Outcome of Single-Sitting Bilateral Type 1 Tympanoplasty in Indian Patients

Shiv Kumar Raghuwanshi · Dinesh P. Asati

Received: 1 December 2012 / Accepted: 1 March 2013 / Published online: 14 March 2013
© Association of Otolaryngologists of India 2013

Abstract Tympanoplasty is the standard and well established procedure for closure of tympanic membrane perforations. Traditionally each ear drum is taken up for grafting sequentially in two different sittings, which leads to huge increase in operation cost, time and discomfort to the patient. Since, simultaneous bilateral tympanic membrane grafting could be quite safe and helpful to the patients, we performed the same in 32 patients with bilateral (64) ear drum perforations due to chronic suppurative otitis media. All patients had a conductive hearing loss corresponding to the size and site of the perforation, without evidence of ossicular chain defect or any other middle or inner ear pathology. The post-aural route was approached for the grafting in 27 ears, endaural in 22 perforations and the remaining 15 small perforations were done via endomeatal approach. All the ears were operated using the Underlay technique. The majority of the grafts were harvested from temporalis fascia (59 grafts), remaining five were obtained from tragal perichondrium. All the patients were subjected to regular follow-up evaluation and audiometry for up to 1 year after the surgery. Six ears showed incomplete recovery with residual perforation, although in two of them the tissue regeneration over next few weeks led to entire shutting down of the defect. Thus, the graft take rate was 93.75 % without any retraction pockets or displaced grafts. We did not encounter any iatrogenic sensorineural hearing loss. Thus the results from

our study reinforce the safety of the single-step procedure and question the traditional apprehension regarding theoretical risk of iatrogenic sensorineural hearing loss making the ENT surgeon reluctant to perform this readily acceptable minor surgery in one sitting.

Keywords Single stage bilateral type1 tympanoplasty · Sensorineural hearing loss · Outcome

Introduction

Chronic Suppurative Otitis Media (CSOM) is a widely prevalent public health problem presenting with otalgia, discomfort, hearing loss, otorrhea, psychological trauma and tympanic membrane perforations [1]. CSOM is characterized by an inflammatory process of the middle ear often associated with irreversible tissue alterations. It may be further broken down into non-cholesteatomatous chronic otitis media (NCCOM) and cholesteatomatous chronic otitis media (CCOM) according to the absence or presence of a cholesteatoma [1]. Non-cholesteatomatous chronic otitis media (NCCOM) is very common condition in India [2], with resultant persistent and broad tympanic membrane perforations. The major symptom these patients present is intermittent otorrhea, usually associated to upper airway infections or a past history of extrinsic contamination (swimming in pools or ocean). The otorrhea is typically painless, without giving off foul smell, together with hearing loss. By doing otoscopy one commonly finds a perforation in the pars tensa of the tympanic membrane of varied size and shape, the middle ear mucosa has an almost normal appearance, except for some degrees of hyperemia [2].

It is imperative to control and treat NCCOM to reduce the auditory sequels and morbidity. NCCOM management

S. K. Raghuwanshi (✉)
Department of ENT, LN Medical College and Research Centre,
Kolar Road, Bhopal 462042, MP, India
e-mail: skumarraghuwanshi@gmail.com

D. P. Asati
Department of Dermatology, LN Medical College and Research
Centre, Bhopal, India

involves three equally important and complementary stages: preoperative clinical control (thorough cleansing and drying of the middle and outer ear under antibiotic coverage), surgical treatment (tympanoplasty with middle ear and ossicular chain exploration, and tympanic membrane reconstruction) and post-operative follow up [3].

The surgical approach for tympanoplasty may be endoaural, transmeatal, post-auricular. The most common grafting techniques are the underlay (medial) and the overlay (lateral). Autologous materials such as temporalis fascia, cartilage or perichondrium are the common choices of grafting material as they are mechanically stable and have necessary acoustic performance for good sound transmission.

Quite often, the disease is bilateral, so is the perforation in the ear drum leading to bilateral conductive hearing loss. Surgery aims at re-establishing sound conduction by obtaining a cavity filled with air and thus restoring the mechanisms that transmit sound, improving hearing and stopping otorrhea. Type 1 tympanoplasty is the most broadly agreed surgical approach to these patients, traditionally performed on each ear in succession. The reluctance to deal with both the sides has been primarily due to a theoretical risk of iatrogenic sensori-neural hearing loss, need of bilateral ear canal gauze packing and chances of graft intake failure. The risk of iatrogenic hearing loss engaged with chronic ear surgery has been found to be variable (1.2–4.5 %), depending upon the pre-morbid conditions like congenital malformations, cholesteatoma or granulating otitis or if concurrent ossiculoplasty was performed [4–6].

Material and Methods

The study period spanned from December 2008 to July 2011. During this period, all the patients who presented signs and symptoms suggesting bilateral tympanic membrane perforations due to NCCOM to the outdoor of JK Hospital and LN Medical College, Bhopal were submitted to an assessment protocol based on a structured history taking, specific physical exam (otoscopy and rhinoscopy) and a baseline audiogram. History taking included questions about patients' symptoms, disease onset, period of time spent without otorrhea, number of ear infections per year and if they had undergone previous otologic surgeries. The ears had to be dry for at least 4 months and there ought to be no local nidus of infection in ear, nose or throat along with good eustachian tube patency before selecting the patient for operation.

The Pre-surgical audiometry was performed in each patient, pure tone average was calculate as a mean of the pure tone hearing threshold at following frequencies: 250, 500, 1,000, 2,000, 3,000, 4,000, 6,000 and 8,000 Hz.

Exclusion Criteria

When the otorrhea was present at the time of surgery or within 4 months prior, having nasal allergy, cholesteatoma or other middle ear pathology, congenital anatomical defect, cleft lip or cleft palate.

All the surgeries were performed under local anaesthesia using post-aural regional infiltration with 2 % xylocaine with adrenaline. External auditory canal was infiltrated with 2 % xylocaine with adrenaline. 0.5 ml was infiltrated at 3, 6, 9 and 12 O'clock positions, about 3 mm from annulus. Patient was premedicated half an hour prior with intramuscular atropine injection and sedated by injection promethazine and pentazocin.

In each patient, the ear with larger perforation was selected as the first operation site so as to exclude concomitant pathology like granulation tissue, cholesteatoma or ossicular chain defect and to simultaneously harvest a large graft from ipsilateral temporalis fascia, which could also be used for the contralateral side. Rim of tissue was removed from the perforation edge and undersurface was abraded to de-epithelize and encourage migration as epithelium and mucosal layer. Posterior tympanomeatal flap was elevated and middle ear status was noted (mucosa, ossicular chain mobility, round window, eustachian tube orifice). Grafts were positioned with a underlay technique (graft placed under handle of malleus). During exploration of the first ear, 14 cases showed small anterior margins, where tugging of the graft with anterior meatal wall could also be done. The middle ear cavity and external auditory meatus was packed with gel foam soaked in non-ototoxic fluoroquinolone antibiotic eardrops. After closure of the wound, a small cotton pad was placed over first ear and secured with micropore. Then turning the head of the patient to the opposite side and the surgical team having changed their gloves, the second ear is taken up using a fresh sterile tympanoplasty set.

The post-aural approach was preferred in 27 patients with larger perforation on one (first) side. The large temporal fascia graft harvested from the ipsilateral side in these patients was cut in two halves, one used immediately on the same side and the other half was preserved for opposite ear. In 5 patients with only moderate size perforations, first ear was operated through endaural approach using small temporalis fascia harvested from the same side of operating ear.

On the other (second) side, 17 ears had either moderate size perforation or narrow canal wall, so they were operated through endaural approach. Temporalis fascia graft left over from the first side was used for grafting in these patients. Fifteen ears had small perforation with wide canal wall and perforation in posterior part of tympanic membrane, but not up to the handle of malleus and it was

Table 1 Approach to the patients and the graft used

First ear		
Approach (number of ears operated)	Post-aural (27 large perforations)	Endaural (five moderate size perforations)
Graft used	Ipsilateral temporalis fascia	
Second ear		
Approach (number of ears operated)	End-aural (17 moderate size perforations)	Endomeatal (15 small perforations)
Graft used	Left over temporalis fascia	Left over temporalis fascia in ten and tragal perichondrium in five ears

possible to visualize all the borders of the perforation so they were selected for endomeatal approach. Out of these, five ears were operated using tragal perichondrium graft and the rest ten using part of temporalis fascia which are harvested from the opposite side. Table 1 depicts both the technique and the type of graft used for each patient who obtained tympanic membrane perforation closure.

Bilateral mastoid bandage were done in 17 patients, in which opposite side was operated through endaural approach (Fig. 1). Rest of the patients had normal mastoid bandage on first ear and box dressing on opposite side where endomeatal approach was used.

All patients received single intravenous dose of 3rd generation cephalosporin antibiotic before operation, post-op antibiotics were continued orally for about 7 days along with topical nasal decongestants. Pressure dressing was removed on 1st post-op day and the stitches were taken out on 7th post-op day. Antibiotic eardrops were given once a day after stitch removal and continued for 3 weeks. Patients were advised to refrain from cough and straining and avoid wetting their ears till graft was satisfactorily

taken up. Regular follow up was carried out on fortnightly basis for 2 months, then at monthly basis for next 3 months. Pure tone audiometry was done in all case pre-operatively, at 6 months and 1 year after the operation.

Results

Of the total 32 patients (64 ears) with NCCOM (who underwent bilateral tympanoplasty, 18 (56.25 %) were females; average age of the patients was 29.87 (range 18–56) years. Surgical success, considering tympanic membrane perforation closure could be demonstrated in 60 ears (93.75 %), although two among them had residual perforations which healed slowly in next 2 months. The rest four ears had failure of the graft intake. The success rate of the 1st operative ear was 92.62 % (29/32 operations) and in second operative ear it was 96.87 % (31/32 operations). None of the patients had bilateral failure, so at least one ear was successfully treated in 100 % cases.

Improvement was noted in hearing threshold in 56 (of 60 successful) ears. The baseline hearing thresholds were 26.5 and 24.4 dB (average 25.45 dB) in the first and the contralateral ears respectively. Post-operatively, the average auditory gain was 10.8 dB (11.3 dB in 1st ear and 10.3 dB in second ear). Notably, there was no worsening of hearing threshold even in unsuccessful ears. Air-bone gap was closed to less than 10 dB in 70 % of ears and within 20 dB in 91.6 % of the ears.

Discussion

The studies discussing the outcome of bilateral single stage tympanoplasty are sparse in the literature. Most of the reports pertain to unilateral operations with average success rates of about 60–100 % [3, 7]. Recently, however, there is growing interest in single stage, bilateral myringoplasty all over the world [8, 9]. The old dogma relating adverse outcome of tympanoplasty to the presence of bilateral perforation has been refuted by good surgical success rates observed by many authors [10–13]. We noticed the scarcity

Fig. 1 Bilateral mastoid bandage

Table 2 Comparison of results of various studies on bilateral tympanoplasty

S.No.	Study	Number of ears	Success rate (%)	Hearing gain
1	Caye-Thomasen et al. [9]	52	94	ABG <10 dB in 92 % ABG <20 dB in 100 %
2	Hydr et al. [14]	100	84	Average ABG <15 dB
3	Mitchell et al. [15]	56	91	Not mentioned
4	Katsura et al. [17]	17	91	ABG <10 dB (29 % case) ABG <20 dB (88 % case)
5	Homoe et al. [18]	34	65	Average gain 18 dB (right ear) 13 dB (left ear)
6	Mane et al. [19]	28	96	ABG <10 dB (92 % of ear) ABG <20 dB (100 % of ear)
7	Present study	64	93.7	ABG <10 dB (70 % of ear) ABG <20 dB (91.6 % of ear)

of Indian studies related to bilateral tympanoplasty [13]. Our study highlights the benefits, easy feasibility and successful outcome of bilateral tympanoplasty.

Yu et al. [8] performed bilateral same-day surgery using inlay butterfly cartilage myringoplasty in 17 patients without any failure in their cases. They also did not use any post-operative external canal packing, thus avoiding any compromise in immediate post-operative hearing. However, harvesting of cartilage could be expertise dependent and needs to be done separately from both the sides, while we could use temporalis fascia gathered from single side in the other ear too. The use of temporalis fascia has been advocated by other investigators as well with satisfactory results [14].

Although there may be moderate hearing compromise temporarily in the immediate post-operative period due to the bilateral ear canal packing, however just after only few days, the packing dries up allowing the passage of air and restoration of hearing gradually [9]. We explained this phenomenon to the patients and their attendants during pre and post-op counselling.

Mitchell et al. [15] performed single-stage bilateral myringoplasty in 28 children using fat as a graft material with 91 % success rate. Sakagami et al. [16] used fibrin glue to close the perforation with success rate of 72 % (18/25 cases) in both the ears and 28 % (7/25 cases) in only one ear. Postoperative air-bone gap of less than 20 dB was achieved in 15 cases (60 %) on both sides and in 23 cases (92 %) on one side in their series [16]. These results are comparable to our study. Comparison of outcomes of various studies on bilateral tympanoplasty is shown in Table 2.

Success rate was better in second operative ear (96.86 %) in our cases than first ear (90.62 %) perhaps because of size of perforation was small in second ear. There was no difference in the outcome among male and female patients. Iatrogenic SNHL did not occur in our

series. However, few (4 patients) did not show functional improvement in hearing despite good anatomic restoration of the ear drum. Similarly, complete closure of the perforation took a longer time of about 2 months in two patients.

Although these studies highlight the ease, high success rate and patient-friendly outcome of bilateral tympanoplasty, this procedure is not without pitfalls. The patients need to be positioned for long time under local anaesthesia, which could be uncomfortable for some, although the bilateral procedure rarely takes more than 1½–2 h in expert hands in uncomplicated cases and if simultaneous mastoidectomy is not needed. There is also a theoretical risk of upper respiratory tract infection in the immediate post-op period leading to simultaneous graft rejection on both the sides, although this possibility is extremely unlikely with the routine post-op use of effective antimicrobials now a days. Bilateral hearing loss due to the temporary mastoid dressings causing physical occlusion is not much of a practical problem provided that the patients and their family members are thoroughly educated and warned beforehand [9].

Conclusion

The present study successfully illustrated the efficacy and safety of single sitting bilateral tympanoplasty for ear perforation due to chronic suppurative otitis media. Simultaneous tympanoplasty has multiple benefits including reduced operating time, anaesthesia procedures, patient visits for operation and follow ups and significant cutting of the total therapy cost. However, keeping in mind the theoretical risk of iatrogenic sensorineural hearing loss, caution should be exercised in choosing the right candidate for one-stage surgery. The patients with granulation tissue,

cholesteatoma or other pathology like need of ossiculoplasty during exploration of the first ear might not be appropriate subjects for simultaneous contralateral surgery.

Conflict of interest None.

References

- Child and Adolescent Health and Development; Prevention of Blindness and Deafness (2004) Chronic suppurative otitis media: burden of illness and management options. World Health Organization, Geneva. ISBN 92-4-1591587
- Singh A, Kumar S (2010) A survey of ear, nose and throat disorders in rural India. *Indian J Otolaryngol Head Neck Surg* 62:121–124. doi:[10.1007/s12070-010-0027-3](https://doi.org/10.1007/s12070-010-0027-3)
- Fukuchi I, Cerchiari DP, Garcia E, Rezende CE, Rapoport PB (2006) Tympanoplasty: surgical results and a comparison of the factors that may interfere in their success. *Braz J Otorhinolaryngol* 72:267–271
- Palva T, Karja J, Palva A (1976) High-tone sensorineural losses following chronic ear surgery. *Arch Otolaryngol* 102:137–139
- Smyth GD (1977) Sensorineural hearing loss in chronic ear surgery. *Ann Otol Rhinol Laryngol* 86:1–6
- Tos M, Lau T, Plate S (1984) Sensorineural hearing loss following chronic ear surgery. *Ann Otol Rhinol Laryngol* 93:403–409
- Hung T, Knight JR, Sankar V (2004) Anterosuperior anchoring myringoplasty technique for anterior and subtotal perforations. *Clin Otolaryngol Allied Sci* 29:210–214
- Yu MS, Yoon TH (2010) Bilateral same-day surgery for bilateral perforated chronic otitis media: inlay butterfly cartilage myringoplasty. *Otolaryngol Head Neck Surg* 143:669–672
- Caye-Thomasen P, Nielsen TR, Tos M (2007) Bilateral myringoplasty in chronic otitis media. *Laryngoscope* 117:903–906
- Adkins WY, White B (1984) Type I tympanoplasty: influencing factors. *Laryngoscope* 94:916–918
- Caylan R, Titiz A, Falcioni M, De Donato G, Russo A, Taibah A, Sanna M (1998) Myringoplasty in children: factors influencing surgical outcome. *Otolaryngol Head Neck Surg* 118:709–713
- Lima JC, Marone SA, Martucci O, Gonzalez F, Silva Neto JJ, Ramos AC (2011) Evaluation of the organic and functional results of tympanoplasties through a retro-auricular approach at a medical residency unit. *Braz J Otorhinolaryngol* 77:229–236
- Singh GB, Sidhu TS, Sharma A, Singh N (2005) Tympanoplasty type I in children—an evaluative study. *Int J Pediatr Otorhinolaryngol* 69:1071–1076
- Hydr AS, Ashfaq M (2007) Single stage bilateral myringoplasty. *Pakistan J Otolaryngol* 23:66–67
- Mitchell RB, Periera KD, Younis RT, Lazar RH (1996) Bilateral fat graft myringoplasty in children. *Ear Nose Throat J* 75:652–656
- Sakagami M, Mishiro Y, Tsuzuki K, Seo T, Sone M (2000) Bilateral same day surgery for bilateral perforated chronic otitis media. *Auris Nasus Larynx* 27:35–38
- Katsura H, Sakagami M, Tsuji K, Muto T, Okunaka M, Mishiro Y, Fukazawa K (2005) Reevaluation of bilateral same-day surgery for bilateral perforated chronic otitis media. *Otol Neurotol* 26:842–845
- Homøe P, Sørensen HC, Tos M (2009) Mobile, one stage, bilateral ear surgery for chronic otitis media patients in remote areas. *J Laryngol Otol* 123:1108–1113
- Mane R, Patil B, Mohite A, Varute VV (2011) Bilateral type I tympanoplasty in chronic otitis media. *Indian J Otolaryngol Head Neck Surg*. doi:[10.1007/s12070-011-0294-7](https://doi.org/10.1007/s12070-011-0294-7)