

# Hearing outcomes following myringoplasty for patients from developing countries with chronic otitis media

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## Abstract

**Objective:** The purpose of this study is to compare hearing outcomes following myringoplasty for chronic otitis media for patients from developing countries with those of urban Australian patients. **Subjects & Methods:** This study is a retrospective review of 110 patients (118 ears) with non-cholesteatomatous chronic suppurative otitis media who underwent myringoplasty at The Royal Victorian Eye & Ear Hospital from 2003 to 2007. Patients who had emigrated from a developing country were analysed as one group and Australian born patients were analysed as another. Patients were excluded from the study if their hearing was normal or only mildly impaired in the affected ear pre-operatively. Outcomes are expressed in terms of tympanic membrane closure, improvement in air conduction (AC) pure tone average (PTA) and achievement of AC PTA  $\leq$  40 dB HL post-operatively. **Results:** Patients from developing countries demonstrated greater improvements in hearing following myringoplasty, mean gain in AC PTA 16.6 dB, than urban Australian patients, 9.6 dB. This difference was statistically significant (unpaired t-test;  $t = 2.66$ ,  $p < 0.05$ ). **Conclusion:** Patients from developing countries with hearing impairment secondary to chronic otitis media can achieve hearing outcomes following myringoplasty at least comparable to urban Australian patients.

This paper was presented at the 2009 Australian Society of Otolaryngology Head and Neck Surgery Annual Scientific Meeting, Gold Coast, QLD.

## INTRODUCTION

The aim of this study is to compare hearing outcomes following myringoplasty for patients from developing countries with moderate to severe hearing loss secondary to CSOM with those of Australian born patients. This work was motivated by a need to better understand the factors that influence the outcomes of myringoplasty when performed in developing countries or remote indigenous communities and to investigate the potential efficacy of myringoplasty as an intervention to improve hearing in these settings.

Several studies have reported outcomes of myringoplasty performed in district hospitals and by surgical outreach teams to developing countries and remote indigenous communities. A few have demonstrated promising results<sup>1-7</sup>, however some of these have not included audiological outcomes<sup>4,5</sup> or were limited by small sample sizes<sup>6,7</sup>, while others have reported disappointing outcomes that are significantly poorer than those achieved at tertiary centres in developed nations<sup>8-10</sup>. The reasons why outcomes of surgery for CSOM remain poor in some developing country and

remote indigenous settings are not well understood. Factors such as the nature of the disease, the availability of peri-operative care, the general health of the patient and the level of surgical expertise have all been considered as potentially relevant<sup>5,8,9,11,12</sup>.

By comparing outcomes for patients from developing countries with those of urban Australian patients in a standardised treatment environment, the current study will investigate whether the nature of CSOM acquired by patients in developing countries is an important factor in determining surgical outcomes.

## METHODS

A retrospective case review of 110 patients (118 ears) with moderate to severe hearing impairment secondary to chronic otitis media who underwent myringoplasty (type I tympanoplasty) at The Royal Victorian Eye & Ear Hospital from January 2003 to December 2007. Patients were grouped according to the country in which they were born, spent their childhood and developed their CSOM. People originating from a developing country (70 patients, 78 ears), as listed by the Australian Ministry for Foreign Affairs<sup>13</sup>, were classified into the "developing country" group. For comparison, 40 urban Australian born patients (40 ears)

were selected at random using a random number generator from a total of 236 eligible patients.

To be included in the study patients were required to have moderate to severe hearing impairment, defined as air conduction (AC) pure tone average (PTA) > 40 dB and ≤ 80 dB, in the affected ear pre-operatively. Patients who underwent concomitant cortical mastoidectomy were included, as were patients undergoing revision surgery. Patients were also required to have undergone both pre- and post-operative audiology within 12 months of the date of surgery and have completed at least six months of outpatient follow up post-operatively.

Patients with normal or only mildly impaired hearing (AC PTA ≤ 40 dB) were excluded, as were patients with predominantly sensorineural hearing impairment, defined as bone conduction (BC) PTA > 30 dB. Cases of traumatic perforation, cholesteatoma and/or erosion of the ossicular chain requiring type 2 to 5 tympanoplasty or ossicular chain reconstruction were also excluded from this study.

All operations were performed via a post auricular incision. Data was obtained regarding surgical technique (underlay, onlay or inlay graft placement) and graft material (temporalis fascia, perichondrium or cartilage). All patients received one week of oral antibiotics post-operatively. Data regarding size of tympanic membrane perforation or presence of otorrhoea pre-operatively was not analysed in this study.

Audiological examinations were conducted with the assistance of an interpreter for all non-English speaking patients. Pure tone averages (PTA) were calculated from thresholds at 500, 1000, 2000 & 4000 Hz. Surgical outcomes are expressed in terms of successful closure of the tympanic membrane, improvement in air conduction (AC) PTA and in terms of the number of patients who achieved normal or only mildly impaired hearing (AC PTA ≤ 40 dB).

This study has been granted approval by The Human Research & Ethics Committee of the Royal Victorian Eye & Ear Hospital.

**STATISTICAL METHODS**

Categorical data including operative variables and success rates for closure of the tympanic membrane and achievement of AC PTA ≤ 40 dB post-operatively were analysed using Fisher’s exact test. Continuous, unpaired, parametric data including patient age and improvement in AC PTA

following surgery were analysed using the unpaired t-test. The relationship between age and improvement in AC PTA was analysed using the Pearson correlation coefficient (r) and two-tailed t-test.

**RESULTS**

Nine patients from the developing country group and four from the urban Australia group were lost to follow up, leaving 61 patients (69 ears) and 36 patients (36 ears) in each group respectively.

The mean age of patients in the developing country group was 40.5 years (range 14-78, SD 13.6), and the urban Australia group was slightly but significantly older 51.6 years (range 13-71, SD 13.5, unpaired t-test; p = 0.0001). The numbers of revision surgeries did not differ between groups (Fisher’s exact test; p = 1.00), and neither did the numbers of patients undergoing canal wall up mastoidectomy (Fisher’s exact test; p = 0.181) (Table 1).

The developing countries represented most frequently were Vietnam 29% (n=18), Turkey 15% (n=9), Sudan 8% (n=5) with individuals from the Phillipines, China and Sri Lanka 6% each contributing 4 patients.

**Figure 1**

Table 1. Patient and operative variables by demographic group.

	developing country (n=69)	urban Australia (n=36)	p-value
Age, y			
mean (SD)	40.5 (13.6)	51.6 (13.5)	0.0001
range	14-78	13-71	
Revision, % (n)	11.5 (8)	13.9 (5)	0.761
Mastoidectomy, % (n)	7.2 (5)	16.6 (6)	0.181
Technique, % (n)			
underlay	69.6 (48)	75.0 (27)	0.652
onlay	27.5 (19)	22.2 (8)	0.642
inlay	2.9 (2)	2.8 (1)	1.000
Graft material, % (n)			
fascia	91.4 (63)	94.4 (34)	0.712
perichondrium	4.3 (3)	2.8 (1)	1.000
cartilage	4.3 (3)	2.8 (1)	1.000

Successful closure of the tympanic membrane was observed following 81.1% (C.I. 70-89%) of operations in the developing country group and 75.0% (C.I. 59-86%) of operations in the urban Australia group (Fisher’s exact test; p = 0.461).

For the developing country group the mean AC PTA decreased from 52.4 dB (S.D. 10.1) to 35.8 dB (S.D. 12.3) following myringoplasty, an improvement of 16.6 dB (S.D. 11.6). For the Australian born group the mean air conduction PTA decreased from 51.7 dB (S.D. 10.4) to 42.1 dB (S.D. 16.0), an improvement of 9.3 dB (S.D. 14.8). This difference was statistically significant (unpaired t test; t = 2.66, p <

0.05). The percentage of patients who achieved an average hearing threshold of  $\leq 40$  dB post-operatively was 68.1% (C.I. 57-79%) for the developing country group compared with 52.8% (C.I. 37-68%) in the control group (Fisher's exact test;  $p = 0.140$ ) (Table 2).

The correlation between age and improvement in AC PTA in either group was weak and insignificant (developing country:  $r = 0.1082$ ,  $p$ -value 0.383; Australian born:  $r = -0.1829$ ,  $p$ -value 0.259).

**Figure 2**

Table 2. Outcome of myringoplasty in terms of graft success and hearing improvement by demographic group.

	developing country (n=69)	urban Australia (n=36)	p-value
Graft success, % (n)	81.1 (56)	75.0 (27)	0.461
Hearing, mean (SD)			
pre-op	52.4 (10.1)	51.7 (10.4)	0.739
post-op	35.8 (12.3)	42.1 (16.0)	0.027
improvement	16.6 (11.6)	9.3 (14.8)	0.009
Hearing $\leq 40$ dB, % (n)	68.1 (47)	52.8 (19)	0.140

**COMPLICATIONS**

There were two cases of sensorineural hearing loss in the Australian born group (BC PTA worsened by 22.5 dB for one patient and 25 dB for the other) and one case in the developing country group (BC PTA worsened by 10 dB). There were no instances of injury to the chorda tympani nerve in either group.

**DISCUSSION**

Hearing improvement following myringoplasty for patients who had emigrated from a developing country (16.6 dB mean gain in AC PTA) were significantly greater than those observed in urban Australian born patients (9.6 dB gain). Given that most of the treatment-related variables were controlled in the present study, these results suggest that there may be differences in the nature of the CSOM between the groups. One such factor may be the pre-operative size of the tympanic membrane perforation between the two demographics. There has been shown to be a direct correlation between hearing gains following myringoplasty and the pre-operative perforation size<sup>14,15</sup>. A recent paper by Wasson et al demonstrated that mean air conduction gain following repair of subtotal perforations was up to 9.3 dB greater than that observed following repair of smaller perforations<sup>15</sup>. While this factor was not examined systematically in the present study, anecdotal information from senior surgeons suggests that the incidence of subtotal perforations is higher amongst immigrants from developing countries than Australian born patients.

The author's chose to limit the scope of this study to patients with moderate to severe pre-operative hearing impairment (41-80 dB HL) because the World Health Organisation has declared that in developing countries priority for interventions to improve hearing, including surgery and/or hearing aids, should be given to patients with this degree of hearing disability<sup>16</sup>. That greater than two thirds (68%) of patients from developing countries achieved normal or only mildly impaired hearing that would no longer require the use of a hearing aid post-operatively ( $\leq 40$  dB HL), indicates that myringoplasty is an effective intervention to improve hearing in these patients. This is particularly significant for communities in remote and developing environments where there are significant logistic and economic difficulties with the acquisition and maintenance of hearing aids<sup>16</sup>. Furthermore, for the remainder of patients (32%) in which aided hearing may still be indicated, surgery nonetheless provided the benefit of closing the tympanic membrane and eliminating aural discharge (in greater than 80% of operations), which would otherwise hinder the use of a hearing aid<sup>17</sup>.

The present study demonstrates that patients who have acquired CSOM in a developing country can achieve hearing outcomes following myringoplasty at least comparable to those of urban Australian patients when treatment is provided in a tertiary centre in a developed nation. This result provides evidence that the nature of CSOM acquired by patients in developing countries is not a limiting factor in determining the success of myringoplasty for chronic otitis media. The authors hypothesise that other variables such as surgical expertise, peri-operative care, consistency of follow up and the burden of chronic disease and/or nutritional status of patients are more likely to influence the success of surgery for chronic otitis media when performed in a developing country or remote indigenous setting. Further research could focus upon determining which of these factors most affects surgical outcomes.

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