Original Research Article

Comparison of Healing Time following Modified Radical Mastoidectomy with or without Mastoid Cavity Obliteration

Sanjeev Kumar[1*], Rajeev Ambastha[1], R P Thakur[2]

[1]Senior Resident,Department ENT ,Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India

[2]Associate Professor and HOD ,Department ENT ,Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India

Received: 09-10-2020 / Revised: 30-12-2020 / Accepted: 07-01-2021

Abstract

Background: Modified radical mastoidectomy (MRM) is a type of canal wall down mastoidectomy usually reserved for chronic otitis media squamous active type of disease which is considered as an unsafe type due to high incidence of complications. **Aim:** To compare the healing time after MRM with or without mastoid obliteration in all age groups.**Materials and Methods:** It was a prospective, longitudinal, comparative, interventional study on patients (age ≥8 years) diagnosed with chronic otitis media squamous type in active stage. A total of 30 patients underwent modified radical mastoidectomy (MRM) under general anesthesia in two year period. Study population was randomly divided into two groups: group A (n=15): MRM with mastoid cavity obliteration using inferiorly based musculofascioperiosteal flap and group B (n=15): MRM without mastoid cavity obliteration. Healing time (in weeks) and complications were recorded in both groups after surgery i.e. after 10 -14 days 4-6 weeks, 12 weeks and compared.**Results:** All the patients had healed cavities postoperatively. However, the average healing period in group A was 10.67 weeks and in group B 12.47 weeks. Difference in healing time between the two groups was statistically significant (p value = 0.005).**Conclusion:** The average healing time in MRM with mastoid cavity obliteration is a bit earlier (10.67 weeks) to MRM without mastoid cavity obliteration (12.47 weeks) with statistical significance.

Keywords: Chronic otitis media; Modified radical mastoidectomy; Mastoid cavity obliteration; Healing

Introduction

Chronic otitis media (COM) is a common entity frequently seen by an Otolaryngologist in their day to day practice, characterized by permanent abnormality of the pars tensa or flaccida [1]. COM squamous active is a type of COM, which is associated with production of pus, retraction of pars flaccida or tensa with retained squamous epithelial debris [2]. COM is still one of the most common ear diseases and the prevalence of squamous type of COM is 3.5% in Nepal [1, 4]. The World Health Organization (WHO) estimates that over 5% of the world population has disabling hearing loss [5]. Several factors like genetic, infection, allergy, and environmental, social and racial factors are considered as the etiology and pathogenesis of otitis media [6]. The high prevalence of COM in developing countries is mainly consequent to poor hygiene, overcrowding, nutritional deficit & poor living condition [7]. There is a dramatic decline in the incidence of COM nowadays secondary to improvement in housing, hygiene and antimicrobial therapy [8]. COM may have long term effects on psychosocial as well as educational progress and achievement [9]. Earlier, the radical surgery aimed at disease eradication without giving attention to hearing restoration. Now a days preservation and reconstruction of the hearing mechanism is also emphasized. The combined approach tympanoplasty (CAT) of Jansen popularized in 1960s. However, the emphasis is back on canal wall down (CWD) procedures for better eradication of cholesteatoma and hearing restoration [10]. The most effective surgical method for treating middle ear cleft cholesteatoma and COM is debated[11].The surgery is done either in one stage or multiple stages with reconstruction of canal wall later [12,13]. Among CWD surgeries Modified Radical Mastoidectomy (MRM) is the most commonly performed surgery for active COM squamosal type disease mainly in developing countries, offering a mastoid cavity for the entire life [14]. There are small but expressive number of patients with chronic complaints associated with the persistent mastoid cavity [15].Recurrent drainage and infection along with unable to wear traditional hearing aids due to wide meatoplasty are the most common causes of discontent [16]. The open cavity problems can be avoided by obliterating the mastoid cavity in a same sitting while performing canal down technique or can be done later in the second sitting [14]. Mosher described an obliteration technique using a superiorly based post auricular soft tissue flap [17]. The muscle atrophied over time, causing a progressive enlargement in cavity size, is supported by histological data from the temporal bone study of Linthicum [18]. Palva [19] modified and popularized the technique, by adding bone chips and bone pate.The most frequent and popular techniques consist of either local flaps (muscle, periosteum, or fascia) or free antilogous grafts (bone, cartilage, fat, fascia), or even alloplastic grafts (hydroxyapatite, silicon, synthetics bones, among others) [15]. The problem with the obliteration technique is of difficulty in seeing the recurrence of disease in the mastoid cavity [20]. In our study we have used healthy mastoid cortex bone chips, bone dust and the inferiorly based Musculofascioperiosteal flap for mastoid obliteration in all the age groups. Accordingly this study was conducted to compare the healing time in obliterated and non- obliterated mastoid cavities in COM-squamous active type disease.

**Correspondence*

Dr. Sanjeev Kumar

Senior Resident, Department ENT ,Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India.

E-mail: drskr2004@gmail.com

Materials and Methods

A prospective, longitudinal, comparative and interventional study was conducted at Department of ENT at Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar. The study was approved by Institutional research and ethical committee. An informed and written consent was taken from all the participating subjects. The study was conducted over a period of 2 years time from January 2018 to December 2020. The study population comprised patients of age ≥ 8 years, all genders with COM squamous active (cholesteatoma) disease.

Study population was randomly divided into two groups:

Group A - MRM with mastoid cavity obliteration, and

Group B - MRM without mastoid cavity obliteration.

The study excluded children of age <8 years, with complications of chronic otitis media, revision MRM and with histologically proven middle ear diseases other than COM squamous type e.g., tuberculosis.

Pre-Operative Preparations-Patients were admitted one day prior to surgery in ENT ward. Prophylactic antibiotic ceftriaxone of 1 gram given intravenously 2-4 hour prior to surgery. On the day of surgery shaving was done approximately 2 cm superiorly from the upper attachment of pinna and 2 cm posteriorly from retroauricular groove in the ear to be operated. After the patient was anesthetized, the patient's head was turned to opposite side. Local anesthetic agent 2% lignocaine with adrenaline 1:200,000 solution approximately around 5 ml was used for local infiltration into the incision site and the four quadrants of EAC for hemostasis. After induction of anesthesia, the pinna and the surrounding area was painted and draped. Examination under microscope (EUM) was performed and findings noted.

Surgical procedure-The post aural approach was applied in both groups and the technique was either in to out or out to in. Patients in group B underwent classical MRM whereas patients in group A had some modifications in the surgical steps as described later.

A standard tympanomeatal flap was raised. A curved postaural incision was made 2 cm posterior and parallel to the post auricular groove extending from around 1 cm above the superior attachment of pinna to the mastoid tip so as to obtain a large generous flap. By exposing the temporalis fascia overlying the muscle, a large temporalis fascia graft was harvested from the upper part and the remaining fascia was kept intact inferiorly so as to have an adequate flap for obliteration. An inferiorly based musculofascioperiosteal flap with its base on the mastoid process with its length extending 1 cm superiorly to superior attachment of pinna was fashioned. The flap comprised 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. The flap was turned inferiorly and kept wrapped in wet gauze and kept wet by pouring normal saline on it time to time. Initially the normal mastoid cortical bone was collected using a gouge and hammer. Bone dust was collected while drilling normal bone from the healthy mastoid cortex. Then, CWD mastoidectomy was performed.

The posterior canal wall was lowered adequately to eradicate the disease process. To have better obliteration, the saucerization of the mastoid cavity was avoided. After the entire removal of 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. The inferiorly based muscleofascioperiosteal flap was placed over the bone chips and dust filled with cavity. The temporalis fascia was placed in middle ear as in the usual reconstruction as well as used to cover the attic reconstruction, posterior canal wall, and if possible obliterated mastoid cavity with bone chips, dust and flap. Gel foam pieces were kept in the middle ear and over external auditory canal (EAC) and the graft, and rest of the canal was packed with medicated pack. Routine wide meatoplasty was done in group B however meatoplasty was not fashioned in group A cases. The incision was closed in two layers (soft tissue with vicryl 3.0 round body and skin with proline 4.0 cutting body). The mastoid bandage was applied and the dressing was changed on the first postoperative day (POD) and on alternate days. Oral amoxicillin and clavulinic acid was prescribed for 2 weeks. Oral paracetamol - ibuprofen (10-15mg/ kg eight hourly) combined was prescribed for 3 days and then if necessary for analgesia. Oral antihistamines were also prescribed. Sutures and medicated pack were removed on the 7th postoperative day (POD). Patients were discharged on the 7th postoperative day (POD). Topical (antimicrobial and steroid) eardrops were prescribed for 4-6 weeks. All patients were advised for strict aural precautions post operatively. Post operatively patients were assessed on 10-14 days, 4-6 weeks and 12 weeks. The healing time of the mastoid cavity were recorded in both the groups. Dry ear was defined as lining of the external auditory canal and middle ear without signs of infection.The result of our study was analyzed in terms of: Mean of healing time (dry ear) between group A and group B patients and, the data collected was statistically analyzed using Statistical Package for Social Sciences (SPSS) 11.0 software. Independent T test was applied.

Results

There were 8 (53.3%) male patients and 7 (46.6%) female patients in both obliterated and non-obliterated groups. There was no statistically significant difference noted in gender distribution in both the groups (p = 1.00) (Table 1).

Table 1: Gender Distribution of Patient in Two Groups

Groups	Male	Female	P-Value
Group A (MRM With Obliteration (n=15)	8 (53.3%)	7 (46.6%)	1
Group B (MRM Without Obliteration (n=15)	8 (53.3%)	7 (46.6%)	

The observation showed that maximum number of cases fall in the age group of 10-19 years with frequency of 6 (40%) in non-obliterated group and 10 (66.6%) in obliterated group, followed by 6 (40%) non-obliterated and 3 (20%) obliterated in age group of 20-29 years. The minimum frequencies 1 (6.6%) were seen in age group of 40-49 years in both non-obliterated and obliterated group. There was no statistically significant difference noted in age distribution in both group (p = 0.416) (Table 2).

Table 2: Age Distribution of the Patient in Two Groups

Age Groups (Years)	Group A (MRM With Obliteration (n=15)	Group B (MRM Without Obliteration (n=15)	P-Value
10-19	10 (66.6)	6 (40%)	0.416
20-29	3 (20%)	6 (40%)	
30-39	1 (6.6%)	2 (13.3%)	
40-49	1 (6.6%)	1 (6.6%)	

The average healing period in group A (MRM with obliteration) was 10.67 weeks and in group B (MRM without obliteration) was 1 2.47 weeks. There was statistically significant difference in healing time between the two groups (p value= 0.005) (Table 3).

Table 3: Healing Time (Average) Of Mastoid Cavity of Two Groups

Group	Average healing (Weeks)
Group A (MRM With Obliteration(n=15)	10.67
Group B (MRM Without Obliteration(n=15)	12.47

On comparing the healing time (weeks) between MRM with obliteration (Group A) and MRM without obliteration (Group B) with 15 cases in each group in which group A healed faster (10.67±1.447 weeks) than that of group B (12.47±1.807 weeks) which was statisticall y significant (p-value=0.005) (Table 4).

Table 4: Comparison of Healing Time between Two Groups

	Type of Surgery	N	Mean + Std. Deviation	Std. Error Mean	P Value
Healing Time (Weeks)	MRM With Obliteration	15	10.67 ± 1.447	0.374	0.005
	MRM Without Obliteration	15	12.47 ± 1.807	0.467	

Discussion

The aim of surgical management of COM squamous active type is to eradicate the disease, have dry ear, prevent recurrence and to reconstruct the hearing mechanism. CWD or open cavity mastoidectomy is one of the management options with the long-term goal of the surgery to provide the patient with a safe, dry and 'self-cleaning' ear [21]. A discharging mastoid cavity is distressing and predisposes to various problems [22]. Two-stage operation and regular follow-up is problemetic [23]. Considering the fact, we compared CWD with and without mastoid obliteration techniques to find out the healing time and open cavity problems.In this study, we used inferiorly based Musculofascioperiosteal flap based on post auricular artery.Ghiasi S [24] studied "Mastoid cavity obliteration with combined palva flap and bone pate". Wadhwa [25] reported the first Indian study with "periosteo-temporofascial flap for cavity obliteration".Mokbel and Khafagy [26] presented a case series of "Single flap with three pedicles, bone pate and split-thickness skin graft for immediate mastoid obliteration after canal wall down Mastoidectomy". Singh V [27] reviewed Obliteration of the persistently discharging mastoid cavity using the middle temporal artery flap". "Canal wall reconstruction tympanomastoidectomy with mastoid obliteration" was reviewed by Gantz BJ [28]. Saunders [21] presented "Mastoid misery: quantifying the distress in a radical cavity". In this study we randomly allotted patients to group A and group B. In group A patients underwent MRM with mastoid cavity obliteration where as in group B, patients underwent MRM only. In our study, age range was 10-49 years in both groups. The mean age of group A was 19 ± 8.611 years and 22.93 ± 8.11 years in group B. The most common age range being 10-19 years. The male population outstripped the female population (male=8, female=7 in group A; male=8, female=7 in group B). Yung [30] included 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). Ramsey [31] included total of 59 patients with age ranged from 4 to 84 years, with a mean age of 39 years. There was an even distribution between male patients (n=28) and female patients (n=31). All patients underwent CWD mastoidectomy and mastoid obliteration (MO) for COM. In our study all the cases in both the groups were healed. The average healing period in group A was 10.67±1.447 weeks and 12.47±1.807 weeks in group B. There is statistically significant difference in healing time between the two groups in our study (p value=0.005). In a study by Wadhwa [25], periosteo-temporofascial flap was used to obliterate the mastoid cavity, sample size being 50 (25 patients underwent obliteration technique and 25 patients non obliteration technique) and the aim of the study being comparison of healing rate of the mastoid cavity between two groups, showed the rate of healing faster in obliteration group. The total number of the obliterated cases that healed was 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. Chhapola S, Matta [24] in a comparative study of "Mastoid Obliteration Versus Open Cavity" had a sample size of 40; patients were randomly divided into two groups of 20 each. The group of 20 controls had an open mastoid cavity. Out of the 20 cases, patients were divided in four groups of 5 each. For each group the mastoid cavity was obliterated with cartilage, bone dust, hydroxyapetite and Singapore swing. Healing of the cavity as evidenced by epithelialisation, at the end of 6 months, was better in those ears where cavity was obliterated (90%) as compared to those with open cavity (70%). Cases obliterated with bone dust and Singapore swing had better and early epithelialisation (100%) as compared to cartilage and hydroxyapetite (80%).In our study, the patients were assessed thrice post operatively. The patients' assessment was on 10-14 days, the second on 4-6 weeks and the third and final assessment on 12 weeks after discharge from the hospital. The mastoid cavity of all patients of both the groups was examined. The cavity was considered healed if there was no discharge or debris in the cavity or any other signs of infection. As CWD surgery secures good surgical view, lesions could be removed completely; nonetheless, its shortcomings are cavity problems, difficulties in the fitting of hearing aids, etc. [32]. To reduce such shortcomings, attempts have been made by reconstruction of posterior canal wall and obliteration of mastoid cavity. Several studies had assessed the quality of patient's life after mastoid obliteration and reported that self-confidence was improved, embarrassment or inconvenience was felt less, and self-consciousness was lessened. In addition, mastoid obliteration prevents and minimized changes of resonance of external auditory canal after CWD surgery [33]. In this study we only address short-term healing rates, which may change with time. Most of the concern for mastoid obliteration is that of residual disease which may be buried underneath the fillers and so to detect residual cholesteatoma, a long term follow up of these patients is necessary [30]. So, the limitations of our study are being small sample size and short term followup.

Conclusion

The healing time is earlier in MRM with cavity obliteration group compared to non obliterated group. The obliteration technique is able to lessen the burdens of the open cavity problems and can be followed in developing countries mainly where adequate follow up is not feasible.

References

1. Browning GG, Merchant SN, Kelly G, Swan IR, Canter R, et al. (2008) Chronic otitis media. Scott-Brown's Otorhino-

laryngology, Head and Neck Surgery,7thed.London:Edward Arnold publisher Ltd; 3395-445
2. WHO (2004) library cataloguing in-Publication Data Chronic Suppurative otitis media: Burden of illness and management options.World Health Organization, Geneva, p.19.
3. Adhikari P, Sinha BK, Pokhrel NR, Kharel B, Aryal R Prevalence of chronic suppurative otitis media in school children of Kathmandu district. J Inst Med.2007; 29(3):10-12.
4. WHO (2015) Deafness and hearingloss.
5. Maharjan M, Bhandari S, Singh I, Mishra SC (2006) Prevalence of otitis media in school going children in eastern Nepal. Kath Univ Med J 4(16): 479-482.
6. Mills RP (1997) Management of chronic suppurative otitis media. In Scott-Brown's Otolaryngology, Vol 3, 6th ed. London:Reed Educational and Professional Publishing Ltd;3/10/1-11.
7. Adhikari P.Pattern of ear diseases in rural school children: experiences of free health camps in Nepal. Int J Pediatr Otorhinolaryngol .2009;73(9): 1278-1280.
8. Berman S.Otitis media in developing countries. Pediatrics. 1995; 96(1): 126-131.
9. Monasta L, Ronfani L, Marchetti F, Montico M, Vecchi Brumatti L, et al. Burden of disease caused by otitis media: systematic review and global estimates. Plos One 2012; 7(4):e36226.
10. Göçmen H, Kiliç R, Ozdek A, Kizilkaya Z, Safak MA, et al. Surgical treatment of cholesteatoma in children. Int J Pediatr Otorhinolaryngol.2003; 67(8): 867-872.
11. Vaidya S, Agarwal A, Pagare R, Sharma VK . Evaluation of application of a cream inpost operative mastoid cavities. Indian journal of otology .2006;12:33-37.
12. Sheey JL (1983) Cholesteatoma surgery: canal wall down procedures. Ann Oto lRhinolLaryngoln 97(1): 30-35.
13. Kveton JF (2003) Open cavity mastoid operations. Glasscock-Shambough Surgery of the Ear (5thedn), NewDelhi, India, pp.499-415.
14. Guragain RP. How I do it? Mastoid cavity obliteration in children. Nepalese journal of ENT Head and Neck Surgery 2011;2(2):1
15. Mehta RP, Harris JP.Mastoid obliteration. Otolaryngol Clin North Am .2006;39(6): 1129-1142.
16. Roberson JB, Mason TP, Stidham KR. Mastoid obliteration: autogenous cranial bone pate reconstruction. Otol Neurotol. 2003;24(2): 132-140.
17. Yung M, Bennett A. Use of mastoid obliteration techniques in cholesteatoma. Curr Opin Otolaryngol Head Neck Surg. 2013; 21(5):455-460.
18. Linthicum FH. The fate of mastoid obliteration tissue: a Histo-pathological study.Laryngoscope.2002;112(10):1777-1781.
19. Palva T.Mastoid obliteration. Acta Otolaryngol Suppl 1979; 360: 152- 154.
20. Wadhwa V, Anand TS, Kumar S, Kathuria G, Rana I Periosteo-Temporofascial flap for cavity obliteration - first Indian study. Indian JOtolaryngol Head Neck Surg.2003; 55(3):170-174.
21. Males AG,Grey RF.Mastoidmisery: quantifying the distress in a radical cavity. Clin Otolaryngol Allied Sci.1991; 16(1): 12-14.
22. Mehta RP, Harris JMastoid obliteration. OtolaryngolClinNorth Am .2006;39(6): 1129-1142.
23. Beutner D, Helmstaedter V, Stumpf R, Beleites T, Zahnert T, et al.Impact of partial mastoid obliteration on caloric vestibular functionin canal wall down mastoidectomy. Otology & neurotology.2010; 31(9): 1399- 1403.
24. Chhapola S, Matta I . Mastoid obliteration versus open cavity: acomparative study. Indian J Otolaryngol Head Neck Surg. 2014; 66: 207-213.
25. Ghiasi S . Mastoid cavity obliteration with combined palva flap and bone pate. Iran J Otorhinolaryngol 2015;27(78): 23-28.
26. Mokbel KM, Khafagy YW Single flap with three pedicles, bone pate and split-thickness skin graft for immediate mastoid obliteration after canal wall down mastoidectomy. Eur Arch Otorhinolaryngol.2012; 269(9): 2037-2041.
27. Singh V, Atlas M (2007) Obliteration of the persistently discharging mastoid cavity using the middle temporal artery flap. Otolaryngol Head Neck Surg 137(3):433-438.
28. Gantz BJ, Wilkinson EP, Hansen MR .Canal wall reconstruction tympano mastoidectomy with mastoid obliteration. Laryngoscope.2005; 115(10): 1734-1740.
29. Harun A, Clark J, Semenov YR, Francis HW . The Role of Obliteration in the Achievement of a Dry Mastoid Bowl. Otology & neurotology: official publication of the American Otological Society ,American Neurotology Society and European Academy of Otology and Neurotology.2015; 36(9) :1510-1517.
30. Yung M, Smith P.Mid-temporal pericranial and inferiorly based periosteal flaps in mastoid obliteration. Otolaryngol Head Neck Surg.2007; 137(6): 906-912.
31. Ramsey MJ, Merchant SN, McKenna MJ .Postauricular Periosteal-Pericranial Flap for Mastoid Obliteration and canal wall down tympanomastoidectomy. Otol Neurotol.2004; 25(6): 873-878.
32. Meuser W.The exenterated mastoid: A problem of ear surgery. Am J Otol.1985; 6(4):323-325.
33. Jang CH, Lee JS.The effect on acoustic characteristics of surgical modification of the external ear. Korean J Otolaryngol 1999;42(12): 1501- 1504.

Conflict of Interest: Nil
Source of support:Nil