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MAIN ARTICLE

Factors affecting myringoplasty success

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Abstract

Objective: To identify factors that significantly influence myringoplasty success.

Methods: A retrospective study was performed of all adults and children who underwent myringoplasty from January 2005 to January 2010 in a teaching hospital. Outcome measures were tympanic membrane perforation closure and air–bone gap closure to within 20 dB HL. The factors assessed were the surgeon grade, pre-operative condition of the ipsilateral and contralateral middle ears, perforation site, perforation size, graft material, and whether simultaneous cortical mastoidectomy was performed. Factors with statistically significant effects were determined by logistic regression analysis.

Results: In the adult group, the perforation site significantly influenced tympanic membrane closure ($p = 0.016$): anterior ($p = 0.008$) and subtotal ($p = 0.017$) sites had the greatest influence. None of the factors proved to have a significant influence on tympanic membrane closure in the paediatric group.

Conclusion: There was a significant association between perforation site and tympanic membrane perforation closure in adults. Anterior and subtotal perforations had a significantly reduced closure rate.

Key words: Myringoplasty; Tympanic Membrane; Adult; Child; Hearing

Introduction

Myringoplasty is a well-established procedure for tympanic membrane perforation closure. A variety of methods exist, employing different techniques and materials. Although many factors are thought to affect the success rate, there is no consensus. Therefore, our study aimed to identify which factors significantly influence tympanic membrane perforation closure.

Materials and methods

A retrospective study was performed of all patients, both adults and children (i.e. less than 16 years old) who underwent myringoplasty from January 2005 to January 2010 in a teaching hospital. All patients were identified using the theatre coding system. Inclusion and exclusion criteria used were in accordance with the National Comparative Myringoplasty Audit.[1] Inclusion criteria comprised perforations of the pars tensa, all age groups, and cortical mastoidectomy and myringoplasty for non-cholesteatoma ears. Exclusion criteria comprised cholesteatoma surgery and concomitant ossiculoplasty. The two main outcome measures were an intact tympanic membrane and air–bone gap (ABG) closure by at least 20 dB HL or by at least 10 dB HL if the ABG was within 20 dB HL at post-operative follow up.

Potential influencing factors were surgeon grade (consultant, associate specialist or registrar); pre-operative condition of the ipsilateral middle ear (inactive or active chronic otitis media, with persistent or intermittent discharge); pre-operative condition of the contralateral middle ear (normal, otitis media with effusion, inactive chronic otitis media or active chronic otitis media); perforation site (anterior, posterior, inferior or subtotal); perforation size (0–20 per cent, 21–40 per cent, 41–60 per cent or subtotal); and simultaneous cortical mastoidectomy. The indication for a cortical mastoidectomy was myringoplasty in the presence of an actively discharging ear or a revision paediatric case. Several different graft materials were used: temporalis fascia, perichondrium, perichondrium and cartilage, fat, and periosteum.

Statistical analysis

Statistical analysis was performed using the XLSTAT statistical computer program (Addinsoft, New York, USA). Logistic regression analysis was used to determine which factors significantly influenced outcome. Statistical significance was set at a p value of less than 0.05.

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Results

A total of 394 procedures were included, involving 313 adults and 81 children. The mean overall age was 35.8 (range 10–72), and the mean length of follow up was 7.5 months (range 2–48).

In the adult group, there were 263 (84 per cent) primary procedures and 50 (16 per cent) revisions; in the paediatric group, there were 70 (86 per cent) primary cases and 11 (14 per cent) revisions. The graft take rate was 81 per cent in the adult group and 85 per cent in the paediatric group. In the adult group, the tympanic membrane perforation site significantly influenced successful tympanic membrane closure at follow up ($p = 0.016$), with anterior ($p = 0.008$) and subtotal perforations ($p = 0.017$) demonstrating the greatest influence (Table I). No other factor significantly influenced tympanic membrane closure or ABG closure to within 20 dB HL. In the paediatric group, none of the factors significantly influenced either intact tympanic membrane closure or ABG closure to within 20 dB HL.

Discussion

The graft success rate achieved in this study is comparable with other studies, which report graft take rates of between 70.8 per cent and 97.8 per cent for both adults and children.[1–9]

This study demonstrated a significant association between perforation site and graft take rate, with anterior and subtotal perforation sites having the most influence on outcome. Anterior perforations were previously demonstrated to have an increased graft failure rate because of the technical difficulty of ensuring that the graft heals at the anterior rim of the perforation whilst avoiding anterior blunting and lateralisation of the graft.[10] Using fluorescein staining, Applebaum and Deutsch demonstrated the anterior to be the least vascular part of the tympanic membrane.[11] Subtotal perforations are more likely to fail because there is no tympanic membrane remnant for the graft to heal on to. Previous studies either agree or disagree with this study. Frade Gonzalez *et al*. demonstrated that perforation site affects the perforation closure rate: subtotal perforations were associated with a reduced success rate.[12] Jurovitzki *et al*. demonstrated that anterior perforation grafts were less successful than those of other perforation sites.[1] Albera *et al*. demonstrated that the perforation site has a significant influence on the graft take rate, although they found that posterior perforations have a lower success rate.[13] In contrast, several studies have found no significant relationship between perforation site and graft take rate in adults[2,14,15] and in children.[16,17]

Yung demonstrated a relationship between perforation site and hearing gain, with posterior perforations

TABLE I
FACTORS THAT SIGNIFICANTLY AFFECT OUTCOME IN PAEDIATRIC AND ADULT PATIENTS*

Factor	Paediatric patients (*n*)			Adult patients (*n*)		
	Total	Intact TM	ABG closure	Total	Intact TM	ABG closure
Grade of surgeon						
– Consultant	27	22	6	105	84	31
– Associate specialist	22	15	4	74	61	37
– Registrar	32	26	11	134	98	48
Condition of ipsilateral middle ear						
– Inactive COM	9	8	4	44	31	17
– Active COM – ID	55	44	14	200	153	82
– Active COM – PD	8	5	1	55	46	25
Condition of contralateral middle ear						
– Normal	45	37	14	241	189	95
– OME	5	3	1	7	6	1
– Inactive COM	16	11	5	37	29	17
– Active COM	13	9	2	28	20	11
Perforation site						
– Anterior	32	25	5	103	73	69
– Posterior	13	13	13	64	56	40
– Inferior	18	13	13	66	55	36
– Subtotal	18	15	15	81	47	44
Perforation size						
– 0–20%	24	19	2	73	61	24
– 21–40%	31	25	10	117	95	36
– 41–60%	8	5	0	39	28	16
– Subtotal	18	14	9	84	60	36
Cortical mastoidectomy	12	9	1	55	36	15
Graft material						
– Temporalis fascia	75	56	20	290	224	107
– Perichondrium	0	0	0	5	5	1
– Perichondrium & cartilage	1	1	0	7	6	2
– Fat	4	4	0	4	3	0
– Periosteum	3	3	1	6	5	1

*Outcome is an intact tympanic membrane or air–bone gap closure to within 20 dB HL. TM = tympanic membrane; ABG = air–bone gap; COM = chronic otitis media; ID = intermittent discharge; PD = persistent discharge; OME = otitis media with effusion

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showing the greatest pre-operative hearing loss and post-operative gain.[18]

None of the other factors assessed in this study had a significant influence on perforation closure or hearing gain. In agreement with this study, Wasson *et al*. demonstrated that neither surgeon grade nor graft material had a significant effect on closure rate or hearing outcome.[19] In contrast, similar studies reported other factors to have significant effects on outcome. Several studies demonstrated a relationship between perforation size and closure rate. Jurado *et al*. and Lee *et al*. demonstrated a relationship between perforation size and both closure rate and hearing gain.[20,21] Others demonstrated a relationship between perforation size and hearing gain.[19,22,23] In a study of 106 patients with a central dry perforation and an intact, mobile ossicular chain, Pfammatter *et al*. demonstrated complete closure of the ABG in 20 per cent of patients and closure to within 10 dB HL in 80 per cent of cases. These authors stated that perforation size had the greatest positive impact on outcome.[22] In a study of 169 myringoplasties, Thiel *et al*. demonstrated ABG closure to within 10 dB HL in 53 per cent of patients and stated that hearing gain was more likely with larger perforations.[23] Vartiainen and Nuutinen demonstrated that perforation size had no effect on either ABG closure or hearing.[2]

This study found no significant relationship between a discharging ear (either persistent or intermittent) or a dry ear and either closure rate or hearing gain. In agreement with this, Onal *et al*. and Albera *et al*. demonstrated no difference in closure rates between discharging and dry ears.[9,13] Caylan *et al*. demonstrated that operating on actively discharging ears increased the closure rate from 75 per cent to 100 per cent in children.[16] Mills *et al*. demonstrated no significant difference in closure rate between actively discharging (either intermittent or persistent) and inactive ears in a study of 268 ears over a 10-year period.[24] Thiel *et al*. demonstrated that patients with a discharging ear at the time of surgery were less likely to have an audiological gain following the operation.[23]

This study demonstrated that the condition of the contralateral ear has no impact on closure rate or hearing gain. This is consistent with several other studies;[6,13] however, other studies reported the contralateral ear status to have a significant effect on closure rate.[9,16,25]

This study demonstrated no relationship between simultaneous cortical mastoidectomy and graft take rate or hearing gain. In agreement, Albu *et al*. demonstrated that cortical mastoidectomy has no significant effect on graft take rate.[26] McGrew *et al*. demonstrated that concomitant mastoidectomy was not necessary for successful perforation repair, although it did reduce the number of patients requiring future procedures and slowed disease progression.[27] Yoon *et al*. demonstrated no significant difference in graft take rate between children who had undergone mastoidectomy and those who had not (97 per cent *vs* 98 per cent after 6 months), although they performed mastoidectomy in the presence of cholesteatoma.[28] Improvements in myringoplasty success when performed in conjunction with cortical mastoidectomy were previously demonstrated by Jackler and Schindler. These authors proposed that this occurred because a small mastoid volume, as well as chronic infectious middle-ear disease, has a detrimental effect on graft survival following myringoplasty.[29,30]

- **There is no consensus about which factors influence tympanic membrane closure and hearing gain following myringoplasty in adults or children**
- **This study demonstrates a significant relationship between perforation site and closure rate in adults**
- **In adults, lowest graft take rates are associated with anterior perforations**
- **No factors significantly influence outcome in children**
- **Surgeons should consider which factors influence myringoplasty success when obtaining patient consent and performing the procedure**

This study identified no significant causative factors affecting the paediatric group. This result is consistent with several other studies. In a study of 604 children, Sckolnick *et al*. investigated many potential influencing factors, including graft material, prior otorrhoea and perforation site.[31] Only myringoplasty performed with Gelfoam® (as opposed to fat or paper) proved to have a significant effect on outcome. Kumar *et al*. showed that only younger age and anterior perforations were associated with a poorer outcome in a study of 132 children.[32] Knapik *et al*. investigated similar factors to those used in this study and demonstrated no significant effect for any.[33]

Although reports are variable, it is important that surgeons appreciate which factors may influence myringoplasty outcome when obtaining informed consent and deciding whether to operate.

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