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SCARLESS AND STITCHLESS SINGLE INCISION ENDOSCOPIC TYMPANOPLASTY

Otorhinolaryngology

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ABSTRACT

Introduction: Endoscopic tympanoplasty has many advantages over microscopic tympanoplasty like it is easier to evaluate the deep anatomic structures from different angles, the operation time is shorter, the postoperative pain is at a lesser intensity,and the hospitalization time is shorter .in addition to this when we use small incision which lies behind tragus for harvesting perichondrium graft this surgery becomes more aesthetic and painless.disadvantages of the endoscopic ear surgery are the direct or thermal effect of the endoscope light which may cause damage to the external auditory canal and middle ear structures. Also using one of the hands only during the endoscopic tympanoplasty procedure may hamper surgical manipulations. However, in the these limitations will be reduced with increasing experience. **Aims and Objectives:**to evaluate the rate of graft success, hearing outcomes and complications in SSSI endoscopic tympanoplasty surgery and to document situations in which this endoscopic surgery was converted into microscopic tympanoplasty surgery.**Material and Method;** 57 adult patients who had Dry central perforation in tympanic membrane and planned for tympanoplasty surgery were enrolled in this study. 49 patients were completely operated by SSSI endoscopic tympanoplasty and 8 surgeries were converted into microscopic tympanoplasties intra operatively. **Results;**in this study success rate of graft uptake was 96% ,surgical complications were seen in 6% of patients and residual perforation after 6 months of surgery was seen in 4% of patients.audiological results after 6 months of surgery showed statistically significant improvement in both SSSI endoscopic and microscopic tympanoplasties.Extensive middle ear tympanosclerosis was main reason (75%) for conversion of 8 SSSI endoscopic tympanoplasties into microscopic tympanoplasties .**Conclusion;**SSSI endoscopic tympanoplasty is best method for repair of tympanic membrane perforations .surgery by this method is scarless and stitchless which results in less morbidity and less psychological trauma to the patient.graft uptake and audiological results are similar to microscopic surgery.

KEYWORDS

Endoscopic Tympanoplasty, perichondrium, Tragal cartilage,Tympanosclerosis

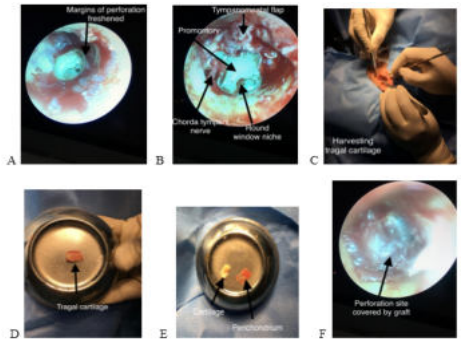
Introduction: Tympanoplasty is commonly used procedures for the treatment of chronic otitis media. Tympanoplasty involves eradication of the disease in the middle ear, repair of the perforated tympanic membrane and restoration of hearing. Endaural,transcanal and postauricular approaches are used during tympanoplasty surgery. Recently, transcanal endoscopic approaches have become popular. The endoscopic approach provides a much larger field of view. When training interns, this view translates into a better visual image, as the middle ear and the ossicles can be visualized through the perforation. In the microscopic approach, a retroauricular approach is preferred for anterior perforations, while the endaural approach is preferred for posterior perforations, and small perforations are commonly treated using the transcanal approach [1,2]. The tortuous anatomy of the outer ear and bone protrusions negatively affect microscopic views and impair visualization of deep structures. Canalplasty may be required in such cases. On the other hand, the panoramic and wide angled views obtained by the back and forth movements of the endoscope are not affected by the tortuous anatomy of the external ear canal. The view beyond the end of the endoscopy is easily presented to the surgeon, while magnification can also be achieved through various endoscope manipulations, eliminating the need for canalplasty [3]. the minimally invasive techniques have gained popularity. There is an increasing interest in the minimally invasive techniques in otologic and neuro-otologic surgeries. Endoscopic ear surgeries were introduced in the 1990s and they gained popularity in otology. The anatomical structures of the middle ear, the anterior and posterior epitympanic spaces, tympanic sinus, and the facial recess can be visualized more clearly by endoscopy [4, 5].While a functional success is accepted to achieve an improvement in hearing along with a reduction in the airbonegap < 20 dB, an intact graft is recognized as an anatomical success [6]. There are a limited number of studies in the literature, reporting the outcomes of endoscopic tympanoplasties.

Aims And Objectives: The present study was aimed to evaluate the rate of graft success, hearing outcomes and complications in stitchless,sutureless single incision endoscopic tympanoplasty surgery and to document situations in which this endoscopic surgery was needed to convert into microscopic tympanoplasty surgery.

Material and Method;The study was done at Department of Otorhinolaryngology, Associated hospital Government medical college Baramulla.informed written consent was obtained from all participants included in the study. Fifty seven patients who had dry central perforation in tympanic membrane and planned for endoscopic tympanoplasty surgery between april 1, 2019 and september 1, 2021, were included in this study. All operations were performed by the same surgeon. The patients' age, gender, perforation side and size, preoperative and postoperative pure tone audiometry, graft failure, postoperative pain and complication status were evaluated.intra operative circumstances in which operation was converted into microscopic surgery were documented.Postoperative audiometry tests were performed 6 months after the operation, and the pure tone audiometry were obtained at 0.5, 1, 2, and 4 kHz.The criteria for admission to the study were the absence of ear drainage for the last 3 months prior to surgery, no evidence of inflammation or cholesteatoma.

All patients were operated under general and hypotensive anesthesia using 0◦ and 30◦ otoendoscopes of 2.7 mm in diameter (Karl Storz, Tuttlingen, Germany). The combination of adrenaline and lidocaine was used to infiltrate the tragal cartilage graft site and the four quadrants of the external ear canal.. The perforation edges on the tympanic membrane were refreshed by scraping its margins.The tympanomeatal flap was elevated with an incision made from 4 to 6 mm lateral to the annulus. Adrenaline- impregnated cotton was used to reduce the bleeding and facilitate the dissection during the elevation. After the flap elevation,the tympanic membrane was removed from the malleus. Subsequently, a 5 mm incision was made from the posterior part of the tragus for tragal cartilage retrieval. The tragus apex was protected to prevent cosmetic deformation. Perichondrium was peeled off from the cartilage graft, and this perichondrium graft was used as graft material for covering tympanic membrane perforation and bare cartilage piece was used to fill the gaps between ossicles in cases of ossicular discontinuity .The tympanomeatal flap was laid back into the canal and whether the perforation was completely closed was then checked. The external ear canal was then filled with spongostan.medicated guaze canal pack was kept in outer part of external auditory canal to provide aseptic pressure dressing on tragal cartilage harvesting site incision .The patients weredischarged on the first postoperative day.

Fig. 1 shows (A) the surgical field after freshening margins of perforation.elevation of the tympanomeatal flap, (B) the surgical field after elevation of the tympanomeatal flap,(C) harvesting of tragal Cartilage (D) harvested Tragal Cartilage (E) peeled of perichondrium form cartlage (F) endoscopic view of the tympanic membrane after grafting.



All statistical analyses were performed with SPSS 20.0(IBM Co., Armonk, NY, USA). Patients' characteristics, such as age and gender, perforation side and size, preoperative and postoperative pure tone audiometry, graft success rates, and duration of surgery were analyzed using the Student's and paired-sample t-tests. Statistical significance was accepted as $p < 0.05$.

Table 1; distribution of patients into endoscopy surgery group and conversion into microscopic surgery group

	male	Female	Total
Number of patients	36	21	57
Number of patients requiring tympanic membrane perforation repair with or without ossicular chain reconstruction/ tympansclerosis removal but managed by endoscopic surgery	29	20	49
Number of patients needed conversion to microscopic surgery	03	05	08

Table 2 ; patients requiring tympanic membrane perforation repair with or without ossicular chain reconstruction/ tympansclerosis removal but managed by endoscopic surgery only

	Male	female	Total
Number of patients	29 (59.18%)	20 (40.81%)	49 (100%)
Age (years) (average---range)	27.73 (15---40)	22.02 (15-35)	24.34 (15-40)
Perforation size (mm) (longitudinal axis)	5.88	6.19	6.01
Graft closure rate	96.21%	95.82%	96%
Mild Tympanosclerosis (ossified ligament/ T.s patches)	2 (4%)	3 (6%)	6 (10%)
Ossicular chain discontinuity (necrosed lenticular process of incus)	1 (2%)	2(4%)	2 (6%)
Complications	1 (2%)	2 (4%)	3 (6%)
Residual perforation	1 (2%)	1 (2%)	2 (4%)
Swelling and pain	2 (4%)	1 (2%)	3 (6%)

Table 3 Details of patients needed conversion to microscopic surgery

	Male	Female	Total
Number of patients	03	05	08
Age (years) (average-range)	29.73 (25-40)	31.02 (30-35)	30.34 (25-40)
Perforation size (mm) (longitudinal axis) average	5.74	6.11	6.0
Extensive Tympanosclerosis	2 (25%)	4 (50%)	6 (75%)
Ossicular chain discontinuity due to ossicle necrosis	1 (12.5%)	1 (12.5%)	2 (25%)

Table 4; pre and post operative Pure Tone Audiometry (PTA) Findings

Surgery	Preoperative air bone gap on PTA(mean+SD)	Postoperative air bone gap on PTA (mean+SD)	P value
Endoscopic n=49	35+5	12+5	<0.05
Microscopic n=8	42+5	20+5	<0.05

Results; fifty seven patients were enrolled in this study out of which 49 patients undergo complete surgery by endoscopic method were as in 8 patients we needed to use microscope in order to complete the surgery (Table 1). Reason for converting endoscopic surgery into microscopic during the procedure was extensive tympanosclerosis involving medial surface of maleus and/or incus in 6 patients and necrosed incus in 2 patients (table 3).

Those 49 patients who got operated completely by endoscopic procedure were 29 male and 20 females in age group 15-40.average perforation size was 6mm in longitudinal length.anatomical success rate was 96% after 6 months of surgery (Table 2).preoperative and post operative mean air bone gap (at frequencies of 0.5, 1, 2 and 4 kHz) was 35db +5 Db and 12+ 5 Db respectively with p value < 0.05. which means statistically significant improvement in hearing 6 months after surgery (Table 4).

Complications were seen in 3 patients, 1 male and 2 females all three of them had persistent otorheo and otitis externa for about 2 months after surgery. 2 patients had residual perforations after 6 months of surgery.mild swelling on tragal region and pain was noted in 3 patients after surgery 2 were males and 1 female (table 2).both swelling and pain subsided with time and required 3 days of additional anti infilamatory medications.

Discussion; Endoscopic ear surgery was applied first in an excision of a cholesteatoma and in a myringoplasty procedure.Then, the endoscope has been used in surgeries involving the middle ear, in ossiculoplasties, tympanoplasties,and in cochlear implantation operations [7].The available studies demonstrate that the endoscopic ear surgery is a reliable method with minimal complication and morbidity rates. The use of the endoscopic techniques in the middle ear operations has led to the development of the concept of minimally invasive surgery. This enabled the surgeons to avoid mastoidectomies, retroauricular incisions, and tissue dissections in selected cases [8–10]. Our study is based on this concept of minimal invasive surgery combined with use of perichondrium graft obtained from harvested tragal cartilage by small 5mm incision behind the tragus. this small incision was allowed to heal without stitching. this defines our scarless and stitchless single incision endoscopic tympanoplasty surgery.

The advantages of endoscopic tympanoplasty can be listed in the following that, when the endoscope is used, it is not necessary to manipulate the head of the patient, it is easier to evaluate the deep anatomic structures from different angles, the operation time is shorter, the postoperative pain is at a lesser intensity,and the hospitalization time is shorter. However, there are also disadvantages of the endoscopic ear surgery.The direct or thermal effect of the endoscope light may cause damage to the external auditory canal and middle ear structures. Also using one of the hands only during the endoscopic tympanoplasty procedure may hamper surgical manipulations. In the case of a sudden hemorrhage, the image provided by the endoscope can be disrupted [11, 12]. However, in the endoscopic technique,the limitations brought by only using one hand will be reduced with increasing experience. Moreover, the current information in the literature demonstrates that endoscopic tympanoplasties can be performed successfully in the hands of experienced surgeons [13]. It is because the operating surgeon in our study was not much experienced in endoscopic ear surgeries we had to convert 8 surgeries into microscopic surgeries intra operatively.

There are several studies in the literature comparing the anatomical and functional outcomes of the microscopic and endoscopic

tympanoplasty techniques. Jiyothi et al. [12] compared endoscopic and microscopic myringoplasties in a study, reporting the anatomical success rate as 91.67% for endoscopic tympanoplasty and as 93.3% for microscopic tympanoplasty. The functional success rates were reported to be 91.67 and 93.3% for endoscopic and microscopic tympanoplasties, respectively,in the same study.Anatomical success rate of endoscopic tympanoplasties in our study was 96% which is slightly higher .this can be due to less sample number and less follow up period (6 months) in our study. The functional success rate measured by improvement in pure tone average before and 6 months after surgery showed statistically significant improvement in both endoscopic surgeries and in converted microscopic surgeries.

The major difference between microscopy and endoscopy is the surgical view.Tarabichi et al[14,15] reported that the view during microscopic surgery is defined and limited by the narrowest segment of the ear canal. By contrast, transcanal endoscopy bypasses the narrow segment of the ear canal and provides a wide view, even when a 0° endoscope is used.Furukawa et al,[16]Lade et al,[17]and Harugop et al[18] conducted studies to compare the microscopic and endoscopic views in tympanoplasty. They reported that in the microscopy groups, the tympanic anulus was not completely visualized in 17%to 20% of patients, thus requiring canalplasty. However, in the endoscopy groups, the tympanic anulus was completely visualized;hence, no patient required canalplasty. Ayache[19] reported an even higher rate of 73% of patients in whom anterior perforations of the tympanic membrane were poorly visualized.

The above-mentioned endoscopic surgical technique should be preferred, especially in cases of simple tympanoplasty without ossicular involvement. In all cases in our study, the external ear canal has sufficient width and flatness. Endoscopic methods are less easily performed in cases accompanied by diseases narrowing the external ear canal, such as craniofacial anomalies and Down syndrome/ Goldenhar syndrome etc.[20] At the same time, the risk of traumatic mechanical damage due to the use of the endoscope during operation and the thermal effect of the xenon light source can be mentioned. Kaya et al.[21]stated that cochlear functions stabilized after endoscopic transcanal tympanoplasty with a cold light source. Kozin et al [22] recommended decreasing the light intensity, changing the position of the endoscope frequently, and removing the endoscope to allow tissue cooling. In the endoscopic method, the short duration of the procedure reduces the risk of light damage for both the surgeon and the patient. The main risky process for light damage was assessed as after the tympanomeatal flap and annulus elevation. Promontorium is under direct light especially in removing the tympanic membrane from the malleus. in our study we decreased the illumination of our light source to 35% to prevent this thermal damaging effect of light and also to decrease glare produced by reflection of direct light from promontory.we performed all procedures under general anesthesia hence prevented the harmfull effects of head movement during surgery.in our study we achieved heamostasis by injecting 1ml of 1:10000 adrenaline injection in the four quadrants of external auditory canal and by using small cotton balls soaked in 1:1000 adrenaline solution during tympanomeatal flap elevation.

In the presence of anterior tympanic membrane perforations,the anterior part of the residual membrane may not be appropriately viewed by microscopic approach in some patients, while endoscopy allows adequate visualization of this region [23]. Furukawa et al. (2014) [16] reported that the perforation edges could not be completely visualized by microscopic approach in 12% of the cases before denudation. Moreover, they maintained that the perforation edges could not be completely visualized in 20% of the cases following membrane denudation. Endoscopic myringoplasty technique can be beneficial in patients with narrow ear canals, in the presence of anterior tympanic membrane perforations, in patients with bone protrusions in the ear canal, and in cases where the perforation edges cannot be easily visualized (Poe and Bottrill, 1994) [24]. In our study we could operate all cases of anterior tympanic membrane operforations, narrow external canal due to exostosis and large tympanic membrane perforations by endoscopic method. Only cases which required major ossicular reconstruction and extensive tympanosclerosis cases were converted into microscopic procedures.

Conclusion;SSSI endoscopic tympanoplasty is best method for repair of tympoanic membrane perforations , for minor ossicular chain repair and also for removal of limited middle ear tympanosclerosis.surgery by this method is scarless and stitchless which leads less morbidity and less psychological trauma to the patient.graft uptake and audiological results are similar to microscopic surgery.conditions like extensive tympanosclerosis and major pathology in ossicular chain which in this study needed conversion into microscopic surgery can be managed by endoscopic method also as soon as surgical expertise of operating surgeon increases with time.

REFERENCES

1. Coskun, B.U., Cinar, U., Seven, H., Ugur, S., Dadas, B., 2006 Sep. The effects of the incision types in myringoplasty operations on cosmesis. Eur. Arch. Otorhinolaryngol. 263 (9), 820e822.
2. Kessler, A., Potsic, W.P., Marsh, R.R., 1994 May. Type 1 tympanoplasty in children. Arch. Otolaryngol. Head Neck Surg. 120 (5), 487e490.
3. Patel, J., Aiyer, R.G., Gajjar, Y., Gupta, R., Raval, J., Suthar, P.P., 2015.Endoscopic tympanoplasty vs microscopic tympanoplasty in tubotympanic CSOM: a comparative study of 44 cases. Int. J. Res. Med. Sci. 3 (8),1953e1957.
4. Kaya I, Turhal G, Ozturk A, Gode S, Bilgen C, Kirazli T. Results of endoscopic cartilage tympanoplasty procedure with limited tympanomeatal flap incision. Acta Otolaryngol. 2017;137(11):1174–7. https://doi.org/10.1080/ 00016489.2017.1354393.
5. Hunter JB, O'Connell BP, Rivas A. Endoscopic techniques in tympanoplasty and stapes surgery. Curr Opin Otolaryngol Head Neck Surg. 2016;24(5):388–94. https://doi.org/10.1097/MOO.0000000000000297.
6. Yegin Y, Çelik M, Koç AK, Küfeciler L, Elbistanlı MS, Kayhan FT. Comparison of temporalis fascia muscle and full-thickness cartilage grafts in type 1pediatric tympanoplasties. Braz J Otorhinolaryngol. 2016;82(6):695–701. https://doi.org/10.1016/j.bjorl.2015.12.009
7. Kozin ED, Gulati S, Kaplan AB, Lehmann AE, Remenschneider AK, Landegger LD, et al. Systematic review of outcomes following observational and operative endoscopic middle ear surgery. Laryngoscope. 2015;125(5):1205– 14. https://doi.org/10.1002/lary.25048
8. Tarabichi M. Transcanal endoscopic management of cholesteatoma. Otol Neurotol. 2010;31(4):580–8. https://doi.org/10.1097/MAO.0b013e3181db72f8.
9. Marchioni D, Villari D, Alicandri-Ciufelli M, Piccinini A, Presutti L. Endoscopic open technique in patients with middle ear cholesteatoma. Eur Arch Otorhinolaryngol. 2011;268(11):1557–63. https://doi.org/10.1007/s00405-011-1533-y.
10. Marchioni D, Alicandri-Ciufelli M, Gioacchini FM, Bonali M, Presutti L.Transcanal endoscopic treatment of benign middle ear neoplasms. Eur Arch Otorhinolaryngol. 2013;270(12):2997–3004. https://doi.org/10.1007/s00405-013-2371-x.
11. Dundar R, Bulut H, Yukkaldiran A, Guler OK, Demirtas Y, Iynen I, et al. Temperature rises in the round window caused by various light sources during insertion of rigid endoscopes: an experimental animal study. ClinOtolaryngol. 2016;41(1):44–50. https://doi.org/10.1111/coa.12468.
12. Jyothi AC, Shrikrishna BH, Kulkarni NH, Kumar A. Endoscopic Myringoplastyversus microscopic Myringoplasty in Tubotympanic CSOM: a comparative study of 120 cases. Indian J Otolaryngol Head Neck Surg. 2017;69(3):357–62. https://doi.org/10.1007/s12070-017-1147-9.
13. Tseng CC, Lai MT, Wu CC, Yuan SP, Ding YF. Learning curve for endoscopic tympanoplasty: initial experience of 221 procedures. J Chin Med Assoc. 2017;80(8):508–14. https://doi.org/10.1016/j.jcma.2017.01.005.
14. Tarabichi M. Endoscopic middle ear surgery. Ann Otol Rhinol Laryngol. 1999;108(1):39-46.
15. Tarabichi M, Ayache S, Nogueira JF, Al Qahtani M, Pothier DD. Endoscopic management of chronic otitis media and tympanoplasty. Otolaryngol Clin North Am. 2013;46(2):155-163.
16. Furukawa T,Watanabe T, Ito T, Kubota T, Kakehata S. Feasibility and advantages of transcanal endoscopicmyringoplasty. Otol Neurotol. 2014;35 (4):e140-e145.
17. Lade H, Choudhary SR, Vashishth A. Endoscopic vs microscopicmyringoplasty: a different perspective. Eur Arch Otorhinolaryngol.2014;271(7):1897-1902.
18. Harugop AS, Mudhol RS, Godhi RA. A comparative study of endoscope assisted myringoplasty and micrsoscope assisted myringoplasty. Indian J Otolaryngol Head Neck Surg. 2008;60(4):298-302.
19. Ayache S. Cartilaginousmyringoplasty: the endoscopic transcanal procedure. Eur Arch Otorhinolaryngol. 2013;270(3):853-860.
20. Yin D, Li C, Juan H, Li J, Yang L, Zhang T, et al. Morphological characteristics of osseous external auditory canal and its relationshipwith external auditory canal cholesteatoma in patients with congenital aural stenosis. Otol Neurotol. 2017;38:1528---34.
21. Kaya I, Turhal G, Ozturk A, Gode S, Bilgen C, Kirazli T. The effect of endoscopic tympanoplasty on cochlear function. Clin Exp Otorhinolaryngol. 2018;11:35---9.
22. Kozin ED, Lehmann A, Carter M, Hight E, Cohen M, Nakajima HH,et al. Thermal effects of endoscopy in a human temporal bone model: implications for endoscopic ear surgery. Laryngoscope. 2014;124:332---9.
23. Migirov L, Wolf M. Minimally invasive transcanal endoscopic ear surgery. http://dx.doi.org/10.5772/60551.
24. Poe, D.S., Bottrill, I.D., 1994 Nov. Comparison of endoscopic and surgical explorations for perilymphatic fistulas. Am. J. Otol. 15 (6), 735e738.