
Obliteration of mastoid cavity and reconstruction of attic area using conchal cartilage

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ABSTRACT

Aim: Aim of this study was to describe an effective technique for mastoid cavity obliteration and reconstruction attic region in canal wall down Tympano mastoidectomy for unsafe chronic otitis media and to review its efficacy in producing a dry, low maintenance, small mastoid cavity. **Material and method:** In this prospective study, 100 patients were selected who were undergoing procedures for active and inactive chronic otitis with cholesteatoma. All surgical interventions involving mastoid cavity obliteration or reconstruction of attic area and restoration of middle ear space by use of conchal cartilage with reconstruction of tympanic membrane and also ossicular reconstruction was achieved with either a partial or total ossicular replacement prosthesis. The preoperative inclusion criteria were a cholesteatoma with attic destruction, a sclerotic mastoid with poor Eustachian tube function and an intact posterior canal wall. Other middle ear diseases such as chronic otitis media without cholesteatoma were included, but the latter two criteria were applied equally. **Results:** A completely dry cavity was achieved 80 to 85% of hundred patients (80 to 85 % confidence interval) had an overall significant improvement of in hearing and their P value was >1% to 2% and there were no residual or recurrent cholesteatoma. The peak age incidence in this study was out of 100, the highest was seen among 20-30 years' age group i.e. 40 out of 100. And among 40, 26 were males and 14 were females. The least age incidence in this study was 2 which were seen in age of above 60 years. The conchal cartilage was used the highest in cholesteatoma i.e. 66 of 100 of which 40 were males and 26 were females. The % rate of graft failure was highest in Rev. CWD method i.e. 37.5%. The least % rate of graft failure was 10 % in ICW method. **Conclusion:** Conchal cartilage is the best material for reconstruction obliteration of cavity proved to be a useful adjustment in the surgical management of the chronically draining cavity.

Keywords: Conchal cartilage, Ossicular reconstruction, Cholesteatoma

Introduction

In the ear disease the chronic suppurative otitis media is common in all age and sex. So the main objective of the surgery in chronic otitis media is to eradicate infection by producing a safe and dry ear and also the main aim of surgery is to preserve or to improve hearing whenever possible. The obliteration/reconstruction procedure of the surgical cavity is used in order to eliminate postoperative problems such as patient intolerance to water exposure, frequently required cleaning of cavity, vertigo or the aesthetic inconvenience due to too large meatoplasty, most of

the obliteration techniques are using local flaps or free grafts like fat, bone fragments, bone dust and cartilage. In surgery for chronic otitis media, mastoid obliteration plays a roll of reducing air burden of the Eustachian tube and preventing retraction of the attic area/ post auricular area in mastoid surgery out of all the materials used for mastoid obliteration autogenies tissues are most ideal especially the conchal cartilage [1] The major surgical techniques for attic cholesteatoma are the 'canal wall down' (CWD) and 'intact canal wall' (ICW) tympanomastoidectomy procedures. The CWD approach can give improved exposure but produces significant clinical problems after surgery, such as late healing, postoperative hearing loss and the need for long-term care of the mastoid cavity. The advantages of the ICW technique are rapid wound healing and avoidance of the need to clean the ear periodically. However, residual and recurrent cholesteatomas are common after this approach because it is difficult to access the

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epitympanum. Canal wall down mastoidectomy (CWD)[2] is one of those common surgical techniques with variations of long-term outcomes. Although the majority of patient's experience little to no long-term problems postoperatively, there is a small but expressive number of patients with chronic complaints associated with the persistent mastoid bowl. Recurrent drainage and infection are the most common cause of discontent and medical return for patients with mastoid bowls. Other frequent complaints may include water intolerance, leading to infection, the need for frequent otomicroscopic cleaning, calorically induced vertigo from either water or air exposure, barometrically induced vertigo and in those with compromising hearing loss, being unable to wear traditional hearing aids. The most frequent and popular techniques consist of either local flaps (muscle, periosteum, or fascia) or free autologous grafts (bone, cartilage, fat, fascia), or even alloplastic grafts (hydroxyapatite, silicon, synthetics bones, among others). Mosher, in 1911[3], started the idea of mastoid obliteration to promote healing of a mastoidectomy defect. Mosher described an obliteration technique using a superiorly based post auricular soft tissue flap. The researcher noticed that the muscle atrophied over time, causing a progressive enlargement in cavity size. This observation is supported by histological data from the temporal bone study of Linthicum, which demonstrates the replacement of muscle with fibroconnective tissue and fat. These findings encouraged surgeons to associate other filler materials inside the bowl. Palva modified and popularized the technique, further adding to it the use of bone chips and bone pate in combination with an anteriorly based musculo periosteal flap. The goals of surgery for attic cholesteatoma are the complete removal of the mass, the restoration of hearing if possible and the prevention of residual or recurrent cholesteatomas. The benefits and drawbacks of ICW and CWD for cholesteatoma are well established. The greatest problem with ICW

techniques are the recidivism rates, reported as high as 40 to 60% in children and 20% in adults. This high rate of recurrence is associated with the relatively deficient exposure during surgery, the persistence of Eustachian tube dysfunction, and the persistence of mucosa in the mastoid that keeps resorbing gas and creates a negative pressure environment for resurfing of retraction pockets. Although the CWD technique is known to have lower residual and recurrent cholesteatoma rates, as mentioned previously, it is often accompanied by the problems associated by the mastoid cavity such as crust accumulation, water intolerance and intermittent discharge. The decision whether to perform an intact canal wall mastoidectomy (ICW) or CWD operation in patients with chronic ear disease is usually based on several factors, such as the extent of disease, an assessment of middle ear ventilation, the hearing in the ear in question, the state of the opposite ear, any preoperative complications, the condition of the patient, the possibility for follow-up, and the surgeon's preference[4]

Materials and methods

This prospective study, 100 patients were selected who were undergoing procedures for active and inactive chronic otitis with cholesteatoma. All surgical interventions involving mastoid cavity obliteration or reconstruction of attic area and restoration of middle ear space by use of conchal cartilage with reconstruction of tympanic membrane and also ossicular reconstruction was achieved with either a partial or total ossicular replacement prosthesis. Inclusion criteria were a cholesteatoma with attic destruction, a sclerotic mastoid with poor Eustachian tube function and an intact posterior canal wall. Other middle ear diseases such as chronic otitis media without cholesteatoma were included, but the latter two criteria were applied equally.

Results

Table 1: Demographic distribution.

Age Distribution (Years)	Male	Female	Total
10-20	6	4	10
20-30	26	14	40
30-40	13	11	24
40-50	9	8	17
50-60	4	3	7
> 60	2	0	2
Total			100

The peak age incidence in this study was out of 100, the highest was seen among 20-30 years' age group i.e. 40 out of 100. And among 40, 26 were males and 14 were females. The least age incidence in this study was 2 which were seen in age of above 60 years.

Table 2 : Cases according to disease

Disease	Conchael Cartilage Used		
	Male	Female	Total
Chronic Otitis Media	8	5	13
Cholesteatoma	40	26	66
Adhesive Otitis Media	11	6	17
Cavity Problems	2	1	3
Cholesterol Granuloma	0	1	1
TB Otitis Media	0	0	0
Total	61	39	100

The conchael cartilage was used the highest in cholesteatoma i.e. 66 of 100 of which 40 were males and 26 were females.

Table 3: Rate of graft failure according to the surgical method

Conchael Cartilage	ICW	Rev. ICW	CWD	Rev. CWD	Total
%	10	50	12.5	37.5	15/100
N	4/40	2/4	6/48	3/8	

The % rate of graft failure was highest in Rev. CWD method i.e. 37.5%. The least % rate of graft failure was 10 % in ICW method.

Discussion

Few studies have shown the obliteration of mastoid cavity and the reconstruction of the attic area. **Ricardo Dourado Alves et al** [5], in this study they evaluated the effectiveness of the mastoid obliteration with autologous bone in mastoidectomy surgery with canal wall down from chronic otitis, with or without cholesteatoma. Nine studies of case series comprehending mastoidectomy surgery techniques on 1017 total cases of operated ears in both adults and children with atleast 12 months follow up. From this study, it can be concluded that mastoid obliteration with autologous bone has been used for many years to present date and it seems to be safe, low cost with low recurrence rates when compared to traditional canal wall down procedures. In a study conducted by **Shao-Cheng Liu** [6], a total of 44 patients between January 2002 to October 2009 were selected and 27 of them were revision cases. Preoperative and postoperative pure tone average (PTA) and air bone gap (ABG) were assessed and compared after 1 to 4 years after surgery.

The results were that the middle ear was well healed and aerated in 40 patients (90.9%) and the tympanic membrane was intact in 42 patients (95.5%). Recurrent cholesteatoma was found on postoperative follow up in two of the revision patients (7.4%) but none in primary patients. Seven patients were found to have partial canal bone absorption, but revision surgery was not required. Over 86.4% of all cases were resistant. Long lasting improvement and preservation of hearing with maintenance of PTA-ABG closure in 63.7% of all the cases within 20 dB were obtained. From this study, it was concluded that the efficacy of the technique after a canal wall down mastoidectomy was satisfactory and the rate of complication was acceptably low. **Ji Heui Kim et al** [7], in these study ninety-eight ears in 98 patients were operated on using atticoantrotomy between October 2002 and December 2006. A retrospective review of the otology database (operative findings and methods, postoperative physical examination and pre- and postoperative audiometry) was performed.

There were 58 female and 40 male patients with a mean age of 40 yr. The cholesteatoma was limited to the attic region in 24 patients (24.5%); attic with antrum in 18 (18.4%); and attic with antrum and middle ear in 56 (57.1%). Attic obliteration was performed in 59 patients (60.2%), attic reconstruction in 39 (39.8%) and ossicular reconstruction was performed in 59 (60.2%). The mean preoperative and postoperative air-bone gaps were 29.2 ± 13.5 dB and 25.0 ± 15.4 dB, respectively ($P=0.01$) and the mean preoperative and postoperative high-tone bone conduction levels were 14.5 ± 9.7 dB and 15.23 ± 14.0 dB, respectively ($P=0.411$). A recurrent cholesteatoma was detected in 3 ears (3%) and revision surgery was performed on these patients. This study concluded that atticotomy showed a low recurrence rate and no deterioration in hearing levels. If there is an intact malleus head or body of incus, attic reconstruction was possible and this procedure could lead to improved hearing. However, postoperative retraction occurred in 18% of patients. So-Hyang Kim *et al* [8], conducted a retrospective case review of 401 ears in 398 patients was performed. The EMO technique consists of a simple mastoidectomy, atticotomy, epitympanectomy and epitympanoplasty with mastoid obliteration. The results of 12 years of surgery performed between December 1994 and June 2007 were analyzed and the outcomes of the procedures were evaluated. The postoperative results from 401 ears were evaluated. The mean age was 42 years, and the mean follow up period was 30 months. There was a 6.2 (7.8 dB hearing gain ($p < 0.05$), and the tympanic cavity cholesteatoma recurrence rate was 4.2%. In 0.9 % of cases, there was a residual mastoid cholesteatoma, and these cases underwent revision CWD surgery. There was no attic retraction or retraction pocket formation. It concluded that Using Epitympanectomy Mastoid Obliteration techniques, we can eliminate the disadvantages of CWD and CWU mastoidectomy. Cavity problems can be avoided and retraction pocket formation can be prevented. EMO is a useful technique and can be considered before CWD surgery.

Conclusion

The incidence of discharge, debris formation, giddiness, pain, was reduced in obliterated cavity and prevention of retraction pockets in attic areas as compared to non obliterated cavities and retraction pockets in attic area. Using conchal cartilage in obliteration of mastoid cavity

and reconstruction of attic area is well epithelized and the end of three months was better in obliterated ear versus non obliterated area. Patients with obliteration required less cavity care, thus decreasing doctor dependency, frequent OPD visits and fewer courses of medical treatment and hence less burden on hospital resources. Conchal cartilage is the best material for reconstruction / obliteration of cavity proved to be a useful adjustment in the surgical management of the chronically draining cavity.

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