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# Management of Chronic Otitis Media in the Only Hearing Ear

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***Objective:*** **Chronic ear surgery is difficult. The management of such a disease either with or without cholesteatoma and in an only hearing ear is particularly challenging. Consequences of disease or unintended outcomes of therapy can both result in patient lifestyle alterations of major proportion. This report offers a diagnostic and treatment plan for chronic otitis media with and without cholesteatoma in the only hearing ear.** ***Methods:*** **More than 10,000 charts of patients with chronic otitis media were retrospectively reviewed. Twenty-seven charts of patients with chronic otitis media in an only hearing ear who underwent surgical treatment were identified. The patients were followed for an average time of 43 months.** ***Results:*** **Overall, the chronic otitis media was well controlled, and there was no change in the average discrimination or hearing thresholds when comparing preoperative and postoperative results.** ***Conclusions:*** **Chronic otitis media with and without cholesteatoma in an only hearing ear can be treated successfully with hearing preservation. Canal wall down tympanomastoidectomy is performed in most cases. Manipulation of the ossicular chain is avoided, and cholesteatoma that lies over a potential fistula is exteriorized.** ***Key Words:*** **Chronic otitis media, cholesteatoma, only hearing ear, fistula.**

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## INTRODUCTION

When treating a patient with chronic otitis media in an only hearing ear, many difficult management decisions must be made regarding how to control the disease while optimizing a hearing result. Questions arise such as the following: "Is it appropriate to prolong medical management of the chronic otitis media in these patients to minimize the risk of surgical compromise of the hearing in that ear?" "Should a canal wall down mastoidectomy always be performed on an only hearing ear?" "What surgical maneuvers minimize the risk of hearing loss in an only hearing ear, and how do these maneuvers differ from those that are performed in a patient with normal hearing in the contralateral ear?"

Several reports have been published addressing these issues,[1–7] although no consensus exists regarding the indications and type of surgery to be performed. Yamamoto et al.[1] in 1997 performed intact canal wall tympanomastoidectomy in 16 of 30 patients, and Perez de Tagle et al.[2] performed canal wall down tympanomastoidectomy in 7 of 8 patients. In both studies, surgery was performed in cases of refractory otorrhea or cholesteatoma involving an only hearing ear. In 1992, Sanna et al.[3] sent a questionnaire to prominent otologists in Europe and the United States asking how they treat patients who have chronic ear disease in an only hearing ear. The questionnaire indicated that there is no consensus regarding type of surgical treatment, and it also suggested that there is a mix of opinions regarding indications for surgery. Respondents agreed that cholesteatoma is a strong surgical indication whereas refractory otorrhea is a weaker indication. Earlier reports by Althaus[4] in 1981, Gacek[5] in 1973, Schuknecht and Gacek[6] in 1973, and Chandler and Freeman[7] in 1972 confirmed the lack of consensus regarding indications for surgery and type of surgery to be performed.

We agree with the tenets put forth by Glasscock et al.[8] in 1990, who published a review of 12 patients treated surgically for cholesteatoma in an only hearing ear, with a follow-up of 2 to 48 months. Surgery was advocated in cases of progressive hearing loss in association with chronic ear disease, increasing cholesteatoma size, and uncontrolled otorrhea. One-stage canal wall down procedures were performed to minimize the number of operations performed on an only hearing ear. Cholesteatoma that was over apparent cochlear and labyrinthine fistulas was left in place, the overriding principle being to preserve hearing.

In the current study, 27 cases are retrospectively reviewed with an average follow-up of 43 months, and the critical issues that arise when treating chronic otitis media in an only hearing ear are addressed. Indications for surgery, complications from surgery, and hearing results are discussed. Surgical maneuvers that minimize hearing loss and optimize hearing results are highlighted, and treatment recommendations are formulated.

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## MATERIALS AND METHODS

Retrospective review of more than 10,000 charts was performed. Twenty-seven patients diagnosed with chronic ear disease, with or without cholesteatoma, in an only hearing ear were identified. An only hearing ear was defined as the opposite ear having no response to pure-tone testing or as an ear with testable pure tones but less than 50% discrimination.

On presentation, 26 of the 27 patients complained of intermittent chronic otorrhea in their only hearing ear. Fifteen of these patients complained of hearing loss. Only one patient complained of hearing loss but no otorrhea. Eight of the 27 patients complained of preoperative room-spinning vertigo, a sign of possible labyrinthine fistula. Nine of the 27 patients had prior surgery on their only hearing ear, but the remainder were referred to The Otology Group without a history of prior surgery. Seventeen right ears and 10 left ears had been treated, and the average duration of disease before surgery was 71 months. The age range of the patients was 6 to 67 years, with 19 male and 8 female patients.

The etiology of the contralateral dead ear was a point of interest. Twelve of the patients reported experiencing a loss of hearing after chronic ear surgery in that side. Nine of the patients reported loss of hearing in that side during childhood episodes of otitis media. One patient lost hearing on that side because of trauma, another was diagnosed with sudden sensorineural hearing loss, another was deaf at birth in that side, one reported temporal lobe resection as a result of histiocytosis X, and the last patient was diagnosed with autoimmune inner ear disease with deafness on the contralateral side.

On physical examination, 20 of the 27 patients presented with cholesteatoma. Six of the 27 patients had evidence of chronic otorrhea without cholesteatoma. One patient who complained of otorrhea had evidence on initial examination of severe atelectasis but no cholesteatoma or obvious drainage.

Preoperative and postoperative audiograms as well as computed tomography (CT) scans of the temporal bone were ordered routinely. Audiograms were performed on a regular basis during follow-up care for the patients. Follow-up ranged from 1 month to 13 years. To assess the hearing results after surgery, the patient's latest audiogram was compared with the preoperative audiogram. Because this analysis was meant to reflect the patient's ability to understand speech, both the pure-tone averages at 500, 1000, 2000, and 4000 Hz and the speech discrimination scores were analyzed. This analysis is in accordance with the guidelines established by the Committee on Hearing and Equilibrium for the evaluation of results of treatment of conductive hearing loss.[9] The 3000-Hz frequency was not routinely used.

| PROCEDURE | # PATIENTS |
|---|---|
| Classic Tympanoplasty with Canal Wall down Mastoidectomy | 24 |
| Bondy Procedure | 1 |
| Tympanoplasty with Intact Canal Wall Mastoidectomy | 1 |
| Transcanal Tympanoplasty | 1 |

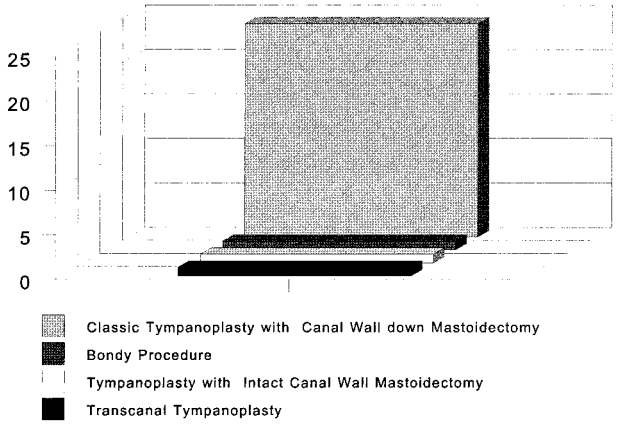


Fig. 1. Variety of operations performed.

Audiograms revealed mixed hearing loss in 21 of the patients, pure conductive hearing loss in three of the patients, pure sensorineural hearing loss in two of the patients, and no hearing loss in one patient. The patient who had normal hearing presented with chronic otorrhea but no cholesteatoma. In the 21 patients with a mixed loss, the sensorineural component could not be attributed to any factor other than chronic otitis media in the involved ear or a history of prior surgery.

Preoperative CT scans of the temporal bone were performed primarily to assess the location and the extent of the disease within the middle ear and mastoid and secondarily to look for bony erosion of the otic capsule as an indication of labyrinthine fistula. Six CT scans of the head with and without contrast were performed in patients who had active drainage from the only hearing ear to evaluate for abscess formation or dural enhancement.

In patients with chronic otitis media without cholesteatoma, aggressive medical management was empirically performed for 14 days with ciprofloxacin drops, 2% acetic acid, and broad-spectrum intravenous antibiotics such as ceftriaxone plus levofloxacin. Surgery was performed only when medical therapy failed (seven patients). In patients with cholesteatoma who had progressive symptoms or signs (20 patients) surgery was recommended. This included a case of room-spinning vertigo with possible labyrinthine fistula. Of the 27 patients, 25 had tympanoplasties with canal wall down mastoidectomies in the only hearing ear (Fig. 1). One patient had a classic Bondy procedure in which the canal wall was taken down but the matrix was left intact over the incus and malleus because the patient had excellent hearing preoperatively. Postoperatively, his hearing remained unchanged. Another patient had a transcanal tympanoplasty, and a second patient had a tympanoplasty with intact canal wall mastoidectomy (Fig. 1).

The patient who had the transcanal tympanoplasty had a central perforation anteriorly secondary to trauma with associated otorrhea. His perforation was easily and successfully approached in transcanal fashion. The second patient had cholesteatoma in the anterior epitympanum and eustachian tube and was thought to be safely removed without taking the canal wall down. However, this patient did develop a perforation postoperatively that had to be revised. A second time, the canal wall was left intact, and the revision operation was successful.

In general, canal wall down mastoidectomies were performed to optimize control of infection and cholesteatoma while minimizing the risk to hearing. The goal of the surgery is to achieve a safe, clean, dry, and healed bowl free from future operations. Nerve integrity monitoring is performed routinely. During the procedure, if the ear is found to be inflamed with granulation tissue or frank pus or if labyrinthine fistula is suspected, antibiotic prophylaxis is performed. One gram of cefazolin IV is given unless penicillin allergy is apparent. In this case, 900 mg clindamycin IV is given once. Patients with evidence of labyrinthine fistula receive 10 mg dexamethasone IV to prevent postoperative labyrinthine inflammation and hearing loss.

When the matrix of the cholesteatoma appears dimpled or flattened over, a cuff of matrix with a 2- or 3-mm rim is left down over the dimpled or flattened area. The rest of the cholesteatoma matrix is removed. All air cells are removed in standard fashion

with a cutting burr, and the cavity is burnished with a diamond burr. Once the cavity is clean, the remnant matrix is exteriorized. In an only hearing ear, matrix should be left down on areas suspect for fistulas, including cases when cholesteatoma is found in the oval window niche. Cholesteatoma is removed from a dehiscent facial nerve unless attached, and in our series no such attachment, facial paresis, or paralysis occurred. No brain hernias were encountered.

## RESULTS

### *Residual Cholesteatoma and Postoperative Otorrhea*

Cholesteatoma was completely removed except in six of the cases. In three of the cases, the matrix of the cholesteatoma was left over lateral semicircular canal fistulas. In three other cases, oval window cholesteatoma was left intact to prevent postoperative sensorineural hearing loss.

In the patients with lateral canal fistulas, none of the patients lost their hearing. In one patient in whom the matrix was left on the fistula, otorrhea developed 4 years after the operation. There was a cholesteatoma sac covering the promontory that was opened to exteriorize the cholesteatoma. The patient did have recurrent otorrhea, which eventually resolved. The other two patients with lateral canal fistulas have been followed without incident.

In the three cases in which cholesteatoma was left in the oval window, one patient developed otorrhea 6 months after the initial procedure. This was treated conservatively and resolved on its own with otic drops. Another patient with cholesteatoma left on the oval window developed infection 6 years after the procedure. This otorrhea resolved independently and was not associated with perforation. The last patient with cholesteatoma left on the oval window developed complete sensorineural hearing loss 4 years after the procedure and later refused a cochlear implant.

The patient having transcanal tympanoplasty developed an otitis externa that did not threaten the integrity of the graft. This infection resolved with otic drops, and the graft healed nicely. Of note, recurrence of cholesteatoma did not occur in patients who had their cholesteatoma "completely" removed.

### *Hearing*

No significant change in hearing was defined as a change in discrimination of less than 15% and a change in the pure-tone averages of less than 10 dB. On averaging the hearing results of the 27 patients, no significant changes in discrimination or in the pure-tone averages were found. Five of the 27 patients did have greater than 15% change in their discrimination. Table I outlines the changes in discrimination in these patients. Three patients had a drop in discrimination, and two of the patients had improvement in their discrimination and went from unusable to usable hearing.

The changes in the air-conduction pure-tone average at 500, 1000, 2000, and 4000 Hz are shown in Figure 2. Of the 27 patients, 16 had no significant change in their hearing thresholds. Six had greater than 10 dB improvement in their hearing, and five had a greater than 10 dB decrease in their hearing. Of the five patients who had a decrease in their hearing thresholds, two retained 100% discrimination whereas three had diminished discrimination. One of the three patients, as described earlier, had cholesteatoma that was not removed from the oval window niche because of the risk to hearing, and his discrimination dropped down to zero 4 years postoperatively. He refused a cochlear implant. The second patient also had oval window cholesteatoma that was not removed. Over a 6-year period, this patient had a slow drop in discrimination with a score of 48%, whereas it was 84% preoperatively. The third patient did not have residual cholesteatoma but gradually developed a drop in discrimination from 96% to 60% over a 5-year period after the surgery. There was no infection or evidence of recurrent cholesteatoma to explain this drop.

Of the three patients who had cholesteatoma matrix left on their labyrinthine fistula, one had stable hearing

TABLE I.
Significant Changes (>15%) in Discrimination.

| No. | Preoperative Discrimination | Postoperative Discrimination | Associated Finding |
|---|---|---|---|
| 1 | 32% | 0% | Oval window cholesteatoma with matrix left in place |
| 2 | 84% | 48% | |
| 3 | 96% | 60% | No cause found |
| 4 | 20% | 72% | Labyrinthine fistula with matrix left in place |
| 5 | 8% | 44% | Labyrinthine fistula with matrix left in place |

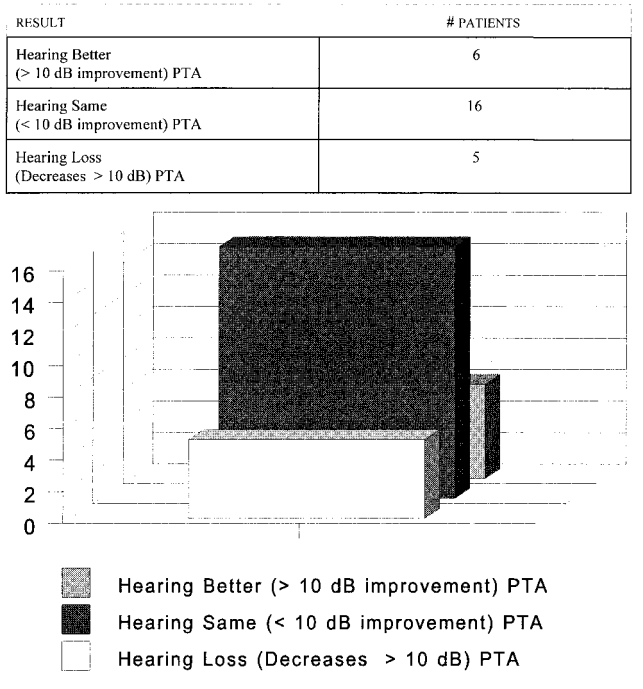


Fig. 2. Hearing results of latest audiogram (air-conduction pure-tone average) compared with preoperative audiogram. Of the five patients with hearing loss, two of the five did not drop their discrimination, whereas three did.

TABLE II.
Predictive Factors for Labyrinthine Fistula.

| Risk Factor | No. of Patients With Fistula/No. of Patients With Risk Factor |
|---|---|
| Preoperative vertigo | 3/8 |
| Prior surgery | 3/9 |
| Temporal bone CT-scan with evidence of fistula | 3/1 |

whereas two developed improved discrimination during their follow-up. One patient had a preoperative discrimination score of 20% that increased to 72%, whereas another patient had discrimination of 8% that increased to 44% over a 4-year period. Of the three patients who had labyrinthine fistula, only one had evidence of a fistula on CT scan preoperatively, although three of three patients with fistulas had prior surgery, as well as preoperative vertigo (Table II).

## DISCUSSION

Chronic otitis media, with or without cholesteatoma, in an only hearing ear poses a risk to the labyrinthine function of the ear, and we suggest managing it surgically if medical management fails and if there is no medical contraindication. It is appropriate to evaluate all patients with chronic ear disease in an only hearing ear with a high-resolution CT scan of the temporal bone. This aids in evaluation of anatomy and extent of disease. All therapeutic and interventional measures are directed toward preserving labyrinthine function. One-stage canal wall down procedures are preferable for tympanic membrane perforations with cholesteatoma to minimize the number of times that the ear is placed at risk. It is our surgical philosophy to be concerned that cholesteatoma in an only hearing ear is associated with a labyrinthine fistula. Matrix over the otic capsule is exteriorized, and matrix over a fistula is left intact. The ossicular chain is not manipulated to minimize the possibility of footplate or oval window trauma. Therefore, cholesteatoma is not removed from the stapes, and when fistula is suspected, perioperative intravenous antibiotics and steroids are used.

Preoperatively, the presence of vertigo in patients with cholesteatoma who have had prior surgery is a strong indication that a labyrinthine fistula probably exists, and patients in this scenario should be approached with caution in the operating theater (Table II). Of the eight patients who presented with preoperative vertigo, three had labyrinthine fistulas discovered during surgery. Of the 27 patients, 9 had prior surgery, and all of the patients with fistula fell into this prior surgery category (Table II). The fistula test is not a sensitive indicator of a labyrinthine fistula and has a reported false-negative rate of 50% to 54%.[10–12] It was not used routinely. Sensorineural hearing loss preoperatively also was not associated with the presence of a fistula. Of the 27 patients, 22 had sensorineural hearing loss to some degree, and only 3 of these 22 had fistulas. Sensitivity of the CT scan for detection of labyrinthine fistulas ranges in the literature from 55% to 97%.[13,14,15] In our series, only one of the three patients who had a lateral semicircular canal fistula had evidence of the fistula on CT scan.

When cholesteatoma was present over a labyrinthine fistula or in the oval window, the matrix was left in place. When cholesteatoma matrix is left in place, the chance of developing postoperative otorrhea and sensorineural hearing loss is increased, more so, it seems, when left in the oval window niche.

The management of a labyrinthine fistula or cholesteatoma in the oval window in an only hearing ear presents a critical problem. Should the cholesteatoma be removed from the fistula or the oval window, or should it be left in place? The presence of a fistula indicates an increased risk of sensorineural hearing loss as shown by Sheehy,[16] who reported that 5 of 11 patients who had postoperative sensorineural hearing loss had a lateral semicircular canal fistula which was discovered intraoperatively. Gacek[17] noted that when matrix was removed from a cochlear fistula, 100% of the patients developed profound sensorineural hearing loss. However, Gacek also reported that when matrix was removed from a semicircular canal fistula, no severe sensorineural hearing loss was noted in nine of nine patients. In addition, Sheehy and Brackmann[12] reported that there was an identical incidence of sensorineural hearing loss when matrix was left on the fistula as opposed to being removed but suggested leaving matrix over a fistula for later evaluation during a second-stage procedure. Although there is a lack of consensus regarding management of cholesteatoma over labyrinthine fistulas, it is our opinion that the matrix should be left on the fistula or in the oval window when an only hearing ear is involved. We also assume that in an only hearing ear the matrix is covering a fistula even when the fistula cannot be detected preoperatively on temporal bone CT scan or seen directly intraoperatively. When taking these precautions, our results indicate that cholesteatoma surgery on an only hearing ear can be performed safely while minimizing the risk to hearing.

## CONCLUSION

Chronic otitis media with or without cholesteatoma in an only hearing ear can be treated successfully with hearing preservation. High-resolution CT scans of the temporal bone are performed on all patients with chronic otitis media in an only hearing ear to evaluate anatomy and extent of disease. Chronic otitis media without cholesteatoma is treated with otic drops and broad-spectrum IV antibiotics for 14 days. Refractory otorrhea and growing cholesteatoma are indications for surgical treatment. Canal wall down tympanomastoidectomy is performed in most cases, with control of disease and hearing preservation being the priorities. Manipulation of the ossicular chain is avoided during the procedure. Cholesteatoma that lies over a potential fistula is exteriorized.

## BIBLIOGRAPHY


1. Yamamoto E, Tasaka Y, Mizukami C, Ogata T, Okumura T, Tanabe M. Tympanoplasty on the only hearing ear with chronic otitis media. *Adv Otorhinolaryngol* 1997;51:35–40.
2. Perez de Tagle JR, Fenton JE, Fagan PA. Mastoid surgery in the only hearing ear. *Laryngoscope* 1996;106:67–70.

3. Sanna M, Shea CM, Gamoletti R, Russo A. Surgery of the 'only hearing ear' with chronic ear disease. *J Laryngol Otol* 1992;106:793–798.
4. Althaus SR. Surgery on the only hearing ear. *Laryngoscope* 1981;91:765–770.
5. Gacek RR. Surgery on 'only-hearing' ears with chronic suppurative middle ear disease. *Ann Otol Rhinol Laryngol* 1973;82:290–296.
6. Schuknecht HF, Gacek RR. Surgery on only-hearing ears. *Trans Am Acad Ophthalmol Otolaryngol* 1973;77:257–266.
7. Chandler JR, Freeman J. Otologic surgery in patients with one hearing ear only. *Laryngoscope* 1972;82:848–863.
8. Glasscock ME, Johnson GD, Poe DS. Surgical management of cholesteatoma in an only hearing ear. *Otolaryngol Head Neck Surg* 1990;102:246–250.
9. Committee on Hearing and Equilibrium guidelines for the evaluation of results of treatment of conductive hearing loss. American Academy of Otolaryngology–Head Neck Surgery Foundation, Inc. *Otolaryngol Head Neck Surg* 1995;113:186–187.
10. Gormley PK. Surgical management of labyrinthine fistula with cholesteatoma. *J Laryngol Otol* 1986;100:1115–1123.
11. McCabe BF. Labyrinthine fistula in chronic mastoiditis. *Ann Otol Rhinol Laryngol (Suppl)* 1974;83:3–19.
12. Sheehy JL, Brackmann DE. Cholesteatoma surgery: management of the labyrinthine fistula—a report of 97 cases. *Laryngoscope* 1979;89:78–87.
13. Soda-Merhy A, Betancourt-Suárez MA. Surgical treatment of labyrinthine fistula caused by cholesteatoma. *Otolaryngol Head Neck Surg* 2000;122:739–742.
14. Fuse T, Tada Y, Aoyagi M, Sugai Y. CT Detection of facial canal dehiscence and semicircular canal fistula: comparison with surgical findings. *J Comput Assist Tomogr* 1996; 20:221–224.
15. Parisier SC, Edelstein DR, Han JC, Weiss MH. Management of labyrinthine fistulas caused by cholesteatoma. *Otolaryngol Head Neck Surg* 1991;104:110–115.
16. Sheehy JL. The intact canal wall technique in management of aural cholesteatoma. *J Laryngol Otol* 1970;84:1–31.
17. Gacek RR. The surgical management of labyrinthine fistula and chronic otitis media with cholesteatoma. *Ann Otol Rhinol Laryngol (Suppl)* 1974;83:3–19.