COMPARISON OF OVER-UNDERLAY AND UNDERLAY TECHNIQUES OF MYRINGOPLASTY

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ABSTRACT

Objectives: To compare the success rate of over-underlay and underlay techniques of myringoplasty regarding rate of graft acceptance, hearing improvement and complications.

Design: Quasi-experimental study

Place and duration of Study: This study was conducted at the Department of Otorhinolaryngology and Head & Neck Surgery, Foundation University Teaching Hospital, Rawalpindi from 1st January 2003 to 31st December 2005.

Patients and Methods: Clinical records of patients who underwent myringoplasty by either over-underlay or underlay techniques in the past three years were analyzed. A total of 62 patients who had dry central tympanic membrane perforations of various sizes secondary to chronic tubotympanic suppurative otitis media were included in the study. These patients were divided into two groups. In group A (study group), 34 patients were included in which tympanic membrane was repaired by using over-underlay technique of myringoplasty whereas group B (control group) comprised of 28 cases of myringoplasty in which underlay technique was used. The results of two techniques were compared in terms of graft success rate i.e., full take or failure to takeup, medialization or lateralization of graft within 6 months of operation and improvement in hearing at the end of 6 months of follow up.

Results: In group A, graft success was noted in 32 (94.1%) cases compared to 26 (92.8%) in group B ($p < 0.05$). Medialization of graft was seen in only 1 (2.9%) case in group A whereas it was noted in 5 (17.8%) patients in group B ($p > 0.05$). Lateralization of graft was not observed in any case in either group. As far as hearing improvement is concerned, the mean air bone gap closure was 10.8 dB (SD+ 5.56) in group A compared to11.3 dB (SD+5.84) in group B ($p < 0.05$).

Conclusions: Over-underlay technique of myringoplasty is equally effective to more commonly practiced underlay technique in terms of graft take and hearing improvement. As far as complications are concerned, over-underlay technique is associated with less chances of graft medialization.

Keywords: Myringoplasty, Tympanic membrane, middle ear

INTRODUCTION

Myringoplasty is a surgical technique used to restore the integrity of tympanic membrane and to improve hearing level. This procedure has undergone significant refinements over a period of time and now become an established procedure with rewarding results [1]. The otological surgeons have cultivated various effective techniques of myringoplasty over past 40 years in an attempt to achieve perfection by improving the result of the procedure.

Many techniques of myringoplasty are described in the literature. A few of the numerous techniques are underlay technique [2], overlay technique [3], "Gelfilm Sandwich" technique [4], "Swinging Door" technique [5], tipple "C" technique [6], double breasting technique [7], fascial pegging technique [8], anterosuperior anchoring technique [9] and laser assisted "spot welding" technique [10]. Mostly the technique utilized by the surgeon depends upon his or her familiarity with the particular procedure and training experience.

The two most common techniques for positioning the graft relative to the remnant of both the tympanic membrane and the tympanic annulus are the 'overlay' and the

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Received: 18 Aug 2006: Accepted: 09 Oct 2006

'underlay' techniques [11]. In overlay technique, graft is placed lateral to the annulus and any remaining fibrous middle layer of tympanic membrane after the squamous layer has been meticulously removed. In contrast, underlay technique is relatively simple in which graft is placed entirely medial to the remaining drum and malleus. Each technique has its advantages and disadvantages. Overlay technique is more useful in repairing large and anterior perforation while underlay technique is ideal for posterior perforation [12]. Underlay technique is technically easier, less time-consuming and has high success rate [13]. Due to these advantages, it is the most commonly performed technique. By placing the graft medial to the tympanic membrane remnant, underlay technique is associated with chances of reduction in middle ear space which may lead to medialization or atelactasis.

A new technique that has evolved from the two classical techniques of overlay and underlay and aimed at eliminating the disadvantages of these techniques is over-underlay myringoplasty [14]. In this technique, graft is placed lateral (over) the handle of maleus but medial (under) the tympanic membrane remnant and annulus.

In this study, we have compared the new over-underlay technique with the most commonly utilized underlay technique regarding graft success, complications and hearing improvement.

PATIENTS AND METHODS

The record/data of patient who underwent myringoplasty by either over-underlay or underlay technique in the past three years (between 1st January 2003 to 31st December 2005) at the Department of Otorhinolaryngology and Head & Neck Surgery, Foundation University Teaching Hospital, Rawalpindi were retrospectively reviewed. The following information was obtained: age, sex, duration of disease, size of tympanic membrane perforation, status of middle ear mucosa and ossicles, presence of rhinosinusitis, myringoplasty technique utilized, complications in post operative period and hearing improvement at the end of six months of follow up. All those patients with chronic rhinosinuistis, prior ear surgery, atticoantral type of disease, ossicular necrosis, no pre or post operative audiograms and less than six months of follow up were excluded from the study.

A total of 62 patients who met the above mentioned criteria were included in the study by using non probability purposive sampling technique. In 34 patients, tympanic membrane was repaired by using over-underlay technique. These patients were included in group A (study group). The remaining 28 cases in which underlay technique was utilized to repair tympanic membrane perforation were included in group B (control group).

In all patients, myringoplasty was performed under general anesthesia via a postauricular approach. A large temporalis fascia was harvested, cleaned of residual muscle and placed on a ceramic block to allow drying. Margins of perforation were debrided. The under surface of tympanic membrane was then abraded with a round knife to increase adhesion of the graft. A posterior tympanomeatal flap was raised and drum remnant was elevated off and completely removed from the long process of malleus using microdissection. The status of middle ear was then inspected for disease. The Eustachian tube and middle ear were than packed with gel foam. The temporalis fascia graft was shaped to proper size needed for the perforation. In underlay technique, temporalis fascia graft was placed medial to the long process of malleus, tympanic membrane remnant and tympanic annulus

whereas in over-underlay technique, fascia graft was placed lateral to (over) the long process of malleus and medial to (under) the drum remnant and tympanic annulus. Gelfoam was then placed over the drum remnant and graft. The external auditory canal was packed with ribbon gauze soaked with bismuth iodoform paraffin paste. Post auricular incision was closed in layers. Postoperative antibiotic cover was give for 5 days. Patients were discharge on second postoperative day and were followed up after three weeks when bismuth iodoform paraffin past pack was removed from the external auditory canal. Status of the graft was noted on that visit. Patients were then followed up at monthly interval for up to at least 6 months. During that period, patients were observed for the development of any complication e.g, graft failure, medialization or lateralization of graft.

In this retrospective case review, the two techniques of myringoplasty were compared in terms of graft success rate (partial or full take, medialization or lateralization) and hearing improvement. Graft take was defined as full, intact healing of tympanic membrane graft at 6 months postoperatively. Hearing improvement was reviewed as the change in air-bone gap at the end of six months follow up period. Gap change was defined as the difference between the pre and postoperative air-bone gap. Air-bone gap was calculated as the average difference between air conduction and bone conduction at 0.5, 1 and 2 kHz. Results were statistically analyzed using SPSS version 10.0. Both groups of patient were compared in terms of age, sex and duration of disease. Results of two techniques of myringoplasty between both groups were compared utilizing Chi square test for graft success rate and complications and T-test was utilized to compare pre and postoperative air-bone gap change. Statistical significance was accepted as $p<0.05$.

RESULTS

A total of 62 patients underwent myringoplasty between 1st January 2003 and 31st December 2005. Group A comprised of 34(54.8%) cases whereas 28 (45.2%) cases were included in group B. Mean age of patients in group A was 23.7 years (SD+10.6) with a range of 13 to 45 years and in group B, it was 18.6 years (SD+5.2) which ranged between 11 to 38 years ($p > 0.05$). Female to male ratio in group A and B were 1.8:1 and 6:1 respectively. Average duration of disease in Group A and B were 10.5 years (SD+8.3) and 10.3 years (SD+6.0) respectively ($p < 0.05$). Size of tympanic membrane perforations in both the groups (Table-1)

No statistically significant difference ($p <0.05$) was observed when two groups were compared in terms of graft success rates but when they were compared with respect to medialization of graft, results were statistically significant ($p > 0.05$) as 5 (17.8%) cases in group B (underlay technique group) were associated with graft medialization. Lateralization of graft was not noticed in any case of either group. Graft success rate and complications in both groups of patients (Table-2).

Overall hearing improvement was noted in all patients whether treated by underlay or over-underlay technique except those who met with graft failure. In group A, mean air-bone gap closure was 10.8 dB (SD+5.56) with a range between 3 to 24 dB whereas in group B, it was 11.3 dB (SD+5.84) with a range between 5 to 22 dB. The difference in results of hearing improvement between two groups was statistically not significant ($p<0.05$).

DISCUSSION

Myringoplasty has now become an established and rewarding procedure done routinely by otological surgeons all over the

world. Quest is going on to improve the results of myringoplasty by devising new techniques. This is manifested by numerous techniques of myringoplasty described in the literature. Each technique is presented with the claims of better anatomical and functional results.

The two most widely accepted techniques of myringoplasty are overlay and underlay techniques. Among them underlay technique is much more popular among the otological surgeons because it is not only easy to perform but also associated with promising results. Each technique is associated with some advantages and disadvantages. The over-underlay myringoplasty is relatively a new technique that has evolved from the two classical and currently well-established overlay and underlay techniques and aims at eliminating the disadvantages of these two techniques.

In the present study, we tried to compare the results of the most popular method of tympanic membrane repair i.e, underlay technique with that of a relatively new procedure, over-underlay myringoplasty. We studied these two techniques regarding graft success rate, complications and hearing improvement and tried to find out that which technique is better.

All the patients included in our study were divided into two groups depending upon the technique utilized to repair the tympanic membrane perforation. When we compared group A (over-underlay technique group) with group B (underlay technique group), it was observed that more female patients were present in both groups. This difference was due to the fact that out hospital is providing health care facilities to families of retired army personal and males only upto the age of 18 yrs. Consequently most of our patients are females but this does not affect the result of myringoplasty as the result of this operation is not affected by the sex of the patient [1]. The difference in duration of disease between the two groups was not significant. When two groups were compared regarding age of the patients, a statistically significant difference was noted. Age range of all the patients included in this study in both groups was between 11 to 45 years. This difference in age between the two groups does not affect the result of myringoplasty in our study because many studies have shown that results of myringoplasty in children older than 8 years of age and adults are comparable [15-16].

In our study, we achieved graft success rate of 92.8% with underlay technique with only 7.2% graft failure rate. Comparing this with over-underlay technique, 94.2% of patients had full graft take whereas only 5.8% had graft failure. When we compared graft success rate of both the techniques, it was found to be statistically insignificant. Ashfaq et al reported graft success rate of 73% with underlay technique in a study conducted on

Table-1: Size of Tympanic Membrane Perforation in Both Groups

Size of perforation	Group A Over-underlay technique *n* =34	Group B Underlay technique group *n* = 28
Small	0 (0%)	5 (17.8%)
Medium	19 (55.8%)	14 (50.0%)
Large	9 (26.5%)	8 (28.5%)
Subtotal	6 (17.6%)	1 (3.5%)

Table- 2: Graft Success Rates and Complications in Both Groups

	Group A Over-underlay Technique *n* = 34	Group B Underlay Technique *n* =28
Full take	32 (94.1%)	26 (92.8%)
Graft failure	2 (5.9%)	2 (7.2%)
Medialization	1 (2.9%)	5 (17.8%)
Lateralization	0 (0%)	0 (0%)

105 cases [1]. Utilizing the same underlay technique on 94 cases, Intisar et al reported 77.5% graft success rate [17]. Other studies reported graft success rate between 70 to 96% utilizing underlay technique [13, 16].

In literature, the graft success rates of over- underlay technique varies between 94 to 100%. Yigit et al reported graft success rate of 94.9% utilizing over-underlay technique in 58 patients [14]. In another study, Kartush et al reported 100% graft success rate with over-underlay technique [12].

In underlay technique, graft is placed medial to tympanic membrane remnant. Due to the placement of graft medial to the tympanic membrane remnant, middle ear space is reduced which may lead to medialization of graft and subsequent atelactasis. This secqulae not only jeopardize the results of myringoplasty in terms of reduction in hearing improvement but also leads to development of retraction pockets and accumulation of squamous debris leading to chloesteatoma. This can be prevented by using over under-lay technique in which medialization of graft is prevented by placing the graft lateral (over) the handle of maleus and medial (under) the tympanic membrane remnants and annulus. In this way, not only middle ear space is not reduced but maleus handle provides excellent medial support to the graft preventing its medialization [12]. This view is supported by the results of our study. We noticed statistically significant difference between medialization of graft utilizing underlay and over-underlay technique. Our study showed medialization of graft in 5 (17.8%)cases in which tympanic membrane was repaired by utilizing underlay technique whereas graft medialization was seen in only 1 (2.9%) [14] case in over-underlay technique group. Yigit et al reported atelactasis in 19.5% and 12% of cases utilizing underlay and over-underlay techniques respectively in a study conducted on 104 patients with 11 months post surgery follow up. Kartush et all reported atelactasis in 14 % of cases with over-underlay technique in 120 patients, in all these cases atelactasis occurred more than one year after surgery [12]. The difference in the results regarding graft medialization between these studies and ours may be due to short (6 months) follow up in our study.

Despite our initial concern that graft placed lateral to the malleus handle might predispose to epithelial pearls formation due to burying of squamous epithelium attached to the malleus handle, no such cases were seen. This may be due to the fact that we tried our best to remove any residual drum remnant attached to the malleus by microdissection before placing the graft over it. Similar results are achieved in other studies reported in literature [12, 14].

Both techniques of myringoplasty utilized in our study were associated with hearing improvement in all patients except those with graft failure. With over-underlay technique (group A), average closure of air-bone gap was 10.8 dB (range 3 to 24 dB) whereas with underlay technique (group B), average closure of air-bone gap 11.3 dB (range 5 to 22 dB). Difference in hearing improvement results with these two techniques were statistically insignificant showing that both techniques were equally good in this respect. This is also supported by another study in which two techniques were compaired [14].

CONCLUSION

Over-underlay and underlay techniques of myringoplasty are equally effective in terms of graft success rate and hearing improvement. As far as complications are concerned, over-underlay techinique is superior to underlay technique as it is

associated with less chances of graft medialization.

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