A Study on Outcome of Underlay, Overlay and Combined Techniques of Myringoplasty

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Myringoplasty is a procedure which deals on repair of the tympanic membrane. This procedure can be done via postaural, endaural or endomeatal route. Various grafts such as temporalis fascia, vein graft, perichondrium are used. The technique can be categorized as underlay, overlay, interlay or its combination depending on the placement of the graft material. This study was done to compare underlay, overlay and combined technique in terms of the closure of the membrane defect, postoperative complications and over all success rates. Apart from few complications, this study revealed over all success rate was best with combined technique but the difference was not significant statistically when the methods are comparable among them.

Keywords Myringoplasty · Chronic otitis media · Underlay myringoplasty · Overlay myringoplasty

From seventeenth to nineteenth centuries, several attempts were made at closing the perforations of the tympanic membrane. Perforation of the tympanic membrane occurs mostly as a result of chronic otitis media. Apart from discharge, perforation of tympanic membrane also leads to considerable amount of hearing loss. Blake used paper patch, a prosthetic material to close a perforation in 1887 [1]. In 1952, Wallstein [2] first published a method of closing perforation by split thickness skin graft. One year later Zollner [3] described his experiments with similar grafts. In 1956, Zollner [4] used fascia lata to close

perforation. In 1958, Heerman [5] began to use temporal is fascia.

Technique wise, overlay myringoplasty was not giving consistent results specially with small and anterior placed perforations. In the year 1960, Shea and Tabb [6–8] introduced the concept of placing the graft material medial to the drum remnant.

Wandong She et al. [9] showed result of over under myringoplasty i.e. by placing the graft medial to the membrane but lateral to the handle of malleus. The technique gave little better result than underlay technique. Eoro Vantiainen et al. showed that the technique of placing the graft material did not affect the graft take rate and rather postoperative infection and larger size of perforation are the main cause of reperforation.

Labatut Pesce et al. [10], in his study used lateral grafting, medial grafting and mixed methods for myringoplasty.

This study was undertaken to compare underlay, overlay and combined technique in terms of closure of membrane defects, postoperative complication and overall success rates.

Materials and Methods

This study, a prospective one, was carried out in 40 patients who attended the out patient department of E. N. T. of S. S. K. M. Hospital and I. P. G. M. E. R. and were operated for tympanic membrane defect during the period of February 2008 to February 2009. All the patients were followed up for 6 months from the date of operation. The patient variability does not include those aged less than 15 years, or with systemic complications or those with previous failed operative procedure. The patients

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diagnosed as having unsafe variety of chronic otitis media were not included in this study.

Cases selected for study were subjected to detailed history and clinical examination. Patients were prepared for surgery under local anesthesia. In our study, postaural approach was taken maximally. Depending on the placement of the graft material, this study compares underlay, overlay and combined techniques of myringoplasty procedure. In overlay technique, the graft material was placed over the fibrous layer of membrane remnant. In underlay technique, the graft material was placed under the membrane remnant including the flap after elevating the tympanomeatal flap beyond the annulus. The combined technique included the placement of two separate fascia grafts, one over the fibrous layer of tympanic membrane and the other under the membrane remnant. The graft in general was placed medial to the handle of malleus in underlay technique, lateral to handle of malleus in overlay technique and accordingly in combined technique.

All the patients were followed up for 6 months or more after uneventful postoperative period. The data were collected accordingly and the results were tabulated.

The variations were analyzed as percentage of three groups. Comparisons of outcome between these groups were performed by Chi square test, Fishers exact test two tailed *P* value and ANOVA one way analysis of variance. The *P* value smaller than 0.05 was taken as significant.

Observations

Among the series of patients, underlay technique was done in 40% (*n* = 16) patients, overlay technique in 35% (*n* = 14) patients and the combined technique in 25% (*n* = 10) patients.

In our study, commonest symptom was discharge per ear with hearing loss found in 57.5% of cases. The mean preoperative air-bone gap measured by pure tone audiometry was within 25–48 dB and the overall mean value was 29.15 (± 5.56). Based on the size of perforation, two groups were made for simplicity. Large perforations included perforation size of more than 50% of membrane area. Postaural route was chosen in 78% cases (*n* = 28).

In our study, overall wound infection was 7.5% (*n* = 3), discharge at 1 month found in 12.5% (*n* = 5) cases, myringitis granulosa occurred in 10% (*n* = 4) cases, granuloma formation in external auditory was found in 5% (*n* = 2) cases, graft lateralization, medialization and atelectasis were found in 7.5% cases respectively (Fig. 1).

The status of graft was observed at 1 month. In this study 92.5% patients (*n* = 37) had successful graft take up (Fig. 2).

Fig. 1 Post operative complications. WI wound infection, D discharge, MG Myringitis granulosa, G, E granuloma in the EAC, GL graft lateralization, GM graft medialization, OME otitis media with effusion

Fig. 2 Graft take up rates

Fig. 3 Post operative A-B gap

The actual fraction of post operative patient who had improvement in hearing was evaluated by pure tone audiometry at 6 weeks after operation. In this study overall 85% patients had reduced mean air bore gap (Fig. 3).

At the end of 6 months, overall success was noted for those patients who had both anatomical closure of membrane defect and simultaneous hearing improvement. Overall success rate among three methods did not vary significantly (Table 1; Fig. 4).

Discussion

Heerman was first to use temporalis fascia as graft material [5]. Shea and Tabb [6–8] were first to introduce the concept of placing the graft medial to drum remnant. Efforts are made, since then, to standardize the method of repairing the

Table 1 Overall success rates

Overall Success Rates		
Methods	Yes	No
Underlay	13 (81.25%)	3
Overlay	12 (85.71%)	2
Combined	9 (90%)	1
Total	34 (85%)	6 (15%)

$P \geq .05$ (1.000) by Fisher's exact test two tailed p-value, comparing two groups at a time.

$P \geq 0.05$ (1.000) by Fisher's exact test two tailed P value, comparing two groups at a time

Underlay myringoplasty**Fig. 4** Underlay myringoplasty

membrane defect. Our study also aimed at identifying the best method of membrane defect repair.

In this study, the minimum age of the patient was 16 and the maximum was 40, the mean was 27.2 (± 6.65). This correlates well with a study done by Ashifaque Ahmed Shaikh et al. [11] where age range was 18–40 years with mean age 31.2

Membrane perforation can occur in any age group but more predominant in active age group that is within 15–30 years.

In this study, 55% ($n = 22$) were female and 45% ($n = 18$) were male where the difference in age among

three groups were not significant statistically ($P > 0.5$). This correlates well with other studies by Fadl [12].

In our study, 25% patients had discharge per ear alone, 57.5% patients had discharge and hearing loss, 12.5% had hearing loss alone. Sheahan et al. [13], in his study showed 74 and 69% of patients of active mucosal disease had hearing loss and discharge per ear.

The minimum mean air bone gap was 25 dB and the maximum mean air bone gap was 48 dB in our study. The mean was 29.15 ± 5.56 . Shrestha et al. [14] in her study found preoperative air bone gap of around 30 dB in 76% of her patients. Thus most cases of membrane perforation have mean air bone gap of around 30 dB.

In our series, 70% of patients had small perforation while 30% had large perforation. Ajmal Hussain et al. [15] had patients with small perforation in 75% of cases and large perforation in 25% of cases. In another study by Gupta et al. [16], 72% of patients had large perforation while 28% patients had small perforations.

Labatut Pesce et al. [17] had undertaken postaural route approach in 66% of his cases, which correlated well with our study.

In a study by Yigit Uzgar et al. [18], the rate of atelectasis by underlay was greater than overlay technique. Mangal Singh et al. in his study observed overall minor complications in only 6.6% cases of underlay technique and 33.3% of overlay technique. These findings correlated well with our study.

The overall graft take up rate was 92.5% ($n = 37$) in our series. Although percentage wise, the anatomical success rate was more with underlay technique but statistically it failed to be significant (>0.5). There are other studies whose datas matched well with us namely Mcrovetto et al. [19] and Parikh Mishra et al. [20].

In our study overall anatomical failure at 6 months was 12.5% ($n = 5$). Overlay technique had slightly greater failure percentage wise, there was no statistical significant difference. Other studies like Strauss et al. [21] had failure in 18% of cases.

In a study of Shrestha et al. [14], post operative hearing after myringoplasty between 0–10, 11–20 and 21–30 dB were found in 16, 60 and 14% patients. In a study by Javid et al. [22] postoperative mean reduction in air bone gap in underlay technique was better (21 dB) than overlay technique. So hearing results of our study is comparable to other studies.

In our study, 85% of patients ($n = 34$) had overall successful results that is both anatomical closure of tympanic membrane as well as hearing improvement. The overall success rates among underlay, overlay and combined technique were 81.25, 85.71 and 90%. Percentage wise combined technique had best results but the three groups statistically failed to differ significantly ($P > 0.5$).

Overlay placement of graft

Fig. 5 Overlay placement of graft

Fadl et al. [12] had 85.4% success in his underlay technique series and 66.7% success in overlay technique. Gupta et al. [16] had 86.6% success in his overlay technique series. Brown [23] had 74% success in underlay technique series and 100% success in overlay series.

In this study, since success rate among three groups failed to be statistically significant, so results of the techniques are comparable. This result is well supported by the studies of Vartiainen et al. [24] and Frank Rizer et al. [25] (Fig. 5).

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