

Labyrinthine Fistula in Chronic Otitis Media with Cholesteatoma

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Abstract

Objective: To present the experience in the operative management of labyrinthine fistula caused by cholesteatoma.

Methods: The clinical charts of 16 patients who underwent surgical procedures for cholesteatoma complicated by labyrinthine fistula between 2003 and 2008 were reviewed retrospectively. In this period, 108 ears were operated for cholesteatoma. In each patient, the site and size of the fistula were evaluated during surgery and the hearing thresholds were compared before and after surgery.

Results: The fistula involved the lateral semicircular canals in 15 patients. Multiple fistulae were observed in one patient. Postoperative hearing levels were unchanged or improved in 88% patients. Favourable outcomes were obtained in patients treated with surgical sealing of the interrupted labyrinth.

Conclusion: The current study confirmed that careful manipulation of the labyrinthine fistula is mandatory to preserve hearing function in these patients. According to the author's experience, the canal wall down transmastoid approach with mastoid cavity obliteration is a favourite technique of labyrinthine fistula treatment.

Keywords: Labyrinthine fistula, Chronic otitis media, Cholesteatoma (JPMA 61:352; 2011).

Introduction

Labyrinthine fistula represents an erosive loss of the endochondral bone overlying the labyrinth. This loss of the overlying protective bone allows pressure or mass-induced motion of the underlying endosteum, perilymph, and by contiguity, the endolymphatic compartment, evoking vestibular and sometimes auditory symptoms.¹

Labyrinthine fistula occurrence is one of the most common complications in chronic otitis media with cholesteatoma.²⁻⁶ The incidence of labyrinthine fistula secondary to cholesteatoma has remained relatively constant over the last 50 years. A frequency of 5-10 % is frequently reported in most studies.^{7,8} Very commonly, the fistula is seen in the lateral semicircular canal.⁹⁻¹²

Controversy remains regarding the optimal management of this condition. Specifically, considerations of intact canal wall versus canal wall down approaches as well as total or incomplete matrix removal remain unsettled. These concerns are based on the destructive nature of the cholesteatoma and the risk of losing cochlear and /or vestibular function following surgical opening of the labyrinth. Some otolaryngologists feel that preservation of cholesteatoma matrix predisposes to further progression of disease and advocate complete removal to prevent further complications.¹³ Alternatively, others feel that preservation of the matrix over a fistula with exteriorization through an open cavity serves to protect labyrinthine and cochlear function.¹⁴ This study was undertaken to identify the risks of damage to labyrinthine function secondary to complete

cholesteatoma removal with primary fistula repair.

Patients and Methods

This retrospective study showed that 108 ears with cholesteatoma underwent surgery by the authors between 2003-2007. Patients with limited bony erosion, such as a "blue lining" were excluded. Based on these criteria, 16 patients with Labyrinthine Fistula were identified. The group consisted of 10 males and 6 females with ages ranging from 19-48 years (mean, 27.18 ± 5.01 years).

Symptoms of aural discharge and hearing loss since early childhood were noted in all the patients. Ten patients reported symptom of vertigo preoperatively. Intermittent symptomatic vertigo was seen in 6 patients and persistent in 4 patients. Four (25%) patients had undergone prior otologic surgery. Two patients had had canal wall down procedures, while the other two had been subjected to an intact canal wall mastoidectomy with tympanoplasty. On otoscopic examination, the tympanic membrane was perforated in 7 patients (44%), whereas the remaining 9 (56%) showed a posterosuperior retraction cholesteatoma. Preoperative audiometric evaluations were obtained in all patients. Results were given utilizing the pure tone average of 500, 1000, and 2000 HZ. Normal auditory function was defined as 0-20 dB HL. A conductive hearing loss of 30-55 dB was noted in all patients. One patient manifested a dead ear preoperatively.

All patients underwent preoperative computed tomography (CT). A lateral semicircular canal fistula was identified in three cases. One patient was documented as

having multiple fistulae in lateral, superior semicircular canals, vestibule, and cochlea. This case had a dead ear. The remaining patients revealed findings consistent with cholesteatoma but an intact otic capsule.

Based on the patient's history and physical or radiographic findings, a fistula was suspected in 11 of 16 (69%) patients before surgery. This included those who had a positive fistula test and/or preoperative symptoms of vertigo.

Procedure: Infections were prevented by using topical, oral or when indicated, systemic antibiotics in the preoperative period. All patients in this series underwent a canal wall down mastoidectomy with tympanoplasty upon the discovery of a fistula. Only one patient with a dead ear had radical mastoidectomy.

Uninvolved matrix was incised and underlying keratinaceous material removed, leaving only the portion of the matrix covering the semicircular canals. The remaining matrix was slowly elevated. If a fistula was identified, the matrix was returned to its original position. All remaining tissues were removed, leaving only matrix overlying the involved canal until the termination of the procedure, including the creation of canal wall down mastoidectomy and generous meatoplasty. In this step, the matrix remaining over the fistula was carefully removed under constant irrigation. The fistula was immediately sealed with bone dust reinforced with fascia (Figure). In all patients mastoid cavity was obliterated by bone pate and Palva flap. In one patient with a dead ear having multiple fistulae of the

semicircular canals, vestibule and cochlea, the matrix was removed at the end of the operation. Immediately after removing the matrix over the fistulae, there was a massive cerebrospinal fluid (CSF) leak. In this particular case, fistulae were covered with the temporalis fascia and then mastoid and middle ear space were obliterated with abdominal fat tissue.

Results

The distribution of the sites of the labyrinthine fistula in the 16 study patients are shown in Table-1.

All patients developed a dry, well epithelialized cavity within 3 months following surgery. After 6 to 12

Table-1: Distribution of sites of the labyrinthine fistula.

Site of fistula	No. of patients (%)
Lateral Scc	15 (93.75)
Lateral,superior,posterior SCC,vestibule and Cochlea	1 (6.25)

Table-2: Postoperative hearing function.

Postoperative bone conduction	No. of patients (%)
Unchanged	10 (64)
Improved (5dB)	4 (24)
Deteriorated (5-20dB)	2 (12)

months, all patients, except one, underwent second look surgery and ossicular reconstruction. Three patients had residual cholesteatoma (pearl) at the sinus tympany area. Residual cholesteatoma was removed and ossicular reconstruction was then carried out. Neither of these patients has developed recurrent disease.

A major concern following repair of any labyrinthine fistula is the presence of vertigo. Seven patients had symptoms of mild positional dizziness that resolved within 72 hours.

The remaining patients had lingering symptoms of vertigo that subsequently resolved over a period of 1-2 months. All were able to return to their original activities. Nine of 16 (56%) patients were discharged on the first postoperative day. The remainder 7 (44%) required an additional day for vestibular suppression prior to discharge.

All patients in these series underwent postoperative audiometric evaluation. Results were reported by using the previously mentioned pure tone average. Normal auditory function was considered to be between 0 and 20 dB HL. Bone conduction represented an assessment of cochlear stability. In 2 (12%) patients, the bone conduction average decreased by 10 dB. Four (24%) patients had improved 5 dB bone conduction. All remaining patients had no change in their bone conduction pure tone average (Table-2).

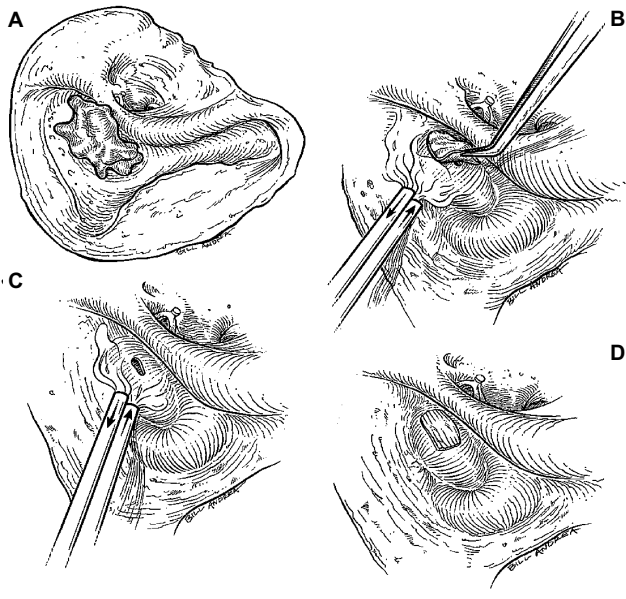


Figure: The operative technique in managing a labyrinthine fistula due to cholesteatoma. A: Illustration of a typical cholesteatoma overlying the lateral semicircular canal. B: Removal of the matrix of the cholesteatoma overlying a semicircular canal fistula under constant irrigation. C: Fistula exposed under constant irrigation. D: Repair of the fistula with bone dust and fascia.

Postoperative air conduction pure tone average varied according to the status of the ossicles. Except one patient with dead ear, all patients underwent a planned second-stage ossicular reconstruction. In each of these cases, improvement in auditory function of 15-35 dB was realized.

Discussion

The evaluation and management of labyrinthine fistula secondary to cholesteatoma remains unsettled. Definitive preoperative diagnosis is not possible in all patients. Further, universal consensus on management of this problem does not exist.

While the incidence of chronic otitis media and cholesteatoma have decreased, certain factors should alert the otologist to potential or impending complications. The presence of vertigo in association with otorrhea and/or sensorineural hearing loss should increase the level of suspicion of labyrinthine involvement secondary to a middle ear or mastoid pathology. While a positive fistula test strongly suggests labyrinthine involvement, this finding was noted in only 69% of the patients in this report. The absence of positive findings on pneumatic otoscopy is most likely secondary to a mass effect within the middle ear that prevented transmission of a pressure change to the inner ear. This abnormality, as well as such other signs of the labyrinthine involvement as decreased bone conduction and facial nerve involvement, should serve to alert the otolaryngologist to the possibility of a fistula. When history or physical findings suggest labyrinthine invasion, radiographic imaging of temporal bones should be considered.

Current-generation CT has allowed increased resolution of the structures within the temporal bones and is now considered the investigation of choice. While it would be expected that this type of imaging would be helpful in confirming the presence or absence of labyrinthine invasion by cholesteatoma, only a small minority of fistulae in this series were identified with CT. Similar difficulties were noted in other previous reports.¹³ Preliminary consultation with the neuroradiologist should improve the likelihood of an accurate diagnosis. Unfortunately, fistulae measuring less than 2.0 mm may be missed, depending on the positioning of the patient, even with thin-section CT.¹²

The treatment of this complication is the source of many controversies. Some authors¹⁵ favour the use of closed techniques, recommending staged removal in selected cases. Others advocate open techniques¹⁶ for the management of labyrinthine fistula. This type of approach ensures a more extensive intraoperative exposure and a safer postoperative observation.

The use of these different approaches was dependent on matrix treatment. There were various options: matrix left in situ, matrix removed, matrix preserved at the first stage and then removed at the second stage. In this context, Gacek¹⁷ described four factors that one should consider when managing labyrinthine fistula: (a) a surgeon's ability and experience; (b) the location and size of the fistula; (c) the residual hearing in the ear with the fistula compared with the opposite ear; and (d) the mechanism of bony erosion of the cholesteatoma.

The last factor is important in understanding the need for complete removal of the matrix. It is known that cholesteatoma produces collagenase. This substance is felt to be responsible for bone destruction.¹⁸ In addition, it is evident, that mechanical pressure enhances granulation tissue, and this may in turn induce osteoclast bone resorption.¹⁹ Therefore, leaving matrix behind may lead to continued erosion of the underlying labyrinth. In fact, Palva et al.²⁰ noted that 10% of patients with residual cholesteatoma matrix over a known fistula were noted to have a delayed sensorineural hearing loss due to suppurative labyrinthitis. Furthermore, a residual cholesteatoma may be the source of persistent otorrhea.

It is essential that complete removal of cholesteatoma matrix overlying a fistula should be attempted whenever it is feasible. Removal of matrix that is adherent to the membranous labyrinth is reported as highly risky. Staged removal proved to be efficacious, although it is safe only with a thin keratinizing matrix.¹³ In some patients, spontaneous closure of the fistula was described at the second operation.^{21,22} The choice of management for cochlear fistula and only-hearing ear complicated by labyrinthine fistula is an open technique and preservation of the cholesteatoma matrix over the fistula. In such instances, we still prefer an open technique and preservation of the cholesteatoma matrix over the fistula. In some reports, open and closed techniques did not differ significantly regarding outcome.¹²

Our patients had a huge cholesteatoma in the middle ear and mastoid. In all patients, open technique had been used to remove pathology completely. The fistula of labyrinth was sealed with bone dust and reinforced with fascia. Then, the mastoid cavity was obliterated with bone plate and Palva flap. No patients in these series developed a significant cochlear loss as a result of cholesteatoma removal and primary fistula repair utilizing our surgical technique.

A fistula larger than 2.0 mm was not encountered in these series. Reports have suggested that when a larger fistula is detected, the matrix should be left over the

involved area and removal deferred to a second stage.²² Some researchers have described spontaneous dissolution of cholesteatoma matrix with bony closure of the fistula at the time of second review.²¹ Others have noted that even if the matrix remains, the size of the fistula may decrease in an uninfected state.^{21,23}

Controversy continues with regards to canal wall up or down procedures for management of labyrinthine fistula. Many authors report success in two-stage intact canal wall approaches.^{21,22} They advocate leaving behind the matrix over the fistula at the first stage with subsequent removal at a later date. It is the author's opinion, that removal of the canal wall enhances the exposure needed in efficiently removing the underlying pathology.

All of the patients of the presented series had a history of ear discharge since childhood. In such patients, however, it appears that fistula formation is the result of long-term mastoid involvement.

Conclusion

This study confirmed that in labyrinthine fistula due to cholesteatoma careful manipulation of the labyrinthine fistula is mandatory to preserve hearing function in these patients. The author's experience shows that, the canal wall down transmastoid approach with mastoid cavity obliteration (by bone pate and Palva flap) is the favourable technique of labyrinthine fistula treatment. Major advantages of this technique are complete removal of cholesteatoma and preservation of hearing.

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