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# Chronic otitis media surgery in the only hearing ear

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**Abstract.** *Chronic otitis media surgery in the only hearing ear. Objectives*: The present study aimed to investigate how quality of life was impacted in patients who underwent surgery for chronic otitis media in their only remaining hearing ear (OHE). Such surgical treatment is controversial, and avoided by many surgeons due to the high risk of hearing loss due to surgery. However, if the patient is left untreated, hearing may further deteriorate over time, decreasing the patient's quality of life to an undesirable level.
*Method*: We performed a retrospective single-institution study of a prospectively collected database in a tertiary university hospital. Twenty-three patients with OHE who underwent surgical treatment were retrospectively analyzed. The patients' age, sex, treated ear, indications, and preoperative and postoperative hearing levels were recorded. The data were statistically analyzed.
*Results*: Of the 23 patients with OHE, 15 regularly attended follow-up for at least two years. In all cases, the tympanic membrane perforations were closed and the ear drum became dry. An air-bone gap gain of ≥20 dB was measured in five patients, ≥10 dB in seven, and two patients showed no significant change (4-10 dB). One patient showed minimal hearing deterioration of –2 dB.
*Conclusion*: Patients with OHE can be treated surgically to improve hearing levels and quality of life. Modern surgical techniques and instruments – especially in experienced hands – may reduce the possible surgical risks. If hearing deteriorates due to surgery, it may be improved, for example, with cochlear implantation surgery.

## Introduction

Management of chronic otitis media (COM) in an only hearing ear (OHE) remains controversial. It is particularly difficult to decide whether to perform surgery in such cases. Most surgeons avoid operating on an OHE due to the risk of hearing deterioration.[1-4] However, some claim that careful surgery with modern surgical techniques and instruments may reduce the possibility of surgical injury, enabling the performance of surgery such as tympanoplasty or tympanomastoidectomy.[5,6] Furthermore, in the event of hearing deterioration following surgery on an OHE, methods such as cochlear implant surgery can be performed to rectify this problem.

Increased hearing leads to an increase in quality of life. Therefore, here we investigated the results of ear surgery – including tympanoplasty, ossiculoplasty, and mastoidectomy, when necessary – in cases of COM in an OHE. We present the results of these surgical approaches and the effects of the surgeries on quality of life.

## Materials and methods

This retrospective study was approved by the local ethics committee (2012/63). Among operated 1,240 cases of COM, 23 had OHE and underwent surgical treatment by the same surgeon (MTK) between 2000 and 2014, and had at least two years of postoperative follow-up. These cases were retrospectively analyzed. OHE was defined as the contralateral ear with sensorineural hearing loss of more than 80 dB on pure tone audiometry. Indications for surgery were conductive hearing loss, drainage, perforation, and/or cholesteatoma due to COM.

Surgical methods were chosen based on the extent of disease and hearing status. Preoperative pure tone audiometry was performed one day before surgery. Postoperative pure tone audiometry tests were performed at 3, 6, and 12 months postoperatively, and repeated every year after the surgery. Pure-tone audiometry was performed in a double-walled sound room using standard procedures. Audiometric testing of air conduction

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(AC) and bone conduction (BC) thresholds was performed at 250, 500, 1,000, 2,000, and 4,000 Hz. For each frequency, we recorded the AC, BC, and the air-bone gap (ABG) between the pre- and postoperative tests. Frequency-specific changes were statistically analyzed by comparing pre- and postoperative averages. As a parametric test, a t test was used for statistical evaluation. The Kolmogorov-Smirnov test showed a p value of >0.05, indicating that the data showed a normal distribution.

## Results

Of the 23 patients with OHE, 15 regularly attended follow-up evaluations for at least two years. The mean follow-up period was 42.7 months (range, 24 to 71 months). The patient ages ranged from 14 to 64 years (mean, 37.9 years). Nine of the patients were female and six male. The operated ear side was the right for seven patients and left for eight (Table 1).

Of the 15 cases, one underwent canal wall up mastoidectomy with type 1 tympanoplasty, one incudostapedial rebridging with bone cement plus tympanoplasty, two type 2 tympanoplasty, and 11 cases underwent type 1 tympanoplasty alone. Only one case had cholesteatoma (Table 1). Tragal cartilage was utilized as graft material for 11 cases and temporalis muscle fascia for 4 cases.

### *Postoperative ear status*

In all cases, tympanic membrane perforations were closed and the ear drum dried during the postoperative period. No patients experienced problems with the auditory canal or cavity. No complications or adverse effects occurred following surgery.

### *ABG data analysis*

Hearing at all frequencies improved after surgery in all patients except one. ABG data revealed significantly improved mean changes at all frequencies (Tables 2 and 3). As shown in Table 1, ABG gain improved by ≥20 dB in five patients and by ≥10 dB in seven patients, and did not significantly improve (between 4-10 dB) in two patients. One patient showed minimal hearing deterioration of –2 dB.

*Table 1*

Patient characteristics

| No. | Name | Age | Sex | Site | Diagnosis | Tympanoplasty Type | TS | Pre ABG | Post ABG | ABG Gain | Follow-up (Months) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | TC | 41 | F | R | COM without Ch | Type 1 | – | 27 | 23 | 4 | 41 |
| 2 | HS | 61 | M | L | COM without Ch | Type 1 | – | 27 | 16 | 11 | 24 |
| 3 | IA | 55 | M | R | COM with Ch | Type 1 + CWU | – | 48 | 26 | 18 | 39 |
| 4 | EA | 51 | F | R | COM without Ch | Type 1 | – | 31 | 19 | 12 | 24 |
| 5 | MA | 16 | F | R | COM without Ch | Type 1 | + | 26 | 4 | 22 | 27 |
| 6 | GA | 42 | F | L | COM without Ch | Type 1 | – | 19 | 9 | 10 | 61 |
| 7 | HD | 28 | F | R | COM without Ch | Type 1 | – | 20 | 10 | 10 | 29 |
| 8 | FC | 34 | F | R | COM without Ch | Type 2 | + | 26 | 20 | 6 | 62 |
| 9 | FD | 53 | M | L | COM without Ch | Type 1 | – | 18 | 20 | –2 | 63 |
| 10 | GI | 23 | F | R | COM without Ch | Type 1 | – | 33 | 21 | 12 | 71 |
| 11 | EK | 16 | F | L | COM without Ch | Type 1 | – | 32 | 21 | 11 | 58 |
| 12 | NT | 63 | M | L | COM without Ch | Type 2 | – | 36 | 9 | 27 | 30 |
| 13 | GY | 14 | F | L | COM without Ch | Type 1 | – | 39 | 19 | 20 | 62 |
| 14 | ASY | 34 | M | L | COM without Ch | Type 1 + BC | – | 37 | 10 | 27 | 24 |
| 15 | AG | 38 | M | L | COM without Ch | Type 1 | – | 28 | 6 | 22 | 26 |
| Mean | | | | | | | | 29.8 | 15.6 | 14 | 42.7 |
| SD | | | | | | | | 8.11 | 6.86 | 8.43 | 17.86 |

TS: Tympanosclerosis; Pre: Preoperative; Post: Postoperative; ABG: Air bone gap; F: Female; M: Male; R: Right; L: Left; CWU: Canal wall up mastoidectomy; BC: Bone cement; COM: Chronic otitis media; Ch: Cholesteatoma; SD: Standard deviations.

*Table 2*
Values of mean preoperative ABG, postoperative ABG, and ABG closure

| Audiometry Results | ABG Preop (dB) | ABG Postop (dB) | ABG Closure (dB) |
|---|---|---|---|
| 250 Hz | 33 | 15 | 18 |
| 500 Hz | 30 | 14 | 16 |
| 1000 Hz | 31 | 15 | 16 |
| 2000 Hz | 26 | 14 | 12 |
| 4000 Hz | 30 | 20 | 8 |
| Mean | 30 | 16 | 14 |

*Table 3*
Postoperative ABG success rates

| Postoperative ABG | n | % |
|---|---|---|
| 0-10 dB | 6 | 40 |
| 11-20 dB | 5 | 33.3 |
| 21-30 dB | 4 | 26.7 |
| Total | 15 | 100 |

ABG: Air bone gap.

## Discussion

Surgery for COM, with or without cholesteatoma, in an OHE carries a high risk of postoperative hearing loss, leading the majority of surgeons to avoid surgery in an OHE.[1-4] However, some authors propose that careful surgical management by experience surgeons is warranted in such cases if medical management is insufficient for healing and there exists no medical contraindication.[5,6] These operations require careful detailed examination, including a high-resolution CT scan of the temporal bone. Surgeons must avoid or minimize unnecessary manipulation of the ossicular chain. With these precautions, tympanoplasty may be performed on patients with COM in an OHE when permitted by the patient's general health status.

There is no consensus regarding the management of cholesteatoma in OHE cases. Battaglia *et al*. suggested that cholesteatoma should not be removed from stapes, and that the matrix should be left in place in patients with cholesteatoma because cholesteatoma in OHE may be associated with a labyrinthine fistula.[4] Gacek found that removal of the matrix from the fistula resulted in severe SNHL development in 100% of patients in a study.[7] In contrast, Sheehy and Brackmann reported an equal incidence of SNHL when the matrix was left on the fistula compared to when it was removed, but they recommended leaving the matrix over the fistula for assessment during a second-stage procedure.[8] In 1992, Sanna *et al*. sent a questionnaire to 15 European and American otologists regarding their approach to OHE surgery. The questionnaire answers indicated that surgery is necessary for OHE with cholesteatoma, that a very experienced surgeon should perform the surgery, and that special attention should be given in cases with a labyrinthine fistula.[9] Their results further suggested that most surgeons prefer performing open procedures to avoid second-stage procedures, and keep the cholesteatoma matrix on site in the presence of a labyrinthine fistula.

In the present study, one patient had attic cholesteatoma and underwent canal wall up mastoidectomy plus type 1 tympanoplasty. The stapes footplate was free from the cholesteatoma. During the cholesteatoma surgery, we used MESNA (sodium 2-mercaptoethane sulphonate) – a synthetic sulfur compound that produces mucolysis by disrupting disulfide bonds and breaks disulfide bonds in the structure of the matrix in cholesteatoma surgery, thus increasing surgical success and decreasing the need for second-look surgery.[10,11] MESNA application in the middle ear carries no side effects and/or hazards related to hearing.[12,13] Therefore, we believe that MESNA can be used safely on OHE to remove a cholesteatoma matrix. For the patient with cholesteatoma in our study, diffusion magnetic resonance imaging was performed to control recurrent or residual cholesteatoma. Cholesteatoma did not re-occur in the postoperative 39-month follow-up period. This case showed a good postsurgical gain of ABG values (Table 1).

Sanna *et al*. reported that surgery should be performed for a draining OHE without cholesteatoma only if SNHL ensues – not to treat central OHE perforations.[9] Sakagami *et al*. reported that hearing deterioration in a unilateral perforated ear with COM (0.61 dB/year) is significantly greater than in the contralateral normal ear (0.13 dB/year). Therefore, they recommend operating on an OHE with COM to prevent hearing deterioration in the future.[14] Most studies of surgery on an OHE recommend avoiding ossicular manipulation to prevent possible inner ear damage.[1-4] The use of modern surgical techniques and instruments make it easier to avoid such damage during operation.[5,15]

In our practice, we prefer to treat patients with COM in an OHE as soon as possible to avoid the hearing deterioration that may occur if the OHE is left untreated. We recommend surgical treatment ranging from myringoplasty to open cavity mastoidectomy, performed by an experienced surgeon using modern tools and techniques. Sakagsami *et al*. discussed the very low risk for inner ear damage during an operation performed by an experienced surgeon.[15] In the event of unexpected hearing loss after surgery, cochlear implantation may be an option for salvage. There are many reports of successful cochlear implantation in COM and canal wall down tympanoplasty cavities.[16]

Bone cement is a good and inexpensive option for resolving some ossicular chain problems, such as incudostapedial rebridging to achieve successful hearing improvement.[17] Bone cements are safe and do not affect inner ear functions, and some reports have demonstrated their biocompatibility and osseointegration.[18] In the current study, one patient exhibited erosion on the long process of the incus. In this case, AquaCem glass ionomer bone cement (Dentsply, Konstanz, Germany) was used for incudostapedial rebridging, and this patient achieved a great gain in ABG values after a 24 months follow-up period (Table 1). The pre-operative air-bone gap of 37 dB was reduced to 10 dB postoperatively.

Currently, the graft materials most commonly used for tympanic membrane perforation are temporalis muscle fascia and tragal cartilage. Comparable hearing results are found with these two materials. Graft material is selected based on the middle ear status, with tragal cartilage preferred for advanced middle ear disorders (e.g., total perforations, atelectasis, or recurrent perforations) and temporalis muscle fascia for central perforations.[19] We selected tragal cartilage as the graft material for 11 cases and temporalis muscle fascia for 4 cases.

Our opinion is similar to that of Tos – that surgery on OHE should not be rejected and may be performed with only a small possibility of worsening the hearing loss.[20] To avoid postoperative deterioration of hearing, patients must be carefully selected, the ears must be treated medically during the preoperative period if necessary, the eustachian tube should be open, the operation must be performed by an experienced otosurgeon, and gentle operative methods must be used.[20]

## Conclusion

Surgery in an only hearing ear remains controversial and presents otosurgeons with a clinical and medico-legal dilemma. It was previously believed that surgery for COM on an OHE should be avoided due to the high risk of hearing deterioration. However, in our opinion, these patients can be treated surgically for hearing improvement, with the aim of improving the patient's quality of life and alleviating their anxiety. Modern surgical techniques and instruments – especially in experienced hands – can reduce the risk of surgical hearing deterioration. Furthermore, in the event that hearing deteriorates secondary to ear surgery, it can be improved with cochlear implantation surgery.

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