

## Original Research Article

# Minimally invasive cartilage myringoplasty: our technique and experience

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### ABSTRACT

**Background:** Chronic suppurative otitis media is an inflammatory process in the middle ear and is an important health problem in India. Myringoplasty is the most common procedure performed that aims to close the tympanic membrane perforation which is traditionally done with temporalis fascia graft under microscope. Recent studies using the transcanal cartilage “push-through” technique of myringoplasty have demonstrated that it to be very feasible and effective. The aims and objectives of the study was to analyze the results of endoscopic transcanal ‘push-through’ myringoplasty in dry small central perforations in cases of inactive mucosal type of chronic otitis media.

**Methods:** This retrospective study was conducted in 16 patients who underwent transcanal endoscopic cartilage ‘push through’ myringoplasty and patients were called for regular follow up for 12 weeks and results were statistically analysed.

**Results:** A total of 16 cases were included in the present study. The graft uptake rate in the present study was found to be 93.75%. The mean preoperative air bone gap was 21.76 dB and the mean postoperative air bone gap was reduced to 12.6 dB. The air bone gap was 10 dB or less in 37.5% ears.

**Conclusions:** Endoscopic push-through technique of cartilage myringoplasty is an effective, minimally invasive and feasible method and has good success rate in terms of graft uptake as well as hearing gain. It may also represent a first choice approach for small and medium sized tympanic membrane perforations.

**Keywords:** Chronic suppurative otitis media, Carilage, Endoscopic ‘push through’ myringoplasty, Air bone gap, Graft uptake

### INTRODUCTION

Chronic suppurative otitis media (CSOM) is an inflammatory process in the middle ear confined to the mucoperiosteal lining of the middle ear cleft. It is an important health problem in India and has an adverse impact on quality of life.<sup>1</sup> Myringoplasty is the most common procedure performed that aims to close the tympanic membrane perforation to prevent recurrent otorrhea and to restore sound-conducting mechanism. It was introduced by Berthold and was further popularized

and developed by Wullstein and Zollner.<sup>2</sup> Since that time, numerous graft materials and methods of placement have been described to reconstruct the TM. Skin, fascia, vein, perichondrium, periosteum and cartilage have all been described as grafting materials for myringoplasty. Use of cartilage in reconstructive middle ear surgery is not a new concept, it was found to be the second most suitable graft material. It has been recommended on a limited basis to manage retraction pockets since many decades with excellent anatomical results.<sup>3,4</sup> Cartilage also has been described for use in cases of recurrent perforation and

revision tympanoplasty with encouraging results.<sup>5</sup> Cartilage tympanoplasty gained popularity after Eavey who used tragal cartilage with both side perichondrium for myringoplasty in children with small perforations.<sup>6</sup>

Minimally invasive surgery is becoming standard in many fields and it has been incorporated into ear surgery. Otolgic surgeries were traditionally performed under microscope, are now increasingly being done endoscopically.<sup>7</sup> Endoscope provides great advantage in transcanal techniques as it bypasses the narrow segment of canal and provides a close up and wide angle surgical view. Recent studies using the transcanal ‘push-through’ myringoplasty have demonstrated that it to be very feasible and effective.<sup>8</sup> According to the principles of minimally invasive surgery, minimal trauma of healthy tissue is produced with the result of minimizing local and general postoperative adverse reactions. In the present study, we report our outcomes of the transcanal “push-through” myringoplasty technique, aiming to analyse the rate of graft success, hearing outcomes, and complications.

### Objectives

To analyze the results of endoscopic transcanal ‘push-through’ myringoplasty, in terms of graft uptake and hearing improvement in dry small central perforations in cases of inactive mucosal type of chronic otitis media.

## METHODS

### Place of study

The present study was conducted at Subbaiah Institute of Medical Sciences, Shimoga from January 2017 to February 2019.

### Type of study

Retrospective study.

### Inclusion criteria

Patients with inactive mucosal chronic otitis media having small central perforation in which the ear had been dry for at least 6 weeks.

### Exclusion criteria

Patients with active disease, those with cholesteatoma, ossicular discontinuity, tympanosclerosis, sensorineural or mixed hearing loss, presence of focus of infection in nose, sinuses, or throat and failure to follow up for at least 3 months post operatively.

All these cases had undergone detailed workup which included history, clinical examination of ear, nose and throat including oto-endoscopy, tuning fork tests, pure tone audiometry, X-ray mastoid (Schuller’s view) and

routine lab investigations. Informed consent was obtained from all the patients.

All the cases were performed under local anaesthesia with intravenous sedation, through transcanal approach using zero degree wide angle 4 mm rigid endoscope. Margines of the perforation were freshened using a curved pick and the mucosa undersurface of the remnant pars tensa scraped using round knife to create more raw area. A 4 to 5 mm incision was given 2 to 3 mm medial to the free border of tragal cartilage, incising the skin and the cartilage. The cartilage was freed of the perichondrium on one side leaving the perichondrium attached to the cartilage on opposite side. Adequate size cartilage perichondrium graft was harvested which is 2 mm larger than the size of the perforation after freshening the margins. The incision site was closed with 3-0 vicryl. Middle ear is filled with adequate amount of gelfoam and the cartilage graft is pushed through the perforation with the perichondrium free surface facing the middle ear over the gelfoam support as an underley graft. The external auditory canal was filled with gelfoam and cotton smeared with mupirocin ointment was placed at the meatus and external dressing was applied. The dressing and the cotton was removed on next day prior to discharge. All the patients received oral antibiotics, topical antibiotic ear drops and antihistamines in the postoperative period for 2 weeks and analgesics as required. Patients were followed up regularly at 1<sup>st</sup> week 2<sup>nd</sup> week 4<sup>th</sup> week, 6<sup>th</sup> week and at the end of 3 months. Graft uptake was assessed and audiometry was repeated at 3months in the postoperative period and results were statistically analyzed using ‘paired t test’.

## RESULTS

A total of 16 cases were included in the present study. The age of the patients ranged from 20 to 62 years, with mean age of 35 years. Maximum number of patients was in the age group of 20 to 30 years (Table 1). Among total of 16 cases 10 (62.5%) were male and 6 37.5%) were female patients with male female ratio of 1.6:1 (Table 2).

**Table 1: Age distribution of patients.**

Age group (in years)	N	%
20-30	7	43.75
30-40	4	25
40-50	4	25
50-60	0	0
60-70	1	6.25

**Table 2: Gender distribution of patients.**

Gender	N	%
Male	10	62.5
Female	6	37.5
Total	16	100

**Perforation closure**

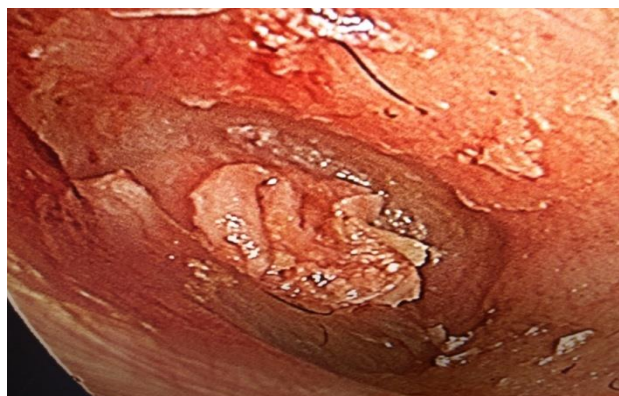
The overall success rate for closure of perforations was 93.75% and the graft was taken up in 15 out of 16 patients (93.75%) while one patient had recurrence of perforation at the end of 12 weeks as shown in Table 3.

**Table 3: Success rate for closure of perforations.**

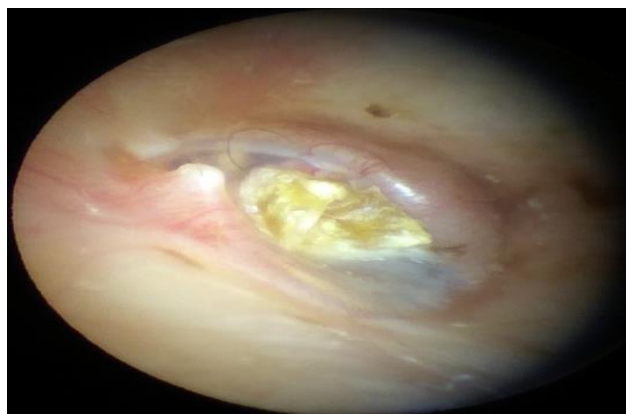
Outcome	Number of patients	%
Successful closure of perforation	15	93.75
Failure of graft uptake	1	6.25

**Hearing results**

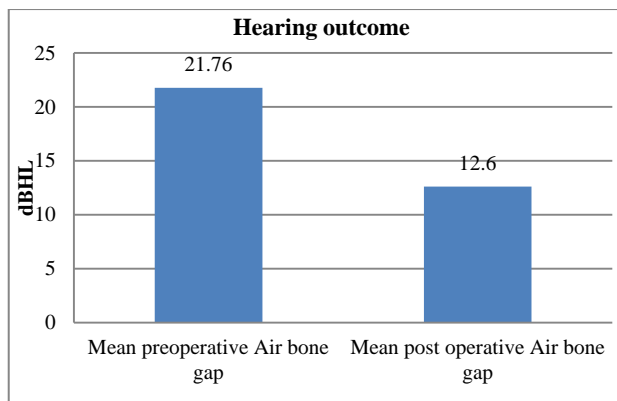
All patients who had successful graft uptake had an overall satisfaction with the treatment and reduced average air bone gaps were seen in all these ears post operatively as compared to respective preoperative average air bone gaps (shown in Figure 3). The overall mean preoperative air bone gap was 21.76 dB and overall mean post operative air bone gap was reduced to 12.6 dB as shown in Table 4 and Figure 3. The air bone gap was 10 dB or less in 6 (37.5%) ears.



**Figure 1: Intraoperative picture after placement of cartilage graft.**



**Figure 2: Well taken up graft at the end of 12 weeks.**



**Figure 3: Average overall mean pre and postoperative air-bone gaps in study population.**

**Table 4: Outcome of hearing in patients having successful graft uptake.**

Mean pre-operative air bone gap	Mean post-operative air bone gap	Mean post-operative hearing gain
21.76 dB	12.6 dB	9.16 dB

On statistical analysis using ‘paired t test’ it was found that there is a significant difference between average preoperative air bone gap and postoperative air bone gap at 5% level of significance with  $p < 0.001$ .

The average duration of the procedure in the present study was 45 minutes. All the patients had acceptable scar at the graft donor site.

**DISCUSSION**

A number of techniques have been described for repair of small tympanic membrane perforations. Traditional approach includes microscopic underlay placement of a graft beneath a tympanomeatal flap prepared with skin incisions using endaural or post aural approach. In the transcanal endoscopic push through technique of cartilage myringoplasty described herein, the graft can be placed through the freshened perforation without any need for skin incisions or preparation of a tympanomeatal flap. The advantages of this technique are, no need for external skin incision except the incision performed for harvesting the cartilage graft, no need for elevation of tympanomeatal flap, short operative time, no need for a mastoid dressing postoperatively, fast postoperative wound healing, patient comfort and good cosmetic results.

Cartilage is increasingly accepted as grafting material as it has low metabolic rate to serve longer and is well accepted in the middle ear.<sup>9</sup> Cartilage grafts are easy to harvest from tragus and conchal bowl. However, cartilage graft is criticized regarding hearing results because of its thickness.<sup>10</sup>

Success rate of transcanal cartilage tympanoplasty in our study was 93.75% which is comparable to other studies. Eavey performed cartilage myringoplasty in children and demonstrated 100% results.<sup>6</sup> Lin et al reported the success rate of 82.1% in 28 patients and Kim et al reported 96.4% success rate in 29 patients.<sup>11,12</sup> Ayache described minimally invasive butterfly cartilage tympanoplasty by transcanal endoscopic procedure and reported 96% success rate.<sup>13</sup>

In a multi-centre prospective case series by Loh et al in 241 patients who underwent transcanal “push-through” myringoplasty 87.2% of patients had successful grafts and intact tympanic membranes and the air-bone gap was significantly lower after surgery.<sup>8</sup>

Mourya et al performed a comparative study on tympanoplasty using butterfly cartilage and temporalis fascia in 110 patients with 55 patients in each group and reported success rate of 93.7% and 96.3% respectively.<sup>14</sup> However, in terms of time taken, butterfly cartilage tympanoplasty took less time (about 30 min) than temporalis fascia (about 55 min). In the present study the mean duration of surgery was 45 minutes and is comparable to study conducted by Mourya et al.<sup>14</sup>

In a study conducted by Celik et al in 32 patients who underwent endoscopic ‘push through myringoplasty the success rate of graft uptake was 87.5%, preoperative mean air conduction hearing threshold was 25.9 dB and the mean air-bone gap was 11.9 dB while these values improved to 19.5 dB and 5.3 dB respectively in the postoperative period.<sup>15</sup> The mean hearing gain was 6.4 dB. In the present study the mean preoperative air bone gap was 21.76 dB which was reduced to 12.6 dB post operatively with mean postoperative gain in air bone gap was 9.16 dB.

In a comparative study on endoscopic ‘push through’ myringoplasty and microscopic underlay myringoplasty by El-Hennawi et al the graft success rate was 92.9 per cent in the endoscopic group versus 85.7 per cent in the microscopic group.<sup>16</sup> The corresponding pre-operative mean air-bone gaps were 17.4 dB and 18.5 dB, improving to 6.1 dB and 9.3 dB post-operatively. Mean air-bone gap closure was 11.4 dB in the endoscopic group and 9.2 dB in the microscopic group. Mean operative time was 37.0 minutes in the endoscopic group, versus 107 minutes in the microscopic group. The success rate and hearing gain of above study is comparable to the present study.

Transcanal ‘push through’ technique of cartilage myringoplasty is a better option for small to medium sized perforations. Endoscopic transcanal approach does not require surgical exposure such as a retroauricular skin incision to get an anterior view and provides many advantages in performing ear surgeries. Endoscope gives the wide angle, panoramic, close and magnified view of whole of the tympanic membrane, ear canal and middle

ear cavity with better illumination without having to manipulate the patient's head or tilting the table. Endoscopic surgery is a better procedure for demonstrating the surgical steps, and it also enables viewing of the anatomic structures in the same field, resulting in a better appreciation of their relationship. The primary advantage of our technique was that we perform grafting with a small incision at donor site and removing the perichondrium on one side only made it easy to push the graft through the perforation. In addition, the perichondrium which is attached to the graft offered the advantage of being used for the purpose of establishing the contact between the cartilage and the remnant tympanic membrane at places where it is not in contact with the remnant tympanic membrane.

### **Limitations of the study**

Relatively short follow-up time and the low patient number is the main limitation of this study. Further studies with larger patient groups and longer follow-up periods are needed regarding minimal invasive technique of myringoplasty employed in the present study.

### **CONCLUSION**

Endoscopic push-through technique of cartilage myringoplasty is an effective, minimally invasive and feasible method and has good success rate in terms of graft uptake as well as hearing gain. It may also represent a first choice approach for small and medium sized tympanic membrane perforations.

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