

# Myringoplasty — effects on hearing and contributing factors

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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.

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'Myringoplastik' was introduced by Berthold in 1878 but the modern era began only in the 1950s with the work of Wullstein<sup>1</sup> and Zoellner.<sup>2</sup>

Many techniques and materials have been used over the years but the underlay technique as advocated by Austin and Shea<sup>3</sup> is now universally used. Hough<sup>4</sup> 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.<sup>5-8</sup>

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 pre-operative air and bone conduction levels of 500, 1 000 and 2 000 Hz should serve as baselines for determining the air-

bone gap.<sup>5</sup> 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 pre-operative 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.<sup>9</sup> Our success criteria were an air-bone gap closure to under 10 dB and/or a postoperative air conduction threshold of < 30 dB.<sup>9</sup>

The benefit of myringoplasty has been controversial, with some authors quoting both low graft take rates<sup>10</sup> and poor results in respect of hearing.<sup>11</sup> There has been a report of a relatively high incidence (1,5%) of complete cochlear hearing loss following tympanoplasty.<sup>12</sup> Palva *et al.*<sup>13</sup> reported high-frequency sensorineural hearing losses in the 4 - 8 kHz range in 4,5% of cases. Smyth<sup>6</sup> 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.

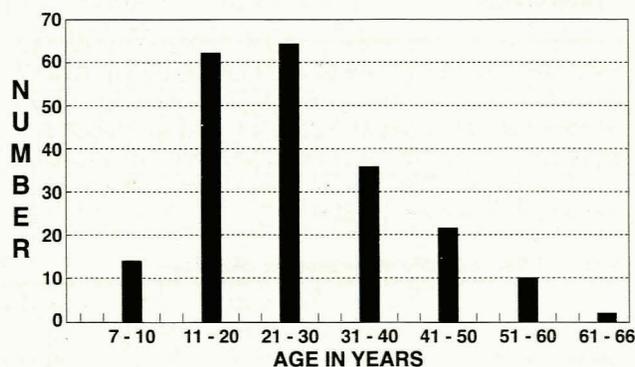


Fig. 1. Graph of the age distribution.

All factors listed in Table I were assessed where data were available. The surgical technique was usually post-auricular (179 patients), with only 32 patients having undergone a permeal approach. All the tympanoplasties were underlays, usually supported on spongistan (189 patients), and all were grafted with temporalis fascia. Graft take was assessed at first visit and all subsequent follow-up visits, with an average follow-up time of 8 months. The criterion for success was an intact tympanic membrane at all follow-up visits.

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**Table I. Factors implicated in graft take rate**

Previous surgery to that ear <sup>14,15</sup>
Grade of surgeon <sup>15</sup>
Size of perforation <sup>14,16,17</sup>
Infection at time of surgery <sup>14,16,17</sup>
Eustachian tube patency <sup>10,14,16,18,19</sup>
Presence of tympanosclerosis <sup>14</sup>
Age of patient <sup>14,15,17,20,21</sup>
Permeatal/postauricular approach <sup>10,16</sup>
Use of middle-ear gelfoam <sup>16</sup>

All audiograms were obtained in a sound-proof room and the ascending method of Carhart and Jerger was used. Three correct responses at the same level were the criterion used for the determination of the hearing threshold. The stimulus equipment consisted of a clinical audiometer (Grason Stadler Incorporated 10) together with Telephonic T.D.H. 59 earphones. The system was regularly calibrated according to ANSI S 3,6/1969 for air conduction and ANSI S 3,26/1981 for bone conduction. Narrow-band noise was used for masking purposes, according to the formulae suggested by Liden *et al.*<sup>22</sup>

Postoperatively, 191 patients returned for follow-up. Only 145 patients, however, were followed up for longer than 6 months. All 211 patients had audiograms performed immediately prior to surgery, while 154 patients had postoperative audiograms. Audiometric results reported postoperatively are based on the most recent audiograms available for these 154 patients. Poor social and economic circumstances resulted in this relatively poor follow-up attendance.

## 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  $> 0,5$ .

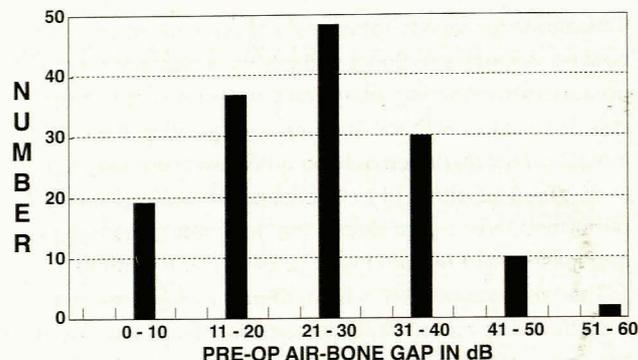
**Table II. Effect of grade of surgeon on take rate**

Grade of surgeon	No.	Graft		Expected failure rate (%)
		intact	failed	
Grade 1 (Senior consultant)	33	31 (94)	2 (6)	7,2
Grade 2 (Junior consultant)	35	29 (83)	6 (17)	7,6
Grade 3 (Senior registrar)	34	30 (88)	4 (12)	7,5
Grade 4 (Junior registrar)	94	62 (66)	32 (34)	21

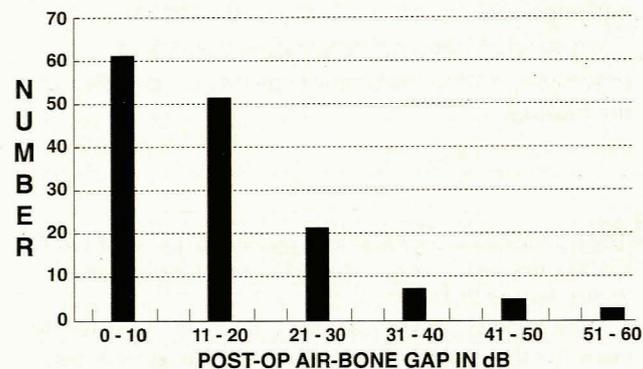
**Table III. Effect of size of perforation on take rate**

Size of perforation	No.	Graft		Expected value (%)
		intact	failed	
Subtotal (rim only)	25	15 (60)	10 (40)	5,8
Large (> 60%)	44	33 (75)	11 (25)	10,2
Medium (40 - 60%)	38	29 (76)	9 (24)	8,8
Small (< 40%)	78	65 (83)	13 (17)	18,1

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,<sup>20</sup> with postoperative air-conduction of less than 30 dB were present in 79% (122 of 154) of these patients. Postoperatively 77,9% (120 of 154) of our patients had an air-bone gap of less than 20 dB.



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



**Fig. 3. Graphic representation of the postoperative 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 - 4 000 Hz range.<sup>6</sup> 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.*,<sup>14</sup> 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.

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