Otology & Neurotology
29:19–22 © 2007, Otology & Neurotology, Inc.

Management of Chronic Otitis by Middle Ear Obliteration With Blind Sac Closure of the External Auditory Canal

*Mario Sanna, *†Francesco Dispenza, *‡Sean Flanagan, *Alessandro De Stefano, and *Maurizio Falcioni

**Gruppo Otologico Piacenza, Rome; †Dipartimento Scienze Otorinolaringoiatriche, Universitàˆ degli Studi di Palermo, Palermo, Italy; and ‡St. Vincent Hospital, Sydney, Australia*

Objective: Description of a technique of middle ear obliteration (MEO) with blind sac closure of the external auditory canal with discussion of the indications for its use in cases of recalcitrant chronic otitis and in far advanced disease.
Patients: All patients underwent otologic examination and audiologic and radiologic assessments in a quaternary center.
Results: Fifty-three cases of MEO were analyzed. For 9 patients, primary surgery was performed. One case of residual disease was identified. The minimum follow-up was 2 years.
Conclusion: The decision to perform a MEO is one that is made only rarely. However, this is a technique that should be part of every otologist's armamentarium. Whereas the indications for its use are more straightforward in an ear with unserviceable hearing, a MEO is occasionally required in an ear with good cochlear reserve due the severity of disease. All of our patients managed by MEO have had an improvement in their quality of life and a high rate of successful eradication of disease. **Key Words:** Cholesteatoma—Chronic otitis—Mastoid obliteration—Meningoencephalic herniation—Middle ear obliteration—Middle ear revision surgery.

Otol Neurotol **29:**19–22, 2008.

Middle ear obliteration (MEO) using abdominal fat with blind sac closure of the external auditory canal (EAC) and obstruction of the eustachian tube is a surgical option for difficult cases of chronic ear disease. It is a technique that aims to give the patient, often plagued with chronic discharge, multiple previous surgical interventions, and unserviceable hearing a safe dry ear.

Although most chronic ear disease is managed successfully using an individualized approach, it is the meticulous eradication of disease and the creation of a stable cavity able to prevent recurrence that is the cornerstone of success. The restoration of hearing function is a secondary, albeit important, goal. There are cases, however, where even the most experienced otologist is unable to prevent ongoing suppuration despite multiple revision surgeries and assiduous office-based management.

The presence of large areas of exposed dura, and/or meningoencephalic herniation, coexisting with active disease places the patient at significant risk of serious complications (1). Whether iatrogenic or the result of the disease process, most cases can be managed using a combined transmastoid and extradural middle cranial fossa approach (2,3). There are those instances, however, where this is impracticable or inadequate, and a MEO provides the safer option.

Readily available magnetic resonance imaging (MRI) with the use of fat suppression and diffusion sequences makes surveillance of these cases more straightforward, removing the need for second-look surgery but still requiring long-term follow-up (4,5).

In this study, we analyzed the indications and results of our series of 53 patients undergoing MEO for the management of chronic suppurative otitis media with or without meningoencephalic herniation at the Gruppo Otologico between 1983 and 2005.

MATERIALS AND METHODS

A retrospective chart review of 53 patients with an MEO treated at Gruppo Otologico (quaternary center) between 1983 and 2005 was conducted. We included in the present study only patients with a minimum of 2 years of follow-up. Thirty-four patients were men, and 19 were women. Average age was 57 years (range, 7–84 yrs). The right side was involved in 28 cases, and the left side in 25. All patients underwent

Address correspondence and reprint requests to Francesco Dispenza, M.D., Gruppo Otologico Piacenza Via Paolo Emiliani Giudici, 37, 90127 Palermo, Italy; E-mail: francesco-dispenza@libero.it

clinical otologic examination, preoperative, and postoperative audiologic assessment, including pure-tone average (PTA; average of 0.5-1-2-4 kHz) and SDS (speech discrimination score) and a computed tomographic scan of temporal bone. These cases represented a very small proportion (1.06%) of more than 5,000 cases of chronic suppurative ear disease treated by the senior author (M.S.).

INTERVENTION

Meticulous technique is required to perform a blind sac closure. Care not to tear the skin flap of the EAC is important, and the use of a second layer of soft tissue to reinforce the closure is preferable. In the setting of previous surgery, however, especially with the presence of a large meatoplasty, this can be challenging.

Complete exenteration of the disease, mastoid air cells, and mucosa with removal of all skin, tympanic membrane, malleus, and incus is performed. Canal plasty and lowering of the floor of the canal is essential to ensure complete removal of squamous epithelium.

The presence of cholesteatoma matrix adherent to dura can be difficult to manage. The dura itself is often friable, and attempts to achieve complete removal can lead to a dural defect and cerebrospinal fluid (CSF) leak. Bipolar devitalization of residual matrix should be performed as opposed to dural resection (6).

In the presence of meningoencephalic herniation, the prolapsed tissue is reduced using the bipolar diathermy, and a muscle plug or cartilage is placed to reinforce the defect (7).

Once eradication of disease has been completed, the opening of the eustachian tube is abraded and packed with bone wax and soft tissue. The cavity is then obliterated with an abdominal fat graft and immersed in rifampicin. Fibrin glue is also used in the presence of a CSF leak.

Because of the closure of the EAC, radiologic follow-up is mandated. Although CT will give information regarding further bone destruction, an MRI scan using fat suppression and diffusion sequences allows accurate identification of residual disease. We advocate an initial scan 1 year postoperatively, followed by a further scan at 3, 5, and 10 years (4,5,8).

RESULTS

Primary MEO

Middle ear obliteration as the primary surgery was performed in 9 of 53 cases. Cholesteatoma with meningoencephalic herniation was found in 5 cases. In 4 cases, PTA showed a conductive hearing loss (air conduction PTA, 50 dB; bone conduction PTA, 18 dB), all of whom had significant meningoencephalic herniation with cholesteatoma. The remaining 5 cases had a preoperative profound sensorineural hearing loss (SNHL), 4 of which had extensive cholesteatoma, the other with persisting otorrhea after a temporal bone fracture associated with a facial nerve injury.

Sensorineural hearing function was preserved in 3 patients with preoperative conductive hearing loss (interestingly, the air conduction worsened in only 1 case). In 1 patient with mesotympanic cholesteatoma, meningoencephalic herniation, and a CSF leak, a complete SNHL occurred unexpectedly 1 year after MEO.

Secondary MEO

Of the 44 patients undergoing revision surgery; 18 patients had already undergone more than 2 procedures, whereas in the remaining 26 patients, MEO was the second operation. Thirty-five cases revealed recurrent cholesteatoma. Twenty-five patients were found to have meningoencephalic herniation (16 cases with CSF leak), and in 6 cases, significantly exposed dura with the intraoperative discovery of a CSF leak were identified (Table 1).

Nineteen patients had a dead ear at preoperative audiologic assessment. The average air conduction PTA of the remaining 25 patients was 79 dB (range, 50–110 dB), whereas mean bony conduction PTA was 42 dB (range, 20–70 dB). After MEO, both conductive and sensorineural hearing function were preserved in 20 patients. In 1 case with a primary LSC (lateral semicircular canal) fistula, the bony threshold worsened by 10 dB. Worsening of bony conduction and improvement of air conduction were obtained in 1 case. Two patients suffered a complete SNHL, 1 of whom had a deep fistula into the LSC.

During follow-up, 1 case of residual cholesteatoma was identified 2 years postoperatively on routine MRI scanning. This was easily removed, with evidence of only minimal infiltration of the surrounding fat (Fig. 1).

One patient developed a postaural fistula 2 months after surgery recalcitrant to conservative management. Reinforcement using a mucoperiosteal flap was successful in resolving this problem.

DISCUSSION

From the first description of MEO by Rambo in 1957, there have been sporadic reports regarding its use (9–13). Most recently, Kos et al. (9) published their series of 46 patients undergoing tympanomastoid obliteration for

TABLE 1. *Intraoperative finding*

	Primary surgery (9 patients)	Revision surgery (44 patients)	Whole series (53 patients)
Stenosis of external auditory canal	0	8	8
Cholesteatoma	8	35	43
Facial nerve exposed	3	15	18
Dura exposed	6	30	36
Meningoencephalic herniation	5	25	30
CSF leak	1	16	17
Labyrinthine fistula	2	12	14

CSF indicates cerebrospinal fluid.

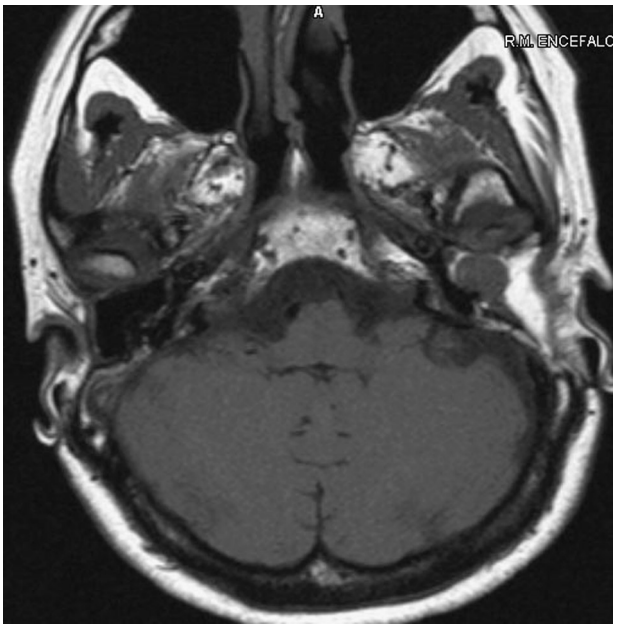

FIG. 1. T1-Weighted axial scan showing residual cholesteatoma. Note the fat creating an ideal interface to detect residual disease.

chronic ear disease. Of 32 cases with cholesteatoma, they reported 4 recurrences, 1 of which required the reversal of the obliteration due to multiple recurrences. Seven cases of postoperative abscess formation or discharge were also noted, with no continuing problems after secondary intervention. Our reduced rate of infective complications can be explained by the routine use of antibiotics with antipseudomonal action. The other interesting aspect of this article was that, despite long-term success, 1 of 4 patients was not satisfied. This emphasizes the importance of patient selection and detailed preoperative counseling.

A high proportion of our series had evidence of meningoencephalic herniation (30 of 53). Meningoencephalic herniation of the temporal bone is most commonly associated with chronic suppurative ear disease, with a high proportion of cases having undergone previous surgery (1,2,14–16). In this series, 25 of 30 cases had had previous surgery at alternate centers. Although there is no doubt that iatrogenic injury plays a role in the cause, active disease also plays a significant part. This can often be a difficult diagnosis to make preoperatively, and a high index of suspicion should be maintained in all revision mastoid surgery. Magnetic resonance imaging scanning is a helpful adjunct in this setting to delineate cholesteatoma, granulation tissue, and meningoencephalic tissue.

The treatment of meningoencephalic herniation is dependent on the status of middle and inner ear, the extent of herniation, and the presence or absence of active disease. When conditions are favorable, a middle cranial fossa approach is used, allowing preservation of middle ear function (1,2,14,16), which is the situation in a high proportion of cases. However, in ears with poor reserve, in cavities unable to sustain a middle cranial fossa repair, and those with extensive herniation, MEO is the safest and most definitive treatment modality. This is especially so when there is a combination of active disease and an active CSF leak. The significant degree of herniation in 4 of our primary cases with good cochlear reserve was the essential reason to perform a MEO.

The decision on whether to obliterate after EAC closure and what material to use is an important point. We advise the use of abdominal fat, as supported by Kos et al. (9) and Mehta and Harris (13), for a number of reasons. First, in cases of meningoencephalic herniation and CSF leak, obliteration minimizes the risk of persisting leak and meningitis. The presence of obliterative material also reinforces the closure of the external canal and minimizes the cosmetic defect. Others have reported the use of muscle, pericranial, and or periosteal flaps to obliterate their cavities, but in revision cases, there is often insufficient local tissue to adequately obliterate the cavity without significant tissue mobilization and attendant morbidity. Despite some expressed concerns in the literature regarding infection of the fat graft, this did not present a problem in this series. Indeed, the fat itself has been reported to have inherent immunoreactive properties that may suppress infection (17).

Importantly, the use of fat provides a ready contrast medium to help detect residual cholesteatoma. The use of fat suppression and diffusion sequences on MRI provides us with a very accurate method to detect early recurrence. The routine use of postoperative radiologic surveillance obviates the need for reexploration unless suspicions are raised by these investigations.

The decision to perform an MEO is one that is made only rarely. Of the more than 5,000 cases of chronic suppurative ear disease we have performed, only 53 had MEO. However, this is a technique that should be part of every otologist's armamentarium no matter how skilled or experienced. Whereas the indications for its use are more straightforward in an ear with unserviceable hearing, an MEO is occasionally required in an ear with good cochlear reserve due the severity of disease.

Follow-up scanning is essential in all cases, and this must be reinforced to the patient before the procedure.

In almost all cases, the patient greatly appreciates the creation of a safe, dry ear, with minimal associated morbidity and no lifestyle restrictions, at the cost of a maximal conductive hearing loss in an ear that is already significantly impaired.

It also provides definitive management of CSF leaks through the temporal bone and in the management of meningoencephalic herniation.

REFERENCES

1. Mosnier IFL, Shaidi A, Sterkers O. Brain herniation and chronic otitis media: diagnosis and surgical management. *Clin Otolaryngol* 2000;25:385–91.
2. Aristegui M, Falcioni M, Saleh E, et al. Meningoencephalic herniation into the middle ear: a report of 27 cases. *Laryngoscope* 1995;105:512–8.

3. Wootten CT, Kaylie DM, Warren FM, et al. Management of brain herniation and cerebrospinal fluid leak in revision chronic ear surgery. *Laryngoscope* 2005;115:1256–61.
4. Stasolla A, Magliulo G, Parrotto D, et al. Detection of postoperative relapsing/residual cholesteatomas with diffusion-weighted echo-planar magnetic resonance imaging. *Otol Neurotol* 2004;25: 879–84.
5. Ayache D, Williams MT, Lejeune D, et al. Usefulness of delayed postcontrast magnetic resonance imaging in the detection of residual cholesteatoma after canal wall-up tympanoplasty. *Laryngoscope* 2005;115:607–10.
6. Omran A, De Donato G, Piccirillo E, Leon A, Sanna M. Petrous bone cholesteatoma: management and outcomes. *Laryngoscope* 2006;116:619–26.
7. Sanna M. *Middle Ear and Mastoid Microsurgery*. New York, NY: Thieme, 2003.
8. El-Kashlan H, Telian SA. Cochlear implantation in the chronically diseased ear. *Curr Opin Otolaryngol Head Neck Surg* 2004;12: 384–6.
9. Kos MI, Chavaillaz O, Guyot JP. Obliteration of the tympanomastoid cavity: long term results of the Rambo operation. *J Laryngol Otol* 2006;120:1014–8.
10. Gacek RR. Mastoid and middle ear cavity obliteration for control of otitis media. *Ann Otol Rhinol Laryngol* 1976;85: 305–9.
11. Bartels L, Sheehy J. Total obliteration of the mastoid, middle ear, and external auditory canal. A review of 27 cases. *Laryngoscope* 1981;91:1100–8.
12. Black B. Mastoidectomy elimination: obliterate, reconstruct, or ablate? *Am J Otol* 1998;19:551–7.
13. Mehta RP, Harris JP. Mastoid Obliteration. *Otolaryngol Clin N Am* 2006;39:1129–42.
14. Jackson CG, Pappas DG Jr, Manolidis S, et al. Brain herniation into the middle ear and mastoid: concepts in diagnosis and surgical management. *Am J Otol* 1997;18:198–205.
15. McMurphy AB, Oghalai JS. Repair of iatrogenic temporal lobe encephalocele after canal wall down mastoidectomy in the presence of active cholesteatoma. *Otol Neurotol* 2005;26: 587–94.
16. Savva A, Taylor MJ, Beatty CW. Management of cerebrospinal fluid leaks involving the temporal bone: report on 92 patients. *Laryngoscope* 2003;113:50–6.
17. Fantuzzi G. Adipose tissue, adipokines, and inflammation. *J Allergy Clin Immunol* 2005;115:911–9.