Myringoplasty: Impact of Size and Site of Perforation on the Success Rate

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Abstract Myringoplasty aims to reconstruct the tympanic membrane, restoring protection to the middle ear and improve hearing. Success of Myringoplasty in terms of anatomical closure is influenced by many factors. This study focuses on the influence of size and site of tympanic membrane perforation on success rate of Myringoplasty. This is a prospective study of 60 patients who underwent myringoplasty and were then followed up for 6 months from the date of operation. Patients with dry perforation, with good cochlear reserve, intact and mobile ossicular chain, functioning Eustachian tube were selected randomly for the operation. Video Otoendoscopy of all cases with storz 0 degree endoscope were done. All images were recorded on the computer [DELL VOSTRO 3400]. Using ‘Image J’ [version 1.35j] geometrical package, the area of perforation (P) and the entire area of the tympanic membrane (T) were calculated. Then, the percentage area of the perforation [$P/T \times 100 \%$] for each ear was obtained. Site of perforation also documented. Success rate for pin-point and small perforations was 100 %, for medium size 80 %, and for large & subtotal perforations 69.2 and 42.9 % respectively. We regard size of the perforation as a major factor that influences success of Myringoplasty. Site of perforation failed to be a statistically significant influencing factor in this study.

Keywords Myringoplasty · CSOM · Tympanic membrane perforation

Introduction

The repair of tympanic membrane (TM) dates back more than a century. In 1878 Berthold [1] successfully closed a perforation with full thickness skin graft and introduced the term ‘Myringoplastik’. The term myringoplasty refers to reconstructive surgery that is limited to the TM only. By definition any manipulation of the ossicular chain is beyond the scope of a pure myringoplasty. The term myringoplasty and tympanoplasty without ossicular reconstruction (type-I tympanoplasty) are synonyms unless other manipulation of the middle ear is included in the tympanoplasty procedure. Tympanic membrane perforation is a condition as old as the evolution of the human species. It is one of the most common causes of hearing impairment. Among the many causes, infection is the principle cause of TM perforation. Infection may be bacterial or mycobacterial, acute or chronic. Perforation of TM may be caused by various types of trauma—blunt trauma, penetrating trauma, surgical trauma etc. Perforations due to trauma and acute infection usually heal if treated timely. A simple perforation of pars tensa with intact annulus (central perforation) with no additional lesion of the middle ear is indicated for myringoplasty. In these conditions myringoplasty serves two purposes: 1. Isolate the middle ear cavity from external environment and prevent contamination by exposure to pathogens. 2. Restores the vibratory area of TM and affords round window protection, thus improving hearing. Now the success of myringoplasty in terms of anatomical closure (graft take) and audiological improvement is influenced by many factors, like size of perforation, site of perforation, previous surgery to that ear, experience of surgeon, infection at the time of surgery, Eustachian tube dysfunction, presence of tympanosclerosis, graft material, age of the patient etc. Our study focused on the influence of two factors, size of perforation and site of perforation on the success rate of myringoplasty.

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Aims and Objective

To investigate the impact of size and site of TM perforation on the success rate of myringoplasty.

Materials and Methods

This is a prospective study of 60 patients who attended the OPD of ENT department of SSKM Hospital and IPGME&R, Kolkata and were operated for TM defect between April 2010 and March 2011. The patients were followed up for 6 months from the date of operation. Ethical clearance for the study was obtained from the Institutional Ethics Committee, IPGME&R. Patients were assigned to the study randomly from those patients fulfilling the inclusion and exclusion criteria. Consent (informed, written and well understood) was obtained from each patient. The aims and objectives of the study, the benefits to be obtained, the confidentiality of participants and results, the voluntary nature of participation and free-will to withdraw from the study without penalty were clearly spelt out to the participants.

Inclusion Criteria

1. Patients belonging to both genders, with ages ranging from 16 to 60 years.
2. Patients with chronic otitis media, non-healing traumatic TM perforations and residual perforation following ASOM.
3. Having dry TM perforation for at least 6 weeks.
4. Patients with good cochlear reserve.
5. Patients with healthy middle ear mucosa.

Exclusion Criteria

1. Age <16 years and >60 years.
2. Patients previous failed myringoplasty.
3. Patients with cholesteatoma, retraction pockets or associated mastoiditis.
4. Known Eustachian tube dysfunction (diagnosed by–Valsalva test and Impedence Audiometry).
5. Patients with upper respiratory tract pathologies, including DNS, sinusitis, chronic tonsillitis or pharyngitis.
6. Patients with deformity of external auditory canal.
7. Patients with malignancy, diabetes, and other debilitating disease.

Parameters to be Studied

- (a) Pre-operative otoscopic and video otoendoscopic examination to document size of perforation (in percentage) and site of perforation (Ant., Post., Inf. and Central).

- (b) Post-operative otoscopic examination.

Determination of Perforation Size and Site [2]

Video otoendoscopy of all cases with Storz 0 degree endoscope was done. All images were recorded on the computer [DELL VOSTRO 3400]. Using 'Image J' [version 1.35j] of Wayne Rasband, National Institute of Health USA] geometrical package, the area of perforation (P) and the entire area of the tympanic membrane (T) were calculated. Then, the percentage area of the perforation [$P/T \times 100 \%$] for each ear was obtained. For the purpose of this study, the TM was divided into four segments for clarity (1–3 represents the three quadrants and the 4 represents involvement of more than one quadrant.). (1) Anterior; (2) Posterior; (3) Inferior and (4) Central for the localization of the site of perforation. To exclude other confounding factors all cases were operated through post-auricular approach, using underlay technique. We used temporalis fascia graft for all cases (Fig. 1).

Result

Sixty consecutive patients fulfilling the inclusion criteria underwent myringoplasty between April 2010 and March 2011. For statistical analysis we divided sixty patients into five groups according to their size of perforation; Pinpoint ($\leq 20 \%$), Small (21–40 %), Medium (41–60 %), Large (61–80 %), Subtotal ($>80 \%$) and into four groups according to their site of perforation; Anterior(A), Posterior(P), Inferior(I), Central(Cn). Result was analyzed according to these groups. We used Pearson's Chi square test, Paired *t*-test, unpaired *t*-test and correlation study to evaluate the results. We regarded *p*-value smaller than 0.05 as significant. In this study the age range of patients were from 16 to 60 years, although most patients were within 21–30 years of age. In our study the number of males was more than that of females and male: female ratio was 1.3:1. Left sided disease was predominant in our study and right:left was 1:1.3. Mean duration of symptom was 12.27 (± 7.70) months. Hearing loss alone was found to be most common symptom in our study. CSOM was the predominant cause of perforation (Fig. 2).

In our study, among 60 myringoplasties, success rate was 80 % (*n* = 48) and failure was 20 % (*n* = 12). Success rate for pin-point and small perforations was 100 %, for medium perforations 80 %. But in large and subtotal perforations success rates were 69.2 and 42.9 % respectively. We regard size of the perforation as a major factor that influenced success of myringoplasty (Table 1).

Fig. 1 Objective assessment of perforation size by “Image J”

Fig. 2 Success rate according to Size

In our study success rate was highest (100 %) for posterior perforations and lowest (74.4 %) for central perforations. In Anterior and Inferior perforations it was 75.0 and 85.7 %. Success rates among the site groups were not statistically significant (Table 2).

Discussion

Many published studies have identified myringoplasty as a successful procedure for closing TM perforations and

improving air conduction hearing. However, the impact of perforation size and site upon myringoplasty success is poorly documented. This study is aimed at finding out these aspects of myringoplasty surgery. Intact graft after 1 month of surgery was taken as anatomical success.

In our study among 60 myringoplasty success rate was 80 % (n = 48) and failure was 20 % (n = 12). In literature the success rates of myringoplasty vary widely.

In our study success rates according to size were statistically significant (p-value 0.018). So size does matter in myringoplasty success. In literature there are varied opinions regarding this view.

P. Lee, G. Kelly and R.P. Mills [3] in their study ‘myringoplasty: does the size of the perforation matter?’ have shown success rate in small perforations is 74 % but in large perforations, their success rate was only 56 %.

Francisco J. Aviles Jurado et al. (2008) [4] in their study found success rate for small perforations as 90 % and for large perforations as 54.54 %.

Sudhangshu shekhar Biswas et al. (2010) [5] and Zu-lkifal Awan et al. (2008) [6] also found that small perforations had better success rate. Some more studies shown below (Table 3).

In our study success rate was highest (100 %) for posterior perforations and lowest (74.4 %) for central perforations. In Anterior and Inferior perforations it was 75.0 and 85.7 %. Success rate among the site groups was not

Table 1 Result according to size group

		Result		Total
		Failure	Success	
Size group	<20 % (pin point)	0	8	8
		0.0 %	100.0 %	100.0 %
	21–40 % (small)	0	12	12
		0.0 %	100.0 %	100.0 %
	41–60 % (medium)	4	16	20
	61–80 % (large)	4	9	13
		30.8 %	69.2 %	100.0 %
	>80 % (subtotal)	4	3	7
Total		57.1 %	42.9 %	100.0 %
		12	48	60
		20.0 %	80.0 %	100.0 %

Pearson Chi Square Test (DF-4): p-value = 0.018 (< 0.05)

Table 2 Result according to site groups

		Result		Total
		F	S	
Site group	Anterior (A)	1	3	4
		25.0 %	75.0 %	100.0 %
	Posterior (P)	0	10	10
		0.0 %	100.0 %	100.0 %
	Inferior (I)	1	6	7
	Central (Cn)	10	29	39
		25.6 %	74.4 %	100.0 %
	Total	12	48	60
		20.0 %	80.0 %	100.0 %

Pearson Chi Square Test (DF-3): p-value = 0.323(>0.05)

Fig. 3 Success rate according to Site

statistically significant (p value 0.323). So in our study site of perforation is not a prognostic factor for myringoplasty success (Fig. 3).

Anterior perforations are technically more difficult to access and the blood supply is also poorer. So many

authors have mentioned that the perforation site influences prognosis more than the perforation size. Bhat NA et al. (2000) [17]; Gersdorff M et al. (1995) [18] in their studies found success to be dependent on site.

Singh et al. (2005) [19] showed that graft integration rate was 34 % in anterior perforations, 91 and 100 % in inferior and posterior perforations respectively.

In our study we found that success rate in posterior perforations are better than anterior perforations but it was not significant statistically.

José Carlos Bolini de Lima et al. (2011) [20] in their study found that success rate does not depend on location of perforation. Sade J et al. (1981) [21]; Meranda D et al. (2007) [22] and Leonardo E et al. (2008) also found that site of perforation does not influence success rate of myringoplasty.

Mean duration of follow up was 9.53(± 3.20) months. Minor post-operative complications occurred in 40 % of

Table 3 Comparative studies

Success depends on size	Success doesn't depend on size
Francisco J. Aviles Jurado et al. (2008) [4]	Vartianinen and Nuutinen (1993) [11]
Black and Wormald (1995) [7]	Yung (1995) [12]
Adkins and White (1984) [8]	Denoyelle et al. (1999) [13]
P. Lee, G. Kelly and R.P. Mills [3]	de Grado et al. (1993) [14]
S. A. Al-Ghamdi (1994) [9]	Black et al. (1995) [15]
Ophir et al. (1987) [10]	Prescott and Robartes (1991) [16]

cases, among them otorrhea and OME/atelectasis were most prevalent. All the minor complications could be treated with simple measures.

Conclusion

- This is a large prospective study with objective, standardized perforation size assessment methods in order to confirm the result as genuinely valid and also to overcome the pit-falls of previous studies.
- Size does matter. Success of myringoplasty surgery depends on pre-operative perforation size.

Conflict of interest The authors declare that there is no conflict of interest.

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