

Modified Rosen's incision was given in canal skin as described in fig. leaving anterior skin as vascular strip which meets posteriorly to meatotomy incision. Tympanomeatal flap elevated all around along with 360 degree elevation of annulus after denuding handle of malleus. . Anteriorly annulus is lifted up from its sulcus and the anterior canal wall skin elevated using a circular knife from medial to lateral direction and Tympanomeatal skin reflected anteriorly by laterally based anterior skin flap between 2 to 4 o'clock for right ear. This way medial part of bony canal wall is visible all around. Any drilling to reduce anterior, inferior canal hump is done. Graft is placed all around over bony meatal wall medial or lateral to handle of malleus. Tympanomeatal flap is reposited back over graft maintaining anterior angle. No gel foam was placed in middle ear as graft is well supported all around. EAC packed with medicated gel foam and wound sutured (Figure 1).

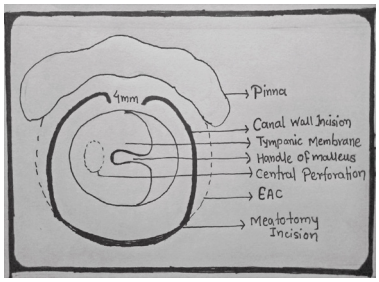

Figure 1 Schematic diagram of left ear showing modified Rosen's incision. Upper incision start at 4 mm lateral to anterior annulus at 10 o' clock curves spirally superiorly laterally and posteriorly to meet upper end of meatotomy incision. Similarly lower incision starts at 4 mm laterally to anterior annulus at 8 o' clock curves spirally inferiorly laterally and posteriorly to meet lower end meatotomy incision.

Patients were evaluated at 3 month post operatively for canal healing, granulations, graft uptake. Post-op audiometric evaluation was done at 3 months post-op.

Statistical analysis

All the results were analyzed from master chart considering the intact graft at 3rd month post-operative period as successful graft uptake and difference in pre-operative and post-operative average air-bone gap as hearing gain. "P" value is determined using paired-t test with the help of EPI-INFO SOFTWARE 2.2.1,

http:// http://insilico.net/tools/statistics/ttest and MICROSOFT EXCEL

Results

In this study a total number of 40 cases of chronic otitis media inactive mucosal type with dry perforation were taken. Out of 40 cases, 47.5% were male and 52.5% were female. Age range was from 15 to 60 years. Average age of male patients is 30.73 years and female patients are 32.77 years. Right ear was operated in 19 (47.5%) patients and left ear was operated in 21 (52.5%) patients.

Patients were classified on the basis of degree of hearing loss. Patient were categorized in 4 groups less than 10 dB loss, 10 to 20 dB loss, 20 to 30 dB loss and more than 30 dB loss. In all the cases only conductive hearing loss was recorded in pure tone audiometry. Bone conduction up to 5 decibels is considered as test error and was not taken into consideration.

There were no granulations, edema in EAC in any of the patients at 3 months. Complete healing of canal wall was present in all the 40 cases. Graft uptake was successful in 39 /40 patients with success rate of 97.5% at 3 month post op period.

The avg hearing loss in preop patient is 38.55dB which improves to 17.33 in post op patient with improvement by 21.22 dB. Determining 'P' value for the pre op and post op hearing comes out to be taking two sided confidence interval as 95% (Table 1) (Figure 2)..

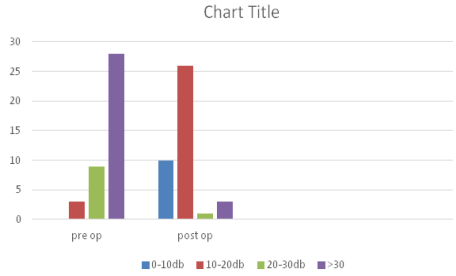

Figure 2 Showing category wise distribution of patients pre op and post op. It can be seen that in preop group more patients are there in 3rd and 4th category where as there is improvement in hearing loss in post op categories with more patients in 1st and 2nd categories.

Table 1 Deriving 'p' value and the significance of the study

Groups	Sample size	Mean	Standard deviation
Pre-op	40	38.55	10.33
Post-op	40	17.33	8.33
'P' value		< 0.05 Significant	

Discussion

The ultimate goal of Myringoplasty is to re-establish a tympanic membrane. The surgical outcome of Myringoplasty is influenced by many factors which include both disease factor and surgical technique. Healing has a much poorer prognosis in cases of suspected tubal dysfunction, adhesive processes, tympanic fibrosis, bilateral disease, and defects of the entire tympanic membrane.[9–11]The success of Myringoplasty also depends on the surgical technique which allow us complete eradication of the disease and recreation of a healthy, functional and aerated middle ear.[12]

In our study the main point of discussion are canal incision which gives surgeon good exposure of canal wall and create Tympanomeatal flap with good blood supply, 360 degree elevation of fibrous annulus from its sulcus, circumferential sub annular placement of graft on bony canal wall and no placement of gel foam in middle ear. And the success of this technique to be evaluated by healing of EAC, graft uptake and hearing improvement.

Many canal wall incisions were described in literature like Rosen's incision, Lampert 1 incision, 3 flap techniques, spiral incision by Ugo fisch. Palva[13] introduced his Swing Door Technique to enhance anterior visualization of the tympanum. Ralli et al.,[14] used underlay anchored Myringoplasty which utilizes anterior and posterior tunnels to achieve proper tension of the tympanic membrane as well as lateral traction of the malleus handle. It resulted in drum healing (91.7%) and pure tone average (PTA) post operatively was 27dB as compared with 55 dB preoperatively. Primrose & Kerr[15] were able to improve graft tension by using an anterior tunnel created under the annulus.

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Gristwood & Venables[16] described an underlay Myringoplasty creating two anterior tunnels for graft stabilization. Sauvage et al.,[17] presented a surgical technique that included the creation of a large anterior flap for stabilizing the fascia

Most of these technique are either suitable for anterior or posterior perforation or are difficult to learn. The main aim of canal incisions is to maintain healthy blood supply to the Tympanomeatal flap, should be easy to learn and perform, can be tailor made according to canal size, should provide good view of bony canal wall to address any overhangs, should be able to give 3 to 4 mm of margins all around perforation to prevent rolling of margins and should be easy to handle during Tympanomeatal flap repositioning over graft. The incision we proposed as modified Rosen's incision provides all these benefits. Start point of upper incision is 3 to 4 mm lateral to annulus at 2 o'clock for right ear and spirally goes upward backward and posteriorly to meet meatotomy incision and inferior incision starts at same level from 4 o'clock for right ear goes spirally downward laterally and posteriorly to meet inferior end of meatotomy incision. There are no corners in this incision so better apposition is achieved while repositioning can easily cover wider bony canal after canal widening. The incision can be placed medially or laterally in case of small canal and wide canal respectively to provide adequate balance between bulk of Tympanomeatal flap and working space for graft placement.

The anterior annulus elevation is done by blunt circular knife to sub luxate fibrous annulus from its sulcus and sharp elevation by circular knife to cut anterior mucosa to free Tympanomeatal flap just lateral to Eustachian tube opening from medial to lateral direction. The entire TM flap is reflected laterally and anteriorly by laterally based canal skin flap between 2 to 4 o'clock for right ear. This dissection is similar to making anterior tunnel for anterior tuck technique but gives advantage of addressing anterior canal wall bulge which was not possible in anterior tunnel technique.

Annulus is raised 360 degree after dissecting flap from malleus and entire middle ear cavity is visible along with medial bony canal. Graft is then placed over canal wall. Graft can be placed medial or lateral to handle of malleus as per ease. Tympanomeatal flap is repositioned over graft. Anterior angle should be maintained with help of dry gel foam placed lateral to Tympanomeatal flap. Since graft is sandwiched between canal wall and Tympanomeatal flap it does not require any gel foam support from medial side and hence no gel foam is to be placed in middle ear. This gives additional advantage of early hearing gain and prevents any fibrosis in middle ear. Iraninan author Samad et al.,[18] also advocated no gel foam to be used in middle ear[18] for advantage of early hearing improvement and preventing the risk of middle ear fibrosis.

In our study no granulations or canal wall sagging were found on pack removal on 10th post op day and canal wall was nicely healed by that time. Canal edema settles down by 2 to 3 weeks post operatively. Results obtained were similar to the study done by Roychaudhury[19] and Vaidya.[20]

The success rate of graft uptake of 97.5% percent in our study which is similar to many other techniques of Myringoplasty and considered as good uptake rate. The only case in which graft uptake was not successful was a result of otitis media in early post op period resulting in re perforation. Study done by Murugendrappa MA et al.,[21] had shown 96% success rate. Mokhtarinejad et al.,[22] reported 95% success in graft uptake by circumferential sub annular graft technique although his mean air-bone gap (ABG) had reduced postoperatively. There were no cases of anterior blunting and graft lateralization in both groups. Raghuwanshi et al.,[23] the graft take rate was 93.75 % without any retraction pockets or displaced grafts for Single stage bilateral type1 tympanoplasty. Khandelwal et al.,[24] 94.5%. Schraff et al.,[25] described the modified window shade technique in that the anterior fibrous annulus was mobilized of its bony sulcus their overall success rate was 94.5%. There were no cases of tympanic membrane lateralization or significant blunting.

In our study we got hearing improvement with A-B gap closure of less than 20 dB in almost 90 percent patients. Hearing gain is statistically significant in all types of tympanic membrane perforations including smaller, larger and subtotal perforations with 'P' value less than 0.05. Hearing gain analyzed as difference between pre-operative and post-operative air-bone gap came as 21.22 decibel. The 'p'value came significant in respect to hearing gain with the surgical intervention. Results were similar to study by Schraff et al which showed 82% of patients demonstrated closure of their ABG to within 10dB, 16% closed the gap to within 20 dB, and 2% closed the gap to within 30 dB.[25]

Conclusion

The proposed technique can be used for all type of perforation, gives good results of graft uptake and hearing improvement, does not require special skills, easy to learn and perform even for novice ear surgeon. No specific complications were encountered while using this modification of the traditional approac

Compliance with ethical standards

1. Disclosure of potential conflicts of interest-none
2. Research involving Human Participants and/or Animals-This article does not contain any studies with human participants or animals performed by any of the authors."

Conflict of interest

Authors Dr. Shalabh Rastogi, Dr. Rita Pandit, Dr. Prasanna Kumar V D Vasamsetty declares that we had no conflict of interest.

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