

Original Research Article

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Outcome of intact canal wall mastoidectomy for limited attic cholesteatoma

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ABSTRACT

Background: Surgery for cholesteatoma has evolved over the years in terms of efficacy and patient compliance and better life. Intact canal wall technique is best in terms of normalization of the physiology of the ear along with eradication of disease. Hence this study is undertaken to evaluate a technique of intact canal wall mastoidectomy for limited attic cholesteatoma and to study practical considerations during surgery.

Methods: Any person undergoing surgery for attic cholesteatoma has to be thoroughly examined during surgery and decision for doing a canal wall up (CWP) surgery will be taken on the operating table. The patients were regularly followed up and microscopic, otoendoscopic and audiological assessments done at regular intervals. Revision surgery was done only if there were signs of recidivism or if ossiculoplasty was planned for second stage or placement of prosthesis later was considered.

Results: Out of 100 cholesteatoma surgeries, 22 cases found suitable for the CWU technique. Only 1 out of 22 patients required revision surgery due to recurrence. Rest of the patients maintained healthy middle ear for more than a year. Prevention of medialization of attic cartilage piece was found to be a very important consideration.

Conclusions: The CWU technique is a reliable method of management for limited attic cholesteatoma. Selection of subjects should be very meticulous.

Keywords: Canal wall up, Intact canal wall, Atticotomy, Attic reconstruction

INTRODUCTION

Management of unsafe type of chronic otitis media (COM) generally requires surgical intervention. In order to obtain more physiological environment in ears after surgery, several canal preserving techniques are used. Atticotomy, attic reconstruction and tympanoplasty with cartilage/perichondrium, are considered to be a reliable treatment and prevention technique for epitympanic cholesteatoma. It can achieve good morphological and functional results.¹ Post auricular approach atticotomy with reconstruction of the scutum is an useful technique to remove cholesteatoma from the anterior epitympanum.²

The current study aims to evaluate the practical considerations of the method and observation for any complications after atticotomy, reconstruction of lateral attic wall and tympanoplasty. A cortical mastoidectomy is also done in all the cases. Canal wall is preserved in all the cases. Selection of cases suitable for this technique has to be very meticulous and the decision to employ this technique is to be taken on the operating table after thorough microscopic examination of the extent of the disease, being ready to convert into a canal wall down procedure at any point of time if the disease demands. The most suitable cases are those with limited attic cholesteatoma with no or minimal involvement of mesotympanum with or without mastoid involvement. Ossicular involvement or involvement of anterior attic

are not contraindications for the technique and proper ossiculoplasty can be combined with this procedure or can be done in a second stage. Any case with serious intratemporal and/or intracranial complication is excluded from the study.

METHODS

A total of 100 patients presenting to the ENT outpatient department at KBN Teaching and General Hospital over a period of 2 years from April 2015 to March 2017 were carefully subjected to preoperative evaluation which included thorough clinical examination, microscopic examination, pure tone audiogram and fitness for general anesthesia. All patients are explained regarding possibility of a second stage surgery and an informed written consent also taken for the same.

Inclusion criteria involved patients with limited attic defect, erosion or cholesteatoma which seemed confined to the pars flaccida which were suitable for the intact canal wall mastoidectomy.

The procedure begins with a post auricular incision and harvesting of temporalis fascia graft. Vascular strip incisions used for the best exposure. Canal incision at 12 o'clock is made more anteriorly to obtain better visualization of anterior attic. Drill work started at the scutum area, to reach the fundus of the cholesteatoma sac.

Attic cholesteatoma is classified into type I and type II. If the cholesteatoma has only reached the surface of the malleo-incudal joint, it was regarded as type I. If the cholesteatoma has entered the anterior attic space and destroyed the malleo-incudal joint, it was regarded as type II.³ In addition to this, we observed another pattern of disease where the cholesteatoma is going more posteriorly and destroys the Incus partially or completely, whereas sparing the head of malleus. This sac may also extend into the mastoid area through the aditus.

According to the extent of cholesteatoma sac, partial or complete removal of the lateral attic wall is done. The mesotympanum is inspected carefully for any involvement by the disease. If the sac is not involving any ossicles and not extending into the mastoid, the whole of the sac can be exteriorised with careful dissection. Significant involvement of mesotympanum would require alternative methods of surgical intervention. A corical mastoidectomy is done in all cases. If the cholesteatoma is extending into the mastoid area, then the sac is lifted and dissected from all the sides and through the aditus, the sac everted into the attic area. At any point of time, if there is any doubt regarding completeness of removal, then the procedure is converted into a canal wall down mastoidectomy. Involvement of the tip of mastoid is also not a contraindication. Inspection of anterior attic is of crucial importance. If required, careful drilling of anterior scutum and anterior

canal wall in the superior part will give good visualization of the anterior attic. If the cholesteatoma sac is going medial to the head of malleus then tilting of malleus head with tensor tympani still attached at the neck of malleus is done. This also gives a good visualisation. Excision of head of malleus is done if the head is engulfed by the cholesteatoma sac or if the sac cannot be dissected off from the head. Thinning of posterior canal wall done as required to visualise a part of cholesteatoma sac otherwise out of view. Excessive thinning is avoided. The middle ear cavity, attic and mastoid area are thoroughly flushed and irrigated with saline for any retained squamous debris.

Reconstruction of attic is carried out by a piece of tragal cartilage. The piece is kept in such a way that it forms the lateral wall of attic. The size and shape of the piece are decided according to the area of defect created by drilling or disease. The piece is supported from medial side by ossicular heads when present and by putting abundant gel foam if ossicular heads are absent, in order to prevent medialisation. Partial obliteration of aditus was carried out by temporalis muscle where it was found to be very wide. Small defects that remain after reconstruction with a cartilage piece are filled up by bits of temporalis muscle or smashed cartilage.⁴ Temporalis fascia kept lateral to the piece of cartilage and also to cover any defects in tympanic membrane by underlay method. Adequate gelfoam kept in mesotympanum, mastoid and also in the ear canal. Appropriate ossicular reconstruction also carried out when necessary. The patients are advised to maintain strict follow up for at least 2 years and as and when required thereafter. After 6 weeks of surgery, thorough microscopic examination carried out. Oto-endoscopic pictures taken on subsequent visits and the pictures recorded for future comparison.

RESULTS

100 ears were operated in 2 years, where 22 cases (22%) were included in the study which met the inclusion criteria. Amongst them 11 were males and 11 females. Most of the patients were between 20 and 40 years age. Only 4 patients were between 50 and 60 years of age.

Atticotomy, disease removal, attic reconstruction, tympanoplasty, canal plasty and corical mastoidectomy carried out in all of them under general anesthesia. Table 2 shows the distribution of disease in different areas.

There were 7 (31.8%) patients where only limited attic involvement was found. The disease was confined to middle or posterior part of the attic and not involved the anterior attic or the aditus area. In all these patients, all the three ossicles were present and the ossicular chain was intact and mobile. In 4 (18.2%) patients, the disease extended in attic and also the aditus area, blocking communication between the middle ear and mastoid. In 3 of them, the long process of incus found to be partially eroded, and 1 of them had an intact ossicular chain. There

was one case where only the anterior attic and Prussack's space were involved in disease and ossicular chain was intact and mobile. Mastoid involvement was seen in 10 (45.5%) cases, where limited involvement in upper part

was present in 6 patients, whereas 4 cases had extensive mastoid involvement. Anterior attic was significantly involved in 2 of these cases.

Table 1: Age and sex distribution of study participants

No. of patients	Male	Female	Age (20-40)	Age (50-60)
22	11	11	18	4

Table 2: Distribution of disease in different areas of middle ear and mastoid and status of ossicles.

Involvement of area	No. of patients	MSI	MS	NIL/M
A	7 (31.82%)	7 (31.82%)		
A, Ad	4 (18.18%)	1 (4.5%)	3 (13.64%)	
AA	1 (4.5%)	1 (4.5%)		
A, Ad, M1	6 (27.27%)		5 (22.73%)	1 (4.5%)
A, Ad, M2	4 (18.18%)			4 (18.18%)
Total	22 (100%)	9 (40.91%)	8 (36.36%)	5 (22.73%)

A-Attic; Ad-aditus; AA-anterior attic; M1-limited mastoid; M2-extensive mastoid involvement; MSI-all ossicles present and mobile; MS-Malleus handle and stapes present and incus partially or completely eroded; Nil/M-all ossicles absent or only a part of malleus present.

Table 3: Ossicular chain status.

Ossicular chain status	Reconstruction assembly	Air-bone gap (dB)	Second stage procedure	No. of patients (%)
Intact	None	15	None	36.36
Partial malleus, incus	Malleus-stapes	24.2	None	18.18
Eroded long process incus	Cartilage columella	18	None	18.18
No malleus/incus	Cartilage shield-type 3	27	None	9.09
No ossicles	None	-	Recommended	18.18

The patients were followed up for minimum 1 year and longest follow up available was for 2 years with an average of 16 months. Only 1 patient (4.5%) developed recurrence of disease, where revision surgery in the form of a canal wall down procedure had to be performed 4 months after the primary surgery. Rest 21 cases did not have recurrence during the follow up period. 2 of the cases developed sagging of posterior canal wall, which recovered with anti-inflammatory medications and local betamethasone+neomycin ear drops.

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Among all patients, 8 patients with intact ossicular chain had post op air bone gap (ABG) of less than 15 dB, Malleus-stapes assembly with the help of a cartilage piece was carried out in 4 patients, where the post op ABG was observed to be less than 30 dB, with an average of 24.2 dB. No deterioration of bone conduction (suggestive of sensory-neural loss) was observed in any of the 22 cases. In 4 patients, the long process of Incus

was partially eroded and a small piece of cartilage was used to bridge the gap between stapes head and remaining incus, where post op ABG was found to be about 18 dB. In 2 patients, only stapes was present where a type 3 cartilage shield tympanoplasty was carried out with the postoperative ABG in the range of 27 dB. In 4 patients, all ossicles were absent and no ossiculoplasty was performed in them. They were scheduled for a second stage procedure but the patients refused for the same as the other ear had normal hearing and they did not want to undergo another surgery only for improvement of hearing.

DISCUSSION

With increasing awareness regarding health of ears, more patients seek medical advice when there is limited involvement of ear with attic-antral disease. Clinical examination is useful only for diagnostic purpose. CT scan of temporal bone can guide regarding the extent of disease but the decision of doing either a canal wall up or canal wall down procedure has to be taken during surgery after contemplating the true extent of disease and gaining confidence regarding completeness of removal of disease. Various modifications and techniques have been described in literature for canal wall up procedure. Farrior has described a technique of anterior-posterior mastoidectomy.⁵ Tos had described a technique of intact canal wall (ICW) which includes trans-canal atticotomy, drilling of anterior canal wall, post-auricular mastoidectomy and maximum thinning of superior and posterior bony canal wall with good results.⁶ He also concludes that treatment of cholesteatoma should be individualized, that no single method is preferable in all cases, and that an intact ossicular chain should be preserved. Glasscock et al have mentioned that the intact canal wall tympanoplasty is a procedure that will gain acceptance and will be more widely used in the future.⁷ It was a routine practice to do a second look procedure in all cases of ICW surgery. Reimer et al. have quoted a high rate of recidivism and a second stage surgery in most cases of ICW Mastoidectomy.⁸ Mahadeviah and Paarikh have advised thinning of the rim of posterior canal wall in order to visualize sinus tympani area and most of patients did not require a second stage surgery.⁹ A second look surgery was required in 4.8% cases due to residual or recurrent disease. In the current study, the patients were asked to maintain strict follow up and revision surgery was performed only when required.

Table 4: Comparison of recidivism rates of different studies.

Study	Recidivism rate (%)
Current study	4.5
Glasscock et al ⁵	14
Mahadeviah et al ⁶	4.8
Deng et al ¹	0

When a comparative study was done in various study groups, Glasscock et al reported highest rates of recidivism at 14 which required a second stage procedure followed by the Mahadeviah et al at 4.8 and then followed by the current study at 4.5.^{5,6} Deng et al reported 0 rate of recidivism in their study.¹ The probable factors which influence the outcome would be residual disease which seemingly is inaccessible in Sinus tympani and Facial Recess areas via the intact canal wall technique. Hence in the current study a careful assessment was done preoperatively and intraoperatively regarding the feasibility of the technique on the basis of extent of the disease and predicting any difficulty accessing it.

Atticotomy, attic reconstruction, tympanoplasty with or without ossiculoplasty, canalplasty and cortical mastoidectomy as intact canal wall technique for attic cholesteatoma is a reliable method for selected cases. The case selection has to be very meticulous and good follow up is essential. Rate of recidivism is minimal with the technique.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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