



Obliteration of Mastoid Cavity with Temporalis Muscle Pedicle and Abdominal Fat Graft and Compare the Efficacy of Each Method: A Prospective Randomized Clinical Trial

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ABSTRACT

Objective: To compare the outcomes of abdominal fat and temporalis muscle pedicle as material for mastoid obliteration following modified radical mastoideectomy.

Material and methods: Fifty patients were randomly allocated in two groups containing 25 in each. In group 'A' mastoid obliteration was done with pedicle temporalis muscle and with abdominal fat graft in group 'B'.

Patients were followed up for 12 months and cavity problems and complete epithelialization of cavity were noted.

Results: Patient in group 'A' had less discharge as compared to group 'B'. In group 'B' 80%, 48%, 24% and 16% patients had discharge at 6 weeks, 3 months, 6 months and 12 months respectively, and in group 'A' 40%, 20%, 12% and 4% patients had discharge at 6 weeks, 3 months, 6 months and 12 months respectively. Discharge in group 'B' was significantly higher than group 'A' at 6 weeks and 3 months ($P<0.05$). Although discharge was higher among group 'B' at 6 months and 12 months, it was not significant ($P>0.05$).

Another factor evaluated was time of complete epithelialization between two groups. The mean time of complete epithelialization in group 'A' was 8.96 + 8.188 weeks and in group 'B' was 17.52 + 9.820 weeks and the difference was significant ($P<0.05$).

Conclusion: Mastoid cavity obliteration with temporalis muscle is better than that with abdominal fat in term of discharge from cavity and time of complete epithelialization of the mastoid cavity.

Mastoidectomy is performed for chronic otitis media of squamous type. It is either canal wall up or canal wall down depending upon the preservation of the posterior bony ear canal. The canal wall up procedure is more physiological and requires a very shorter healing period. However, because of limited exposure and the preservation of the posterior wall, this procedure results in high rate of residual and recurrence of disease.¹ The canal wall down procedure has good exposure and low rate of recurrences but it creates a large cavity that takes longer to heal and produces extensive anatomical modification.

The reported incidence of postoperative discharging mastoid cavity varies from 20% to 60%.² Sade et al. (1982) have outlined the factors likely to result in a dry mastoid cavity: a small to medium sized cavity, a low facial ridge, an adequately large meatoplasty and a closed middle ear segment which isolates the Eustachian tube from the cavity.³ However, in number of cases despite initial technical success, discharge persists. Obliteration of the mastoid cavity is the important procedure performed at the end of the mastoidectomy to minimize the potential problems by decreasing the size of the mastoid cavity.⁴

Majority of obliteration technique consists of either local flap such as muscles, periosteum or fascia, or free graft like fat, cartilage, hydroxyapatite and so forth.⁵

The aim of this study was to evaluate the obliteration of mastoid cavity with temporalis muscle pedicle flap and abdominal fat graft and compare the efficacy of each of these methods.

Materials and Methods

This study was conducted in the Department of Otorhinolaryngology, B. P. Koirala Institute of Health Sciences, Dharan over a period of 24 months (November 2010 to October 2012), after clearance from ethical committee. It was randomized clinical trial. Patients were included in the study after an informed written consent. All patients who were undergoing canal wall down surgery were randomly included in two groups prior to surgery.

Group 'A' consists of temporalis muscle pedicle flap and group 'B' abdominal fat graft groups. All the patients were investigated in the outpatient department by a thorough clinical examination. Microscopic evaluation of the ear was performed in the minor operating theatre. Audiological status of all the patients was assessed by pure tone audiogram. Radiological evaluation of the mastoid was done by an X-ray mastoids-lateral oblique view. Hematological and other systemic investigations for the purpose of anaesthetic work up were carried out, as required. Canal wall down surgery performed followed by cavity obliteration with one of two men-

tioned material. Patients were followed up on 6th week, 3rd month, 6th month and 12th months of surgery. On follow-up assessment of discharge, complete epithelialization of cavity and post-op hearing status was done.

Inclusion criteria:

All patients undergoing canal wall down surgery.

Exclusion criteria:

1. Subjects not willing for the procedure.
2. Subject undergoing revision surgery.

The treatment protocol for the two groups was as follows:

Group 'A'

The usual post-auricular skin incision was made 10 mm posterior to the post-auricular crease. The deep temporalis muscle fascia was dissected from the underlying temporalis muscle using the iris scissors and harvested as much as possible for tympanoplasty and covering the mastoid cavity. The canal skin incision was made on the posterior canal wall 3 mm lateral to the tympanic annulus from 7 o'clock to 2 o'clock (left ear), or from 10 o'clock to 5 o'clock (right ear).

The tympanomeatal flap was elevated and the middle ear cavity was exposed and complete eradication of the disease was done using the method of canal wall down mastoidectomy. The post-aural incision was extended upwards and backwards into an S-shape. The pedicle temporalis muscle flap based posteriorly was outlined. It derives its blood supply from the posterior auricular and occipital branches of the external carotid artery.

Cutting diathermy was used to develop the flap of perimeter of 2-3 cm. This vascularized temporalis muscle flap was swung on its pedicle like a curtain, into the cavity to line the mastoid bowl.

Next, the conchal skin incision was made horizontally at 3 o'clock (left ear) or 9 o'clock (right ear) after reposition of the auricle. Consequently, two conchal flaps composed with the musculo-periosteal flap and the posterior canal skin were made. The superior conchal flap was folded upward and sutured to the soft tissue medial side of the flap with 3-0 vicryl. Next, the inferior conchal flap was pulled downward and sutured to the soft tissue medial side of the flap using the same suture material. Finally, both the cavity and meatus were firmly packed with antibiotic-steroid ointment impregnated ribbon gauze.

Postoperatively, the patient was treated with intra venous antibiotics for 1 week, and the pack was removed after 1 week. For the following 3 weeks topical steroid and antibiotic ear drops were applied.

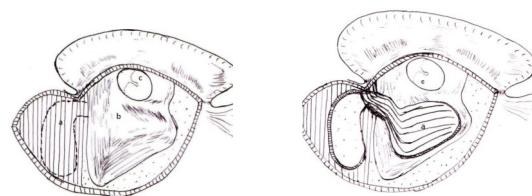


Fig.1 Schematic of Temporalis pedicle harvesting. a: Temporalis muscle pedicle, b: Mastoid cavity, c: Tympanic membrane

Group 'B'

Modified radical mastoidectomy completed as for group 'A', followed by wide meatoplasty. Abdominal fat was harvested from the left lumbar region of abdomen after giving incision of 2 cm. Mastoid cavity was obliterated with fat covered with temporalis fascia and firmly packed with antibiotic-steroid ointment impregnated ribbon gauze.

Postoperatively, the patient was treated on intravenous antibiotics for 1 week, and the pack was removed after 1 week. For the following 3 weeks topical steroid and antibiotic ear drops were applied.



Fig.2 Harvesting abdominal fat.

Statistical analysis

Calculations were performed using SPSS, version 17 (Chicago IL). X² test was used to compare the qualitative data and paired t-test was applied to compare the pre-op and post operative hearing status. For all tests, value of P < 0.05 was considered statistically significant.

Results

During the study period fifty procedures were done, 25 in each group. There were 23 female and 27 male patients and the patients' ages ranged from 15 years to 48 years with a mean age of $26.95 + 9.525$ years. The mean age group of male was $24.78 + 9.512$ years and that of female was $29.61 + 9.457$ years. The mean age group in group 'A' was $25.48 + 7.843$ years and that of group 'B' was $28.52 + 11.214$ years showing the equal distribution of age between groups. Twenty six left-sided procedures and 24 right-sided procedures were performed. Every patient was followed for 12 months. Patients were followed up 2 weekly for first 2 months then monthly up to 12 months. Post operative PTA was done after 3 months of operation and pre-operative air bone gap was compared with post operative air bone gap. In every follow up cavity problems, mainly discharge was noted and sign of complete epithelialization of cavity evaluated and compared between 2 groups. We compared the discharge as cavity problems at 6 weeks, 3 months, 6 months and 12 months.

Patients in group 'A' had less complain of discharge than of group 'B'. In fat group 'B' 80%, 48%, 24% and 16% patients had discharge at 6 weeks, 3 months, 6 months and 12 months respectively and in group 'A' 40%, 20%, 12% and 4% patients had discharge at 6 weeks, 3 months, 6 months and 12 months respectively. Discharge in group 'B' was significantly higher than group 'A' at 6 weeks and 3 months ($P<0.05$), though discharge was higher among group 'B' at 6 months and 12 months also but it was not significant ($P>0.05$).

Material for graft	Time							
	6 weeks	P value	3 months	P value	6 months	P value	12 months	P value
Temporalis muscle group (A)	40%		20%		12%		4%	
Abdominal fat graft (B)	80%	0.004	48%	0.036	24%	0.232	16%	0.174

Table I: Discharge comparison between group 'A' and group 'B'

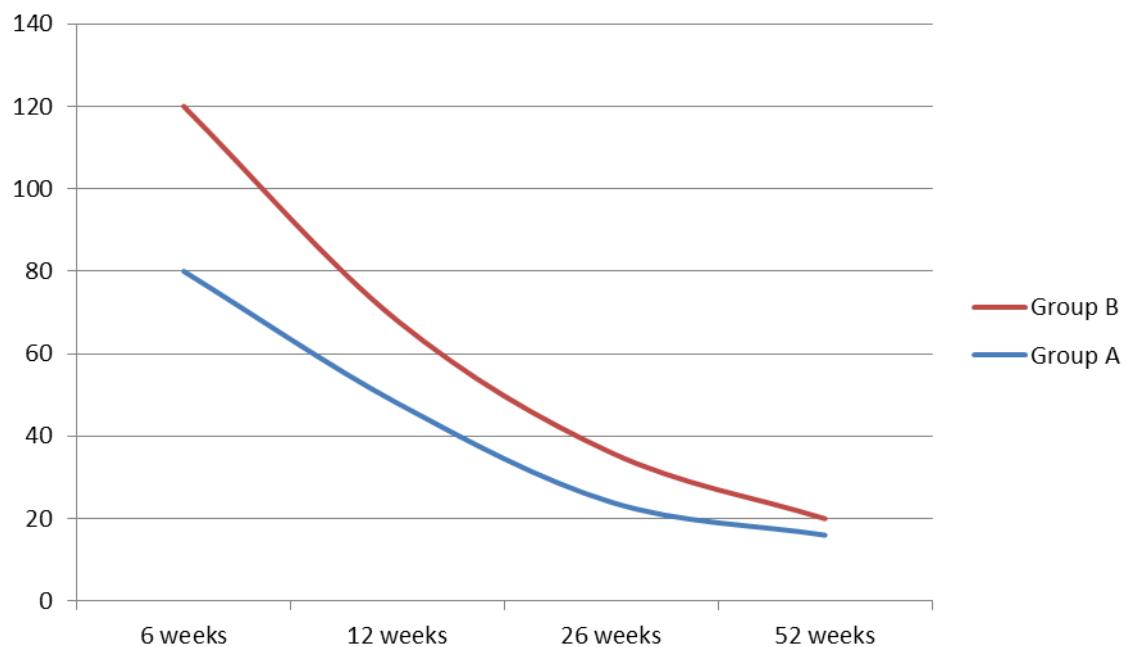


Fig 3 Decreasing of discharge over time in the both groups.

Table: II Hearing comparison. Pre-op and post-op irrespective of groups

Pre or Post	Mean hearing	Mean ABG gain	P value
Pre ABG	38.84 + 13.807 dB	11.300 + 8.469 dB	<0.001
Post ABG	27.54 + 10.795 dB		

Table: III Time of complete epithelialization

Material for obliteration	Number	Mean times in weeks	Std. Deviation	Chi- square test P value
Temporalis muscle	25	8.96	8.188	0.02
Abdominal fat	25	17.52	9.820	



Fig 4.Completely epithelialized post-op mastoid cavity after 26 weeks of obliteration

Pre-operative hearing done before surgery and post operative hearing done after 3 months of surgery and pre-operative and post operative air bone gap was calculated. The paired t test applied and the following results obtained. Mean pre-operative air bone gap was $38.84 + 13.807$ dB and post operative air bone gap was $27.54 + 10.795$ dB and the difference was significant ($P<0.05$) and mean gain was $11.30 + 1.198$ dB.

Another factor which was evaluated was time of complete epithelialization between two groups. The mean time of complete epithelialization among temporalis muscle group was $8.96 + 8.188$ weeks and in abdominal fat graft was $17.52 + 9.820$ weeks and the difference was significant ($P<0.05$).

Other rare complications include one facial nerve palsy in temporalis muscle group, and one dead year and one abdominal wound dehiscence in abdominal fat graft group.

Discussion

Canal wall down surgery is one of the common surgery performed in otolaryngology for unsafe type of chronic otitis media. Cavity problem following mastoid surgery is common problem and it can be minimized by cavity obliteration at the same setting of surgery, as it reduces the cost of re-operation and loss of follow-up of the patients. Loss of follow-up is one of the common problems in our part of world so we usually prefer the canal wall down surgery to the canal wall up and which is followed by cavity obliteration in the same setting. About 20-60% patients suffer from discharge from mastoid cavity.^{2, 6}

The commonest factor implicated in the etiology of chronic discharging ear is inadequate or improper surgical technique following mastoid surgery.⁷ This inadequacy may be in the form of:

- Small meatus: Failure to create an adequate meatoplasty during an open cavity mastoid surgery leads to an inadequate drainage and aeration of the cavity.
- Large cavity: The larger the cavity, the more prolonged the healing phase and the greater the risk of post operative infection.
- Inadequate lowering of posterior buttress: This leads to a high facial ridge and the consequent creation of a 'sump' posterior to the ridge where debris accumulates. These cases tend to self clean poorly and are at significantly greater risk of developing cavity infection.^{7, 8}

The cavity problems that occur even after adequately done surgery can be minimized by obliterating the mastoid cavity. Rambo (1958) first described the obliteration of mastoid cavities with the aim of eliminating post-operative care. He used temporalis muscle for this procedure. Gacek (1976) reported successful obliteration using temporalis muscle and fat.⁹ The majority of obliteration techniques consists of either local flaps (muscles, periosteum, or fascia) or free grafts (bone, cartilage, fat, hydroxyapatite).⁵ Materials used for obliteration of the mastoid cavity should be neither resorbable nor lead to atrophy and should not induce adverse immunological tissue reactions.¹⁰

We randomly use the temporalis muscle flap and abdominal fat graft to obliterate the cavity. Like all pedicled flaps, the vascularized deep temporalis fascial flap (Hong Kong flap) can effectively resurface the entire cavity, and its viability and survival are ensured by means of its rich blood supply. Because it is a tough, living fascial layer, it covers the underlying bone and pockets of mucous membrane that might interfere with the re-epithelialization process or contribute secretions that would moisten the cavity. The dependable blood supply ensures a surface that encourages and supports migration of epithelium across the cavity.¹¹ Some studies show cavity obliterated with fat has low incidence of complications as fat may act as an antiseptic agent and may also impede the growth of epithelial and mucous linings, which is in contrast to the present study. Fat tissue is not inert –as it stores macrophages, which participate in inflammation and the immune reaction. Fat tissue also stores a high proportion of lymphocytes which, associated with the macrophages, can lead to immune regulation.¹²

In present study we compared the rate of discharge and complete epithelialization between temporalis muscle obliteration group and abdominal fat obliteration group at 6 weeks, 3 months, 6 months and 12 months post operatively. In fat group 80%, 48%, 24% and 16% patients had discharge at 6 weeks, 3 months, 6 months and 12 months respectively and in temporalis muscle group 40%, 20%, 12% and 4% patients had discharge at 6 weeks , 3 months , 6 months and 12 months respectively. Discharge in abdominal fat group was significantly higher than temporalis muscle group at 6 weeks and 3 months ($P<0.05$), though discharge was higher among abdominal fat group at 6 months and 12 months also but it was not significant ($P>0.05$). The mean time of complete epithelialization among temporalis muscle group was $8.96 + 9.820$ weeks and in abdominal fat graft was $17.52 + 9.820$ weeks and the difference was significant ($P<0.05$).

Conclusion

Post-operative mastoid cavity obliteration with temporalis muscle is better than that with abdominal fat in term of discharge from cavity and time of complete epithelialization of the mastoid cavity.

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