



Research Article

COMPARATIVE STUDY OF MASTOID OBLITERATION TECHNIQUES IN UNSAFE CSOM

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ABSTRACT

Introduction: Chronic suppurative otitis media is one of the most common diseases in otology. Mastoid obliteration is done to eliminate open cavity problems. This study was aimed to compare the efficacy of mastoid obliteration with musculoperiosteal flap, bone pate and cartilage over obliteration with musculoperiosteal flap alone.

Material and methods: 30 subjects of unsafe CSOM were included in the study and Canal wall down mastoidectomy was performed followed by obliteration of the cavity. In 15 subjects (Group A), musculoperiosteal flap, bone pate and cartilage was used for obliteration while in the other half (Group B) with musculoperiosteal flap alone was used. Outcome was compared at 4 week, 6 week and 8 week in terms of air and bone conduction gap and healing parameters.

Results: Both groups were matched for Age (p=0.49), gender (p=0.49) mean air-bone gap (p=0.39) and mastoid volume (p=0.41).Improvement in study group was found to be statistically significant in both groups. Improvement in air bone gap at post operative 4 weeks (p=0.041), 6 weeks (p=0.037) and at 8 weeks (p=0.028) was found be significantly more in group A compared to group B.Post op discharge (p=0.01), residual disease in form of granulation (p=0.04) was found to be significantly higher in group B.

Conclusion: Followed by mastoidectomy, obliteration with musculoperiosteal flap, bone pate and cartilage yields better results in terms of acoustic parameters and outcome of surgery.

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INTRODUCTION

Chronic suppurative otitis media (CSOM) is one of the most common chronic diseases of Otolaryngology. It is one of the major causes of deafness in India. It is especially common in lower socioeconomic group. In our country burden of the disease is too high considering the huge population. Prevalence of CSOM in the world is around 65-330 million/year. Majority of world CSOM burden is attributed by Southeast Asia, Western pacific and African countries. India falls into countries with highest prevalence (prevalence > 4%).(Chandrashekarayya SH *et al* 2014)

Typical Pathophysiology includes acute inflammation of middle ear (Yorgancilar E *et al* 2013 &Hossain MM *et al* 2006)Conventionally, CSOM is divided into two types: tubotympanic (safe) and atticointral (unsafe). In unsafeCSOM, cholesteatoma destroys the bones which come in its way such as ear ossicles, bony labyrinth, facial nerve canal, sinus plate, and tegmen tympani.(Glasscock ME 1984) The principal goal in cholesteatoma surgery is the complete eradication of the disease to produce a dry, safe and self cleaning ear and creation of new anatomy to prevent recurrence.

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Canal wall up (CWU) techniques have many advantages such as preserving the posterior canal wall, eliminating the need for periodic bowl cleaning, avoiding the risk of recurrent bowl infections, and simplifying ossicular reconstruction. Canal wall down (CWD) mastoidectomy technique is used to completely remove cholesteatoma thus favoring excellent exposure of the entire attic and middle ear and complete eradication of disease. While CWU technique has high recurrence rate, CWD technique has disadvantages such as debris accumulating in exteriorized mastoid cavity, requiring periodic cleaning and water restrictions, non-aesthetic meatoplasty, vertigo and hearing aid problems. (Kim MB *et al* 2010 &de Azevedo AF *et al* 2013)

Mastoid obliteration is done to to eliminate open cavity problems. The clear advantages being less nitrogen-absorbing mucosa thus less recurrence of retraction cholesteatoma in eustachian tube dysfunction, self cleaning cavity with decreased infection, faster epithelialisation and reduction of mastoid cavity problem and role in sound pressure augmentation.Both autologous and synthetic materials such as free graft, fat, cartilage, bone chips, bone pâté, hydroxyapatite, and periostio-muscular flaps are used for obliteration.(Kaur N *et al* 2010 & Chan CY *et al* 2012) Aim of this study was to compare the efficacy of mastoid obliteration with musculoperiosteal flap, bone pate and cartilage over obliteration with musculoperiosteal flap alone on the basis of effective

mastoid cavity volume reduction post operatively and improvement in hearing by assessing reduction in Air Bone Gap.

MATERIAL AND METHODS

This is a prospective analytical cohort study conducted in Department of Otorhinolaryngology, Dr. B.R.A.M. Hospital ,Raipur which included 30 cases of both sexes in the age group ranging between 18 to 41 years who presented to the E.N.T. OPD with chronic otitis media with/without cholesteatoma. Study was approved by institutional ethical committee of Pt. J. N. M. Medical College, Raipur. Study was conducted in accordance with declaration of Helsinki. Study included 30 subjects with CSOM , unsafe type with conductive hearing loss requiring Canal wall down mastoidectomy with mastoid obliteration during the study.

Patients with cholestatoma around the footplate of stapes or protympanum/extensive granulation tissue,those with unsafe CSOM with any intracranial complication, sensorineural hearing loss, other comorbidity or dead ear were excluded from the study. Informed written consent was taken from all eligible subjects. was obtained and thorough examination was done including otoscopic examination, with assessment of vestibular function and tuning fork tests and microscopic examination. Pure tone audology was performed and roentgenogram of Mastoid (B/L) in Schuller’s view was obtained.

Canal wall down mastoidectomy was performed as per standardized procedure in all the patients followed by obliteration of the cavity. In 15 subjects (Group A),musculoperiosteal flap, bone pate and cartilage was used for obliteration while in the other half (Group B) with musculoperiosteal flap alone was used. Mastoid volume was measured using sterile normal saline at body temperature on table in all the patients. (Fig 1 and Fig 2)

Postoperatively, patients were assessed at biweekly intervals from 4 weeks post op in both the groups. The adequacy of conchomeatoplasty,the cavity size,facial ridge, post-operative residual disease,epithelialisation and healing were also assessed.

Data was expressed as percentage and mean ± S.D. Kolmogorove-Smirnove analysis was performed for checking linearity of the data. Student’s t test was used to check the significance of difference between two parameters in parametric data. ANOVA for repeated measures followed by Tukey’s HSD test was used to test the significance of difference between more than two parameters in parametric data. Chi square test was used to analyze the significance of difference between frequency distribution of the data. P value <0.05 was considered as statistically significant. SPSS© for windows™ Vs 17, IBM™ Corp NY and Microsoft excel™ 2007, Microsoft® Inc USA was used perform the statistical analysis.

RESULT

Table 1 shows general characteristics of study subjects. Maximum subjects were present in 26-30 years and 32-35 years of age (12 subjects each). Equal number of male and female subjects was included in the study. In 13 subjects (43.33%) right ear was affected while in 11 subjects (35.67%) left ear was affected. Six subjects (20%). Cholesteatoma was

the commonest finding on pre-operative ear examination (25 subjects, 83.33%) while extent of cholesteatoma was found to be till ET in maximum subjects (25 subjects ,83.33%). Incus was commonest ossicle to be damaged with 17 subjects (56.67%) with eroded incus and 13 subjects (43.33%) with absent incus.

Basic characteristics were compared between two study groups, Group A in which musculoperiosteal flap, bone pate and cartilage was used for mastoid obliteration and Group B in which subjects only musculoperiosteal flap was used. The groups were found to be matched for Age (p=0.49), gender (p=0.49) mean air-bone gap (p=0.39) and mastoid volume (p=0.41). (Table 2)

Improvement in study group was found to be statistically significant in both groups. Further mean air bone gap was significantly lower at 4 weeks. 6 weeks and 8 weeks compared to pre-op , at 6 weeks and 8 weeks compared to that at 4 weeks and at 8 weeks compared to at 6 weeks in both group A and group B. (Table 3, Fig 3)Improvement in air bone gap at post operative 4 weeks (p=0.041), 6 weeks (p=0.037) and at 8 weeks (p=0.028) was found be significantly more in group A compared to group B. (Table 4)While no significant difference was found regarding adequacy of meatoplasty between two groups (p=0.36), Post op discharge (p=0.01), residual disease in form of granulation (p=0.04) was found to be significantly higher in group B. Epithelisation was found to be significantly better In Group A. (Table 5)

Table 1 General characteristics of study subjects

Characteristics	Value (N=30) Percentage	
	Value	Percentage
Age	≤ 25 yrs	3 10
	26-30 yrs	12 40
	31-35 yrs	12 40
	36-40 yrs	2 3.67
	> 40 yrs	1 3.33
Gender	Male	15 50
	Female	15 50
Affected ear	Right	13 43.33
	Left	11 36.67
	Bilateral	6 20
Pre-operative examination	Cholesteatoma	25 83.33
	Polyp	1 3.33
	Granulation	4 13.33
Ear operated	Right	17 56.67
	Left	13 43.33
	ET	25 83.33
	MT	20 66.67
Extent of Cholesteatoma*	HT	10 33.33
	A	22 73.33
	SDA	8 26.67
	TIP	18 60
	ST	8 26.67
Malleus	Eroded	9 30
	Absent	3 10
Incus	Eroded	17 56.67
	Absent	13 43.33
Stapes	Eroded	4 13.33
	Absent	0 0

*ET-Epitympanum,MT-Mesotympanum ,HT-Hypotympanum,A-Antrum, SDA-Sinoduralangle,TIP-Mastoid Tip,ST-Sinus Tympani

Table 2 Comparison of basic characteristics between study groups

Characteristics	Group A (musculoepiosteal flap, bone pate and cartilage) (N = 15)	Group B (musculoepiosteal flap only)(N =15)	p Value
Age (</=30 Years)	8 (53.33)	7 (46.66)	0.49
>30	7 (46.66)	8(53.33)	
Gender Male	7 (46.66)	8(53.33)	0.49
Female	8 (53.33)	7 (46.66)	
Mean Air Bone Gap (dB) (Pre-op)	37.2 ±13.66	36.6±10.62	0.39
Mastoid volume (On table)	1.65±0.33	1.7±0.05	0.41

Table 3 Improvement in hearing Post op in study groups

Study group	Mean Air Bone Gap (dB)				p Value
	Pre op	At 4 weeks	At 6 weeks	At 8 weeks	
Group a	37.2 ±13.66	32.26 ±14.4 ^a	29.4±12.78 ^{a,b}	25.73±10.28 ^{a,b,c}	0.037
Group b	36.6±10.62	33.86±11.66 ^a	31.6±10.9 ^{a,b}	28.8±10.34 ^{a,b,c}	0.043

a p<0.05 Vs Pre-op, b p<0.05 Vs 4week, c p<0.05 Vs6 weeks

Table 4 Comparison of improvement between study groups

Post of duration	Improvement in Air Bone conduction gap (dB)			p Value
	GROUP A	GROUP B		
At 4 weeks	4.24±1.72	2.73±1.69		0.041
At 6 weeks	7.8±2.65	5±2.42		0.037
At 8 weeks	11.47±4.84	8.07±3.32		0.028

Table 5 Comparison of improvement in various parameters in post operative period

Post-op characters	Group A (n=15)	Group B (n=15)	p Value	
Meatoplasty	Adequate	12 (80)	11 (73.30)	0.36
	Inadequate	2 (13.32)	4 (26.64)	
Post op Discharge	Present	1 (6.66)	7 (46.66)	0.01
	Cholesteatoma	0	0	-
Residual disease	Granulation	1 (6.66)	6 (40)	0.04
	Adequate	14 (93.32)	8 (53.32)	0.01

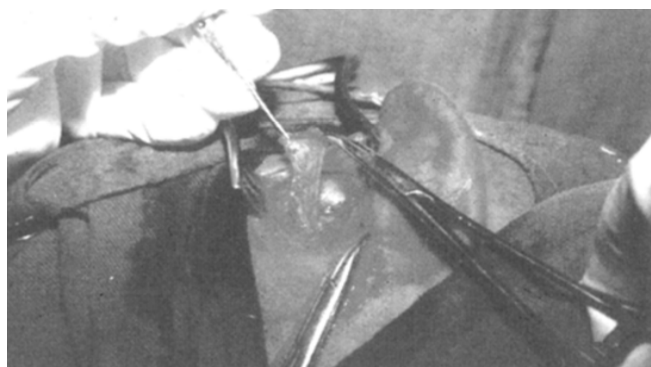


Fig 1 Musculoperiosteal flap

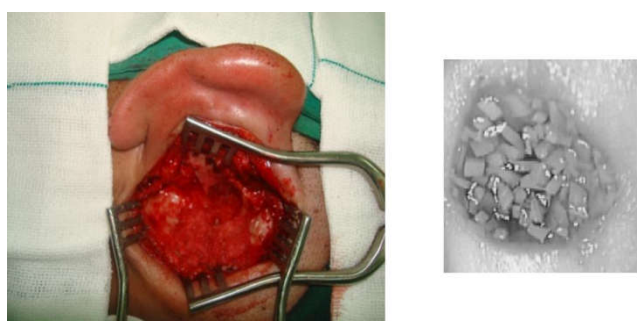
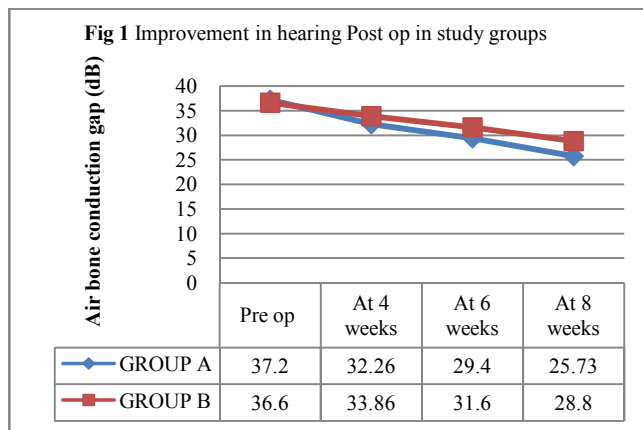


Fig 2 Bone pate filling and minced conchal cartilage



DISCUSSION

In this study t evaluate surgical procedure for unsafe CSOM, 30 patients were examined and analysed. Patients were divided randomly into two groups-First group had mastoid obliteration done with musculoperiosteal flap , bone pate and cartilage and second group with musculoperiosteal flap alone.

Indications for removal of mastoid air cells and obliterating the mastoid cavity varies considerably from surgeon to surgeon. Various obliteration techniques have been recommended to eliminate open cavity problems. Mosher in 1911 was the first to use the soft tissue flap technique in which a post-aural subcutaneous flap is used to fill the cavity after the mastoid has been obliterated. Subsequently, soft tissue flaps, free bone, cartilage grafts, autograft, and synthetic fillers have been used to reduce mastoid cavities and reconstruct the canal wall. (Abdelrahman E *et al* 2015)

In principle, any surgical procedure on the ear can affect its acoustic function, including surgery of the external ear. The volume of the ear canal and the width of its entrance affect sound resonance. In this study, we aimed to find out the difference in hearing improvement and efficacy of reduction in mastoid volume between cases of mastoid obliteration without ossicular reconstruction in which natural materials were used as fillers , one group in which musculoperiosteal flap, bone pate and cartilage is used and another group with musculoperiosteal flap alone.

Studies have been long conducted to understand the benefit of obliterating mastoid cavity over open cavities. Also studies are available comparing natural and synthetic materials for obliteration. Here we have emphasized on the use of two autograft materials and comparing them on the basis of improvement in Air Bone Gap and effective reduction in mastoid volume.

But mastoid obliteration is not without its complications. Late retraction of muscle flap followed by necrosis and enlargement of mastoid cavity and recurrence of cholesteatoma beneath the obliteration material are important among them.

Hearing improvement after cavity obliteration may be explained by improvement of sound resonance in the ear canal. The volume of the ear canal and the width of the canal inlet are important factors in sound conduction which affect the resonance of the canal. A resonance induced amplification of sound pressure reaches up to 20 dB in the normal ear canal at frequencies of 1000–3000 Hz. The wavelengths of these frequencies are about four times the canal length.(Ezzat AE *et al* 2015)

J.Hartwein observed that the altered acoustic behaviour of the open cavity leads to partial extensive discrepancies of the resonance-caused sound-pressure augmentation in the frequencies of 3 and 4 kHz, which are important for speech perception and that differences in the acoustic behaviour of the outer ear as can be found between patients with an open mastoid cavity and normal ears can almost be eliminated surgically.(Hartwein J *et al* 1971)Jang CH compared acoustic changes between external auditory canal open and obliterated mastoid cavity. An open mastoid cavity changed the mean peak resonant frequency of the external ear from 2.1 kHz to 2.3 kHz ($P < 0.02$), with a mean attenuation of 8 dB SPL at 4 kHz. An obliterated mastoid produced higher resonance frequencies from 2.5 kHz to 2.8 kHz. The sound pressure gain of the external auditory canal with an open mastoid cavity was higher than with an obliterated mastoid.(Jang CH *et al* 2002) According to Samad Ghiasi canal wall down mastoidectomy and mastoid cavity obliteration with combined bone pate and Palva flap is an effective option for the complete removal of cholesteatoma and prevention of postoperative mastoid cavity problems. (Ghaisi S 2015)While Shraddha *et al* in a study on 30 subjects with obliteration done using bone dust/flap/cartilage concluded that incidence of discharge, debris, giddiness and pain was reduced with better healing in obliterated cavities.Cavity obliterated with bone dust and flap had better and early epithelialisation compared to cartilage. (Deshmukh S 2012)

A completely dry cavity was achieved in 49 of 56 patients (approx. 88%) by Mani *et al*. Obliteration material used was conchal cartilage and temporalis muscle fascia. An overall statistically significant improvement in hearing ($p < 0.05$) was obtained, with the mean pure-tone average air-bone gap decreasing from 33.4 ± 8.2 dB (average \pm SD) to 18.3 ± 9.7 dB. There were no residual or recurrent cholesteatomas. (Maimu A *et al* 2012) Akram M *et al* however in their study concluded that ABG does not significantly change in the long term. Configuration of cavity tends to change, however, the obliteration material is stable in the long term and significant cavitation rarely occurs. (Akram M *et al* 2008) Abdelrahman E. M. Ezzat *et al* conducted a 6 year study that there was no significant change in BC before and after the operation ($t=2.45$, $p=0.19$). In addition, by paired samples test there was significant improvement of AC after the operation ($t=25.7$, $p \leq 0.05$). However, there was no significant difference ($p \geq 0.05$) between natural and synthetic materials as regards the mean pre- and post-operative AC and BC. (Abdelrahman E *et al*) Della Santina and Lee reported that the postoperative hearing improvement with Ceravital reconstruction after an average of 7 years (range up to 17.8 years) was 43.9 ± 20.5 dB in the mean AC and 16.8 ± 13.8 dB in BC, with an air-bone gap of 27.1 ± 11 dB.(Della Santina CC *et al* 2006)

In our study there was significant improvement in hearing post op at 4 week, 6 week and 8 week by both procedures in subjects. But the improvement was found to be significantly better in subjects with obliteration with musculo periosteal flap, bone pate and cartilage. Also the outcome was better in terms of residual disease, post-op discharge and epithelialisation in subjects in which musculo periosteal flap, bone pate and cartilage was used for obliteration.

Thus we conclude that use of obliteration followed by mastoidectomy is associated with significant improvement in hearing. Also obliteration with musculo periosteal flap, bone

pate and cartilage yields better results in terms of acoustic parameters and outcome of surgery.

Conflict of interest: Authors declare that there were no conflicts of interest.

References

- Abdelrahman M. Ezzat, A.E., El-Begermy, M.M., Mahmoud, A.M. and Eid, M.I., 2015. Comparison Of Natural And Synthetic Materials To Improve Hearing After Obliteration Of The Mastoid Cavity. *Journal of hearing science*, 4(4), p.OA36-41.
- Abdel-Rahman, A.M., Pietola, M., Kinnari, T.J., Ramsay, H., Jero, J. and Aarnisalo, A.A., 2008. Obliteration of radical cavities with autogenous cortical bone; long-term results. *BMC Ear, Nose and Throat Disorders*, 8(1), p.4.
- Chan, C.Y. and Chan, Y.M., 2012. Mastoid obliteration and reconstruction: A review of techniques and results. *Proceedings of Singapore Healthcare*, 21(1), pp.23-29.
- Chandrashekarayya, S.H., Kavitha, M.M., PrakashHandi, P.K. and SS, D., 2014. To study the level of awareness about complications of chronic suppurative otitis media (CSOM) in CSOM patients. *Journal of Clinical and Diagnostic Research: JCDR*, 8(2), p.59.
- deAzevedo, A.F., de Castro Soares, A.B., Garchet, H.Q.C. and de Sousa, N.J.A., 2013. Tympanomastoidectomy: comparison between canal wall-down and canal wall-up techniques in surgery for chronic otitis media. *International archives of otorhinolaryngology*, 17(03), pp.242-245.
- Della Santina, C.C. and Lee, S.C., 2006. Ceravital reconstruction of canal wall down mastoidectomy: long-term results. *Archives of Otolaryngology-Head & Neck Surgery*, 132(6), pp.617-623.
- Deshmukh, S., Sharma, A. and Dabholkar, J., 2012. Mastoid cavity obliteration: our experience. *Otolaryngologia Polska*, 66(6), pp.379-381.
- Ezzat, A.E., El-Begermy, M.M., Mahmoud, A.M. and Eid, M.I., 2015. Comparison Of Natural And Synthetic Materials To Improve Hearing After Obliteration Of The Mastoid Cavity. *Journal of hearing science*, 4(4), p.OA36.
- Ghiasi, S., 2015. Mastoid cavity obliteration with combined Palva flap and bone pate. *Iranian journal of otorhinolaryngology*, 27(78), p.23.
- Glasscock III, M.E., Dickins, J.R. and Wiet, R., 1981. Cholesteatoma in children. *The Laryngoscope*, 91(10), pp.1743-1753.
- Hartwein, J., 1992. The acoustics of the open mastoid cavity (so-called" radical cavity) and its modification by surgical measures. I. Physical principles, experimental studies. *Laryngo-rhino-otologie*, 71(8), pp.401-406.
- Hossain, M.M., Kundu, S.C., Haque, M.R., Shamsuzzaman, A.K., Khan, M.K. and Halder, K.K., 2006. Extracranial complications of chronic suppurative otitis media. *Mymensingh medical journal: MMJ*, 15(1), pp.4-9.
- Jang, C.H., 2002. Changes in external ear resonance after mastoidectomy: open cavity mastoid versus obliterated mastoid cavity. *Clinical Otolaryngology & Allied Sciences*, 27(6), pp.509-511.
- Kaur, N., Sharma, D.K. and Singh, J., 2016. Comparative evaluation of mastoid cavity obliteration by

vascularised temporalis myofascial flap and deep temporal fascial-periosteal flap in canal wall down mastoidectomy. *Journal of clinical and diagnostic research: JCDR*, 10(12), p.MC08.

Kim MB, Choi J, Lee JK, Park JY, Chu H, Cho YS, Hong SH, Chung WH. Hearing outcomes according to the types of mastoidectomy: a comparison between canal wall up and canal wall down mastoidectomy. *Clinical and experimental Otorhinolaryngology*. 2010 Dec;3(4):203.

Maniu, A. and Cosgarea, M., 2012. Mastoid obliteration with concha cartilage graft and temporal muscle fascia. *ORL*, 74(3), pp.141-145.

Yorgancılar, E., Yıldırım, M., Gun, R., Bakır, S., Tekin, R., Gocmez, C., Meric, F. and Topcu, I., 2013. Complications of chronic suppurative otitis media: a retrospective review. *European Archives of Oto-Rhino-Laryngology*, 270(1), pp.69-76.

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