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MASTOID OBLITERATION IN CHILDREN IN NEPAL

ABSTRACT

Objective:
To compare the healing time and complications in obliterated and non-obliterated mastoid cavities in children.

Materials andmethods:
A prospective, longitudinal, comparative, interventional study with a minimum follow up of 6 months was carried between October 2010 to October 2012. A total of 30 patients of age ≤12 years underwent modified radical mastoidectomy (MRM). 15 MRM with mastoid cavity obliteration with inferiorly based muscul of ascioperiosteal flap and remaining 15 MRM without mastoid cavity obliteration under general anesthesia in Institute of Medicine, Tribhuvan University Teaching Hospital, and Nepal. Healing time (weeks) and complications were recorded in both groups after surgery i.e. 10-14 days, 4-6 weeks, 12 weeks and 24 weeks and compared.

Results:
The average healing period in group A was 9 weeks and 11.67 weeks in Group B. There was no statistical significance in healing time between the two groups (p value = 0.496). In group A, 3 cases had vomiting in early post operative and it was controlled with antiemetic.
Ear discharge was seen in 3 cases and 1 case in early 2 weeks postoperative period in groupA and group B respectively. Facial nerve palsy was noted in 1 case in group B in 2 weeks postoperative period. Canal stenosis was recorded in 1 case in group A in 4-6 weeks postoperative period. Swelling behind the pinna was recorded in 1 case in group A in early postoperative period.

Conclusion:
The average healing time in MRM with mastoid cavity obliteration is faster (9 weeks) to MRM without mastoid cavity obliteration (11.6 weeks) however no statistical significance was noted. There were no major complications noted during thestudy period.

Key words: Modified radical mastoidectomy, Mastoid cavity obliteration, Healing, Complication

INTRODUCTION

Chronic otitis media (COM) has a significant impact on health issues since prehistoric times.[1, 2] It is a global disease, seen in all the continents of world having different environmental and socioeconomic background.[3] It is characterized as a permanent abnormality of the pars tensa or flaccida, most likely a result of earlier acute otitis media, negative middle ear pressure or otitis media with effusion. COM squamous active (cholesteatoma) is a type of COM, which is associated with production of pus, retraction of pars flaccida or tensa with retained squamous epithelial debris.[4] It is a commonly encountered disease entity which requires prompt surgical management.[5] The management of cholesteatoma is solely surgical. Pediatric cholesteatoma should be treated by surgery as early as possible. Comparatively the pediatric population has higher rates of recurrent and residual disease, possibly due to anatomic and physiologic differences. Eustachian tube anatomy and dysfunction predisposes children to more frequent infections and retraction pockets, and well pneumatized mastoids in children allow for more extensive disease compared with more sclerotic mastoid bones in adults.[6, 7] Thus posing a greater challenge than in adults in treating cholesteatoma. The goals of surgery are to eliminate epithelial and bone disease thoroughly and prevent the recurrence, produce a dry and safe ear and to restore serviceable hearing.[8] There are different modalities of surgical treatment available, either canal wall up (CWU) or canal wall down (CWD) tympanomastoidectomy depending upon the disease and the patient. The surgery is done either in one stage or multiple stages with reconstruction of canal wall later.[9,10] In developing countries, the cholesteatoma is usually managed by CWD mastoidectomy, thus offering a big mastoid cavity for rest of the life of patients.[11] However, the open mastoid cavity has several problems like persistent ear discharge, wax-debrisformation, dizziness in cold weather & during swimming, non aestheticmeatoplasty, difficulties in placement of hearing aid device[12]. The open cavity problems can be dealt with mastoid cavity obliteration in a same

sitting while performing canal down technique or can be done later in the second sitting.[11] Mosher in 1911 conceptualized the mastoid obliteration to promote healing of a mastoidectomy defect, to reduce mastoid cavity size and to get rid of the open cavity problems using a superiorly based postauricular soft tissue flap.[12,14] Obliterations can be achieved with "flap" and "filler" methods. The former uses local tissue flaps to fill the cavity and the latter uses free grafts or other material, usually covered with skin or tissue flaps.[13] Local flaps like meatally based musculoperiosteal flap (Palva flap), inferiorly based periosteal-pericranial flap, superiorly basemusculoperiosteal flap, temporalis muscle flap, temporoparietalfascial flap etc. and freegrafts like bone chips/bone pate, fat, cartilage, fascia, hydroxyapatite and so on have been used.[12] The principle of obliterating the mastoid cavity is that the mastoid cavity lining after the surgery has to derive its nutrition from bare bone of the mastoid cavity, however,vascularity is reduced due to smoothening of the cavity with the diamond burr and hastens the epithelial regeneration[5].

MATERIALS AND METHODS

A prospective, longitudinal, comparative and interventional study was conducted from October 2010 to October 2012 at Ganesh Man Singh Memorial Academy (GMSMA) of ENT and Head and Neck Studies, Tribhuvan University Teaching Hospital, Maharajgunj, Kathmandu, Nepal. Patients of age ≤12 years, all genders with COM squamous active (cholesteatoma) disease were included in the study. All the cases were performed under general anesthesia by the senior faculty. Patients with complications of chronic otitis media, revision MRM and with histologically proven middle ear diseases other than COM squamous e.g., tuberculosis were excluded from the study. Informed consent was taken from all patients pre-operatively after explaining the procedure. Ethical approval was taken from Institution Review Board of Tribhuvan. University, Institute of Medicine. Study population was randomly divided into two groups consisting of 15 patients in each group as Group A (MRM with mastoid cavity obliteration) and Group B (MRM without mastoi d cavity obliteration)

SURGICAL PROCEDURE:

The soft tissue approach in both groups was post aural approach and the technique was either in to out or out to in technique. Patients in group B underwent classical MRM where as patients in group A had some modifications in the surgical steps as described later. A standard tympanomeatal flap was raised. A postaural incision was made 2 cm posterior and parallel to the post auricular groove extending from around 1cm above the superior attachment of pinna to the mastoid tip so as to obtain a large generous flap . Temporalis muscle and fascia were exposed and a large temporalis fascia graft harvested from the upper part of the temporalis fascia keeping the remaining fascia intact in lower part to create a flap for obliteration. An inferiorly based musculo fascioperiosteal flap with its base on the mastoid process with its length extending 1cm superiorly to superior attachment of pinna was fashioned (Fig I). This flap consisted of subcutaneous tissue and periosteum in lower part and temporalis fascia, muscle and periosteum in upper part and was about 3-4 cm in width.

Fig I: Inferiorly based musculofascio periosteal flap

The flap was turned inferiorly and kept wrapped in a wet gauze and kept wet by pouring normal saline on it. Initially the normal mastoid cortical bone was collected using a gouge and hammer (Fig II). Bone dust was collected while drilling normal bone (Fig II). Canal wall down (CWD) mastoidectomy was performed.

Fig II: Collection of mastoid cortical bone chips (A) and healthy bone dust (B)

The posterior canal wall was lowered sufficient to eradicate the disease process .

While creating a mastoid cavity it was not saucerized for better obliteration. After eradicating disease from the middle ear cleft, the attic and the posterior canal wall were reconstructed by sculpturing the mastoid cortical bone which was taken previously and the rest of cavity and spaces were obliterated by putting pieces of cortical bones and bone dust (Fig III).

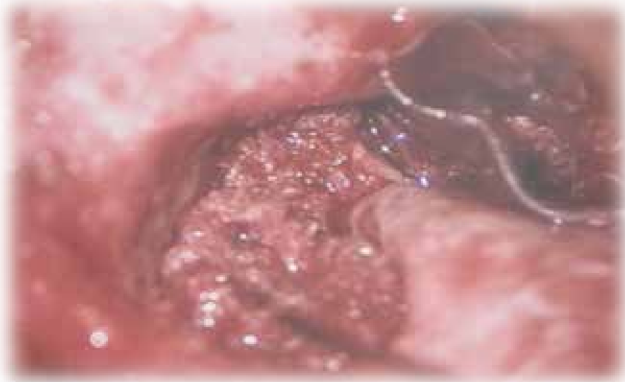

Fig III: Mastoid cavity filled with bone chips and bone dust

The inferiorly based musculofascioperiosteal flap was placed over the bone chips and dust filled with cavity (Fig IV). The temporalis fascia was placed in middle ear as in the usual reconstruction. The fascia covering the attic reconstruction, posterior canal wall, and if possible obliterated mastoid cavity with bone chips, dust and flap .

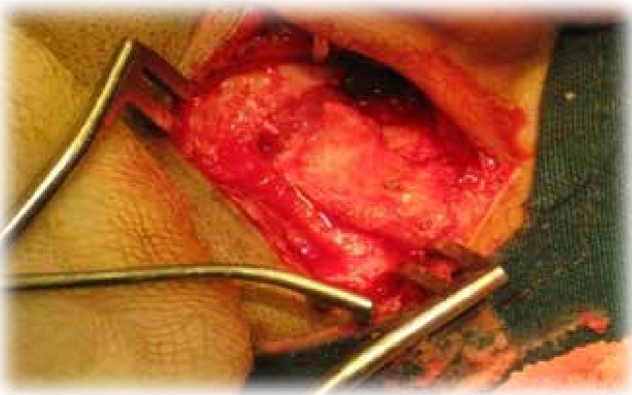

Fig IV: Repositioning of musculofascioperiosteal flap over the filled mastoid cavity

Post operatively patients were assessed on 10-14 days, 4-6 weeks, 12 weeks and 24 weeks. The healing time of the mastoid cavity were recorded in both the groups. The complications like swelling (postaural/EAC), hematoma, infection,postaural deformity, stenosis of EAC, necrosis of flaps, recurrent or residual cholesteatoma in the middle ear vertigo, facial nerve palsywere recorded. Statistical Package for Social Sciences (SPSS) 18.0 software was used for data analysis and independent T test was applied.

RESULTS

There were 8 (53.3%) male patients and 7 (46.6%) female patients in MRM with obliteration group (Group A) and 11 (73.3%) male and 4 ((26.6%) female patients in MRM group (Group B). Male: female ratio was 1.14:1 in group A and 2.75:1 in group B. There was no statistically significant difference noted in gender distribution in both the groups ($p = 0.067$). Ages of the patient were ≤12 years in both groups. There were none in 0-6 years range and 15 each in 7-12 years range in both groups with mean age of 10 years in group A and 9.67 years in group B. The most common age group was 7-12 years in both the groups. There was no statistically significant difference noted in age distribution in both the groups ($p = 0.360$)

The average healing period in group A was 9 weeks and 11.67 weeks in group B. There was no statistically significance in healing time between the two groups (p value = 0.496) (Fig V, VI ; Table 1).

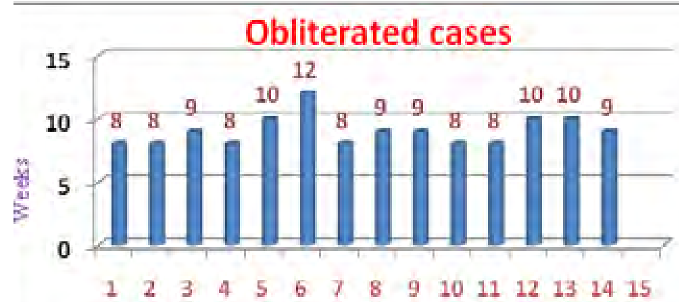

Fig V. Healing time of mastoid cavity in Group A

Fig VI. Healing time of mastoid cavity in Group B

Table 1: Healing time (average) of mastoid cavity in two groups	
Group	Average healing time(weeks)
Group A (MRM with obliteration)(n = 15)	9
Group B (MRM without obliteration) (n = 15)	11.67

Table 2: Comparison of healing time between two groups						
Group Statistics (independent T- test)						
Healing time (Weeks)	Type of surgery	N	Mean	Std. Deviation	Std. Error Mean	P value
	MRM with obliteration	15	9.00	1.177	.314	0.496
	MRM without obliteration	15	11.67	1.397	.361	

There was no statistical difference noted between these two groups ($p = 0.496$) (Table 2).

Regarding the complications , in group A, 3 cases had vomiting in early post operative period and vomiting was controlled with antiemetics. Ear discharge was seen in 3 cases in group A and 1 case in group B in 2 weeks postoperative period. Ear discharge was dried by application of antimicrobial and steroid mixed ear drops locally. Facial nerve palsy was noted in 1 case in group B in 2 weeks postoperative period. On next visit facial nerve palsy was improved totally. Canal stenosis was noted in 1 case in group A in 4-6 weeks postoperative period. However, the pars tensa and pars flaccid parts could be well visualized later on otoscopy examination. Swelling behind the pinna was noted in 1 case in group A in early postoperative period.[2] cases in group B had fungal infections in 12 weeks post operative period which were improved with topical antifungal ear drops (Table 5)

Table 3: Complications recorded in two groups		
Complications	Obliterated cavities	Non-obliterated cavities
Vomiting	3 (early postop)	
Ear discharge	3 (2 wks postop)	1 (2 wks postop)
Facial nerve palsy		1 (2 wks postop)
Fungal infection		2 (12 wks postop)
Canal stenosis	1 (4-6 wks post-op)	
Swelling behind pinna	1 (early postop)	

DISCUSSION

Children with COM squamous active type disease should promptly undergo surgery so as to make ear safe by eradicating the entire disease along with optimal hearing restoration and discharge free. Generally, cholesteatomous patients treated with CWU procedures have shown higher rates of recurrence and residual disease hence majority of authors prefer second-look operations to detect recurrent cholesteatoma for CWU procedures. Some patients even have to go through a third-stage procedure, and frequently have to be treated with the CWD technique in the subsequent operation. However, two-stage or third-stage operations are not always possible, because some patients will not turn up during the follow up period , especially in underdeveloped countries where most of them are from rural areas of the country[6]. In addition, canal wall down technique has open cavity problems like persisting otorrhea, regular aural toileting,wax-debris formation, dizziness in cold weather and during swimming, non aestheticmeatoplasty, difficulties in placement of hearing aid device[12]. Thus, two-stage operation, and even regular follow-up are a problem for them [6]. So the choice was made of canal wall down CWD mastoidectomy in all cases and obliterated the mastoid cavity and epitympanum.

The objectives of the study were to compare the healing rates and complications in obliterated and non obliterated mastoid cavitiesin children.

In this study, the inferiorly based usculofascio periosteal flap based on posterior auricular artery was used as a coverer and healthy mastoid cortex bone chips and bone dust as fillers of the cavity after CWD surgery in the same sitting. As postauricular artery is readily available, good vascular supply that ensures a surface that encourages and supports migration of epithelium across the cavity, would enable early detection of recurrence and finally the procedure is simple and only requires extension of post auricular incision.

In our study, there were 7-12 years range patients in both groups with mean age of 10 years in group A and 9.67 years in group B. The most common age group was 7-12 years in both the groups. Jia Qiang et al included the patients with a range of 5-12 years and the mean age was 10 years in their study.[6] All patients underwent canal wall down mastoidectomy with mastoid and epitympanum

obliteration. Yung et al included the patients with a range of 5-80 years and a total of 30 obliterations were performed on children below 16 years and the commonly affected population was male (64 males and 32 females).[16] In our study, the most commonly affected population belonged to 7-12 years in both the groups (30 cases). The male population outnumbered the female population (male=8, female=7 in group A; male=11, female=4 in group B). Parmekar et al included the patients with age range from 6 to 60 years (single 6 years old male child) and the male to female ratio was 14 to 6.[18] All the patients underwent mastoid cavity obliteration. Ramsey et al included total of 59 patients with ages ranged from 4 to 84 years, with a mean age of 39 years.[15] There was an even distribution between male patients (n=28) and female patients (n=31). All the patients underwent canal wall down mastoidectomy and mastoid obliteration for COM.

All the cases in both the groups were healed. The average healing period in group A was 9 weeks and 11.67 weeks in group B. However, there is no statistically significance in healing time between the two groups in our study. In a study by Wadhwa et al. using periosteo- temporofascial flap to obliterate the mastoid cavity, sample size being 50 (25 patients underwent obliteration technique and 25 patients non obliteration technique), showed the rate of healing faster in obliteration group [5]. The total number of the obliterated cases which healed were 21 out of 25 (84%) and in the non obliteration group it was 15 out of 25 (60%). The average time of healing in obliteration group was 8 weeks and in non obliteration group it was 16 weeks.[5] In study by JiaQiang et al. 2010 using inferiorly based dermal and musculoperiosteal flaps for mastoid cavity obliteration along with cartilage of external auditory canal and concha, bone pate with sample size of 45 showed that all obliterated ears completed epithelisation and were dry within 8-10 weeks.[6] Kong et al. in his study using combined flap of post-auricular musculoperiosteal and ear canal skin flap with bone pate with sample size of 71 patients had the period of complete re-epithelialization in 3 weeks to 1.5 months with a mean period of 29 days and all had a dry, mastoid cavity.[17] In a study by Yung M et al 2007 study, using mid-temporal pericranial& inferiorly based periosteal flap, hydroxyapatite granules and conchal cartilage with the sample size of 96, the complete re-epithelialization of the cavity was within 12 weeks following obliteration.[16]

In our study, the patients were assessed on 10-14 days, 4-6 weeks, 12 weeks and on 24 weeks after discharge from the hospital. The cavity was considered healed if there was no discharge or debris in the cavity or any other signs of infection.

In our study, 3 cases in group A had vomiting which could be a consequence of general anesthesia in early post operative period and it was controlled with antiemetics. Ear discharge was seen in 3 cases in group A and 1 case in group B in 2 weeks post operative period. The cause behind it might be due to inadequate fulfillment of strict post operative aural precautions as advised. The ear discharge was controlled with a further 2 weeks course of topical ear drop and oral antibiotics. Facial nerve palsy was noted in 1 case in group B in 2 weeks post operative period which could be due to pressure effect and on subsequent follow up it was better. Swelling behind the pinna was in 1 case in group A in early post operative period which might be due to loose application of pressure bandage and got improved later on. Canal stenosis was noted in 1 case in group A in 4-6 weeks post operative period. However, it was adequate to see the pars tensa and the attic region through the canal on subsequent visits. Aural discharge was detected in two cases in obliteration technique performed by Jiaqiang et al.and the discharge was controlled with antibiotic ear drops without complications later on.[6] The mean follow up period was 3.7 years (range 2-5 years). In Yung et al. study, 5 cases suffered intermittent otorrhoea following obliterations including two incidences of myringitis and one incidence each of attic retraction pocket, meatal stenosis and incomplete epithelialisation of the obliterated cavity.[16] A total of 17 cases had to undergo further surgery. The follow up were at 3 weeks, 6 weeks, 3 moths, 6 moths & then yearly basis (minimum follow up of 1 year). None of the patients had major postoperative complications, such as dead ear, facial palsy, or prolonged dizziness. Parmekar et al. study had six cases of persistent perforation leading to persistent otorrhea following obliteration.[18] The follow up period ranged from 4-32 months. Kong et al. had disease free mastoid in more than 2 years follow up period following obliterations. Ramsey et al. had 5 cases of intermittent otorrhoea and 4 cases of meatal stenosis in 12 months follow up period.[15] Our study addresses only short-term healing rates.

A concern with mastoid obliteration is that residual cholesteatomas may be buried underneath the fillers and so to detect residual cholesteatoma, a long term follow up of these patients is necessary.[16] So, the limitations of our study is being small sample size and short term follow up.

Conclusion

Avenue for further research is that canal wall down mastoidectomy with mastoid and epitympanum obliteration is a good choice for cholesteatoma in children.

Recommendations

- A large sample size study would be a better study.
- A longer follow up period study would show the better results.

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