

## Surgical Outcome of Mastoid Cavity Obliteration with Bone Dust versus Open Cavity in Canal Wall down Mastoidectomy - A Comparitive Study

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### Abstract:

**Background:** Chronic suppurative otitis media (CSOM) is a long standing infection of a part or whole of the middle ear cleft characterized by ear discharge and a permanent perforation<sup>1</sup>. The concept of mastoid obliteration promotes healing of a mastoidectomy defect at an early phase.

**Objective** To analyse the surgical outcomes of mastoid cavity obliteration with bone dust/ pate compared to open cavity. By employing the technique of obliteration for improving cavity healing period, otorrhea, giddiness and wax formation were assessed.

**Study design:** Prospective, Randomized, Comparative study.

**Methods:** After informed consent,this study was conducted on 40 subjects who are diagnosed of active squamous chronic otitis media. The patients were randomly divided into two groups of 20 each. The group of 20 controls with an open mastoid cavity and another group of 20 cases, the mastoid cavity was obliterated with bone paté stabilised with a musculoperiosteal flap. Healing of the cavity and the associated cavity problems in terms of cavity healing period, discharge, giddiness and wax formation, were assessed.

**Results:** The incidence of ear discharge, giddiness and wax formation were markedly reduced in obliterated cavities as compared to the open cavities. Healing of the cavity as evidenced by early epithelialisation, at the end of 3 months, was better in those ears where cavity was obliterated (95%) as compared to those left unobliterated(75%).

**Conclusion:**This study shows that mastoidectomy with obliteration using bone paté offers a reduced incidence of discharge, giddiness and wax formation..

**STATISTICAL ANALYSIS**All the results were analysed by TEST STATISTICS: CHI SQUARE

**Key words:** Mastoid cavity; Obliteration; Bonepaté; surgical outcome.

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### I. Introduction

Chronic suppurative otitis media (CSOM) with cholesteatoma can be associated with active bacterial infection leading to profuse malodorous otorrhea, or be filled with keratin and remain dry<sup>4</sup>. Cholesteatomas are potentially dangerous because of their potential to cause resorption of bone, leading to intracranial or intratemporal complications<sup>1</sup>.

Open mastoidectomy technique has a long distinguished history and has been the mainstay of the management of cholesteatoma<sup>2</sup>, for the past one and half century These procedures are identified by many names- modified radical mastoidectomy, canal wall down mastoidectomy, radical mastoidectomy<sup>5,6</sup>, and the Bondy mastoidectomy- depending on how the middle ear, mastoid and the disease are managed.

The concept of mastoid obliteration was first introduced by Mosher<sup>7</sup> in 1911,initially to promote the healing of a mastoidectomy defectThe vast majority of obliteration techniques consist of either using local flaps (fascia, muscle, or periosteum) (fig 3) or free grafts (bone, fat, cartilage, biocompatible synthetic materials<sup>8,9,10</sup> and so on).

Autogenous bones can be used as bone plate, bone chip or bone paté. The greatest advantage of bone paté is its ability to reduce the size of the cavity and smooth out the rough surfaces of the walls of the cavity.

The most common indication for mastoid cavity obliteration is following canal wall down mastoidectomy for chronic otitis media, unsafe type. A canal wall down mastoid cavity, if not obliterated, can result in cavity problems (fig 4)like discharge, dizziness, deafness, dependency<sup>11</sup> to doctor. Other problems associated with a mastoid cavity may include difficulty with the use of a hearing aid<sup>12</sup>, water intolerance due to a susceptibility to infection, the need for frequent cleaning, and propensity to vertigo<sup>13</sup> by a caloric stimulus such as warm/cold water or air. Obliteration of the mastoid cavity is also indicated to reduce the size of the

cavity. It has to be ideally conducted as a primary procedure at the time of canal wall down mastoidectomy but can also be carried out as a second stage procedure in chronically infected mastoid bowl<sup>14</sup>

Canal wall down mastoidectomy and mastoid cavity obliteration with bone paté is a surgical procedure quite often done in our ENT department. So we need to study the end results and patient benefits of this procedure as compared to the open cavity controls in the management of unsafe type of chronic suppurative otitis media.

#### **AIM OF THE STUDY**

To study the surgical outcomes of mastoid cavity obliteration with bone dust compared to open cavity.

By employing the above mentioned technique to assess the improvement of **cavity healing period, otorrhea, giddiness and wax formation.**

### **II. Materials And Methods**

**Study design** Prospective, Randomized, Comparative study.

**Study setting** This study is a hospital based study performed in patients with chronic otitis media- Squamous disease, undergoing surgery in Government Kilpauk medical Hospital and Government Royapettah Hospital.

#### **Study period**

December 2015 to September 2016

#### **Sample size**

Study was conducted on 40 adult patients having evidence of active squamous chronic otitis media and were randomly allocated into two groups of 20 each. The group of 20 cases, the mastoid cavity was obliterated with bone dust. The other group of 20 controls with an open mastoid cavity.

#### **Inclusion Criteria**

- Patients between the age group of 14 to 60 years
- Patients having evidence of active squamous chronic otitis media (Unilateral, bilateral or recurrent), based on history, clinical examination and otomicroscopy, were included in the study.

#### **Exclusion Criteria**

- Patient's age below 14 years and above 60 years.
- Patients with other co existing conditions like malignancy, uncontrolled diabetes, immunosuppression, etc.
- Patients with history of previous mastoidectomy surgeries.
- Patients medically unfit for surgery / unwilling to undergo surgery.

**Ethical committee approval** :obtained

**Consent** :Informed written consent obtained

**Financial support** : Nil

**Conflict of interest** : Nil

### **III. Methodology**

A detailed history regarding the etiology and symptoms associated with COM-Squamous type was elicited. Presence of comorbid conditions was noted. Due approval from the institutional ethics committee was obtained. In this study patients within the age group of 14-60 years were selected. Patients below 14 years of age were excluded because cholesteatoma is reportedly more aggressive in children than in adults. Residual cholesteatoma, is also more common in the pediatric age group. Patients above 60 years were excluded, as more comorbid conditions exist in this group.

Pre operatively ear swab was taken and sent for culture and sensitivity test. Relevant antibiotics (topical and oral/ intravenous) were given for a period of 7 days. After 2 weeks, repeat ear swab for culture was sent. Further management was carried out after the control of secondary bacterial infection.

Otomicroscopy was performed to confirm the presence of cholesteatoma, retraction pockets, granulation, scutum erosion, and attic retraction or perforation.

Hearing evaluation was done by performing Pure tone audiogram, which documented both air and bone conduction.

After the pre operative assessment was performed, the patients were randomly allocated into two groups (Group A- CANAL WALL DOWN MASTOIDECTOMY with OPEN CAVITY and Group B- CANAL WALL DOWN MASTOIDECTOMY and CAVITY OBLITERATION with BONE DUST ), using randomization table. The otologists performed the post operative follow up of the patients and results were assessed. Surgical procedures (MRM with Open cavity and Mastoid obliteration) were performed by senior Otologists. A standardized procedure was used in both groups.

**STANDARDISATION OF PROCEDURE**

**Group A**

Under general anesthesia, large temporalis fascia graft was harvested, and canal wall down mastoidectomy is done.

**Group B**

Under general anesthesia, a large temporalis fascia harvested .mastoidectomy done .Bone collector was attached to the suction tube . Bone pâté from the superficial cortex of the mastoid was harvested using a cutting burr and continuous irrigation. It was collected in the mucous extractor . (Fig11). The drilling and collection of bone dust was restricted to the thick cortical bone and care was taken not to include diseased bone or cholesteatoma. Meanwhile, the bone pâté (fig 12) that was recovered from the bone collector was placed in a covered sterile container containing Ciprofloxacin solution . About 3.5- 5 ml of bone pâté was usually required to obliterate the cavity depending upon the size. At the end of the procedure, enough moisture was retained in the bone pâté to make a paste that lends itself to sculpting within the cavity to be obliterated and to avoid the sump effect.

Then the mastoid cavity was completely filled with bone pâté (Fig 13) and was covered by the flap/fascia graft harvested earlier.

The temporalis fascia graft placed over the obliterated cavity, also cover the remnant ossicular chain, without attempting primary reconstruction of ossicular chain. The wound was closed in layers using 3-0 Ethilon and 3-0 silk sutures. Mastoid compression dressing was applied and patient was extubated.

**Post operative follow up** :At the end of first week patients were reviewed for suture removal and assessment of post aural wound healing. They were followed up for a period of 12 weeks (3 months) as per the study protocol.The postoperative assessment were done at the end of 4<sup>th</sup>week, end of 8<sup>th</sup>week (2 months) and at the end of12<sup>th</sup> week (3 months).

**IV. Results :**

A total of 40 patients were included in the study, with 20 patients in each group.

*Table 1: Mean age distribution between the two groups.*

Age distribution	No. of Patients	Mean Age (Yrs) ±SD	Range (Yrs)
<b>Group A</b>	20	35.1 ± 13.24	19-56
<b>Group B</b>	20	33.8 ± 11.83	17-54

The age difference between the two groups is not statistically significant.

*Table 2: Gender Distribution*

sex	Group A	Group B	total
<i>male</i>	11	8	19
<i>female</i>	9	12	21

*Table 3: Preoperative symptoms*

Preoperative symptoms	Group A	Group B
Otorrhoea	90	100
Impaired hearing	90	80
Otalgia	20	15
Tinnitus	15	10

*Table 4 : Postoperative cavity status and ear discharge assessed by Merchant et.al., at the end of 4<sup>th</sup> , 8<sup>th</sup> and 12<sup>th</sup> week*

	end of 4 <sup>th</sup> week		end of 8 <sup>th</sup> week		End of 12 <sup>th</sup> week	
	GroupA	GroupB	GroupA	GroupB	GroupA	GroupB
<b>Grade 0</b>	.0%	5.0%	10.0%	45.0%	70.0%	95.0%
<b>Grade 1</b>	25.0%	85.0%	75.0%	50.0%	25.0%	5.0%
<b>Grade2</b>	55.0%	10.0%	15.0%	.0%	5.0%	.0%
<b>Grade3</b>	20.0%	.0%	.0%	5.0%	.0%	.0%
<b>Total.</b>	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

**Table 5 : GIDDINESS 4<sup>th</sup>, 8<sup>th</sup> and 12<sup>th</sup> week**

	end of 4 <sup>th</sup> week		end of 8 <sup>th</sup> week		End of 12 <sup>th</sup> week	
	GroupA	GroupB	GroupA	GroupB	GroupA	GroupB
<b>Count</b>	4	0	2	0	1	0
<b>Total</b>	04		02		01	
<b>percentages</b>	10%		5%		2.5%	

**Table 6 : Postoperative Subjective Satisfaction Scores at the end of 4 weeks, 8 weeks and 12weeks.**

Score	end of 4 <sup>th</sup> week		end of 8 <sup>th</sup> week		End of 12 <sup>th</sup> week	
	GroupA	GroupB	GroupA	GroupB	GroupA	GroupB
<b>0-4</b>	0	4	0	5	6	20
<b>5-8</b>	20	16	20	15	14	0
<b>9-12</b>	0	0	0	0	0	0
<b>Total.</b>	20	20	20	20	20	20

**Table 7: Postoperative cavity healing at the end of 4 weeks, 8 weeks and 12weeks.**

	end of 4 <sup>th</sup> week		end of 8 <sup>th</sup> week		End of 12 <sup>th</sup> week	
	GroupA	GroupB	GroupA	GroupB	GroupA	GroupB
<b>Healed</b>	5	13	16	17	3	1
<b>Not healed</b>	15	7	4	3	3	1
<b>Total.</b>	20	20	20	20	20	20

**Table 8 : Postoperative cavity status and ear discharge assessed by Merchant et.al., at the end of 4<sup>th</sup>, 8<sup>th</sup> and 12<sup>th</sup> week**

	end of 4 <sup>th</sup> week		end of 8 <sup>th</sup> week		End of 12 <sup>th</sup> week	
	GroupA	GroupB	GroupA	GroupB	GroupA	GroupB
<b>Grade 0</b>	.	5	10	45	70	95
<b>Grade 1</b>	25	85	75	50	25	5
<b>Grade2</b>	55	10	15	0	5	0
<b>Grade3</b>	20	0	0	5	0	0
<b>Total.</b>	100	100	100	100	100	100

**Table 9: mean postoperative patient's satisfaction scores(SSS)**

	GROUP	N	Mean	Std. Deviation	Std. Error Mean	P
4TH WEEK POST OPERATIVE SUBJECTIVE SATISFACTION SCORE	A	20	6.75	.967	.216	0.000<0.001
	B	20	5.25	.967	.216	
8TH WEEK POST OPERATIVE SUBJECTIVE SATISFACTION SCORE	A	20	5.80	.696	.156	0.000<0.001
	B	20	4.75	.639	.143	
12TH WEEK POST OPERATIVE SUBJECTIVE SATISFACTION SCORE	A	20	4.85	.671	.150	0.000<0.001
	B	20	3.45	.605	.135	

## V. Discussion :

Among the two surgical techniques available in the management of COM-Squamosal type, CWD (canal wall down) is considered as the gold standard procedure. The problems associated with CWD surgeries are those of a large mastoid cavity such as frequent infection with otomycosis, water intolerance, caloric induced vertigo, difficulty wearing hearing aid, dependency for frequent cleaning (accumulation of debris / wax), subsequently resulting in a depressed patient with poor functional outcome.

To overcome these problems, Blake (1898) attempted mastoid obliteration using blood clots as a medium for fibrous growth and thereby reducing the size of the resultant mastoid cavity. Mosher (1911) introduced surgical technique for Mastoid cavity obliteration.

The Mastoid obliteration reduces the size of mastoid air cell system, increases the biological stability of the ear, thereby reducing the mucosal lining available for gas absorption. It therefore prevents the formation of new retractions in the neo-tympanic membrane and also lowers the incidence of recurrent cholesteatoma. Even if retraction forms, they are shallow and self-cleansing.

Samad Ghiasi, used bone pâté for cavity obliteration in 48 patients and 56 ears. The mean age in his study was 28 years (8 -56 years). In our study all the patients belonged to the age group of 14 to 60 years with mean age group of  $35.1 \pm 13.24$  years in open cavity age group and  $33.8 \pm 11.83$  years in Bone pâté group (Group B). In this study the mastoid cavity healing were graded at the end of 4th week, 8th week and 12th week. It was observed that at the end of 4 weeks, the cavity was well epithelialized (grade 0, 1) in 25% of the patients in open cavity group (Group A), and in 90% in Bone pâté group (Group B). This difference was found to be statistically significant  $p < 0.000$ .

20% of patients who had undergone open cavity showed poor cavity healing at the end of 4 weeks. The presence of ear discharge and granulations, decreased in this group at the end of 8th week. Patients in bone pâté group progressed from grade 1 to grade 0 by end of 2 months.

At the end of 8 weeks, 95% of group B had well-healed and epithelialized cavity. At the end of 12th week it was observed that in 5% of the patients in open cavity group (Group A), the cavity grading was still grade 2. Ninety five percent of patients in Bone pâté group (Group B) had well

epithelialized cavity and was in grade 1. Seventy percent of patients in open cavity had achieved a well healed, mastoid cavity grade 0, at the end of 3 months. Patients in open cavity group (Group A), took a longer time to heal compared to Bone pâté group (Group B), and the obliterated cavity had a good postoperative outcome at the end of 12th week. Patients of both groups had intermittent otorrhea, Unhealthy granulation tissue were treated conservatively. Subjective satisfaction was analyzed at the end of 4th week, 8th week and 12th week. The minimum or the best score was 0 and 12 was the maximum or worst score. At the end of 4th week, 20% of patients in open cavity group (Group A) and 100% in Bone pâté group (Group B) were completely or partially satisfied. Patients in open cavity group had more discharge compared to patients in Bone pâté group, owing to the granulation present in the healing mastoid cavity and hence poorer satisfaction with respect to open cavity at the end of 4th week. At the end of 8th week, patients in open cavity group improved symptomatically and 100% were partially satisfied. 25% of patients in Bone pâté group were completely satisfied and 75% were partially satisfied. At the end of 12th week all patients in open cavity group

(Group A) were satisfied completely or partially, and none of the patients in both the groups were dissatisfied. This difference was statistically significant with  $p$  value 0.000.

Joseph et al., found that Mastoid obliteration normalizes the eustachian tube function and mesotympanic aeration in majority of the patients, thereby preventing the formation of retraction pockets and reducing the incidence of recurrent cholesteatoma. As theorized by Holmquist and Bergstrom, decreasing the surface area available for gas resorption, and eradication of mucosal edema and chronic infection, may allow improvement in eustachian tube function<sup>70</sup>.

Two patients in our study in the bone pâté group had developed retraction pockets, which were shallow and self cleansing without any accumulation of keratin debris, associated with cavity formation. These patients are on regular follow up.

## VI. Conclusion

To conclude, mastoid cavity obliteration with bone pâté is an effective option for prevention of postoperative mastoid cavity problems.

Mastoid cavity healing as evidenced by epithelialisation, were better in obliterated ears *versus* non obliterated ears at the end of three months. The incidence of discharge, wax formation/ dependence, giddiness were significantly reduced in obliterated cavities as compared to non-obliterated cavities.. Cavity obliterated with bone pâté had better surgical outcome. Bone pâté is a safe and extremely effective option for treatment of the problematic canal wall-down mastoid cavities.

This technique seems to provide a low cost, lowest recurrence rate combined with low cavity problems.

In long term follow up patient with obliteration required less cavity care, thus decreasing doctor dependence, less frequent OPD visits and fewer courses of medical treatment.

Post operative patient subjective satisfaction score was also better and provided a good quality of life benefit for those patients whose cavities were obliterated

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