



A STUDY OF CANAL WALL DOWN MASTOIDECTOMY WITH SOFT-WALL RECONSTRUCTION IN CHRONIC SUPPURATIVE OTITIS MEDIA

ENT

Baldev Singh

PG Resident, Department Of ENT, RNT Medical College, Udaipur, Rajasthan, India.

Jaideep Singh Chouhan*PG Resident, Department Of ENT, RNT Medical College, Udaipur, Rajasthan, India.
*Corresponding Author

ABSTRACT

Introduction:- Chronic suppurative otitis media (CSOM) is a long standing infection of a part or whole of the middle ear cleft characterized by ear discharge and a permanent perforation. Chronic suppurative otitis media is divided into two groups, tubotympanic (safe type) and atticoantral (unsafe type) disease. Atticoantral disease commonly involves pars flaccida and is characterized by the formation of cholesteatoma-non-neoplastic lesion in the temporal bone.

Cholesteatomas are potentially dangerous because of their potential to incite resorption of bone, leading to intracranial or intratemporal complications. Current treatment options for cholesteatoma are medical management of superimposed infection with topical antibiotic eardrops and surgical management in the form of either (a) Canal wall up (CWU) mastoidectomy or (b) Canal wall down (CWD) mastoidectomy. Mastoid reconstruction and obliteration procedures can be performed in patients undergoing CWD mastoidectomy to assist in creating a dry and 'self-cleaning' cavity. It can be done by using Free grafts and local flaps. The aim of this study is to evaluate the surgical outcome of mastoid cavity with soft wall reconstruction using cartilage in canal wall down mastoidectomy and compare these result to those obtained with canal wall mastoidectomy without soft wall reconstruction.

Material and methods:- This study was conducted on 50 patients of CSOM having unsafe type of disease attending Department of ENT, with written informed consent, willing for regular follow up, in RNT Medical College and MB Hospital, Udaipur from Feb. 2019 to Dec 2019.

50 cases of active squamous chronic otitis media were studied. The patients were randomly divided into two groups of 25 each. One group underwent soft wall reconstruction of posterior canal wall by using conchal cartilage and other group had no soft wall reconstruction done i.e. had a open mastoid cavity. The data were collected and analysed with suitable statistical tools using SPSS statistical software.

Results:- The present study found that soft wall reconstruction of posterior canal wall is better for elimination of cavity problems after canal wall down mastoidectomy.

KEYWORDS

Chronic Suppurative Otitis Media, Mastoidectomy, soft wall reconstruction, mastoid cavity.

INTRODUCTION:

Chronic suppurative otitis media (CSOM) is a long standing infection of a part or whole of the middle ear cleft characterized by ear discharge and a permanent perforation. It is fairly prevalent disease in this part of the country with symptoms of recurrent ear discharge and diminished hearing. Chronic suppurative otitis media is divided into two groups, tubotympanic and atticoantral disease. Tubotympanic disease is characterized by a perforation of pars tensa. Generally this disease is not complicated and is called safe type of disease. Atticoantral disease commonly involves pars flaccida and is characterized by the formation of cholesteatoma. This type of the disease is generally considered to be at risk of developing intracranial or extracranial complications and is called unsafe type.^[1]

"Cholesteatoma" is a well-demarcated non-neoplastic lesion in the temporal bone, which is commonly described as "skin in the wrong place."

Classification Based on Location in the Tympanic Cavity in Relation to the TM On the basis of their site of origin, middle ear cholesteatomas can be classified as the following:

- Pars flaccida (attic) cholesteatomas
- Pars tensa (sinus) cholesteatomas

Histologically, cholesteatomas display a squamous cell cyst representing an external matrix formed by a stratified strongly keratinizing squamous epithelium, which is similar to epidermal tissue elsewhere.

Middle ear cholesteatomas present with the following clinical signs:

- Chronic discharge of the ear, and some form of hearing loss.
- Facial nerve paralysis occurs rarely with middle ear cholesteatomas but can be present in 20%-64% of extensive cholesteatoma cases, half of which are higher grades.
- Vertigo, tinnitus, otalgia, and headache.
- The hallmark of a cholesteatoma is its retention of keratinous debris. Cholesteatomas are potentially dangerous because of their potential to incite resorption of bone, leading to intracranial or intratemporal complications.^[2]

Current treatment options for cholesteatoma are medical management of superimposed infection with topical antibiotic eardrops and surgical management in the form of either (a) Canal wall up (CWU) mastoidectomy or (b) Canal wall down (CWD) mastoidectomy. The first operation has a low to intermediate risk for otorrhoea but has an increased risk of cholesteatoma recurrence.

The risks for canal wall down mastoidectomy are reversed – lower risk of recurrence but higher risk of otorrhoea.

The purpose of the open cavity procedure is to exteriorize the mastoid cavity for future monitoring of recurrent cholesteatoma, provide drainage for unresectable temporal bone infection, and occasionally, provide exposure for difficult to access areas of temporal bone.^[3]

The 'open' or modified radical mastoidectomy has been the mainstay of surgical management of active squamous otitis media or cholesteatoma for the last one and half centuries.

Surgical options for the large mastoid cavity are:

1. Autologous cultured epithelial graft
2. Large meatoplasty
3. Revision mastoidectomy with/without meatoplasty
4. Soft wall Reconstruction with an aerated cavity
5. Mastoid cavity obliteration
6. Mastoid and middle ear obliteration

Mastoid reconstruction and obliteration procedures can be performed in patients undergoing CWD mastoidectomy to assist in creating a dry and 'self-cleaning' cavity. These should be performed as a primary procedure in the same sitting as the CWD mastoidectomy but may be conducted as a secondary revision procedure in mastoid bowls with chronic otorrhoea and poor healing.

Mastoid reconstruction and obliteration procedures can be classified into two main categories:

(A) Free grafts, which are further sub-divided to biologic and non-biologic and (B) local flaps.

(A) Free Grafts:- (a) Biologic Techniques

These include the use of cortical bone pate, allogeneous/autogeneous

bone chips, cartilage, fat and fascia to fill the mastoid cavity after CWD mastoidectomy has been performed. The cartilage is often harvested from the conchal cartilage whereas cortical bone pate is obtained from the lateral mastoid cortex, taking care not to enter diseased air cells.

(b) Non-biologic Techniques

These include use of hydroxyapatite crystals, calcium phosphate ceramic granules and bioactive glass ceramic to fill or reconstruct the canal wall following CWD mastoidectomy.

(B)Local Flaps:-

A lining with epithelial migration is important for a dry and 'self-cleaning' cavity. Pedicled flaps resurface the cavity, covering raw surfaces that interfere with re-epithelisation. Their robust blood supply also ensures a conducive surface for epithelial migration.

Several types of flaps have been described, including the Palva flap (Meatally-based musculoperiosteal flap), middle temporal artery flap, Hong Kong flap, temporoparietal fascial flap (TPFF), pedicled superficial temporalis fascial flap, postauricular-periosteal-pericranial flap, temporalis muscle flap, inferiorly based fascio-periosteal flap, and post-auricular myo-cutaneous flap. Often a combination of various techniques is used to achieve the most favorable result.

The most common indication for mastoid reconstruction is following canal wall down mastoidectomy for chronic otitis media. A canal wall down mastoid cavity, if not reconstructed, can result in persistent otorrhea that can be difficult to control even with topical antibiotic therapy and frequent cleaning of the cavity. Other problems with open cavity include difficulty with the use of a hearing aid, water intolerance due to susceptibility to infection, and propensity to vertigo by a caloric stimulus such as warm/cold air or water. Soft wall reconstruction of the mastoid cavity is indicated to reduce the size of the cavity. It is ideally conducted as a primary procedure at the time of canal wall down mastoidectomy.¹⁴

The aim of this study is to evaluate the surgical outcome of mastoid cavity with soft wall reconstruction using cartilage in canal wall down mastoidectomy and compare these result to those obtained with canal wall mastoidectomy without soft wall reconstruction.

MATERIALS AND METHODS: This study was conducted on 50 patients of CSOM having unsafe type of disease attending Department of ENT, with written informed consent, willing for regular follow up, in RNT Medical College and MB Hospital, Udaipur from Feb. 2019 to Dec 2019.

INCLUSION CRITERIA: 1.Chronic suppurative otitis media 2.Atticoantral pathology, retraction or perforation. 3.Posterosuperior marginal pathology cholesteatoma or granulations. 4.Secondary acquired cholesteatoma.

EXCLUSION CRITERIA: 1.Chronic otitis media without cholesteatoma, 2.Acute otitis media with coalescent mastoiditis, 3.Persistent secretory otitis media, 4.CSOM- tubotympanic type, 5.CSOM with intracranial complications.

50 cases of active squamous chronic otitis media were studied. The patients were randomly divided into two groups of 25 each. One group underwent soft wall reconstruction of posterior canal wall by using conchal cartilage and other group had no soft wall reconstruction done i.e. had a open mastoid cavity.

Method of collection of data

Clinical Evaluation:- All patients underwent detailed medical history and clinical examination. Each patient underwent otoscopic examination, tuning fork test, pure tone audiometry, bilateral mastoid x-rays and HRCT temporal bone (if needed).

The primary outcome measure was the creation of a dry, infection free, low maintenance mastoid cavity as assessed by a grading system developed by Merchant et al¹¹. This semi-quantitative scale takes into consideration both patient symptomatology and clinical signs such as otorrhea and the presence of infection. The scale ranges from grade 0, representing a complete dry, healed ear, through to grade 3, in which there is persistent infection

The patients were graded at every follow up attendance and their

summary grade used to assess the outcome of the degree of control of infection. The summary grade is defined as the worst score obtained at any point during the entire follow up. Grades 0, 1, and 2 are considered adequate control of infection, whereas grade 3 indicates failure of control of infection. Secondary outcome measures include postoperative complications and hearing improvement which were assessed by pure tone audiogram.

Surgical procedure

After induction of general anesthesia, the ear was prepared by pouring povidone iodine solution and spirit into the ear canal and scrubbing the auricle and post auricular area. Lignocaine with 1:100000 epinephrine was injected into the post auricular region and the ear canal for hemostasis. Incisions were made in the ear canal and posterior meatal skin flap was elevated. A post auricular incision was made in the post auricular skin crease and a plane is developed between the subcutaneous tissue and temporalis muscle and periosteum of the mastoid. Temporalis fascia was harvested and set aside to dry.

Subcutaneous incision was made for exposure of mastoid cortex and middle ear¹⁰. A horizontal incision was made superior to the temporal line through temporalis muscle and a curvilinear incision is carried down to mastoid tip along the posterior bony canal. The mastoid bone is exposed using periosteal elevator by raising periosteum posteriorly, the vascular strip is elevated and reflected out of ear canal anteriorly using a self-retaining retractor. Canal flap was elevated and rotated anteriorly and secured in the anterior sulcus.

A simple mastoidectomy was done using a large cutting bur. Cholesteatoma and granulations filling the central mastoid tracts were removed at this time. Posterior canal wall were safely taken down and the facial ridge can be lowered until a thin layer of bone removed over the vertical segment of facial nerve. Removal of anterior (preservation of medial part) and posterior buttress was done. Ossicular chain was assessed, and if diseased they were removed. Total clearance of cholesteatoma and granulations from mastoid cavity, attic and middle ear was done along with saucerization of mastoid cavity. This step was followed by underlay myringoplasty, anterior tugging and ossiculoplasty. Free skin grafting over the fascia and bone was done.

Mastoid cavity was now reconstructed by using conchal cartilage. Adequate meatoplasty was done. Finally the external auditory canal was packed with ointment pack. The post-auricular incision was closed in layers after completion of homeostasis. A bulky pressure dressing was applied.

Postoperative treatment and follow-ups

Each patient was given an antibiotic, analgesic and antihistaminic medication for one week. Ear pack was removed two weeks after surgery. Patients were discharged on the seventh postoperative day and were appointed for follow-up, after one week and one month PTA was carried out at 3 and 6 months respectively.

RESULTS:

Table: 1 Comparison of cavity size and healing of cavity

Cavity size	Technique	No. of Cases	No. of healed cavities	%
Small	Soft wall reconstruction	5	5	100
	No Soft wall reconstruction	9	9	100
Medium	Soft wall reconstruction	13	12	92.30
	No Soft wall reconstruction	11	7	63.63
Large	Soft wall reconstruction	7	4	57.14
	No Soft wall reconstruction	5	2	40

Table: 2 Hearing status

Gain of air conduction	Cases		Controls	
	Number	% age	Number	% age
No gain	1	4	2	8
<10 dB	15	60	19	76
11–20 dB	5	20	4	16
21–30 dB	4	16	0	0

Table: 3 Result of Complications

Complications	Cases	Controls
Occasional otorrhea	4%	16%
Infection	4%	12%
Flap necrosis	4%	0
Medial stenosis	4%	0
Perichondritis	0	0%
Postop. granulation	0	4%
Cholesteatoma recurrence	0	0

DISCUSSION:

The goal of surgery in CSOM is to create a dry, safe ear and preserve or restore hearing as much as possible. A high residual and recurrence rate continue to be major drawbacks to canal wall up surgery. Glasscock^[5] reported a recurrence rate of 14%. Recurrence rates up to 20–40% have also been reported. Nyrop^[6] and Bonding's 10 year follow up of canal wall up cases in Copenhagen showed that 70% required a later canal wall down surgery.

The canal wall down technique creates an open cavity after removal of the bony posterior canal wall, providing excellent exposure for cholesteatoma removal. Recurrence rate is lowered up to 5–10%. The main disadvantages of technique are related to the necessity for periodic cleaning of the mastoid cavity with persistent otorrhea. These problems can be minimized by different obliterative procedures and soft wall reconstruction of posterior canal wall.

Soft wall reconstruction of posterior canal wall of the mastoid cavity leaves a smaller surface which epithelialises easily and rapidly, with a reduced likelihood of developing cavity granulations. The cavity, being smaller, is also more likely to retain its epithelial migratory potential and be self-cleaning. In cases where a cavity has reformed, the mastoid tip usually remains obliterated. The elimination of this sump is probably one of the most important advantages of this technique.

Hearing aids, if required, are better tolerated in a soft wall reconstruction of posterior canal wall cavity than an open cavity.

The major argument against cavity obliteration is the risk of trapping microscopic islands of cholesteatoma deep to the obliteration material. A meticulous surgical approach with removal of the entire cavity lining in continuity will reduce this risk and, if there is any doubt, e.g. when there is uncertainty about clearance of disease from the attic, then this should not be obliterated but left exteriorized.

In the present study during otoscopic examination 84% of patient had cholesteatoma, 10% had granulation, and 6% had polyp. In a study of S, Chhapola, Matta I et al.^[7] eighty percent of patients had cholesteatoma, 12.5% had granulations and only 7.5% had polyp.

In the present study, follow up was done after 15 days, 1 month, 3 month and 6 month of operation and evaluated for pain, discharge, epithelisation, comparison of cavity size and healing of cavity, time of drying of cavity, hearing status, and complications.

In study by S, Chhapola, Matta I et al.^[7] Of the 20 cases, 15 (75%) patients had a dry cavity at the end of 2 months whereas 5 (25%) patients still had ear discharge. Of the 20 control cases, 12 (60%) had a dry cavity and 8 (40%) still had ear discharge.

Three months after surgery, of the 20 cases, 16 (80%) patients had a dry cavity whereas 4 (20%) patients still had ear discharge. Of the 20 control cases, 12 (60%) had a dry cavity and 8 (30%) still had ear discharge. Six months after surgery, of the 20 cases, 18 (90%) patients had a dry cavity whereas 2 (10%) patient still had ear discharge. Of the 20 control cases, 14 (70%) had a dry cavity and 6 (30%) still had ear discharge.

In the present study on postoperative day 15, Of the 25 cases, 13 (52%) patients had a dry cavity whereas 12 (48%) patients still had ear discharge. Of the 25 control patient, 8 (32%) had a dry cavity and 17 (68%) still had ear discharge.

1 month after surgery, out of the 25 cases, 18 (72%) patients had a dry cavity whereas 7 (28%) patients still had ear discharge. Of the 25 control patient, 15 (60%) had a dry cavity and 10 (40%) still had ear discharge.

3 month after surgery, out of the 25 cases, 20 (80%) patients had a dry cavity whereas 5 (20%) patients still had ear discharge. Of the 25 control patient, 15 (60%) had a dry cavity and 10 (40%) still had ear discharge 6 month after surgery, out of the 25 cases, 24 (96%) patients had a dry cavity whereas 1 (4%) patients still had ear discharge. Of the 25 control patient, 22 (88%) had a dry cavity and 3 (12%) still had ear discharge.

In a study of Navjot Kaur, Dinesh Kumar Sharma, and Jagdeepak Singh et al.^[8] on post operative day 90, epithelisation was present 100% in both case and control group. S. Chhapola, Matta I et al.^[7] also found similar results.

The result of the present study are similar to the above mentioned studies and found that healing rate was 100%, 92.30% and 57.14% for small, medium and large cavity respectively in obliterative group, as compared to 100%, 63.63% and 40% respectively in the non obliterative group.

In a study by Mangal Singh, Sachin Jain, Ruchi Rajput, Rabindra K Khatua, Devashish Sharma et al.^[9] mean time period of drying of cavity was 46 days (1.5 months), in case group, while it was 89 days (3 month) in control group. This shows that there was definite and statistically significant decrease in time of drying of cavity in case group as compared to control group.

In the present study mean time of drying of cavity 3 month in case group, while it was 6 month in control group.

In a study by Mangal Singh, Sachin Jain, Ruchi Rajput, Rabindra K Khatua, Devashish Sharma et al.^[9] in 34 patients post operative audiometry was done and there was a gain of 21-30 db in 13.3% of cases and a gain of 11-20 db in 20.0% of cases, while in control group only 15.7% of controls had gain of 11-20 db and no control had again of > 20 db, there was a deterioration of hearing of 1-10 db in patients of control group.

In the present study, in 50 patient post operative audiometry was done and there was a gain of 21-30 db in 16% of cases and a gain of 11-20 db in 20% of cases, while in control group only 16% of control had gaining 11-20 db and no control had gain of >20 db. 1-10 db gain was seen in 60% of case group and 76% of control group, there was no gain in 4% of case group 8% of control group. (Table-2)

Therefore we can say that soft wall reconstruction of posterior canal wall seem to be better than control for improvement in hearing.

In the present study 4% occasional otorrhea present in case group and 16% patient of control group. Infection present in 4% case group and 12% control group. Flap necrosis present in 4% cases, perichondritis and cholesteatoma recurrence was not seen. (Table-3)

C Ravikumar and K Priyatharisini^[10] did study on Canal Wall down Mastoidectomy with Soft-wall Reconstruction.

Of 38 patients 84% had significant hearing improvement following surgery. After surgery, 79% showed well-healed ear with 10% showing no significant hearing outcome. 8% had ear discharge after surgery while 2% showed recurrence.

Hosoi H, Murata K, Kimura H and Tsuta Y^[11] did study on Long-term observation after soft posterior meatal wall reconstruction in ears with cholesteatoma.

Due to the strong possibility of post-operative retraction pocket formation in cases with a large balloon-like retraction, we rejected adopting the canal wall up technique or hard posterior meatal wall reconstruction.

CONCLUSION:

The present study concluded that soft wall reconstruction of posterior canal wall is better for elimination of cavity problems after canal wall down mastoidectomy.

REFERENCE:

1. Plester D, Steinbach E (1977) Histological fate of tympanic membrane and ossicle homograft. *Otolaryngol Clin N Am* 10(3):487–499
2. Sade J, Weinberg J, Berco E, Brown M, Halvey A (1982) The marsupialised (radical) mastoid. *J Laryngol Otol* 96:869–875

3. Grote JJ, Van Butterswrik CA (1986) Reconstruction of posterior canal wall with hydroxypetite prosthesis. *Ann Otorhinolaryngol* 95(supp 123):10–12
4. Males A, Grey Reimer A, Andreasson L, Harris S. Surgical treatment of cholesteatoma: a comparison of closed and open techniques in a follow-up of 164 ears. *Clin Otolaryngol Allied Sci* 1987;12(6):447-54.
5. Juliana Gulya A, Lloyd B Minor, Dennis S Poe. *GlasscockShambaugh Surgery of the ear*, 6th ed. USA: People's Medical Publishing House; 2010. p.515-527.
6. Nyrop M, Bonding P (1993) Achievement of stable ears in cholesteatoma surgery: long term results of three surgical techniques. Paper presented at the Fourth international conference on Cholesteatoma and mastoid surgery, Niigata, Japan.
7. Chhapola S, Matta I et al. Mastoid obliteration versus open cavity; A Comparative Study. *Indian J Otolaryngol Head and Neck Surg* (January 2014).
8. Navjot Kaur, Dinesh Kumar Sharma, and Jagdeepak Singh. Comparative Evaluation of Mastoid Cavity Obliteration by Vascularised Temporalis Myofascial Flap and Deep Temporal Fascial-Periosteal Flap in Canal Wall Down Mastoidectomy *J Clin Diagn Res.* 2016 Dec.
9. Mangal Singh, Sachin Jain, Ruchi Rajput, Rabindra K Khatua, Devashish Sharma. Retrospective and Prospective Study of Singapore Swing Method on Healing of Mastoid Cavity. *Indian J Otolaryngol Head Neck Surg* (Octobe2010) 62(4):365-371.
10. Ravikumar C, Priyatharisini K, Kaniitha MS, Pandian DR, Anandan H. A Study of Canal Wall down Mastoidectomy with Soft-wall Reconstruction. *Int J Sci Stud* 2018;5(12):43-46.
11. Hosoi H, Murata K, Kimura H, Tsuta Y. Long-term observation after soft posterior meatal wall reconstruction in ears with cholesteatoma. *J Laryngol Otol* 1998;112:31-5.