Myringoplasty — effects on hearing and contributing factors

J. H. Black, P. J. Wormald

Indications for myringoplasty are chronic otorrhoea and hearing impairment. Some authors have described poor postoperative hearing results and sensorineural hearing loss associated with the surgery, and question the indication for myringoplasty on an ear with normal hearing (<25 dB). This study of 211 consecutive myringoplasties performed over 1 year details the 'take rate,' hearing gains and losses, and factors found to influence the above.

The take rate of 78% is comparable with figures in the literature. The most significant factors influencing this are the grade of the surgeon and the size of the perforation.

The average pre-operative air-bone gap was closed from 23.7 dB to 13.9 dB with a 4.5% incidence of postoperative sensorineural hearing loss. Postoperatively 77.9% of patients had an air-bone gap of less than 20 dB.

We conclude that myringoplasty is a beneficial procedure, closing the tympanic membrane and improving the hearing.

'Smyringoplastik' was introduced by Berthold in 1878 but the modern era began only in the 1950s with the work of Wullstein and Zoellner. Many techniques and materials have been used over the years but the underlay technique as advocated by Austin and Shea is now universally used. Hough modified this underlay technique by utilising autologous temporalis fascia. Many factors have been investigated to determine their effect on the graft 'take rate'. Of these factors, only size of perforation and the presence of bilateral perforations have been shown to affect the tympanoplasty outcome significantly. These factors were also evaluated in our trial.

Controversy exists as to the reporting of audiometric assessments both pre- and postoperatively, as there is no agreement among authors on the standard criteria for the reporting of hearing results. Parameters used and criteria for success vary from author to author.

In 1965 a committee was set up by the American Academy of Ophthalmology and Otolaryngology for the reporting of results of ear surgery. It stated that preoperative air and bone conduction levels of 500, 1000 and 2000 Hz should serve as baselines for determining the air-bone gap. Bone conduction thresholds improve with surgery in successful cases and it is therefore felt that the postoperative bone conduction thresholds are a closer approximation of the cochlear function than the preoperative ones, and should consequently be used for gap calculations. Until masking procedures in audiometry are standardised, however, hearing gain may be regarded as the most satisfactory alternative for the description of hearing results, as it is based on air conduction thresholds only. Our success criteria were an air-bone gap closure to under 10 dB and/or a postoperative air conduction threshold of <30 dB.

The benefit of myringoplasty has been controversial, with some authors quoting both low graft take rates and poor results in respect of hearing. There has been a report of a relatively high incidence (1.5%) of complete cochlear hearing loss following tympanoplasty. Palva et al. reported high-frequency sensorineural hearing losses in the 4-8 kHz range in 4.5% of cases. Smyth reported a 2.5% sensorineural hearing loss in the 0.5-4 kHz range. This article assesses the benefit of myringoplasty in 211 consecutive operations at Groote Schuur Hospital, performed by all the surgeons in the Department of Otolaryngology.

Materials and methods

Two hundred and eleven consecutive myringoplasties (type 1 tympanoplasties) performed at Groote Schuur Hospital between January 1990 and December 1990 were assessed retrospectively. The age distribution varied from 7 years to 66 years, with a mean of 26.7 and a standard deviation of 13.14 (Fig. 1). The male to female ratio was 1:1.33.

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Table I. Factors implicated in graft take rate

<table>
<thead>
<tr>
<th>Factor</th>
<th>Expected Failure Rate (%)</th>
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<tbody>
<tr>
<td>Previous surgery to that ear</td>
<td>7.2</td>
</tr>
<tr>
<td>Grade of surgeon</td>
<td></td>
</tr>
<tr>
<td>Grade 1 (Senior consultant)</td>
<td>2 (6)</td>
</tr>
<tr>
<td>Grade 2 (Junior consultant)</td>
<td>6 (17)</td>
</tr>
<tr>
<td>Grade 3 (Senior registrar)</td>
<td>4 (12)</td>
</tr>
<tr>
<td>Grade 4 (Junior registrar)</td>
<td>32 (34)</td>
</tr>
</tbody>
</table>

The audiometric results are illustrated in Figs 2 and 3. The average pre-operative air-bone gap was 23.7 dB (SD = 11.56), with an average postoperative air-bone gap of 13.9 dB (SD = 10.76). Socially acceptable hearing levels, as described by Tos, with postoperative air-conduction of less than 30 dB were present in 79% (122 of 154) of these patients. Postoperatively 77.8% (120 of 154) of our patients had an air-bone gap of less than 20 dB.

Results

On assessment of the factors influencing the graft take rate, the grade of surgeon (Table II) was found to be significant (P < 0.02). Table III notes the size of perforation and, as can be seen from the expected values, only the subtotal and small perforations differed substantially from their expected values (P < 0.02). The P-value (Yates corrected) for all other factors assessed was > 0.5.

Table II. Effect of grade of surgeon on take rate

<table>
<thead>
<tr>
<th>Grade of surgeon</th>
<th>No.</th>
<th>No. (%)</th>
<th>No. (%)</th>
<th>Expected failure rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1 (Senior consultant)</td>
<td>33</td>
<td>31 (94)</td>
<td>2 (6)</td>
<td>7.2</td>
</tr>
<tr>
<td>Grade 2 (Junior consultant)</td>
<td>35</td>
<td>29 (83)</td>
<td>6 (17)</td>
<td>7.6</td>
</tr>
<tr>
<td>Grade 3 (Senior registrar)</td>
<td>34</td>
<td>30 (88)</td>
<td>4 (12)</td>
<td>7.5</td>
</tr>
<tr>
<td>Grade 4 (Junior registrar)</td>
<td>94</td>
<td>62 (66)</td>
<td>32 (34)</td>
<td>21</td>
</tr>
</tbody>
</table>

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Fig. 2. Graphic representation of the pre-operative distribution of air-bone gaps.

Fig. 3. Graphic representation of the post-operative distribution of air-bone gaps.

Operative cochlear damage was assumed on a finding of postoperative deterioration in bone-conduction thresholds of 10 dB or more in the 500 - 4000 Hz range. This occurred in 4.5% (7 out of 154) of our patients.

Discussion

The debate about which factors affect the final outcome of tympanoplasty surgery, and thus about the relative contraindications to this surgery, continues. No statistical relationship could be shown between the influence of previous surgery to the ear, infection at the time of surgery, Eustachian tube patency, presence of tympanosclerosis, age of patient, type of surgical approach and use of middle-ear gelfoam and the success of the surgery.

The grade of surgeon was found to alter the expected outcome of the procedure significantly, and this illustrates very well the learning curve in tympanoplasty surgery.
Subtotal perforations have a greater likelihood of failure, while small perforations had a higher than expected success rate. The overall success rate of 78% compares favourably with the literature, and the relatively short follow-up period should not compromise these results because, as stated by Packer et al., the success of both take rate and hearing results was no different at 6 months than in the longer term over 1-2 years.

The hearing results indicate that myringoplasty is a beneficial procedure, with a large majority of patients achieving socially acceptable hearing in the operated ear, viz. 79% (122 of 154 patients).

The incidence of postoperative sensorineural cochlear damage is in keeping with the literature, and can be ascribed to excessive manipulation of the ossicles during the procedure. Minimal bone drilling was performed on these patients. We conclude that myringoplasty is a beneficial procedure, with regard to both the successful closure of the tympanic membrane perforation and improvement of the hearing.

REFERENCES
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Macrosomia — maternal and fetal risk factors

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Risk factors associated with fetal macrosomia were studied in 348 pregnancies resulting in the delivery of an infant weighing 4 000 g or more in a black population. Identifiable maternal risk factors included a mother in her 3rd decade of life, multiparity, maternal weight of 70 kg or more at the end of pregnancy, prolonged or post-term pregnancy, abnormal glucose tolerance and previous history of a macrosomic infant. Male infants had a higher risk of being macrosomic. Macrosomic infants accounted for 3.4% of all singleton deliveries, with their caesarean section rate of 33.9% being almost three times that of control infants. The importance of antenatal prediction of fetal weight is emphasised and suggestions for reduction of the high perinatal mortality and morbidity rates, as well as maternal morbidity, are discussed.


Little attention has been paid to fetal macrosomia in black African populations, despite the fact that as a high-risk factor in pregnancy and delivery macrosomia probably deserves as much attention as is currently accorded low birth weight, albeit for different reasons. Although perinatal mortality has decreased considerably in recent years, the risks to mother and fetus are severe enough to warrant early detection of macrosomia during labour, and preferably during pregnancy. In fact, Parks and Ziegler suggested that the risks are sufficiently high to justify consideration of elective caesarean section for delivery of such infants. The only study emanating from Africa known to the authors is that by Okperhe et al. from Nigeria.

Our study attempted to identify maternal and fetal risk factors associated with macrosomia in a black African population from another geographical region of Africa. We defined a macrosomic infant as one weighing 4 000 g or more at birth, the currently accepted definition in the developed world.

Patients and methods

Umtata General Hospital, Eastern Cape, serves a population of predominantly low and medium socio-economic status. Between 1 February 1989 and 31 August 1990, 10 507 singleton infants were delivered at the hospital, of whom 360 were macrosomic. Complete documentation was available

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