Original Research Article

DOI: http://dx.doi.org/10.18203/issn.2454-5929.ijohns20184677

Office myringoplasty by chemical cauterization and paper patching: a prospective study

Garima Upreti*

Department of ENT, Army College of Medical Sciences and Base Hospital, Delhi, India

Received: 10 October 2018 Accepted: 26 October 2018

*Correspondence: Dr. Garima Upreti,

E-mail: grmprt@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Surgery for tympanic membrane perforation entails its own morbidity, risk of anesthesia, psychological trauma, along with long waiting periods for patients, especially in a tertiary care centre like ours. The purpose of this study was to evaluate outcomes of chemical cauterization and patching of perforation, performed as an office procedure in select cases.

Methods: The study was conducted in a tertiary hospital from January 2016 to December 2017. The patients were selected based on the inclusion criteria, after thorough clinical assessment, examination under microscope and pure tone audiogram. All cases underwent cauterization of margins of perforation using 10% trichloroacetic acid (TCA), followed by patching with appropriately sized pre-sterilized cigarette paper patch. The patients were followed up weekly till the perforation was completely healed or till 12 weeks. If required, the procedure was repeated.

Results: 68 cases were included in the study. Most common site of perforation was antero-inferior quadrant of pars tensa. Most common etiology was inflammatory. Number of applications ranged from 1 to 3. The procedure was successful in 62 cases (91.2%). All cases with traumatic perforation, residual perforation post-surgery and persistent perforation after grommet extrusion healed well. All 6 cases with treatment failure had inflammatory etiology, 4 involving postero-superior quadrant.

Conclusions: In patients with small, central, dry perforation of tympanic membrane, chemical cauterization using TCA and paper patching can yield results comparable to that of surgery, while abating the morbidity and psychological trauma of surgery and saving time for both patient and doctor.

Keywords: Tympanic membrane perforation, Myringoplasty, Chemical cautery, Trichloroacetic acid, Paper patching

INTRODUCTION

Tympanic membrane perforations are a common cause for seeking otologic consultation, the etiology being infectious, traumatic or iatrogenic. Long standing perforations can lead to pain, increased susceptibility to middle ear infection, cholesteatoma formation, non-physiological gas exchange, tympanosclerosis, and contribute to conductive hearing loss.

The purpose of myringoplasty is to restore the continuity of the tympanic membrane in order to improve hearing and reduce the incidence of middle ear infections.

With the advent of microscopes (and now otoendoscopes) surgery has long been established as the mainstay of management, with successful closure rates over 90% in most series. Surgery however has its own inherent morbidity, besides being expensive and time consuming. It entails long waiting periods on surgical schedules for the patients especially in a tertiary care centre like ours.

Complications of surgical myringoplasty include damage to chorda tympani nerve, middle ear ossicles, tear of tympanomeatal flap, violation of tissue planes and middle ear, besides the risk of anesthesia and psychological trauma of surgery. Residual or re-perforations can require multiple surgeries to reconstruct, which, in turn, may limit donor fascia in the operative field and can increase donor site morbidity. Failure rates increase with history of recurrent infections and revision myringoplasty.²

Considering the above factors, chemical cauterization of margins of perforation with paper patching of perforation, not only avoids the above mentioned complications, but is cost effective and time saving for both the doctor and the patient.

Chemical closure has its own drawbacks. It requires multiple office visits and patience on the part of both the patient and the doctor. The closure rates of chemical myringoplasty in small perforations before the era of surgical closure rivals that of today's surgery. It can be used for smaller perforations in ears which are dry, with no ear pathology such as signs of inflammation, cholesteatoma, granulations or retraction pockets.

The most widely used chemical for closure is trichloroacetic acid (TCA). The use of TCA for chemical cauterization of margins of perforation was introduced by Okuneff in 1895.³ Juers reported a closure rate of 85-90% with an average of 5-6 treatment visits.⁴ Derlacki reported a 75% closure rate with an average of 14 office treatments carried out at biweekly intervals.⁵ Dunlap treated 15 cases with 100% closure rate (3-33 visits at 2 week intervals).³

Blake in 1887 introduced the paper patch graft.⁶ As shown by Schmitt in the animal model proliferation of stratified squamous epithelium at the edges of perforation begins within 12 hours of perforation and continues at the rate of 1 mm per day. Connective tissue and pavement epithelium on the inner surface however begin to regenerate only after several days. Dunlap and Schuknecht illustrated by means of histological section that when the stratified squamous epithelium grows inwards over the edges of perforation to meet the mucosal epithelium within, the perforation ceases to heal.⁷

The chief objective of paper patch myringoplasty as described by Juers in 1958 are to break and evert the stratified squamous epithelial barrier along the perforation margin, to stimulate tympanic membrane growth and to provide a scaffold for guiding the growth of squamous epithelium.⁴

The purpose of this study was to report the results of chemical cauterization with TCA and paper patch myringoplasty performed as an out-patient procedure, in

long standing dry perforations of the tympanic membrane, to study the number of applications and time needed for complete closure of perforations.

METHODS

This study was carried out in a tertiary care centre from January 2016 to December 2017. The cases were selected amongst those attending the outpatient department during the study period, based on history, clinical assessment, examination under microscope, oto-endoscopy and pure tone audiogram. Cases were included after informed consent based on the following criteria.

Inclusion criteria

Inclusion criteria were small perforation involving single quadrant of pars tensa or $\leq 25\%$ area of pars tensa; size not exceeding 4 mm in diameter (estimated using calipers under microscope); ear dry for at least 3 weeks; air bone gap ≤ 40 dB.

Exclusion criteria

Exclusion criteria were air bone gap >40 dB; marginal perforation; discharging ear; any localized retraction pockets; epithelium ingrowth along margins of perforation; granulations; edematous middle ear mucosa.

Procedure

For local anesthesia, a cotton ball soaked in 4% lignocaine was applied in the external auditory canal under an operating microscope, preventing lignocaine from entering the middle ear cavity.

Under microscope, the margins of perforation were deepithelialised with 10% trichloroacetic acid using a Zollner's needle. Care was taken to avoid spillage of TCA inside the middle ear cavity.

Cigarette paper patch (pre-sterilized by placing in ethylene oxide gas chamber) was trimmed to provide approximately 1-2 mm overlapping margins along the perimeter of the perforation. It was placed over the perforation using alligator forceps. Subsequently, a cotton-tipped applicator soaked in steroid-containing ciprofloxacin ear drops was used to wet the paper to enable it to adhere to the remaining tympanic membrane. The paper patch was secured with 1-2 pieces of gelfoam.

Neither oral antibiotics nor topical drops were prescribed post procedure, with the instructions to avoid nose blowing and avoid water entering into the ear. No packing of external auditory canal was done.

Follow up

The patient was followed up weekly till the perforation was completely healed or till 12 weeks. If the paper patch was not seen in place, the procedure was repeated. If the

perforation did not heal in maximum 12 weeks, it was considered as treatment failure and patient was taken for surgical tympanoplasty.

Once the perforation healed, a repeat pure tone audiogram was performed after 3 months to compare pre and post procedure hearing status.

Criteria for successful procedure were:

- Closure of perforation
- Closure of air bone gap to ≤15 dB

Outcome analysis

The cases were classified based on the quadrant of pars tensa involved and etiology of perforation. The findings were recorded. The outcomes were evaluated based on the success of treatment procedure and number of times the procedure had to be repeated in each sub–group.

RESULTS

During the study period, 68 patients, meeting the inclusion criteria, underwent office myringoplasty with paper patching. Of these 30 were males and 38 were females with age ranging from 15 to 56 years (average 34.6 years).

Table 1: Distribution of patients based on quadrant of pars tensa involved.

Quadrant involved	Number of patients				
ASQ	6				
AIQ	26				
PIQ	22				
PSQ	14				
Total	68				

ASQ: Antero-superior quadrant; AIQ: Antero-inferior quadrant; PIQ: Postero-inferior quadrant; PSQ: Postero-superior quadrant.

Table 2: Distribution of patients based on etiology of tympanic membrane perforation.

Etiology	Number of patients
Inflammatory	38
Traumatic	16
Iatrogenic	6
Residual perforation post-surgery	8
Total	68

All cases had central tympanic membrane perforations and surrounding pars tensa was well vascularized and non-atrophic. Perforations were classified based on the quadrant of pars tensa involved (as depicted in Table 1), and the etiology of perforation (as depicted in Table 2).

Most commonly involved quadrants were antero-inferior and postero-inferior. Most common etiology of perforation was inflammatory, followed by traumatic perforation. 8 cases with residual perforation after previous surgical myringoplasty and 6 cases with history of myringotomy and grommet insertion in the past with persistent perforation (iatrogenic) were also included in this study.

In all cases, the procedure was tolerated well without any complications. Number of applications ranged from 1 to 3. The procedure was successful (i.e. closure of perforation and air-bone gap within 15 dB) in 62 cases (91.2%).

All cases with traumatic perforation, residual perforation post-surgery and persistent perforation after grommet extrusion healed well requiring one to two applications.

The 6 cases with failure even after three applications had inflammatory etiology, 2 involving antero-inferior and 4 involving postero-superior quadrants. These were taken up for surgical myringoplasty later.

Table 3: Distribution of patients in whom successful outcome was achieved, as per the site and etiology of perforation and number of applications required.

Number of applications	Number of cases	Distribution according to quadrant involved			ng to	Distribution according to etiology			
		ASQ	AIQ	PIQ	PSQ	Inflammatory	Traumatic	Iatrogenic	Residual perforation post-surgery
1	34		12	16	6	12	10	6	6
2	22	4	8	6	4	14	6		2
3	6	2	4			6			

ASQ: Antero-superior quadrant; AIQ: Antero-inferior quadrant; PIQ: Postero-inferior quadrant; PSQ: Postero-superior quadrant.

DISCUSSION

In permanent perforations the outer epithelial layer grows medially along the edge of the perforation to contact the inner mucosal layer preventing spontaneous closure. This epithelium should therefore be removed using chemical cauterization (TCA used in this study). This also stimulates epithelial proliferation. The paper patch acts as a scaffold for the epithelium to grow over.⁴

The success rate of surgical myringoplasty varies amongst authors and techniques exceeding 90% in most studies in primary repaired cases. For some patients the risks, cost and inconvenience of surgery are significant concerns. These patients benefit from simple, inexpensive non-surgical office based procedures, with the topical application of TCA found to be the best individual procedure. Here we combine it with paper patching to bridge the perforation and promote healing.

The use of paper patch in an outpatient setting has been a widely used technique for many decades. Several studies have demonstrated that paper patches can be used to promote the healing of perforated tympanic membranes while avoiding a formal surgical procedure. ^{6,9}

Since paper patch tends to get detached during swallowing, yawning, chewing, reapplication is often required.

The size of tympanic membrane perforation has been reported to be the prognostic indicator for successful patch myringoplasty. In study by Golz et al the closure rates were 55.7% in small perforations while that for larger perforations (>5 mm) the closure rate was 12.5%. They recommended paper patching as the first treatment option for tympanic membrane perforations smaller than 5 mm.

Lee et al evaluated only chronic otitis media and followed up the cases through five trials of paper patching, concluding that tympanic membrane perforations of less than 4 mm had significantly higher closure rates. ¹⁰ Park et al have also reported that the outcome predictor of paper patch myringoplasty was perforation size. ¹¹ Other authors too have also found paper patching to be disappointing for larger perforations. Hence in this study only perforations up to 4 mm diameter was included.

We did not use any oral antibiotics post procedure based on the study of Kotecha et al concluding that prophylactic antibiotic did not influence the success rate of myringoplasty. 12

Iatrogenic trichloroacetic acid injury causing necrotizing otitis media, hearing loss and facial paralysis has been reported. ¹³ This did not occur in our series.

The success rate of procedure in our study is 91.2% which is similar to or better than that reported by various authors. 11,14-19

However, our general success rate is lower than that reported by Lou et al.¹⁷ In their study, almost 98% of 504 cases with traumatic TM perforations were acute onset (within 1 month after a trauma), and a spontaneous healing rate of 89% cases was reported. In our study, all perforations with traumatic etiology healed well, whereas

the ones in which the procedure failed had inflammatory etiology.

We have not performed this procedure in pediatric patients. So no conclusion can be made regarding results in these patients. The possibility of performing this as an out-patient procedure has cut down the waiting list and created time and space for other procedures.

CONCLUSION

In carefully selected patients with small central perforation of tympanic membrane, office myringoplasty by chemical cauterization of margins using trichloroacetic acid and paper patching can yield results comparable to that of surgery, while abating the morbidity and psychological trauma of surgery.

Though multiple visits are required, it is a safer, more economical procedure. Since it can be performed as an out-patient procedure, it saves the patient from long waiting periods for surgery. Also, with requirement of minimal sophisticated equipments, this can be tried out even by practitioners working at a peripheral set up.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

REFERENCES

- Sergi B, Galli J, De Corso E, Parrilla C, Paludetti G. Overlay versus underlay myringoplasty: report of outcomes considering closure of perforation and hearing function. Acta Otorhinolaryngol Ital. 2011;31(6):366–71.
- Berger G, Ophir D, Berco E, Sadé J. Revision myringoplasty. J Laryngol Otol. 1997;111(6):517– 20.
- 3. Goldman NC. Chemical closure of chronic tympanic membrane perforations. ANZ J Surg. 2007;77(10):850–1.
- 4. Juers AL. Office closure of tympanic perforations Passe? Laryngoscope. 1968;78:756–8.
- Derlacki EL. Repair of central perforations of tympanic mem- brane. Arch. Otolaryngol. 1953;58:405–20.
- Golz A, Goldenberg D, Netzer A, Fradis M, Westerman ST, Westerman LM, et al. Paper patching for chronic tympanic membrane perforations. Otolaryngol Head Neck Surg. 2003;128(4):565-70.
- 7. Dunlap AM, Schuknecht HF. Closure of perforations of the tym-panic membrane. Laryngoscope. 1947;57:479–90.
- 8. Maria PLS, Oghalai JS. Is office-based myringoplasty a suitable alternative to surgical tympanoplasty? Laryngoscope. 2014;124(5):1053–4.

- Dursun E, Dogru S, Gungor A, Cincik H, Poyrazoglu E, Ozdemir T. Comparison of paperpatch, fat, and perichondrium myringoplasty in repair of small tympanic membrane perforations. Otolaryngol - Head Neck Surg. 2008;138(3):353–6.
- 10. Lee SH, Jin SM, Lee KC, Kim MG. Paper-patch myringoplasty with CO2laser for chronic TM perforation. Eur Arch Oto-Rhino-Laryngol. 2008;265(10):1161–4.
- Park SN, Kim HM, Jin KS, Maeng JH, Yeo SW, Park SY. Predictors for outcome of paper patch myringoplasty in patients with chronic tympanic membrane perforations. Eur Arch Oto-Rhino-Laryngology. 2013;272(2):297–301.
- 12. Kotecha B, Fowler S, Topham J. Myringoplasty: A prospective audit study. Clin Otolaryngol Allied Sci. 1999;24(2):126–9.
- 13. Halle TR, Todd NW, Fainberg J. Iatrogenic trichloroacetic acid injury causing necrotizing otitis media and deafness. Int J Pediatr Otorhinolaryngol. 2017;97:139–42.
- 14. Lee DH, Kim J, Shin E, Kim Y, Cho Y. Clinical analysis of paper patch myringoplasty in patients with tympanic membrane perforations. J Int Adv Otol. 2016;12(2):142–6.
- Pribitkin EA, Handler SD, Tom LW, Potsic WP, Wetmore RF. Ventilation tube removal. Indications

- for paper patch myringoplasty. Arch Otolaryngol Head Neck Surg.1992;118(5):495-7.
- Santhi T, Rajan KV. A Study of Closure of Tympanic Membrane Perforations by Chemical Cauterisation. Indian J Otolaryngol Head Neck Surg. 2012;64(4):389–92.
- 17. Stroud M. Office myringoplasty.. The Laryngoscope 1985; 95(12): 1549-50.
- 18. Camnitz PS, Bost WS. Traumatic perforations of the tympanic membrane: Early closure with paper tape patching. Otolaryngol- Head Neck Surg. 1985;93(2):220–3.
- 19. Lou ZC, He JG. A randomised controlled trial comparing spontaneous healing, gelfoam patching and edge-approximation plus gelfoam patching in traumatic tympanic membrane perforation with inverted or everted edges. Clin Otolaryngol. 2011;36(3):221–6.

Cite this article as: Upreti G. Office myringoplasty by chemical cauterization and paper patching: a prospective study. Int J Otorhinolaryngol Head Neck Surg 2019;5:55-9.