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Original Research Article

A Hospital Based Observational Study to Assess the Results of Endoscopic Transcanal Myringoplasty

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Abstract

Aim: The aim of the present study was to assess the results of endoscopic transcanal myringoplasty.

Methods: The present study was conducted in the Department of ENT, We reviewed the medical records of 50 patients who under- went endoscopic transcanal myringoplasty. The patients with anterior perforations of the tympanic membrane were enrolled; these patients were followed up for at least 6 months.

Results: The changes from preoperative to postoperative air-bone gaps were noted. 34 patients (68%) had preoperative air-bone gaps of less than 20 dB, whereas 49 patients (98%) had postoperative air-bone gaps of less than 20 dB. The association between the rate of graft success and prognostic factors were noted. The success rate among patients with postoperative otorrhea was significantly lower than that among patients without postoperative otorrhea. Notably, the success rate with partial visualization of the perforation was comparable to that with complete visualization of the perforation. No significant differences were seen for larger and marginal perforations.

Conclusion: Our study revealed that wider endoscopic visualization can neglect the factor of partial visualization of the perforation margin through otoscopy, which increases the rate of graft success in anterior perforations of the tympanic membrane. Therefore, the rate of graft success and hearing results are comparable with those of microscopic myringoplasty for repairing anterior perforations of the tympanic membrane.

Keywords: endoscopic transcanal myringoplasty, tympanic membrane, prognostic factors

Introduction

Myringoplasty (tympanoplasty type I) is usually the treatment of choice for tympanic perforations, whether or not associated with non-suppurative chronic otitis media (COM). [1,2] The surgical goal is the total closure of the perforation and, secondly, an improvement of auditory thresholds. [2,3] Transcanal myringoplasty has advantages: it demands lower operative time and minimal external incision. [2,3] When performed with the aid of a surgical microscope, the transcanal procedure depends on a wide external auditory canal (EAC) and on a favorable angle for proper observation of all borders of the tympanic perforation. [3]

Conventional myringoplasty with retroauricular incision, with or without canalplasty, is the classic alternative for cases of unfavorable EAC in transcanal approaches with microscope. In the last decade, there has been an increase in the use of endoscopes in otologic surgery, not just as an adjunct method, but exclusively. [3,4] This approach has the potential to allow ‘‘around the corner’’ visualization of small recesses, through narrow spaces, without the need for canalplasty, even in cases of unfavorable EAC. [5,6] The teaching of otologic surgeries during the otolaryngologist’s training period is traditionally done with the use of microscopes.

Tympanoplasty for closing anterior perforations of the tympanic membrane is considered challenging. The reasons for poor surgical outcomes include a reduced vascular supply, limited anterior margin, poor visualization, and inadequate graft stabilization. [6,7] Overlay tympanoplasty has a high success rate in treating anterior perforations of the tympanic membrane, but it is surgically difficult. [8,9] The modifications of underlay tympanoplasty for repairing anterior perforations of the tympanic membrane include mediolateral graft, window-shade, anterior transcanal, loop overlay, andhammocktechniques. [10,11] Although

effective, these techniques require advanced surgical skills, postauricular incision, and general anesthesia.

The aim of the present study was to assess the results of endoscopic transcanal myringoplasty.

Materials and Methods

The present study was conducted in the Department of ENT, Nalanda Medical College and Hospital, Patna, Bihar, India. We reviewed the medical records of 50 patients who under- went endoscopic transcanal myringoplasty. The patients with anterior perforations of the tympanic membrane were enrolled; these patients were followed up for at least 6 months. Patients with ossicular chain disease and cholesteatoma were excluded. All patients provided oral informed consent.

The main outcome was the rate of overall graft success of endoscopic transcanal myringoplasty. Postoperative complications of recurrent perforations, infections, hemorrhage, and hearing loss were examined. We performed preoperative and postoperative audiograms at frequencies of 500, 1000, 2000, and 4000 Hz to access the closure of the air-bone gap.

We used an otoscope to evaluate the visualization of the perforation margin preoperatively. If this margin could be completely observed, visualization was defined as complete; any other visualization was defined as partial. Anterior perforations were defined as anterior to the malleus handle. The tympanic membrane was divided into 4 quadrants according to the position of the malleus handle, with each quadrant accounting for 25% of the size of the tympanic membrane. If the perforation size was smaller than 2 quadrants, then it was de- fined as less than 50%. Otherwise, the perforation was 50% or greater. A similar method was used in the report by Pinar et al. [12] We defined the operative time as the duration from the start of local anesthesia to the end of wound dressing. We analyzed the association between the rate of graft success and prognostic factors. The prognostic factors included age (<50 or ≥50 years), sex, cause of the perforation, the perforation size (<50% or ≥50%), marginal perforation, hearing level, primary or revision surgery, visualization of the perforation margin, operative time, and postoperative otorrhea.

Surgical Techniques

Two rigid endoscopes (Karl Storz) were used in our surgical techniques (4.0-mm, 0°, 18-cm-long lens and 3.0-mm, 0°, 14- cm-long lens). Patient ears were prepared and draped under sterile conditions without hair shaving. Each patient was ad- ministered intravenous sedation (50 mg of meperidine hydro-chloride and 5 mg of midazolam hydrochloride) 10 minutes pre- operatively by an anesthesiologist. The periaural area and external ear canal were infiltrated with 2% lidocaine hydro- chloride and 1:100 000 epinephrine. Transcanal injections were administered in all 4 quadrants using a 26-gauge needle un- der direct endoscopic visualization. Meanwhile, blanching of the canal skin was observed, and hemorrhagic bulbs were pre- vented by slowly and carefully injecting local anesthesia.

We used the temporalis fascia or the tragal perichondrium as graft material. For harvesting of the temporalis fascia graft, a 2.5-cm incision near the hairline superior and posterior to the helix was made to expose the areolar tissue or temporalis fascia; this connective tissue was harvested and then pressed using a fascia clamp. After achieving hemostasis, the post auricular incision was closed with absorbable sutures. For harvesting of the tragal perichondrial graft, a 1-cm incision was made 2 to 3 mm medial to the free border of the tragal cartilage by cutting through the skin and cartilage. The perichondrium was freed of the cartilage and prepared as a graft. The incision was sutured with absorbable material. Surgical techniques included endoscopic simple underlay myringoplasty (without elevation of the tympanomeatal flap) and endoscopic type 1 tympanoplasty (with elevation of the tympanomeatal flap), as described by Furukawa et al. [13]

Endoscopic Simple Underlay Myringoplasty

For endoscopic simple underlay myringoplasty, the perforation margin and anterior anulus were visualized through endoscopy. The perforation margin was circumferentially freshened using a pick or a sickle knife. The middle ear cavity was tightly packed with an absorbable gelatin sponge (Gel-foam; Pfizer, Inc) through the perforation. Furthermore, the tubal orifice was packed to prevent medialization because of negative pressure produced by sniffing. After being prepared 2 mm larger than the perforation size, the graft was pushed through the perforation and placed in an underlay manner. Absorbable gelatin sponge pledgets soaked with antibiotic drops (ofloxacin ear solution, 0.3%) were placed lateral to the graft in the external auditory canal.

Endoscopic Type 1 Tympanoplasty

When large perforations were observed, we performed endoscopic type 1 tympanoplasty with elevation of the tympanomeatal flap. First, the perforation margin and anterior anulus were visualized through endoscopy. The perforation margin was circumferentially freshened with a pick or a sickle knife. An incision was made 5 mm away from the tympanic anulus posteriorly and extended from the 12-o'clock to the 7-o'clock positions. The tympanomeatal flap was subsequently elevated to the level of the fibrous anulus. Cottonoid pled- gets soaked with epinephrine were applied to reduce

bleeding from the cut edges of the flap. After the middle ear cavity was exposed, the integrity and mobility of the ossicular chain were examined. A graft trimmed to an appropriate size was placed medial to the malleus handle to prevent graft lateralization. Absorbable gelatin sponges were packed in the middle ear cavity to support the graft from medialization. The tympanomeatal flap was subsequently replaced to its original position. The external auditory canal was packed with absorbable gelatin sponge pledgets to the level of the isthmus.

The postauricular incision was covered with a gauze dress- ing, whereas the tragal incision was packed with a cottonoid ball placed in the orifice of the external auditory canal. No mas- toid dressing was required. The patients were discharged on the day of the surgery. The packing and stitches were re-moved 1 week postoperatively. Hearing tests were performed at 3, 6, and 12 months postoperatively.

Statistical Analysis

Statistical analysis was performed using SPSS software (version 16 for Windows; SPSS Inc/IBM). The study results were expressed as mean (SD) for continuous variables and as per- centages for categorical variables. We compared the study data using the paired t, $\chi 2$, and univariate logistic regression tests. Effect sizes were reported as Cohen d and odds ratios (ORs) with 95% CIs. The differences between groups were considered significant at $P < .05$.

Results

Table 1: Preoperative and Postoperative Air-Bone Gaps

Air-Bone Gap, dB	No. (%) of patients	
	Preoperative	Postoperative
<10	14 (28)	39 (78)
10-20	20 (40)	10 (20)
>20	16 (32)	1 (2)

The changes from preoperative to postoperative air-bone gaps were noted. 34 patients (68%) had preoperative air-bone gaps of less than 20 dB, whereas 49 patients (98%) had postoperative air-bone gaps of less than 20 dB.

Table 2: Association between Rates of Graft Success and Prognostic Factors

Prognostic Factor		No. of Patients(n = 50)	Graft Success,No	OR (95% CI)[a]	*P* Value
Age, y	<50	24	24	10.02 (0.51-195.00)	.15
	≥50	26	22	1 [Reference]	
Sex	Male	26	22	1 [Reference]	.18
	Female	24	24	10.02 (0.51-195.00)	
Side	Right	30	27	1 [Reference]	.25
	Left	20	20	6.51 (0.33-126.80)	
Cause	Trauma	2	2	2.38 (0.10-57.47)	.52
	Chronic otitis media	48	46	1 [Reference]	
Perforation size	<50%	42	40	5.88 (0.72-47.90)	.12
	≥50%	8	6	1 [Reference]	
Perforation type	Marginal	7	5	1 [Reference]	.07
	Nonmarginal	43	41	6.86 (0.83-56.80)	
Revision surgery	No	44	42	1 [Reference]	.80
	Yes	6	6	1.39 (0.07-28.56)	
Visualization of the perforation margin	Complete	32	29	1.75 (0.23-13.40)	.55
	Partial	18	16	1 [Reference]	
Postoperative otorrhea	No	45	44	52.00 (4.08-662.55)	.001
	Yes	5	2	1 [Reference]	

The association between the rate of graft success and prognostic factors were noted. The success rate among patients with postoperative otorrhea was significantly lower than that among patients without postoperative otorrhea. Notably, the success rate with partial visualization of the perforation was comparable to that with complete visualization of the perforation. No significant differences were seen for larger and marginal perforations.

Discussion

Since the 1950s, microscopic tympanoplasty has be-come the standard treatment of a perforated tympanic membrane. [14] The operation can be

performed using 2 classic techniques, including underlay and overlay graft tympanoplasty. [8,9] In the underlay technique, the graft is placed medial to the remaining tympanic membrane and malleus. In the overlay technique, the graft is placed lateral to the anulus and remaining fibrous middle layer.

The changes from preoperative to postoperative air-bone gaps were noted. 34 patients (68%) had preoperative air-bone gaps of less than 20 dB, whereas 49 patients (98%) had postoperative air-bone gaps of less than 20 dB. The association between the rate of graft success and prognostic factors were noted. The success rate among patients with postoperative otorrhea was significantly lower than that among patients without postoperative otorrhea. Notably, the success rate with partial visualization of the perforation was comparable to that with complete visualization of the perforation. No significant differences were seen for larger and marginal perforations. During examination and surgery even though narrow or/protruded external auditory canal, endoscope was easily introduce in ear canal without difficulty and endoscopic view shows the entire image of tympanic membrane in one field and clear visualization of the margins of perforation. Endoscopes facilitated reliable refreshing of the perforation edges and grafting procedures. The tympanic cavity could also be observed through the perforation in the endoscopic wide view. Fine structures were also visible through large perforations such as the incudostapedial joint, orifice of the tube, round-window niche, ossicular chain, and tympanic isthmus. Endoscopy revealed no pathology of the tympanic cavity in this study. The endoscope's wide field of view allows observation of the entire circumference of the perforation and approaching the edge of the perforation reveals the under surface of the tympanic membrane. Harugop et al [15] reported that the tympanic annulus was not completely visualized with a microscope in 20% of patients and these patients required canaloplasty. Similar observation done by Takatoshi Fukurawa et al [16] the wide angle of zero-degree endoscope visualizes the entire tympanic membrane in one frame.

Kurhuke to et al [17] point out that using an endoscopic approach could fulfill the goal of causing the least amount of trauma to normal tissues. In addition to the abovementioned quantitative aspects related to the surgical outcome, endoscopic myringoplasty offers some practical advantages to the surgeon. The mobility of the endoscopic camera is much better than a microscope with its fixed heavy stand. It gives a continuous movie camera type of picture by moving easily to the site of interest in contrast to static vision of the microscope. The angled scopes help in increasing the visibility and accessibility to difficult areas like canal wall, anterior recess, anterior perforation and eustachian tube and the ossicular chain. Various factors influence the success rate of myringoplasty, such as age, the perforation portion, the perforation size, postoperative otorrhea, revision surgery, and poor visualization of the perforation margin. [12,18,19] The graft success rate of the patients with postoperative otorrhea was significantly lower than that of the patients without postoperative otorrhea, which could have been caused by un- controlled preoperative or postoperative infections. The operative time with partial visualization of the perforation margin was longer than that with complete visualization. However, visualization of the perforation margin, whether complete or partial, had no significant association with the rate of graft success. This finding indicates that the wider endoscopic visualization neglected the effect of partial visualization of the perforation margin on the rate of graft success in anterior perforations of the tympanic membrane. The larger perforation (≥50%) and marginal perforation type had no significant differences for these 2 factors, which is different from the findings in the previous report. [12]

Conclusion

Our study revealed that wider endoscopic visualization can neglect the factor of partial visualization of the perforation margin through otoscopy, which increases the rate of graft success in anterior perforations of the tympanic membrane. Therefore, the rate of graft success and hearing results are comparable with those of microscopic myringoplasty for repairing anterior perforations of the tympanic membrane. However, our technique is simpler because post auricular incision, canalplasty, and general anesthesia are not required. Thus, endoscopic transcanal myringoplasty should be considered for repairing anterior perforations of the tympanic membrane.

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