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Original Research Article

Mastoid cavity obliteration with bone dust: a retrospective study of 34 cases

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ABSTRACT

Background: Chronic suppurative otitis media leads to ear discharge with hearing loss with squamosal type often presents with cholesteatoma and mainstay of treatment is surgical. Modified radical mastoidectomy is the ideal surgical option in these cases but it results in open mastoid cavity formation with certain common cavity problems. This study done to find the results of mastoid cavity obliteration with autologous bone dust and how this technique is effective in avoiding long term cavity problems and assists in ossiculoplasty.
Methods: This is a retrospective observational study done in a tertiary care hospital. Patients presented with squamosal type of chronic otitis media were operated for a canal wall down modified radical mastoidectomy.The mastoid cavity was obliterated using bone dust. A follow up of the patients was done and the healing of the cavity with the hearing result assessed.
Results: The study includes total of 34 patients. 58.82% were male and 41.18% were female. All patients underwent canal wall down modified radical mastoidectomy and obliteration of the mastoid cavity was done with bone dust. The common cavity problems of discharge, debris were markedly reduced in an obliterated cavity with better healing of the cavity. The middle ear aeration was maintained assisting the ossicular reconstruction.
Conclusions: This study showed that mastoid cavity obliteration with bone dust offers significant long term benefits in providing dry, well epithelized cavity at the same time assisting in ossicular reconstruction.

Keywords: Mastoid cavity obliteration, Chronic suppurative otitis media, Bone dust

INTRODUCTION

Chronic suppurative otitis media is a common disease worldwide. Ear discharge with hearing loss is the most common clinical presentation. Squamosal type of chronic otitis media often presents with cholesteatoma and mainstay of treatment is surgical. Modified radical mastoidectomy is the ideal surgical option especially in extensive cholesteatoma. However, this procedure results in open mastoid cavity formation with certain common cavity problems, like: chronic ear discharge, dizziness due to exposure of semicircular canals, large meatoplasty leading to ugly appearance of the external auditory canal, repeated visits to ENT surgeon for regular cleaning of the mastoid cavity and problems in good fitting of hearing aids. If the cavity is left unobliterated, this can lead to persistent ear discharge not responding to topical medications.[1,2]

Sade in the year 1982 described the causes of post-operative persistent ear discharge, it includes large cavity, high facial ridge, small meatus, persistent tympanic

membrane perforation, incomplete clearance of disease.[3] An ideal mastoid cavity should be: small, well saucerised, with adequately lowered facial ridge, with adequate meatus for drainage, with intact tympanic membrane which separates eustachian tube opening from the external auditory canal and the mastoid cavity. Hence, to minimize the above problems it is necessary to obliterate the mastoid cavity. Mosher in 1911 first described mastoid cavity obliteration.[4] He described obliteration of mastoid cavity with superior based post-auricular soft tissue flap. Others methods of obliteration include bone, fat, cartilage and hydroxyapatite.

METHODS

Study design, location and duration

Current study was a retrospective observational study performed at otorhinolaryngology department of tertiary care hospital in Mumbai, West India from February 2017 to March 2019.

Sample size

Total 34 participants were included in current study. Amongst them, 20 (58.82%) were male and 14 (41.18%) were female. This is a retrospective observational study where data collected from all the patients in the age group of 20 to 50 years presenting with Chronic otitis media of squamosal type with ear discharge.

Inclusion criteria

The study included patients in the age group of 20 to 50 years presenting with chronic otitis media of squamosal type with ear discharge.

Exclusion criteria

The study excluded patients in the age group below 20 and above 50 years.

Tools used in study

All the patients were subjected to detailed history, clinical examination, routine blood examination, pure tone audiometry and an HRCT temporal bone. Examination under microscope was done to confirm the otoscopic findings. All patients were operated for canal wall down modified radical mastoidectomy under general anesthesia. Bone paste was made by the collected bone dust. This paste was then placed in the mastoid cavity and mastoid antrum obliteration was done up-to the mastoid tip. All patients had follow up at 7, 15, 21, 30, 60, 90 days, 6 months and one year after surgery.

Statistical method

Data of the patients was collected and analyzed by tabulating in Microsoft excel sheet. Status of the mastoid cavity with respect to healing, discharge, pain, giddiness and debris formation was assessed.

Surgical technique

Patient was in supine position with head turned opposite to the ear to be operated. After dressing and draping, postauricular incision was given and temporalis fascia graft was harvested. Mastoidectomy was done by classical outside in technique. During the drilling of the mastoid bone cortex, bone dust was collected from healthy autologous bone using large cutting burr with minimum irrigation. Mastoid antrum was opened. Canal wall down Modified radical mastoidectomy was done with removal of disease from the mastoid cavity and middle ear cleft. Exteriorization of the cavity was done by lowering the facial ridge and removing the bridge till the level of lateral semicircular canal. After complete clearance of the disease from the mastoid and the middle ear cleft, clearance of all the mastoid air cells was done by a polishing burr. Bone paste was made by the collected bone dust. This paste was then placed in the mastoid cavity and mastoid antrum obliteration was done upto the mastoid tip. Over obliteration of the mastoid antrum was done because bone dust may get absorbed over a period of time. A piece of cartilage can be placed over the area of removed facial ridge to prevent spillage of bone dust in middle ear near the aditus region. A large temporalis fascia graft was placed over the obliterated bone paste to prevent it from dispersing to middle and external ear. Ossicular reconstruction was done by incus repositioning in 29 patients and TORP (total ossicular replacement prosthesis) in 5 patients. Temporalis fascia graft for the tympanic membrane was kept in continuation with the obliterated mastoid cavity (Figure 1). Meatoplasty was done and post-auricular incision was closed in layers. However, due to obliteration of the mastoid cavity a very wide meatoplasty was not required.

Post-operative care

All patients were given oral antibiotics, anti-histaminics and analgesics for 7 days and skin sutures were removed after 7 days. After suture removal patients were prescribed Hydrocortisone-acetic acid ear drops, two drops twice daily, every alternative days for 2 weeks. All patients had follow up at 7, 15, 21, 30, 60, 90 days, 6 months and one year after surgery. Data of the patients was collected and analyzed. Status of the mastoid cavity with respect to healing, discharge, pain, giddiness and debris formation was assessed (Figure 2).

RESULTS

The study includes 34 patients, with 20 (58.82%) male patients and 14 (41.18%) female patients. All the patients presented with squamosal otitis media with chronic ear discharge. 30 patients (88.24%) presented with reduced hearing, 2 (5.88 %) presented with vertigo and 5 (14.71%) presented with tinnitus. On examination under

microscope 28 (82.35%) patients had frank cholesteatoma, 5 (14.7%) presented with granulation tissue and 2 (5.88 %) presented with aural polyp. On pure tone audiogram, 13 (38.24 %) had hearing loss <30 dB, 17 (50%) percent had hearing loss between 30-60 dB and 4 (11.76%) percent had hearing loss >60 dB (Table 2). At the end of 1st month 24 patients had dry ear and 10 had a discharging ear (Table 1).

Table 1: Post-operative results of patients at 1st, 3rd, 6th month and after 1 year.

Follow up	After 1st month	After 3rd month	After 6th month	After 1 year
Dry ear	24	29	33	34
Discharging ear	10	5	1	0
Total	34	34	34	0

At the end of 3rd month 29 patients had dry ear and 5 had discharging ears. At the end of 6th month 33 patients had dry ear and 1 had discharging ear. The reason for this perhaps could be to narrow meatus with bulky posterior wall. All patients had a dry ear and mastoid cavity at the end of one year. After 3 months pure tone audiometry was done and all patients had hearing improvement up-to 25 dB air bone gap with a good vibrating tympanic membrane and satisfactory middle ear space assisting the middle ear reconstruction. The temporalis fascia was covering the obliterated mastoid cavity.

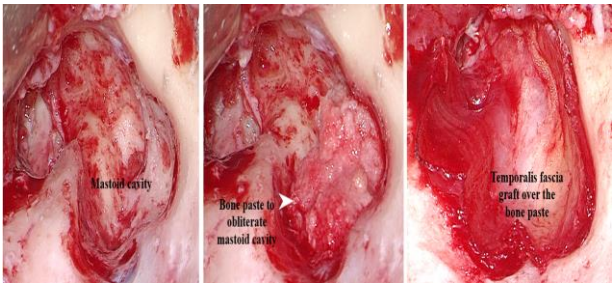

Figure 1: Canal wall down mastoidectomy with obliteration of mastoid cavity with bone dust and graft.

Figure 2: Mastoid cavity after first, third and sixth month follow up after mastoid cavity obliteration surgery.

DISCUSSION

Cholesteatoma is a gradually progressive disease that erodes mastoid and middle ear cleft and if left untreated leads to complications.[5,7] The treatment for extensive squamosal type of chronic otitis media with cholesteatoma is primarily surgical. Surgery is aimed at elimination of the disease by completely removing the cholesteatoma sac and exenterating the mastoid into a single cavity. A safe and dry ear which is self cleansing is required to prevent recurrent disease and debris formation.[5,6] Surgical reconstruction of the hearing mechanism by ossiculoplasty is done as a single stage procedure or at a second stage procedure. Single stage procedure is preferable to avoid a second surgery and chances of improper follow up. Canal wall down modified radical mastoidectomy (CWD MRM) is the term used to describe an operative technique done for treating cholesteatoma in which the all diseased tympano-mastoid air cells are removed, exenterated with removal of the posterior wall of the ear canal to create a common cavity. Ossicular reconstruction is done by various techniques depending on the extent of disease. In our study we did single stage procedures which includes canal wall down modified radical mastoidectomy with obliteration of mastoid cavity with meatoplasty and ossiculoplasty. While doing canal wall down mastoidectomy with cavity obliteration things that should be kept in mind, it include: All the mastoid air cells should be exteriorized and removed adequately till the mastoid tip. Check for any residual disease left over in the hidden areas, which may later result in recurrence. All the inflamed and edematous mucosa should be removed. Mastoid cavity can be obliterated by various techniques, of which cavity obliteration with bone pate is most physiological. Advantages of obliteration of mastoid cavity with bone pate include: it is easily available at the site of operation and can be easily harvested, use of autologous bone has good take up and less risk of subsequent breakdown of the reconstruction as compared to heterologous materials. It closelymimics the process of bone healing that occurs after a bony fracture, thus achieving good osteoinduction and osteoneogenesis, resulting is quick mastoid cavity healing. Wide meatoplasty is not required due to the smaller size of the mastoid cavity which requires aeration.[8] The phases of healing of obliterated mastoid cavity by autologous bone pate include: solidification of the bone graft: It occurs over approximately 3 to 4 weeks. Vascularization, osteogenesis, osteoinduction and radiographic calcification of the bone pate: it occurs over the first 3 to 9 months following the process of solidification. In our study we obliterated the mastoid cavity with autologous bone pate. 80% patients had dry ear after 1st month post-surgery, 85.3% had dry ear after 3rd month post-surgery, 97.1% had dry ear after 6th month post-operation and finally 100% patients showed a dry, epithelialized, healed ear at the end of one year post-operative follow up.

Since the bone pate gets solidified and may have some absorption over time via the above process, thus over obliteration of the mastoid cavity is recommended. Hence in our study we over-obliterated the mastoid cavity with bone pate. As a result even after solidification after 3 to 4 weeks, the obliteration was sufficient.[8] Mastoid cavity obliteration gives more support to the temporalis graft which is placed over the bone pate, facial ridge and bridge, and over the middle ear. This support helps maintain middle ear space which is crucial for a good ossicular reconstruction and proper aeration through the eustachian tube. The above healing process greatly assists the results of ossiculoplasty. Roberson et al did a retrospective case-series study on 62 ears in 56 patients, where canal wall down mastoidectomy was done and the mastoid cavity was obliterated by bone pate and temporalis fascia graft. After 18.5 months follow up 87% patients had dry ear.[8] Beutner et al did a retrospective case-series study on 26 patients with previous canal wall down mastoidectomy, where the mastoid cavity was obliterated by bone paste, conchal cartilage and temporalis fascia.On subsequentfollow up, 100% patients had epithelialized and dry ear.[9] Sun et al did a retrospective Case-series study on 48 ears in 45 children (5-12 years age), where canal wall down mastoidectomy was done and the mastoid cavity was obliterated by bone paste, cartilage and temporalis fascia.

Table 2: Age, sex, symptom, examination under microscope, pure tone audiometry, post-operative cavity after 1st, 3rd, 6th month and one year of surgery.

Age (years)	Sex	Symptom	EUM	PTA	Post-op. 1st month	Post-op. 3rd month	Post-op. 6th month	Post-op. 1 year
22	F	D, R	C	25	DR	DR	DR	DR
30	F	D, R	C	27	DR	DR	DR	DR
32	F	D, R	C	28	DR	DR	DR	DR
34	F	D, R	C	28	DR	DR	DR	DR
22	M	D, R	C	20	DR	DR	DR	DR
24	F	D, R	C	18	DR	DR	DR	DR
26	M	D, R	C	24	DR	DR	DR	DR
27	F	D, R	C	22	DR	DR	DR	DR
35	M	D, R, V, T	C	61	DS	DS	DR	DR
45	M	D, R	C	32	DR	DR	DR	DR
44	F	D, R	C	26	DR	DR	DR	DR
50	M	D, R, T	C	44	DR	DS	DR	DR
20	M	D, R	C	46	DR	DR	DR	DR
45	F	D, R	C	27	DR	DR	DR	DR
38	F	D, R	C	26	DR	DR	DR	DR
39	M	D, R, T	C	61	DS	DS	DR	DR
28	M	D, R	C	28	DR	DR	DR	DR
29	M	D, R	C	29	DR	DR	DR	DR
37	M	D, R, V, T	C	62	DS	DS	DS	DR
36	F	D, R	C	56	DS	DR	DR	DR
32	M	D	G	54	DS	DR	DR	DR
35	F	D	G	35	DR	DR	DR	DR
27	M	D, R	C	36	DR	DR	DR	DR
45	M	D, R	C	56	DS	DR	DR	DR
50	M	D, R	P	57	DS	DR	DR	DR
48	F	D, R	P	48	DS	DR	DR	DR
38	F	D, R, T	C	63	DS	DS	DR	DR
46	M	D, R	C	48	DS	DR	DR	DR
42	M	D, R	G	33	DR	DR	DR	DR
40	M	D, R	C	32	DR	DR	DR	DR
29	F	D, R	C	36	DR	DR	DR	DR
31	M	D	G	32	DR	DR	DR	DR
38	M	D	G	32	DR	DR	DR	DR
28	M	D, R	C	36	DR	DR	DR	DR

M=Male, F=Female, D=Ear discharge, R=Reduced hearing, V=Vertigo, T=Tinnitus, EUM=Examination under microscope, C=Cholesteatoma, G=Granulation, P=Polyp, PTA=Pure Tone Audiometry, DR=Dry ear, DS=Discharging ear.

After 2-5 years follow up there was 95.8% patients had dry ear.[10] Our study retrospective observational study conducted on 34 patients. A regular follow up for one year showed, 80% had dry ear after 1st month post-operation, 85.3% had dry ear after 3rd month post-operation, 97.1% had dry ear after 6th month post-operation and finally 100% patients showed a dry, epithelialized, healed ear at the end of one year post-operative follow up. Pure tone audiometry done at the 3rd month follow up which showed hearing improvement to 25 dB air bone gap with a good vibrating tympanic membrane in all the patients.

Limitations

Limitations of current study was the small sample size, a bigger sample size could give more consistent results.

CONCLUSION

The primary aim of mastoid surgery for cholesteatoma is total clearance of the disease. There is no perfect technique for obliteration of mastoid cavity or its reconstruction. It is important to create an oval shaped mastoid cavity with meticulous saucerization of all the mastoid air cells, proper lowering of the facial ridge, removing all diseased mucosa. Any procedure for mastoid obliteration should be simple, easily available with good healing and epithelialization of the mastoid cavity lining. The patient should have a dry, self-cleaning ear with optimal possible hearing. More importantly the cavity should be easy to inspect for signs of recurrent disease or infection. Bone dust is easily available at the site of operation and follows the natural process of bone healing. Thus bone dust can be very effectively used in mastoid cavity obliteration.

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

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