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MAIN ARTICLE

Comparison of quality of life outcomes following different mastoid surgery techniques

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Abstract

Background: Mastoid surgery carried out to treat chronic otitis media can lead to improvement in objective and subjective measures post-operatively. This study investigated the subjective change in quality of life using the Glasgow Benefit Inventory relative to the type of mastoid surgery undertaken.

Method: A retrospective multicentre postal survey of 157 patients who underwent mastoid surgery from 2008 to 2012 was conducted.

Results: Eighty-three questionnaire responses were received from patients who underwent surgery at one of three different hospitals (a response rate of 53 per cent). Fifty-seven per cent of patients had a Glasgow Benefit Inventory score of 0, indicating no change in quality of life post-operatively. Thirty-five per cent scored over 50, indicating significant improvement. The only significant difference found was that women fared worse after surgery than men.

Conclusion: The choice of mastoid surgery technique should be determined by clinical need and surgeon preference. There is no improvement in quality of life for most patients following mastoid surgery.

Key words: Mastoid; Surgery; Quality Of Life

Introduction

Mastoid surgery is performed to treat both mucosal and squamous chronic otitis media. The primary aim is to provide a dry, healthy and stable ear, although any hearing improvement is also welcome. Objective measures of successful surgery are easy to evaluate; for example, otorrhoea cessation and hearing improvement. However, the disease also has a significant impact on a patient's quality of life. In addition to the physical burden of the disease, there are other factors to consider. These include: repeated hospital visits; multiple courses of topically applied medication; poor communication as a result of reduced hearing, and the associated impact on a patient's social and professional interactions; and the psychological impact of a foul-smelling ear.

There are reports in the literature of improvement in patients' quality of life post-operatively.[1–3] This study investigated post-operative quality of life (using the Glasgow Benefit Inventory, a validated tool for assessing ear symptoms) relative to the type of surgery performed, in particular comparing canal wall up with canal wall down surgery.

Materials and methods

Participants and recruitment

Adults who underwent mastoid surgery from 2008 to 2012 were included in the study. The patients, identified using operating theatre logs, were chosen consecutively. The surgery, carried out for mucosal or squamous chronic otitis media, had been performed by three consultants and their specialist registrars at one of three ENT departments in the Southeast of England (Southend University Hospital, Whipps Cross University Hospital, and the Royal National Throat, Nose and Ear Hospital).

Local research and development approval was obtained without the requirement for ethical approval.

Measures

We performed a multicentre, retrospective survey of quality of life in patients who underwent mastoid surgery from 2008 to 2012. The Glasgow Benefit Inventory, posted to 157 patients, was the primary outcome measure.

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The Glasgow Benefit Inventory is an 18-item validated tool for measuring outcomes after ENT surgical procedures.[4] It measures quality of life in three domains: social, physical and general. Responses are made using five-point Likert scales, where a score of 5 denotes the most favourable outcome, 3 indicates no change and 1 represents the poorest result. The average Likert score for the whole questionnaire is calculated. This mean score has a value of 3 (no change) subtracted, and the result is multiplied by 50. The resultant score ranges from −100 (maximum detriment after surgery) to 100 (maximum improvement after surgery). A score of zero indicates no change in quality of life following the intervention.

Predictors and participant characteristics

The main quality of life predictor was type of surgery. This information was collected from operating theatre logs and confirmed by reviewing the patient notes.

The potential covariates were: disease type (mucosal or squamous chronic otitis media), disease stage, disease location (left or right), grade of operating surgeon, hospital site, primary or revision surgery, age, and gender. These data were all recorded from the medical records. With regard to disease stage, the classification system for chronic otitis media was adapted from the staging of middle-ear cholesteatoma proposed by the Japan Otological Society, as follows:[5] grade 1 – disease limited to the mesotympanum and hypotympanum; grade 2 – epitympanic involvement; grade 3 – extension to the mastoid antrum; and grade 4 – extension beyond the mastoid antrum.

Sample size

A total sample size of 88 was required to detect a medium effect size (w = 0.30), with an alpha value of 0.05 and power of 0.80 between 2 groups (these being combined approach tympanoplasty surgery versus other procedures (degrees of freedom = 1)). This calculation was conducted using the software G*Power, version 3.1.[6]

Statistical analysis

Logistic regression was used to examine univariate and multivariate predictors of surgical outcome ('worse' or 'no change' *vs* 'improvement') using the statistical software package SPSS®, version 20. The categories 'worse' and 'no change' were combined because only a small number of people reported a worse outcome following surgery.

Results

Eighty-three completed questionnaires (out of 157 distributed) were returned by patients who underwent mastoid surgery at one of the three different hospitals (a response rate of 53 per cent). Response rate was not significantly associated with either gender (odds ratio = 1.031, 95 per cent confidence interval (CI) = 0.541–1.965, $p = 0.927$) or hospital site (Wald = 3.268, degrees of freedom = 2, $p = 0.195$), but was significantly associated with age, with a higher response rate for older patients (odds ratio = 1.044, 95 per cent CI = 1.024–1.065, $p < 0.001$; average age among responders *vs* non-responders of 45 *vs* 31 years).

The demographic and clinical characteristics of responders are shown in Table I. Thirty-one responders (37 per cent) had undergone surgery at Southend University Hospital, 21 (25 per cent) at Whipps Cross University Hospital, and 31 (37 per cent) at the Royal National Throat, Nose and Ear Hospital. The average age of responders was 44.5 years (range, 15 to 76 years), with 61 per cent being male.

All the operations at the Royal National Throat, Nose and Ear Hospital ($n = 31$) were performed by a consultant, who carried out combined approach tympanoplasty, as a primary or revision procedure. This technique was never performed at Whipps Cross University Hospital and only twice performed at Southend University Hospital (hence, it was undertaken in a total of 33 patients). In these latter 2 centres, 24 patients underwent modified radical mastoidectomy, 16 patients had atticotomy or attico-antrostomy, 9 patients had cortical mastoidectomy, and 1 patient underwent mastoid exploration and obliteration.

Sixty-three operations (76 per cent) were carried out by consultants and 20 (24 per cent) by specialist registrars. In 59 cases (71 per cent), cholesteatoma was found, with the other 24 cases (29 per cent) showing evidence of mucosal chronic otitis media. Fifty-eight cases (70 per cent) were primary procedures. Twenty-five cases (30 per cent) were revision procedures, of which three were the second revisions and three were the third revisions performed. In 12 of the revision cases, cholesteatoma was present.

The average Glasgow Benefit Inventory score was 14.2. The overall scores for the patients were categorised into the following groups: −100, −50, 0, 50 and 100. A score within (±) 25 of each category determined group assignment. Six patients (7 per cent) scored −50, indicating a significant deterioration following surgery. Forty-seven patients (57 per cent) scored 0, indicating no overall benefit as a result of the surgery. Twenty-nine patients (35 per cent) scored 50, indicating a significant benefit (the patient who underwent mastoid exploration and obliteration scored 50). One patient (1 per cent) scored 100, indicating excellent improvement with no negative consequences at all. The Glasgow Benefit Inventory data for each individual procedure are shown in Table I.

There were no significant associations between the outcome of surgery and any of the other variables examined, such as surgery type, disease type or disease stage (Table II).

When the Glasgow Benefit Inventory scores were broken down according to the different subscales, the physical domain showed a non-significant trend

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TABLE I
OVERALL AND QUALITY OF LIFE RELATED DEMOGRAPHIC AND CLINICAL CHARACTERISTICS

Characteristic	Overall value	Glasgow Benefit Inventory score related values		
		Worse	No change	Improvement
Age (mean (SD); years)	44.5 (16.7)	45.5 (13.7)	44.8 (18.1)	44.0 (15.4)
Gender (*n* (%))				
– Male	51 (61.4)	3 (5.9)	24 (47.1)	24 (47.1)
– Female	32 (38.6)	3 (9.4)	23 (71.9)	6 (18.8)
Disease type (*n* (%))				
– Cholesteatoma	59 (71.1)	5 (8.5)	33 (55.9)	21 (35.6)
– Non-cholesteatoma, non-cholesteatomatous CSOM or retraction pocket	24 (28.9)	1 (4.2)	14 (58.3)	9 (37.5)
Disease stage (*n* (%))				
– 0	4 (4.8)	0 (0)	3 (75.0)	1 (25.0)
– 1	21 (25.3)	1 (4.8)	12 (57.1)	8 (38.1)
– 2	19 (22.9)	0 (0)	13 (68.4)	6 (31.6)
– 3	16 (19.3)	1 (6.2)	9 (56.2)	6 (37.5)
– 4	23 (27.7)	4 (17.4)	10 (43.5)	9 (39.1)
Side (*n* (%))				
– Left	43 (51.8)	1 (2.3)	29 (67.4)	13 (30.2)
– Right	40 (48.2)	5 (12.5)	18 (45.0)	17 (42.5)
Grade of surgeon (*n* (%))				
– Consultant	63 (75.9)	5 (7.9)	38 (60.3)	20 (31.7)
– Specialist registrar	20 (24.1)	1 (5.0)	9 (45.0)	10 (50.0)
Hospital site (*n* (%))				
– Royal National Throat, Nose & Ear Hospital	31 (37.3)	2 (6.5)	18 (58.1)	11 (35.5)
– Southend University Hospital	31 (37.3)	2 (6.5)	21 (67.7)	8 (25.8)
– Whipps Cross University Hospital	21 (25.3)	2 (9.5)	8 (38.1)	11 (52.4)
Surgery type (*n* (%))				
– Any type of combined approach tympanoplasty	33 (39.8)	2 (6.1)	19 (57.6)	12 (36.4)
– Atticotomy or attico-antrostomy	16 (19.3)	1 (6.2)	9 (56.2)	6 (37.5)
– Modified radical mastoidectomy or radical mastoid	24 (28.9)	2 (8.3)	14 (58.3)	8 (33.3)
– Cortical & mastoid obliteration	10 (12.0)	1 (10.0)	5 (50.0)	4 (40.0)
Revision surgery? (*n* (%))				
– No	57 (69.5)	2 (3.5)	32 (56.1)	23 (40.4)
– Yes	25 (30.5)	4 (16.0)	15 (60.0)	6 (24.0)

SD = standard deviation; CSOM = chronic suppurative otitis media

towards greater improvement in the canal wall down group versus the combined approach tympanoplasty group ($p = 0.061$). However, a Bonferroni correction performed because of multiple comparisons (i.e. group difference on the three subscales) meant that a p-value of 0.02 needed to be observed for the difference to be considered significant. In addition, inspection of the means and standard deviations for the physical domain across the two groups (combined approach tympanoplasty *vs* other types of surgery) shows the difference was less than 0.5 of a standard deviation, which is considered the minimal important clinical difference.

The only significant finding revealed by the statistical analysis was that women fared worse after surgery than men (odds ratio = 0.260, 95 per cent CI = 0.091–0.738, $p = 0.011$). Women were more likely to have revision surgery, but there were still significant gender differences when this variable (odds ratio = 0.302, 95 per cent CI = 0.103–0.886, $p = 0.029$), and when all of the other variables shown in Table II, were entered into the analysis (odds ratio = 0.216, 95 per cent CI = 0.063–0.744, $p = 0.015$).

Discussion

Chronic otitis media carries a significant burden of disease for many sufferers. In those who do not respond to conservative and medical treatments, or who have active squamous disease, surgical treatment is often recommended. Broadly speaking, surgical options include canal wall up surgery or canal wall down surgery, with or without primary bony obliteration. It has been shown that there are no significant differences in hearing outcomes associated with the surgical techniques in chronic otitis media patients.[7] However, there is great debate over the relative benefits of these techniques. These include the effectiveness of disease eradication, the need for further surgery, the frequency of aural toileting required and hearing outcomes.

A complication rate of 28 per cent has been reported following mastoid surgery, with the most common complication being residual or recurrent disease. Most other complications, such as meatal stenosis, moist cavity and tympanic membrane perforation, occur within the first six months following surgery. Regular out-patient attendance can prevent these complications, or enable early detection and treatment.[8]

Both canal wall up and canal wall down mastoidectomy procedures are felt to be safe, even when performed in the only hearing ear. In one study, 79 per cent of patients were shown to have stable or improved hearing thresholds at 48 months.[9]

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TABLE II
UNIVARIATE PREDICTORS OF SURGICAL OUTCOME: WORSE OR NO CHANGE VERSUS IMPROVEMENT

Predictor type	Variable	Univariate associations
Demographics	Age	0.997 (0.970–1.024)
	Gender	
	– Male	[1.00]
	– Female	0.260 (0.091–0.738)*
Disease characteristics	Disease type	
	– Cholesteatoma	[1.00]
	– Other (e.g. non-cholesteatomatous CSOM)	1.086 (0.406–2.902)
	Disease stage	
	– Stage 0 or 1	[1.00]
	– Stage 2	0.821 (0.231–2.910)
	– Stage 3	1.067 (0.291–3.916)
	– Stage 4	1.143 (0.355–3.681)
	Side	
	– Left	[1.00]
	– Right	1.706 (0.691–4.211)
Surgery characteristics	Grade of surgeon	
	– Consultant	[1.00]
	– Specialist registrar	2.150 (0.772–5.990)
	Hospital site	
	– Royal National Throat, Nose & Ear Hospital	[1.00]
	– Southend University Hospital	0.632 (0.213–1.881)
	– Whipps Cross University Hospital	2.000 (0.647–6.185)
	Surgery type	
	– Combined approach tympanoplasty	[1.00]
	– Atticotomy or attico-antrostomy	1.050 (0.305–3.614)
	– Modified radical mastoidectomy	0.875 (0.290–2.645)
	– Obliteration	1.167 (0.274–4.976)
	Surgery type	
	– Combined approach tympanoplasty	[1.00]
	– Non combined approach tympanoplasty (atticotomy or attico-antrostomy, modified radical mastoidectomy, obliteration)	0.984 (0.394–2.457)
	Revision surgery?	
	– No	[1.00]
	– Yes	0.467 (0.162–1.347)

Data represent odds ratios (95 per cent confidence intervals) unless indicated otherwise. '[1.00]' indicates the reference values. *$p = 0.011$. CSOM = chronic suppurative otitis media

We present the first study comparing patient-reported outcomes following different surgical techniques for mastoid surgery. The average Glasgow Benefit Inventory score was calculated as 14.2. This correlates well with a large-scale quality of life outcomes study conducted in Scotland by Swan *et al*., which reported an average Glasgow Benefit Inventory score of 13.8 for patients who underwent surgical treatment.[10] These authors also showed a significant gain in the Health Utilities Index mark 3 scores for surgical treatment of active middle-ear disease (+0.156) and inactive middle-ear disease (+0.139). The Health Utilities Index mark 3 is a generic questionnaire widely used in health economic evaluations across all domains of healthcare.

Dornhoffer *et al*. reported an average post-operative Glasgow Benefit Inventory score of 28.9.[1] This correlated well with hearing outcomes and levels of ear discharge in their study. However, the patient cohort studied consisted only of revision cases undergoing mastoid exploration and obliteration.

Merchant *et al*. investigated a similar cohort of patients to our study, with larger numbers (272 patients).[2] The only outcome they recorded was control of infection, with an overall success rate of 95 per cent. As in our study, they found no difference between the type of surgery, extent of disease or whether the surgery was primary or revision. However, patients with cholesteatoma fared better than those with just granulation tissue. This discrepancy, and the gender differences in our study, could be explained by the fact that we used a subjective outcome questionnaire, whereas Merchant *et al*. used clinical examination as the outcome measure.

A cost–utility analysis of tympanomastoid surgery revealed that this was a cost-effective treatment, particularly in those with discharging ears.[3] This aspect of mastoid surgery was not explored in our study.

The surgical aims of creating a safe and dry ear, achieved by eradicating squamous disease, will frequently not be perceived by the patient. It is the prevention of future disease-related morbidity that is often the motivation for mastoid surgery in the presence of cholesteatoma. This helps explain the low Glasgow Benefit Inventory score reported in our study compared to surgical interventions in other specialties.[9]

The current study is also limited by relatively small numbers, although we have shown that there is adequate power to detect a large effect size.

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While others have found improved health-related quality of life using the Chronic Ear Survey questionnaire in surgically managed chronic otitis media cases, they also note other independent factors associated with worse outcomes. These include occurrence of complications, diabetes mellitus, a high level of education and low post-operative air conduction thresholds.[11]

Surgical technique, disease stage and disease type had no impact on patient-reported quality of life as indicated by the Glasgow Benefit Inventory score responses we received. A non-significant trend towards improvement in the canal wall down group for the physical domain was found. Greater numbers of patients may have led to a significant finding in this subscale of the Glasgow Benefit Inventory.

Based on the findings of our study, surgeons should not feel compelled towards a particular type of operation to treat chronic otitis media because of perceived improved outcomes. The surgeon should choose the technique that they feel is most appropriate for the patient in view of disease stage, co-morbidities and follow-up requirements. The lack of a significant difference in outcome associated with disease types and stages suggests that in general an appropriate operation has been performed. This also supports the view that the surgeon should choose the technique he or she feels most comfortable with and that is most appropriate for each case.

- **Chronic otitis media as a disease entity causes significant morbidity and occasional mortality**
- **Patient-reported outcomes indicate minimal changes in quality of life following surgical treatment**
- **No previous studies have investigated patient-reported outcomes in relation to different surgical treatments**
- **This study indicates that different surgical techniques are not associated with different quality of life outcomes, as measured using the Glasgow Benefit Inventory**
- **Disease type and stage also do not affect outcome; however, women had significantly poorer scores than men post-operatively**
- **Surgical technique should depend on disease extent, patient co-morbidities, follow-up requirements and surgeon preference**

There is no clear explanation for the poorer outcomes in women compared to men. Chronic otitis media as a disease process shows no predilection for either gender, and the Glasgow Benefit Inventory score is valid for both sexes. The increased revision rate in women in this series correlates with poorer patient-reported outcomes. This effect is most likely a result of the relatively small numbers in this study, although it could also represent a differing impact of chronic otitis media and mastoid surgery, along with a difference in expectations, between the sexes. Further work with increased patient numbers would provide more information.

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