# **Original Research Article**

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# Modified radical mastoidectomy in children: mastoid cavity problem and its management

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## **ABSTRACT**

**Background:** Various factors are responsible for post MRM chronically discharging mastoid cavity which has to be identified and treated properly so as to avoid further complications. The aim of this study is to evaluate the causative factors responsible for persistent ear discharge in post mastoidectomy cases and their management in paediatric age group.

**Methods:** This is a cross sectional study done from May 2013 to April 2017 in the Paediatric ENT unit of Department of ENT & HNS, TUTH, Kathmandu, Nepal. Children were evaluated for persistent ear discharge and managed for one year. Risk factors like high facial ridge, inadequate meatoplasty, unepithelize mastoid cavity, tympanic membrane perforation and residual or recurrent choleateatoma, infections, nasal or nasopharngeal pathology were evaluated and treated. Outcome of management was measured in terms of achieving dry mastoid cavity over one year period.

**Results:** A total of 92 post MRM children with persistent discharge were included in the study. 33/92 (35.8%) had anatomical defects. Four cases had recurrent or residual cholesteatoma. 22/92 (23.9%) of the cases had granulation and infection. 14 cases had nasophayngeal inflammation and 13 cases had recurrent accumulation of wax or debris. After the treatment of various factors, 43/75 (53.7%) ear became dry within 3 months, 22/75 (29%) ear became dry within 6 months, 6/75 had persistent discharge even 1 year after treatment. Whereas, in 5/75 (13.4%) had on and off discharge.

Conclusions: The chronically discharging mastoid cavity can be well managed by early identification of causative factors.

**Keywords:** MRM, Persistent ear discharge, Causative factors

# **INTRODUCTION**

'Cholesteatoma is a mass formed by keratinizing squamous epithelium in the middle ear and/or mastoid, subepithelial connective tissue and by the progressive accumulation of keratin debris with/without surrounding inflammatory reaction'.<sup>1</sup>

Paediatric cholesteatoma spread more extensively through the temporal bone than in adult as the temporal

bone in children is well pneumatized. The disease in children is frequently more extensive and expanding, with more involvement of the peri-labyrinthine cells and petrous apex.<sup>2</sup>

Modified radical mastoidectomy (MRM) is one of the common surgeries done to eradicate the cholesteatoma. The main aim of MRM surgery is to completely remove disease and minimize the risk of recurrence, and make the ear dry, safe and self-cleaning. After MRM most of the

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time, large cavities are created during the eradication of cholesteatoma which can be problematic in postoperative period. Some of the cavities continue to discharge for a longer period of time.<sup>2</sup> Post MRM discharging mastoid cavity is one of the common problem encountered by the ENT surgeon that may be equally distressing to the patients and their family.

Some of the studies shows a significant proportion of patients (20–25%) continue to have otorrhoea, either intermittent or continuous, after mastoid surgery.<sup>3-5</sup>

There are various factors which are responsible for chronically discharging ear which if identified and treated on time, may decrease the incidence of recurrent ear discharge in post mastoidectomy cases.

In this study, our aim is to evaluate the causative factors responsible for persistent ear discharge after MRM surgery and their management in paediatric age group.

#### **METHODS**

This is a cross sectional study of children who underwent MRM from May 2013 to April 2017. The children with persistent ear discharge were followed up and managed for one year. The study was conducted in the Paediatric ENT unit of Department of ENT & HNS, Institute of Medicine, Tribhuvan University Teaching Hospital, Kathmandu, Nepal. The children who underwent MRM for cholesteatoma were followed up and evaluated for persistent ear discharge. Children undergoing MRM for diseases other than cholesteatoma and MRM with mastoid obliteration were excluded from the study. The factors which are responsible for persistent ear discharge were evaluated and causative factors were managed accordingly.

The post-operative children who had persistent ear discharge were evaluated for anatomical defects which were not treated properly in previous surgery like high facial ridge, inadequate meatoplasty, unepithelizesd mastoid cavity, tympanic membrane perforation and residual or recurrent choleateatoma. Recurrent and residual cholesteatoma were diagnosed clinically and radiologically (high resolution CT scan).

The anatomical defects as well as recurrent or residual cholesteatoma were managed with revision surgery. Tympanic membrane perforation was treated with myringoplasty.

Postoperative mastoid cavity infection was diagnosed with culture sensitivity of ear discharge. The children with positive bacterial growth were treated with oral, topical or intravenous antibiotics according to the growth of organism and sensitivity of antibiotics. Granulation tissue, unepithelized mastoid cavity were detected on examination under microscope. Granulation tissue was

treated with antibiotics and excision of granulation tissue in non resolved cases.

Nasal and Nasopharyngeal infection was detected with anterior rhinoscopy and flexible nasopharyngolaryngoscopy. Nasal or nasopharyngeal infection was treated with antibiotics, antihistaminics and nasal decongestant. Nasal allergy was treated with antihistaminics and in some cases topical steroid spray.

Children with debris and wax collection had suction removal of wax were called for regular follow up for cavity care.

The outcome of treatment was evaluated in terms of time taken for the mastoid cavity to become dry.

## **RESULTS**

A total of 316 children who underwent MRM with and without ossiculoplasty over a period of 4 years from May 2013 to April 2017 were evaluated. Out of 316 children, 92 (29.1%) presented with recurrent or persistent ear discharge whereas 224 (70.8%) did not have any discharge. We evaluated and treated 92 symptomatic children.

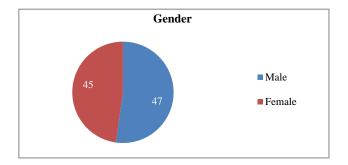


Figure 1: Gender distribution (n=92).

Out of 92 children, 47 were male and 43 were female.

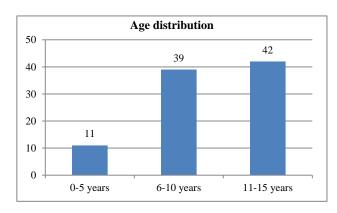


Figure 2: Age distribution (n=92).

The most common age group with recurrent ear discharge belongs to 11-15 years of age.

Anatomical defects like high facial ridge, inadequate meatoplasty, unepithelized cavity, perforation of pars tensa were seen in 33 cases.

Granulation with pus discharge and positive bacterial growth was seen in 22 children. Residual or recurrent cholesteatoma was seen in only four cases.

Nasal and nasophayngeal infection or inflammation was seen in 14 cases. Out of which clinical features suggestive of recurrent acute rhinosinusitis was seen in 4 cases, chronic rhinosinusitis was seen in three cases and allergic rhinitis seen in seven cases.

Table 1: Risk factors in recurrent or persistent ear discharge cases (n=92).

Risk factors	Recurrent ear discharge		
Anatomical defects	33		
Nasopharyngeal infection/inflammation	14		
Granulation with positive bacterial growth	22		
Granulation without bacterial growth	6		
<b>Debris collection</b>	13		
Recurrent/ residual cholesteatoma	4		

On performing the pus culture and sensitivity, most common bacteria isolated was *Pseudomonas aeruginosa* (n=14), which was sensitive to Piperacillin, Ceftazidime. No growth was seen in 28 cases.

Table 2: Anatomical defects (n=33).

Anatomical defects	No of cases
High facial ridge	8
Inadequate meatoplasty	5
Unepithelized cavity	10
Perforation of pars tensa	10

Table 3: Bacteriological growth.

Bacterial growth	No of cases
Pseudomonas aeruginosa	14
Staphylococcal aureus	4
Streptococcus pyogenes	2
Klebsiella species	2
No growth	28

Out of 92 symptomatic patients, 13 cases had wax and debris collection which were managed conservatively with regular suction clearance. Four cases lost to follow up. So, in 75 cases definitive management of various risk factors was done. A total of 33 cases underwent revision surgery.

Table 4: Revision mastoidectomy (n=33).

Indication for revision mastoidectomy	No of cases
Recurrent/residual cholesteatoma	4
High facial ridge with inadequate meatoplasty	12
Unepithelized mastoid cavity	10
Pars tensa perforation	7

**Table 5: Outcome of management of risk factors (n=75).** 

Treatment	Dry within 3 months	Dry within 6 months	On and off discharge	Didn't dry up
Revision mastoidectomy (n=33)	23	8	1	1
Granulation tissue excision with antibiotics treatment (n=28)	15	6	3	4
Treatment of nasopharyngeal disease (n=14)	4	8	1	1
Total N (%)	43 (57.3)	22(29.3)	5 (6.6)	6 (8)

## **DISCUSSION**

Modified radical mastoidectomy is one of the frequently done surgeries in our department. The main aim of MRM is to eradicate all the diseases and make the ear safe and dry. Paediatric MRM is challenging and at the same time may be difficult because of highly pneumatized mastoid ear cell system with extensive cholesteatoma spread. Cholesteatoma is more aggressive in children than in adults, it may spread very fast and it becomes worse by superinfection. In this situation there is high chance of leaving behind the cholesteatoma which may be the reason of recurrence or residual disease.

In our study 316 MRM surgeries were done over the period of 4 years. Out of which 316, 92 (29.1%) children presented with recurrent ear discharge who were evaluated and treated. Some of the study shows post MRM persistent or temporary otorrhea to be about 12-60%.<sup>7</sup>

Multiple factors may be associated with recurrent ear discharge in post MRM cases. In our study we also observed multiple factors like anatomical defects, infection, residual and recurrent cholesteatoma, nasal or nasopharyngeal pathology. Similarly, study done by Nadol also showed that a combination of multiple factors

were responsible for every case of discharging mastoid cavity.<sup>8</sup>

In our study, we observed various anatomical defects 33/92 (35%), which were not addressed in the previous surgery to be the common cause of recurrent ear discharge. Most commonly, the problem arises because of poor surgical technique at the initial mastoidectomy like narrow meatoplasty, a high facial ridge unepithelized cavity and perforation of tympanic membrane. We found high facial ridge in eight cases and inadequate meatoplasty in five cases. Out of 10 cases with perforation, in three cases the perforation healed spontaneously. So seven cases underwent myringoplasty during revision surgery.

Similar anatomical defect were observed in the study done by Wormald and they evaluated the mastoid cavities in 101 patients attending an outpatient clinic between 6 months and 20 years after mastoidectomy. The cavity was actively discharging in 52% and dry in 48% of patients. They detected high facial ridge, sump in cavity below floor of external auditory canal, perforation in tympanic membrane, small external auditory meatus. Some of the literature shows high facial ridge as the most common cause for failure. 7.10

Childhood cholesteatoma has much greater rates of residual and recurrent disease than that seen in adults. <sup>11</sup> In our study, four cases had recurrent or residual cholesteatoma and they underwent revision MRM, where chorlesteatoma was detected in anterior epitympanic cell in one case and in three cases it was detected in retrofacial cell, tip cell and sinodural angle. Kumar found the most frequent site of recurrent cholesteatoma was the tip cells (72%) and the most important cause for failure of surgery with recurence of disease was inadequate meatoplasty (70%). <sup>12</sup>

In our study, 31/33 (93.9%) cases after revision surgery became dry within 6 months. Weiss concluded that revision surgery was successful in providing the patient with a safe, dry ear in 105 (91%) of 116 cases which shows similar result as in our study. In the series of 541 ears, done by Jackson et al. <sup>13</sup> 89% ears were clean, healed and dry after revision surgery. <sup>14</sup> Whereas, Millis study shows 59 per cent of revision operations resulted in a dry ear in one year. <sup>15</sup>

Postoperative cavity infection is notorious problem. In our study, children with cavity infection with granulation were treated with oral antiobiotics like Amoxicillin, Cefixime or Ciprofloxacin. Topical antibiotics steroid drops were also prescribed. The cases who didn't improve with oral antibiotics; pus culture sensitivity was done under aseptic condition. *Pseudomonas aeruginosa* was the frequent organism detected in pus culture 14/22 cases which was followed by staphylococcus in four cases, streptococcus in two cases and *Klebseilla* species in two cases. *Pseudomonas* infection was troublesome

because it was resistant with most of the antibiotics and sensitive to only injectable like Piperacillin, Ceftazidime. Xu An-ting et al found *Staphylococcus*, GRAM + rods, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and fungi as the common organism before and after total middle ear reconstruction. Bacteriological study by Ojala revealed no significant difference between the preoperative & postoperative state regarding the types & specificity of organisms.

In our study, 14 children had recurrent rhinosinusitis and allergic rhinitis which was associated with recurrent discharge from mastoid cavity. They were treated with antibiotics, antihistaminics and occasionally steroid nasal spray and most of the cavity became dry within six month

Granulation tissue is higly vascularized and reactive tissue which has property of bone erosion and cause fibrosis and scaring on healing. <sup>18</sup> Granulation tissue is the main source of otorrhea and the best way to dry the ear is treating the granulation tissue by topical antibiotic, chemical cautery using acetic acid and by excising the granulation tissue. Even in our study, 28/75 (37%) with discharging ear had granulation with positive bacterial growth. After excising the granulation and antibiotics treatment 21/28 (75%) cases became dry within 6 months of treatment.

Six out of 75 cases had persistent discharge even after management of risk factors. Four cases of granulation tissue with recurrent infection were considered for revision surgery. One case of revision mastoidectomy had persistent ear discharge was suspected to have residual cholesteatoma and was planned for re revision MRM. One case of persistent ear discharge with chronic rhinosinusitis was planned for function endoscopic sinus surgery.

#### **CONCLUSION**

The chronically discharging mastoid cavity can be well managed by early identification of causative factors. The large mastoid cavities can be reduced by good surgical technique like making the cavity round and smooth and by partial obliteration of cavities, either with cartilage or prosthetic materials. The cavity must be rounded and smoothly contoured with no overhanging ridges and low facial ridge in order to allow migration of epithelium. The tympanic membrane should be repaired to close all communication between the mastoid cavity and the mesotympanum and Eustachian orifice. The cavity infection should be treated properly with antibiotics and nasal nasopharyngeal infection or inflammation should be well addressed.

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Ethical approval: The study was approved by the

Institutional Ethics Committee

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