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Original Research Article

Myringoplasty: underlay versus overlay techniques- a comparative study

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ABSTRACT

Background: Chronic suppurative otitis media is an inflammation of the mucoperiosteal lining of the middle ear cleft. 10% of Indian population suffers from hearing impairment.
Methods: The study comprises of 60 patients admitted in the department of ENT and head and neck surgery, AJIMS, Mangalore between June 2015 and May 2017. All patients suffered from CSOM, tubotympanic type. Selection criteria was patients with CSOM, TTD type with no or minimal SNHL, AB gap more than 20dB, absence of ossicular defects, no history of previous ear surgery and was operated on worse hearing ear. Exclusion criteria were atticoantral disease, ossicular defects, previous ear surgery, otomycosis and systemic diseases.
Results: The majority of the patients were between the age group of 20-40 years. Out of the 60 patients, 28 were male and 32 female. 8 patients with moderate size and 20 with large perforations underwent underlay myringoplasty. For onlay corresponding numbers were 17 and 13. 26 patients (86.7%) who underwent underlay and 27 patients (90%) who underwent overlay had good hearing improvement. 43.3% of the group had significant hearing improvement at 6 months follow up. 20 patients had pneumatised and 40 patients had sclerotic mastoids in the study. Graft take up was 90% for underlay and 96.6% for overlay. The hearing loss was more with larger perforations.18 patients with large perforations who underwent underlay had good hearing improvement versus 13 for overlay whereas for moderate perforations, only 8 patients had good hearing improvement for underlay versus 15 for overlay.
Conclusions: The hearing improvement obtained with underlay and overlay myringoplasty are comparable. The cellularity of mastoid has no influence on the hearing improvement. The size of the perforation correlates well with the degree of hearing loss. Underlay myringoplasty seems to give better results for large perforations, overlay for moderate sized ones.

Keywords: Myringoplasty, Overlay, Underlay

INTRODUCTION

Chronic suppurative otitis media is an inflammation of the mucoperiosteal lining of the middle ear cleft. According to Indian Council of Medical Research Bulletin 1993, 10% of the Indian population suffers from hearing impairment and this figure is 15% for the under 14 years group. Of the 15%, 8% of the cases of hearing impairment were due to chronic suppurative otitis media. This evidently represents a grave problem as a subset represents an eminently treatable condition that is causing low quality of life and low productivity from younger generation who are the future of the country.

Otologic surgery prior to antibiotics was almost exclusively concerned with the evacuation of pus from the temporal bone. It was but natural that the surgeon during those times was reluctant to attempt reconstruction

because such surgery was almost invariably followed by suppuration and failure.

The introduction of sulpha drugs in 1937 allowed ear surgeries to become constructive rather than destructive. As physicians came to understand physiology and anatomy, they came to understand ear disease as well. The development of antibiotics decreased the morbidity of ear disease, the operating microscope made tympanoplasty possible, the use of fascia made it practical and the meticulous work of many surgeons brought us to the success we routinely enjoy today.

There are two contemporary techniques of tympanic membrane repair, underlay and overlay techniques where graft is placed medial or lateral to the annulus, respectively. Each has its proponents and antecedents, advantages and disadvantages. The relative ease of these procedures once surgical proficiency is mastered, and immense gratitude of the patient who receives the benefit of hearing makes this procedure very rewarding.

Myringoplasty is an operation in which the reconstructive procedure is limited to repair of a tympanic membrane perforation.[1]

To distinguish between myringoplasty and tympano-plasty, Rizer defines tympanoplasty to include all procedures in which the drum is lifted from its position in the ear canal.[2]

Any work on this topic is usually eagerly received. However no universal consensus has been reached as to which is better technique.

Here we attempt to fill the lacunae with the preliminary comparative study.

METHODS

The study comprises of 60 patients admitted in the department of ENT and head and neck surgery, AJIMS, Mangalore between June 2015 and May 2017. All these patients suffered from CSOM, TTD. Each patient was subjected to a detailed examination of nose, PNS and throat for any focus of infection which could influence the result of myringoplasty.

Selection criteria for case

- CSOM, TTD.
- None or minimal SNHL (adequate cochlear reserve).
- AB gap more than 20 Db.
- Operated ear was the worse hearing ear.
- Absence of ossicles defect.
- No history of previous ear surgery on the test ear.

Exclusion criteria were attico antral disease; ossicle defects; previous ear surgery; otomycosis; systemic diseases like DM, and coagulation disorders.

Underlay technique

30 Patients underwent overlay and 30 underwent underlay myringoplasty. All patients underwent myringoplasty via postauricular approach, using temporalis fascia, under general anaesthesia. Techniques followed were as follows.

Underlay myringoplasty

Under aseptic precautions, the four quadrants of the ear canal and post auricular of the ear canal and postauricular area are infiltrated with 2% lignocaine and 1:2,00,000 adrenaline. Working endomeatally through a speculum, the margins of the perforation are freshened, and 2 radial incisions made along the tympanomastoid and tympanosquamous suture lines. The medial ends of these were joined using a medial circumferential incision, and the vascular strip partially elevated from within outwards. A postauricular incision is made about 3 mm behind the fold, and a self retaining mastoid retractor (Mollison's) used to expose the temporalis fascia. Hydrodissection (injection of saline into loose areolar tissue) is used to elevate the temporalis fascia from the underlying muscle, and a large (roughly 2 cm × 3 cm) graft is harvested. The graft is spread on a Teflon block, any attached muscles teased off, and it is left to dry to parchment -like consistency. The retractors are removed, and a 'V' shaped incision made through the subcutaneous tissue and periosteum. The periosteum is elevated anteriorly along with the vascular strip: pinna retracted anteriorly using ribbon gauze, and a canal wall retractor (Plester's) inserted. Using microdisscector and a small cotton ball, the tympanomeatal flap (with the posterior annulus) is elevated. The ossicular chain is inspected, and its mobility noted. The condition of the middle ear mucosa and eustachian tube orifice (ETO) noted. The undersurface of the drum remnant or annulus is denuded of mucosa. Hemostasis achieved. The middle ear space is filled with gelfoam, beginning anteriorly near the ETO and then the rest of the tympanic cavity. The graft is trimmed to size and placed into the ear. A slit can be made for the handle of malleus and the graft tucked under the annulus, after carefully replacing the tympanomeatal flap. The deep meatus is packed with gelfoam (soaked in Neosporin H ear drops and squeezed). The vascular strip is replaced, and the rest of the canal packed with gelfoam and umbilical tape (soaked in neomycin ointment). Post-auricular incision is sutured in layers, and a mastoid dressing applied.

Overlay technique

Under aseptic precautions, the four quandrants of the ear canal and post auricular of the ear canal and postauricular area are infiltrated with 2% lignocaine and 1:2,00,000 adrenaline. Working endomeatally through a speculum, the margins of the perforation are freshened, and 2 radial incisions made along the tympanomastoid and tympano-squamous suture lines. The medial ends of these were

joined using a medial circumferential incision, and the vascular strip partially elevated from within outwards. A postauricular incision is made about 3 mm behind the fold, and a self retaining mastoid retractor (Mollison's) used to expose the temporalis fascia. Hydrodissection (injection of saline into loose areolar tissue) is used to elevate the temporalis fascia from the underlying muscle, and a large (roughly 2 cm × 3 cm) graft is harvested. The graft is spread on a Teflon block, any attached muscles teased off, and it is left to dry to parchment- like consistency. The retractors are removed, and a 'V' shaped incision made through the subcutaneous tissue and periosteum. The periosteum is elevated anteriorly along with the vascular strip: pinna retracted anteriorly using ribbon gauze, and a canal wall retractor (Plester's) inserted.

A lateral circumferential incision is made, along the anterior wall. Anterior skin wall skin is carefully elevated along the epithelial layer of the tympanic membrane remnant, taking care not to leave any residual epithelium over the tympanic membrane. The anterior canal wall skin is removed and preserved. The temporalis fascia graft is trimmed to size and preserved. The temporalis fascia graft is then carefully positioned medial to the handle of malleus, the graft lifted and middle ear filled with gel foam, and final positioning of the graft done. Often, the double breasting technique was used. The anterior canal wall skin is reinserted and positioned so as to overlap the graft. Deep meatus filled with gel foam. Vascular strip replaced. External auditory canal packed with gel foam and umbilical tape. Postauricular incision is sutured in layers, and a mastoid dressing applied.

Patients were all put on antibiotic cover. Nasal steroid sprays were also routinely used. Pack and sutures were removed on postoperative day 7 and patient discharged on ear drops, oral antibiotics and antihistamines, and steroid nasal spray. Ear care was explained.

They were followed up 1 month and 6 months postoperative with

- Symptoms if any
- Subjective hearing improvement
- Examination under microscope to look for
  - Status of graft taken up/not taken up
  - Healing
  - Medialisation / lateralisation
  - Reperforation
- Audiological examination
  - Pure tone average of postoperative air conduction level
  - AB Gap closure.

Hearing results typically are classified based on the postoperative air-bone gap.

Classifications based on the air-bone gap are usually stratified as excellent (<10 db), good (11-20 db), and fair (21-30 db).

Subjective hearing improvement was classified as significant improvement, mild improvement, no improvement or worse hearing as per the patients own assessment of his hearing function.

The above data were noted on a proforma as shown on the next few pages.

F– test and chi-square test were used for the assessment of p value.

RESULTS

The majority of patients were between the age group of 20-40 years.

Table 1: Age incidence.

Age	Underlay	Overlay	All
<20	6	5	11
20-40	19	20	39
>40	5	5	10
Total	30	30	60

Average age incidence for the entire study group was 28.5 years. The average age in the underlay group was 29.6 years and for the overlay group it was 27.6 years. The youngest patient was 10 years old and the oldest patient was 76 years old.

Table 2: Sex incidence.

Sex	Underlay	Overlay	All
Male	19	9	28
Female	11	21	32
Total	30	30	60

Of the 60 patients, 28 were male and 32 female.19 male and 11 female patients underwent underlay myringoplasty, whereas 9 male and 21 female patient underwent overlay myringoplasty.

Table 3: Size of perforations.

Size of perforation	Underlay	Overlay	All
Small	2	0	2
Moderate	8	17	25
Large	20	13	33
Total	30	30	60

8 patients with moderate size of perforations and 20 patients with large perforations underwent underlay myringoplasty. For onlay, the corresponding numbers were 17 and 13 respectively. subtotal perforations were included under the large category.

The majority of study group had pre-operative air bone gap between 20-30 db (Table 4).

Table 4: Preoperative air bone (AB) gap.

Ab gap	Underlay		Overlay		All	
	No	%	No	%	No	%
<20	7	23.3	3	10	10	16.7
21-30	17	56.7	18	60	35	58.3
>30	6	20	9	30	15	25

Table 5: Postoperative air bone (AB) gap.

ABG	Underlay		Overlay		All	
	No	%	No	%	No	%
<10 dB (excellent)	14	46.7	7	23.3	21	35
11-20 dB (good)	12	40	20	66.7	32	53.3
21-30 dB (Fair)	4	13.3	3	10	7	11.7

Table 6: Subjective hearing improvement.

Patient's impression	Underlay		Overlay		All	
	No	%	No	%	No	%
Significant improvement	11	36.7	15	50	26	43.3
Mild improvement	12	40	14	46.7	26	43.3
No improvement or worse hearing	7	23.3	1	3.3	8	13.4

Table 7: X-ray mastoids; compared with post–operative hearing.

	Pneumatised				Sclerotic			
	<10	11-20	21-30	Total	<10	11-20	21-30	Total
Underlay	5	4	0	9	9	8	4	21
Overlay	4	6	1	11	3	14	2	19

Table 8: Graft status on post-operative EUM at 6 months chart.

Patient's impression	Underlay		Overlay		All	
	No	%	No	%	No	%
Graft intact	25	83.3	28	93.3	53	88.3
Graft perforated	3	10.0	1	3.3	1	1.7
Graft lateralised	-	-	1	3.3	1	1.7
Graft medialised	2	6.7	-	-	2	3.3

Table 9: Size of perforation with hearing loss (preop).

	<20	<21-30	>30
Small	0	2	0
Moderate	3	18	4
Large	6	15	12

26 patients (86.7%) who underwent underlay and 27 patients (90%) who underwent overlay had good hearing improvement (Table 5).

Statistical analysis using F-test (multivariate analysis) revealed that these values were statistically insignificant (p value was 0.94) (Table 5).

43.3% of the study group had significant hearing improver and 43.3% had mild improvement of hearing at 6 months follow up (Table 6).

20 patients had pneumatised and 40 patients had sclerotic mastoids in the study group (Table 7).

Graft take up was 90% for underlay and 96.6% for overlay. 3 underlay grafts and 1 overlay graft perforated. 2 underlay grafts medialised, and 1 overlay graft became lateralized (Table 8). The hearing loss was more with larger perforations, as shown in the above tabulation (Table 9).

Table 10: Hearing improvement using different techniques for various sizes of perforations (using post-op AB gap).

	<10 dB		11-20 dB		>30 dB	
	U	O	U	O	U	O
Small	1	0	0	0	1	0
Moderate	4	4	4	11	1	1
Large	9	3	9	10	3	0

18 patients with large perforations who underwent underlay had good hearing improvement, versus 13 for overlay (Table 10).

Whereas for moderate perforations, only 8 patients had good hearing improvement for underlay, versus 15 for overlay.

DISCUSSION

The study comprises of 60 patients admitted in the department of ENT and Head and Neck Surgery, A.J Institute of medical sciences and research centre, Mangalore between June 2015 and May 2017. All these patients suffered from CSOM, TTD. 30 patients underwent overlay myringoplasty, and 30 underlay.

All the myringoplasties were done using the postauricular approach, and temporalis fascia graft. All surgeries were performed under General Anaesthesia.

In our study the female to male ratio 1.14:1. This is contrary to the findings of Sachdev and Bhatia who reported that majority of their cases were males.[3]

The average age incidence in our study was 28.5 years. Average age for underlay was 29.6 years and overlay was 27.4 years. Youngest patients in our study were 10 years old of which 1 underwent underlay and 1 underwent overlay myringoplasty. The oldest patient was 76 years old and he underwent underlay myringoplasty.

Otoscopic and otomicroscopic examinations were used to confirm the presence of tubotympanic disease, size of perforation, and presence or absence of tympano-sclerosis.[4]

The larger the perforation, the worse was the hearing. This is in accordance with the reasons that tympanic membrane perforation cause hearing loss. 18 patients with large perforations who underwent underlay myringoplasty had good hearing improvement, versus 13 patients for overlay. Whereas for moderate perforations, overlay showed better results: 15 patients had good improvement of hearing, compared to just 8 for overlay.

Even though the sample size was inadequate for statistical analysis of this variable, the number seem to imply that underlay technique is better for larger perforations, and onlay for moderate sized ones. This is in contradiction to Rizer's study which found no difference in the 2 techniques for various sizes of perforations.[2]

In our study group, 20 patients had pneumatised mastoids (as assessed by pre op X-ray) and 40 patients had sclerotic mastoids. No relationship was found between mastoid pneumatisation and hearing improvement.

Pre-operative pure tone audiometry showed majority of patients (58.3%) had an air-bone gap between 21-30 dB. Singh et al had majority of patients with hearing between 50-60 dB.[5]

Post-operative PTA was done at 1 month and 6 months follow-up. Objectively, hearing improvement was classified as excellent (AB gap <10 dB), good (11-20 dB), fair (21-30 dB) and poor (>30 dB) according to tympanoplasty reporting protocol.

26 patients (86.7%) who underwent underlay and 27 patients (90%) who underwent overlay myringoplasty had good hearing improvement (good and excellent taken together).

Statistical analysis using F-test (multivariate) analysis revealed that these values were statistically insignificant (p=0.94), showing that both techniques give equally good hearing improvement.

This is in accordance to the studies by Rizer who reported 84.9% of underlay and 80.4% of overlay having good hearing improvement.[2] In contrast, Doyle et al and Parker et al reported better hearing improvement with underlay techniques.[4]

The most recent comparative study between underlay and overlay myringoplasty was done by Singh et al who found 93.3% graft take up for both techniques.[5] However, they found 92.8% of underlay myringoplasty had good hearing improvement, versus only 57.1% receiving the overlay technique.

Sheehy and Anderson in contrast, reported hearing improvement in 80% cases overlay myringoplasty.[1]

Subjective hearing improvement was also assessed in our study, and was found to correspond with the objective hearing improvement in the majority of the cases.

Post-operative otomicroscopy at 6 months showed intact graft in 90% of underlay myringoplasty and 96.6% of overlay myringoplasty. Graft perforations were found in 10% cases of underlay as compared to 3.3% case of overlay myringoplasty. 6.7% underlay grafts medialised and only 3.3% overlay graft lateralised.

Rizer noted complications in 8.9% of cases of underlay and 9.8 cases of overlay. Perforation occurred in 0.7% of underlay and 0.9% of overlay.[2] 1.9% of the underlay graft medialised, whereas 0.9% of the overlay grafts lateralised.

Whereas the studies by Doyle et al and Singh et al report fewer complications with underlay technique.[4,5]

Thus, the overall trend has been towards lesser complications for both underlay and overlay with more recent studies. This can be attributed to better antibiotics, improvement in visualization (better magnification) and technical refinements in the surgical techniques.

CONCLUSION

The hearing improvement obtained with underlay and overlay myringoplasty are comparable. The overlay technique has lesser incidence of graft perforation. The cellularity of the mastoid has no influence on the hearing improvement. The size of the perforation co-relates well with the degree of hearing loss. The subjective hearing improvement co-relates well with the objective closure of AB gap on postoperative pure tone audiometry. Underlay myringoplasty seems to give better results for large perforations, and overlay for moderate size ones.

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