Most of the patients (71.87%) presented with symptoms persisting for >5 years, while 88(25%) had symptoms for last 1-5 years and only 11(3.13%) gave history of <1 year disease duration. The most common symptom was of ear discharge seen in all (100%) patients while hearing impairment was in 275(78.12%) patients. Tinnitus and vertigo was present in 21(6%) and 11(3.13%) patients respectively. Posterosuperior pathology was seen in 43.75% patients while 31.25% had attic pathology. Aural polyp was seen in 15.62% and mesotympanic pathology was seen in 9.38%. 87.5% patients had an Air Bone gap of greater than 20dB, 9.37% had 11-20dB and 3.13% had 0-10dB Air Bone gap. 90.62% patients were

**Table 1: Age and Sex Distribution of Patients**

Age (in years)	No of cases		Total	
	Male	Female	No.	Percentage(%)
6-15	44	11	55	15.63
15-25	66	88	154	43.76
25-35	55	33	88	25.00
35-45	33	22	55	15.62
Total	198	154	352	100.00

**Table 2. Showing Pre-Operative Air-Bone Gap**

Pre-operative air-bone gap(dB)	No of cases	Percentage
0-10	11	3.13
11-20	33	9.37
21-30	154	43.75
>30	154	43.75

**Table 3. Showing Status Of External Auditory Canal At Serial Follow-Up**

Status of external auditory canal	At 2 weeks		At 4 weeks		At 6 weeks	
	No.	Percentage(%)	No.	Percentage(%)	No.	Percentage(%)
Granulations	132	37.50	56	15.9	21	5.96
Epithelial deficit	220	62.50	99	27.8	12	3.40
Complete epithialization	nil	Nil	198	56.2	319	90.60

**Table 4. Showing Post-Operative Air-Bonegap**

Post-operative air bone gap(dB)	No of cases	Percentage(%)
0-10	21	5.96
11-20	235	66.76
21-30	48	13.63
>30	48	13.63

**Table 5. Showing Status of External Auditory Canal & Reconstructed Posterior Canal Wall At 3 Mth Post-Operative Period**

Status of reconstructed PCW	Status of EAC	No. of cases	Percentage(%)
Taken up	Extremely wide	23	6.53
	Sufficiently wide	253	71.88
	Narrow	10	2.84
Not taken up	Medial failure	32	9.09
	Lateral failure	22	6.25
	Total failure	12	3.40

operated for first time and in 9.38% of the cases it was a revision surgery. Attic, middle ear and mastoid was involved in 37.05% and attic and mastoid was involved in 31.25%. Attic and middle ear involvement was seen in 25%, with only attic or only mastoid involvement seen in 3.13% and 3.10% respectively. Incus was involved in 90.61% whereas malleus and stapes were involved in 31.25% and 59.37% cases respectively. Ossicular chain was intact in only 9.37% patients. At 2 weeks postoperatively, 62.50% had epithelial deficit and, at 6

weeks, only 3.40% had epithelial deficit, granulations were seen in 5.96% and complete epithelization in 90.60% patients. Postoperatively 72.72% had an airbone gap of <20dB, 13.63% had 21-30dB and another 13.63% had an airbone gap >30dB. Cartilage was taken up in 286 patients (253 had sufficiently wide canal, 23 had extremely wide and 10 had narrow canal). Medial failure was observed in 9.09% patients, 6.25% showed lateral failure and 3.40% had total failure.

## Discussion

The posterior bony canal wall is important in that it supports the tympanic membrane and ossicles in anatomical position thus maintaining a normal middle ear air space for the ossicles as well as providing a means of aerating the mastoid antrum and air cells. It is also important to prevent the development of retraction pockets and pseudocholesteatoma. Every effort, therefore, should be made to preserve this bony barrier and in case it has to be removed to assure the complete extirpation of the disease, it should preferably be rebuilt nearly to its original size and shape. In case the entire posterior bony wall has been destroyed by disease or previously removed surgically, it can be replaced by complete cartilage wall reconstruction and this is done after all cholesteatoma has been removed.

In the present study, maximum (43.7%) of the patients were in the age group of 15-25 years, with male to female ratio being 9:7. Bilateral involvement of this disease process was found in about 30% of the patients which is consistent with findings of Manekar (13). However, Glasscock *et al* (14) in their study found the disease to be bilateral in only 16%.

Most of the patients (71.8%) in the present study had the symptoms for a period of >5 years. The duration of symptoms in the study of Glasscock *et al* (14) was also more than 5 years in about 70 percent of their patients. Manekar (13) reported a similar findings in 69% of his patients. The most commonly presenting symptom was ear discharge. It was found to be present in 100 percent of the cases and most of the times discharge was mucopurulent in type.

Posterosuperior pathology in the form of granulations, retraction, polyp or cholesteatoma was seen in 43.7% of our patients and 31.2% had an Attic pathology, 16% had aural polyp filling external auditory canal and 95 had mesotympanic pathology. In a study by Sayed (3), 41.9% had posterosuperior pathology, 29% had Attic pathology, 19.3% had aural polyp in EAC, 19.3% had mesotympanic pathology, 6.45 had meatomastoid fistula and similar percentage was of patients with postaural abscess.

Preoperative air-bone gap was found to be >20db in 87.4% of the cases of the present study. This was similar to observation made by Dornhoffer (15) who found the conductive hearing loss of >20db in 73% of his cases. Glasscock *et al* (14) also reported >20db air-bone gap in

majority of his patients. In the present series, revision surgery was performed in only 9.45% of cases. However, Sayeed (3) found the incidence of revision surgery as 32.2% and Austin (16) found the rate to be 20.2%.

37.5% of the cases in the present study had disease in the attic with middle ear and mastoid, 31.2% in the attic and mastoid, 25% in the attic and middle ear and 3.55% each in only attic and only middle ear. The findings are not much different from those of Austin (16) who graded the extent of cholesteatoma and found Grade IV (attic + middle ear + mastoid) in 36.7%, Grade III (attic + mastoid) in 33.3%, Grade II (attic + middle ear) in 23.5% and Grade I (only attic disease) in 6.3%. Glasscock (14) reported more than 30% incidence of cholesteatoma involving attic with the middle ear and mastoid which is consistent with our findings.

Intact ossicular chain was found in only 33 of our cases and incus was found to be the most commonly involved ossicle. This result is similar to result of palva *et al* (17) and Desarada *et al* (18).

Post-op air-Bone Gap reduced to <20dB in 72.72% of the cases, out of which 5.9% had just 0-10dB air-bone gap. Dornhoffer (15) in his study found AB gap reduced to <20dB postoperatively in 92% of his patients. Sayeed [3] in a similar study of posterior canal wall reconstruction with cartilage found hearing improvement in 83.9% cases.

The reconstructed posterior canal wall was taken up in 81% of the cases. Medial failure was seen in 9% and lateral failure was seen in 6%. Total failure occurred in 3%. Out of those in which posterior canal wall was taken up it was found to be sufficiently wide in 71.8%. In 2.8% patients, it was narrow and in 6.5% canal width increased due to posterior displacement of cartilage. Our results were similar to study by Sayeed (3) who found posterior displacement in 6.45 and narrow canal in 3.2% of his cases. Zini *et al* (12) found narrow canal in 22.2% although he had used titanium mesh for reconstruction of PCW.

Epithelization of reconstructed external auditory canal was seen in 90.6% cases. Sayeed (3) in his study found epithelization in all his cases. 96.8% of the ears were completely dry after 6 weeks. Nyrop and Bonding [19] reported 89% dry ears after canal wall down technique.

In the present study, at 3 months follow-up 88.8% patients were available and 15.65 showed ear discharge at this time without any evidence of recurrence. The rest

of the cases were dry at 3 months. No recurrence of cholesteatoma was seen. This is comparable to study by Sayeed (3) who also had no recurrence. However recurrence was found in 66% of cases in a study by Dornhoffer (15) and in 9.1% of the cases in a study by Ikeda (20) in 2003.

### Conclusion

One stage PCW reconstruction in cholesteatoma surgery is a safe procedure for the management of cholesteatoma as a CWD technique is followed which helps in adequate exposure and wide eradication of the disease and when reconstruction of PCW is done a faster healing and lower morbidity is observed as patient is now free from cavity. Moreover, autologous conchal cartilage as a material for PCW reconstruction is safe, readily available, close to the site of surgery and can be easily harvested in sufficient quantities. The cartilage is thick and stiff so can be easily maintained at the desired place and the contour is such that it conforms well to the shape of the area to be reconstructed.

### References

1. Parisier SC. Management of cholesteatoma. *Otolaryngologic Clinics North America* 1989; 927-40
2. Hough J. The canal up or down debate. The case for the canal wall down. *J Laryngology Otolology* 1983;8:92-94
3. Sayeed RH. One stage reconstruction in management of extensive cholesteatoma. *Indian J Otolology* 2002;8(1) : 9-16
4. Smyth GDL. Cholesteatoma surgery. The influence of the canal wall. *The Laryngoscope* 1985;95 : 92-96
5. Grote JJ, Van Blittenswijk CA. reconstruction of the posterior auditory canal wall with a hydroxyapatite prosthesis. *Annals Otolology, Rhinology Laryngology* 1986 ; 95(supp 123) : 6-9
6. Wehrs RE. reconstructive mastoidectomy with homograft Knee cartilage. *The Laryngoscope* 1972 ; 82: 1177-1188.
7. Pulec JL, Conversion of the radical mastoid cavity for obliteration or reconstruction. In operative surgery: Ear, edited by J. Ballantyne, 1976 london : Butter worths .pp. 116-124
8. Marquet J. Homograft in tympanoplasty and other forms of middle ear surgery. In operative surgery : Ear, 3rd edn, edited by J. Ballantyne; 1976. London : Butterworths .pp. 110-115
9. Johns AN. The use of proplast in reconstruction of the posterior meatal wall. *J Laryngology Otolology* 1981 ; 95 :899-904
10. Wiet RJ. canal wall reconstruction. A newer implantation technique. *Laryngoscope* 1993; 103 : 594-599
11. Geyer G, Dazert S, Helms J. performance of ionomeric cement (ionocem) in the reconstruction of the postmeatal wall after curative middle ear surgery. *J Laryngology Otolology* 1997 ; 111 : 1130-1136
12. Zini C, Quaranta N, Piazza F. Posterior canal wall reconstruction with titanium micromest and bone plate. *The Laryngoscope* 2002 ; 112: 753-756.s
13. Manekar G. Cholesteatoma: A review of 1050 patients. *Indian J Otolology* 1999;5(2):71-73.
14. Glasscock M E , Dickens J R E , Wiet R. Cholesteatoma in children. *The Laryngoscope* 1981;91:1743-1752.
15. Dornhoffer J L. Retrograde mastoidectomy with canal wall reconstruction; A single stage technique for cholesteatoma removal. *Annals of Otolology, Rhinology Laryngology* 2000;109:1033-1039.
16. Austin D F. Staging in cholesteatoma surgery. *J Laryngology Otolology* 1989;103:143-148.
17. Palva T. The invasion theory. In : Sade, J(ed), cholesteatoma and Mastoid Surgery, Amsterdam, Kugler; 1982.
18. Desarda K K, Bhisegaonkar DA, Gill S. Tragal perichondrium and cartilage in reconstructive Tympanoplasty. *Indian J Otolaryngology Head Neck Surgery* 2005; 57: 9-12.
19. Nyrop M, Bonding P. Extensive cholesteatoma : Long term results of three surgical techniques. *J Laryngology Otolology* 1997;111:521-526.
20. Ikeda M, Yoshida S, Ikui A. Canal wall tympanoplasty with canal reconstruction for middle ear cholesteatoma; Post operative hearing, cholesteatoma recurrence and status of re aeration of reconstructed middle ear cavity. *J Laryngology Otolology* 2003;117:249-255.