

Original Research Article

Four layers reconstruction of the posterior ear canal wall in one stage surgery

Khaled M. Mokbel Khalefa*

Department of Otorhinolaryngology, Faculty of Medicine, Mansoura University, Egypt

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***Correspondence:**

Dr. Khaled M. Mokbel Khalefa,
E-mail: ootology@yahoo.com

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ABSTRACT

Background: Canal wall down mastoidectomy are still practiced in cases of chronic suppurative otitis media with cholesteatoma to ensure complete disease removal. The resulting cavity is prone to recurrent infection, chronic discharge and frequent care. Reconstruction of the posterior canal wall should be planned by the surgeon. Various techniques for external auditory canal (EAC) reconstruction have been recommended to eliminate open cavity problems. The surgeon should choose the type of grafts either autologous, homografts or synthetic materials. Furthermore, the surgeon should decide whether to do the reconstruction either immediate in the first stage of surgery or delayed as a second stage.

Methods: In this study, the ridge was reconstructed at the same time of mastoidectomy by autologous tissues. The presenting study reconstructed the posterior canal wall in four layers; skin, perichondrial flap, cartilage and periosteal flap in that order from the meatal side to the mastoid side. The presenting study included 48 patients (32 males and 16 females) with age ranged from 18-55 and 20-50 years. All included patients were presented at the outpatient clinic with unilateral chronic suppurative otitis media with persistent discharge. They had been operated at our tertiary hospital between January, 2012 to March 2014.

Results: Successful reconstruction was obtained in all cases, with no dehiscence or necrosis.

Conclusions: The reconstruction of the posterior wall by the four layers technique was successful and efficient. It is recommended to do this repair concomitantly with canal wall down mastoidectomy as one stage surgery.

Keywords: Mastoidectomy, Cholesteatoma, Cartilage graft, Perichondrium, Periosteum

INTRODUCTION

Goals of surgical management of chronic otitis media include eradication of the disease together with preservation and restoration of functional anatomical structures. Many otologic surgeons prefer intact canal wall mastoidectomy with tympanoplasty but sometimes there are indications for canal wall removal because of extensive disease, cholesteatoma difficult to access, operation on the only hearing ear or uncertainty of adequate follow-up.¹ In the canal wall down technique,

the resulting cavity often prone to recurrent infection and needs periodic cleaning. Extensive cholesteatoma with or without granulation tissues is the main pathology that indicate the necessity to the operation. Lowering of the posterior bony canal wall makes myringoplasty and ossiculoplasty difficult.² Leaving the cavity unrepaired is not ethical because it will lead to deterioration of hearing, exposure to recurrent infection and subsequent hearing aid difficult fitting. The reconstruction of the canal wall is necessary to eliminate the resulting cavity problems and to facilitate hearing reconstruction. Canal wall repair can

be achieved by a number of human tissues as autologous, homologous cartilage or mastoid bone pate.^{3,4} Synthetic materials as hydroxyapatite, glass, ceramics, titanium.^{5,6} Beside the hard tissue repair of the canal wall, soft tissue is added to give blood supply to the reconstructed part for that the best is a local pedicled flap as perichondrium and periosteum.⁷ The use of cartilage in repair of tympanic membrane by different techniques are well established hence that encouraged us to reconstruct the canal wall by using autologous conchal cartilage from the same ear. Vascularization of the cartilage graft is necessary for its survival so the necessity to use a vascularized flap where graft necrosis is a possibility if there is lacking in vascularization. The objective of the study was conducted to evaluate the effectiveness of the use of 4 layers (the skin of the canal, flap from the auricular perichondrium, cartilage graft and flap from the postauricular periosteum) in reconstruction of the posterior canal wall after canal wall down mastoidectomy in cases of chronic suppurative otitis media.

METHODS

This work was done after fulfilling and getting the approval of ethics consideration committee of ORL department at Mansoura university hospital, faculty of medicine, Egypt. Informed consent was obtained from all patients included in this study which was conducted over a period of 26 months from January 2012 to March 2014. Patients fulfilling the inclusion criteria were included in this study. Inclusion criteria included patients with unilateral chronic suppurative otitis media with persistent ear discharge, fit for surgery, with no systemic diseases, age not less than 18 years and not more than 55 years. Exclusion criteria included patients with bilateral diseases, dry ears, revision cases and non-fit cases, age less than 18 years or more than 55 years.

The clinical presentations were hearing loss, offensive discharge, cholesteatoma in 30 cases, granulation tissues in 12 cases and aural polyp in 6 cases. Severe conductive hearing loss was detected in all cases. The follow up period ranged from 6-36 months with an average of 18 ± 2.50 .

Canal wall down mastoidectomy was performed in 48 patients (32 males and 16 females) with age ranged 18-55 years (average 22 ± 1.50) and 20-50 years (average 24 ± 2.50) respectively. In all cases canal wall was reconstructed by four layers; skin, composite conchal cartilage graft, pedicled postauricular perichondrial flap and superiorly based periosteal flap. All cases were repaired immediately in the same stage of the operation.

Operation

Under general anesthesia and topical injection of 1:200000 epinephrine, a postauricular incision was taken. The periosteum over the mastoid was incised 2 cm posterior to the auricular crease. The posterior meatal

skin flap was elevated till the tympanic annulus. In the polyp cases, it was removed at first to facilitate the elevation of the skin flap. Canal wall down mastoidectomy was completed conventionally provided that the anterior buttress and the posterior buttress were created. The healthy parts of tympanic membrane and ossicles were preserved intact.

Creation of the composite cartilage, perichondrial and periosteal flaps

The postauricular skin and connective tissue was elevated from the back of the concha. A curvilinear incision is made in the posterior conchal perichondrium. A perichondrium flap was dissected and left attached at the meatal level. A periosteal flap was created by dissecting the periosteum from the lower edge of the bony meatus upwards until above the temporal line. The conchal cartilage is harvested with the perichondrium on the anterior surface. The amount of the cartilage depended on the size of the canal defect. After completing the mastoidectomy in the conventional way, the zygomatic root anterior buttress and the facial ridge posterior buttress are tunneled in order to retain the cartilage which should be inserted under tension. The flap of the perichondrium was draped on the cartilage from the meatal side then the skin flap was spread on the perichondrial flap. The periosteal flap was applied on the mastoid side of the cartilage graft. Now the new posterior wall consists of four layers; skin, perichondrium, the cartilage and the periosteum in that order from the meatal to mastoid side. Silastic strips are inserted into the canal to line it and support the repaired canal. Gel foam/antibiotic ointment is packed in the mastoid cavity. Meroceel ear wick was packed inside the canal. Mastoid dressing was maintained for 48 hours. The external canal pack is removed after 2 weeks and the silastic strips was removed after 3 weeks and then the canal is treated with antibiotic ointment for 1 month.

RESULTS

Canal wall down mastoidectomies were performed at Mansoura university hospital during the period 2012-2014. In all patients canal wall down tympanomastoidectomy was performed with reconstruction of the posterior canal wall with four layers included the skin, composite cartilage, perichondrial flap and periosteal flap. The total number operated on was 48 cases (48 procedures). They were 32 males and 16 females, the age range was 18-55 years (average 22 ± 1.50) and 20-50 (average 24 ± 2.50) years respectively (Table 1). The preoperative pathology was cholesteatoma in 30 cases, granulation tissues in 12 cases and polyps in 6 cases. The average preoperative air-bone gap was 48 ± 10.8 dB (mean \pm SD). The duration of disease ranged between 3 and 5 years. The minimum follow up period was 6 months and the maximum one was 36 months. The number of patient completed the maximum follow up period was 35 patients.

Table 1: Epidemiological data.

Number of patients	Male	Age (in years)	Female	Age (in years)
48	32	18-55 (22±1.50)	16	20-50 (24±2.50)

Table 2: Complications, methods of treatment and result of treatment.

Complications	Number of patients	Treatment methods	Result of treatment
Infection	5	Antibiotics local and systemic for 1 week	Complete recovery
Granulation	4	Cautery by silver nitrate and antibiotic/steroid ointment for 2 weeks	Complete recovery
Necrosis	0	-	-
Stenosis of canal	0	-	-

Table 3: The number of missed and failed cases through the follow up period.

Follow up period (in months)	Missed cases	Failed cases
6	0	1
12	2	2
24	4	2
36	5	1
Total	11	6 (16.20%)

After 4 weeks from the operation, 5 cases showed infection with discharge, the taken culture revealed staph aureus where they were treated with antibiotic ointment and systemic ones for 1 week with complete response. Granulation tissue occurred in 4 cases after 6 weeks, they were treated by silver nitrate cauterization and antibiotic/corticosteroid ointment for 2 weeks, complete healing occurred in all cases. No canal stenosis or dehiscence had occurred in this study (Table 2). After 6 months, failure was detected in one case. After 12 months, there were 2 cases missed in the follow up and the rest of cases showed 2 failures. After 24 months, there were 4 missed cases and 2 failures. After 36 months, there were 5 missed and one failure. The failure in our cases was in the form of granulation tissue formation and necrosis of the reconstructed layers. The number of failed cases at the maximum follow up period was 6 cases and the number of missed cases through the follow up was 11 cases. The percentage of failure was 6/37 (16.20%) and the success rate was 31/37 (83.80%) (Table 3).

DISCUSSION

Still many patients attending to our ENT clinics with suppurative otitis media have advanced disease with cholesteatoma and granulation tissues. Eradication of the pathology is very difficult by using canal wall up technique.⁸ As enthusiasm for intact canal wall tympanoplasty was developing in the mid-1960s, it became apparent that a method for repair of defects in the bony canal wall was imperative.⁹ Different materials such as autograft bone, proplast, plastipore, ceravital, hydroxyapatite, glass ionomer and titanium can be used

for reconstruction of the posterior bony canal.^{5,10-13} Without doubt the uses of autogenic tissues are better to increase the take rate and avoid rejection. We prefer composite conchal cartilage with perichondrium because it is easily accessible and can be harvested in large amount from the same location of surgery without deformity. Cartilage from concha has contour is ideal for the recipient site, it resists retraction and extrusion and easily used for concomitant tympanic membrane reconstruction. The fact that successful canal reconstruction is not only dependent on the substance of the support layer but also on the viability of the overlying tissues has been well established.¹⁰ The vascular flaps keep the viability and survival of the cartilage. Periosteal flap was used by some authors with good results.⁷ In this study periosteal flap was used to make the 4th layer of the new posterior wall to increase its strength and viability. The perichondrium and periosteal flaps are effectively vascularized, easily to harvest and available in the surgical field without the need for further dissection. So it reduces the ischemia of the underlying cartilage graft and the overlying skin. The incidence of dehiscence without the application of the perichondrial flap in the study of McCleve was 10%.⁹ So without doubt good vascularization allows good take rate and good healing, the pedicled flap provides a source of nutritional support for both cartilage and the epithelium. The most common cause of dehiscence in the graft is incomplete soft tissue coverage.¹⁴ Canal stenosis is a problem which is reported in some studies.¹⁵ The cause of stenosis was due to thick flaps so it is essential to make thinning of the flap before insertion.

Limitations

The limitation of the study was the long term follow up to denote the exact durability of the four layer reconstruction.

CONCLUSION

Successful reconstruction of the bony posterior wall (ridge) after mastoidectomy demands that the support matrix be covered by a viable soft tissue. The four layers technique was successful in all cases. The use of the two flaps, perichondrium and periosteum provide both physical and metabolic support to both the cartilage and the canal skin. The flap protects the underlying cartilage from exposure decreasing the incidence of dehiscence and necrosis of the canal wall. This method is recommended because the flaps of perichondrium and periosteum are easily created and the cartilage is easily harvested without the use of expensive synthetic materials which might not be available all the time. Immediate repair is better than the delayed one because there is no scarring and the tissue is more viable and intact.

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

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