

CLOSED VERSUS OPEN TECHNIQUE IN THE MANAGEMENT OF LABYRINTHINE FISTULAE

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ABSTRACT

A labyrinthine fistula is the most common complication of cholesteatomatous chronic ear disease. Its treatment remains a controversial subject. The present paper reports our approach to the management of this complication. Operations were performed on 1,226 cases of chronic otitis media with cholesteatoma between January 1971 and December 1985. A labyrinthine fistula was detected in 158 cases. We favor intact canal wall tympanoplasty even in the presence of medium or large fistulas: in the latter case, the matrix is not removed but is trimmed to cover only the bony defect and it is left in place. Open procedures with the preservation of the matrix over the fistula are done in an only-hearing ear with fistula, in ears with a wide defect of the posterior canal wall, and in ears with multiple labyrinthine fistulas. The management of the matrix over the fistula and the anatomic and functional results following each type of procedure are presented and discussed.

The occurrence of a labyrinthine fistula represents the most frequent complication of cholesteatomatous chronic ear disease. Most commonly the fistula is located in the lateral semicircular canal but it may be found in any of the semicircular canals, in the oval window, or in the promontory. Fistulas may be single or multiple (monofocal or plurifocal), subtotal with only partial exposure of the perilymphatic space, or total with complete exposure.

HISTORY

Nylen¹ was the first to envisage surgery of labyrinthine fistula by removing the matrix and leaving the fistula uncovered. His approach was entirely different from the one used by most surgeons of his time, who believed that the matrix had to be left over the labyrinthine fistula. The 1950s and 1960s were characterized by considerable progress in the field of otologic surgery, in particular by improvements in the fenestration operation for the treatment of otosclerosis and by the introduction of open tympanoplasty as a routine procedure in the management of cholesteatoma. As a result of such developments, the notion of

matrix removal emerged, with the fistula being covered by various materials such as skin, mucous membrane, fascia, vein, or bone. However, most authors considered this operation to be absolutely contraindicated.

Similar problems arose when closed tympanoplasty procedures were introduced. No agreement has been reached as to how the labyrinthine fistula should be managed. For some authors²⁻⁷ the detection of a large labyrinthine fistula precludes any procedure other than a radical or a modified radical mastoidectomy. Others⁸⁻¹³ believe that even a large fistula can be managed with a closed technique.

The management of the matrix is an even more debated subject, and conflicting or at least antithetic opinions have been expressed by different authors. It is our opinion¹²⁻¹³ that the matrix should be left in place in all cases treated with an open procedure. We preferably perform a closed tympanoplasty, even in cases of large fistulas: the matrix is left in place initially and it is removed later during a preplanned second-stage procedure performed 6 months after the first operation. We are reporting herein our experience on this subject based on 158 cases evaluated and treated at our institution between 1971 and 1985.

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MATERIALS AND METHODS

Between January 1971 and December 1985, 1,226 cases of chronic otitis media with cholesteatoma have been operated on at our clinic. A labyrinthine fistula was present in 158 cases (12.8%). The fistula was located in the lateral semicircular canal in over 80% of cases (Table 1). Fistulas have been classified into small (0.5 to 1 mm), medium (1 to 2 mm), and large (greater than 2 mm) according to the intraoperative findings. A large fistula was detected in 74% of cases in the present series (Table 2). Table 3 summarizes the surgical techniques used in the groups of patients considered for the present study, i.e., those with fistula and those without fistula. The evolution of the surgical technique during the years is described in Table 4.

The management of cholesteatoma matrix in closed tympanoplasty procedures varied according to the size of the fistula (Table 5). Table 6 summarizes the management of 117 large fistulas included in the present series.

As previously reported, the matrix was left in place during most open procedures. On the contrary, the closed technique demands that any maneuver on the fistula be delayed until the end of the first-stage operation, when a portion of temporalis fascia has been harvested and prepared to cover the fistula. The portion of cholesteatoma matrix left over the fistula is then removed by means of a sharp elevator, a wet cottonoid and a Brackmann continuous suction-irrigator. The fistula is immediately covered with bone dust and a portion of temporalis fascia is placed on it (Fig. 1).

If the matrix is not to be removed, the portion left over the fistula is trimmed with a sharp knife until a flap of the matrix is obtained that is less than 1 mm larger than the bony margins of the fistula on each of its sides (Fig. 2). The site is reinspected in both instances during a second-stage procedure performed after 6 months.

RESULTS

Both curative results in the sense of eradication of the disease and functional results in terms of postoperative bone conduction level have been

Table 1. Labyrinthine Fistula: 158 Cases in 1,226 Cholesteatomas (12.8%)

Location	No.	%
Lateral		
semicircular canal	127	80.4
Multiple	17	10.8
Cochlea	8	5
Oval window	6	3.8
Total	158	100

Table 2. Fistula Size

	No.	%
Small (0.5-1 mm)	12	7.6
Medium (1-2 mm)	29	18.4
Large (>2 mm)	117	74
Total	158	100.0

considered for the present study. All 37 cases of closed tympanoplasty in which the matrix had been left in situ at first-stage operation were reinspected after 6 months. In 25 cases (67.6%) no trace of the matrix could be found: the region of the fistula was covered by regenerated mucosal lining. A residual cholesteatoma was detected in the remaining 12 cases, but the mucosa had regenerated over the fistula, which allowed cholesteatoma removal without having to open into the membranous labyrinth (Table 7). Bony closure of the fistula had been achieved in 20 of 37 cases (54%).

Postoperative hearing as measured by bone conduction level was tested at regular intervals after surgery and about 50% of cases have a 5-year follow-up. Results were tabulated and subdivided into two groups, i.e., open techniques and closed tympanoplasty (Tables 8 and 9). Hearing results in closed tympanoplasties were subdivided according to the management of the matrix to outline the postoperative outcome of each group (Table 9): the postoperative bone conduction level was unchanged in about 93% of cases (better results were detected in the group in which the matrix was left undisturbed at first operation). No dead ear occurred in this group and bone conduction deteriorated in only one patient. Two patients who suffered deterioration of bone conduction level had cochlear fistulas, which are not included among the results because they should be considered fistulas of the anterior labyrinth and have a worse outcome in general. Two dead ears resulted among the patients in which the matrix had been removed at first operation.

Bone conduction level was unchanged in 96% open tympanoplasties versus 76% of the radical mastoidectomies. The incidences of postoperative bone conduction deterioration and dead ear were both increased in the group of radical mastoidectomies compared with open procedures, in which only one dead ear occurred (4%). We have no explanation for this, because the management of the matrix was the same (the matrix was left in place in both types of surgical procedures).

DISCUSSION

The management of a labyrinthine fistula resulting from chronic cholesteatomatous ear disease still poses major questions to the otologic surgeon:

1. Should the matrix covering the fistula be removed or not?

Table 3. Operative Procedure in Cholesteatoma Cases: Comparison of Fistula and Nonfistula Cases

	<i>Fistula Cases</i>	<i>Nonfistula Cases</i>	<i>Total</i>
Closed tympanoplasty	79 (50%)	880 (82.4%)	959 (78.2%)
Open tympanoplasty	26 (16.4%)	70 (6.6%)	96 (7.8%)
Classic or modified radical mastoidectomy	53 (33.6%)	118 (11%)	171 (14%)
Total	158	1068	1226

Table 4. Evolution of Technique to Repair Labyrinthine Fistula

<i>Procedure</i>	<i>1971-1979</i>	<i>1980-1985</i>	<i>Total</i>
Closed tympanoplasty	17 (38.6%)	62 (54.4%)	79 (50%)
Open tympanoplasty	7 (16.0%)	19 (16.6%)	26 (16.4%)
Classic or modified radical mastoidectomy	20 (45.4%)	33 (29%)	53 (33.6%)
Total	44 (100%)	114 (100%)	158 (100%)

Table 5. Closed Tympanoplasty: Management of Cholesteatoma Matrix in Regard to the Size of the Fistula

<i>Size of Fistula</i>	<i>Matrix in situ</i>	<i>Matrix Removed</i>	<i>Total</i>
Small	2/10 (20.0%)	8/10 (80.0%)	10 (100%)
Medium	5/26 (19.3%)	21/26 (80.3%)	26 (100%)
Large	30/43 (69.8%)	13/43 (30.2%)	43 (100%)
Total	37/79	42/79*	

*In 33 cases, the fistula was covered (with fascia in 7 cases, with fascia and bone dust in 22 cases, with bone dust and fibrin glue in 4); in the remaining 9 cases the fistula was not covered.

Table 6. Management of Large Fistulas (117 Cases)

<i>Procedure</i>	<i>No.</i>	<i>Matrix in situ</i>	<i>Matrix Removed</i>
Closed tympanoplasty	43 (36.8%)	30 (69.8%)	13 (30.2%)
Open tympanoplasty	23 (19.7%)	20 (87%)	3 (13%)
Classic or modified radical mastoidectomy	51 (43.5%)	44 (86.3%)	7 (13.7%)*
Total	117 (100%)	94 (80.3%)	23 (19.7%)

*Five labyrinthectomies.

2. When should the matrix be removed?
3. Which is the surgical treatment of choice for fistula cases?

The presence of a labyrinthine fistula should be suspected during surgery in all cholesteatoma cases until it has been detected or excluded with certainty.

The treatment of the matrix over the fistula remains a controversial subject. Some authors^{3,14,15} advise leaving the matrix undisturbed, believing that its removal threatens the inner ear; others^{2,5,8} recommend that the matrix be removed from the fistula even though a risk to the inner ear is involved. Preplanned staging of the operation for removal of the matrix left in place over the fistula during first procedure is proposed by Wullstein,⁷ Law et al.,⁸ and Glasscock.¹⁶ On the contrary, different techniques for different cases are suggested by Gacek⁴ and by Sheehy.^{9,10} They both remove the matrix and cover the fistula if it is small or

medium-sized; if the fistula is large, the matrix is left in place.

We suggest that the matrix be left over the fistula in all cases when an open technique is performed. On the other hand, when a closed technique is chosen, we believe that the matrix can be removed safely in most cases of small fistulas. In the presence of a medium or large fistula, it is safer to leave the matrix over the fistula and stage the operation: the ear is reinspected after 6 months and it can be expected that cholesteatoma has disappeared in over 67% of cases. A residual cholesteatoma in the form of a small cyst that can be removed safely may be expected in about 33% of cases. Bony closure of the fistula occurs in over 60% of cases. On the whole, it is safer to leave the matrix over the fistula during first-stage operation of closed tympanoplasty: in our hands, no change of the bone conduction level occurred in 97% of cases. This figure is similar to the one found in our series of open tympanoplasties in which the matrix

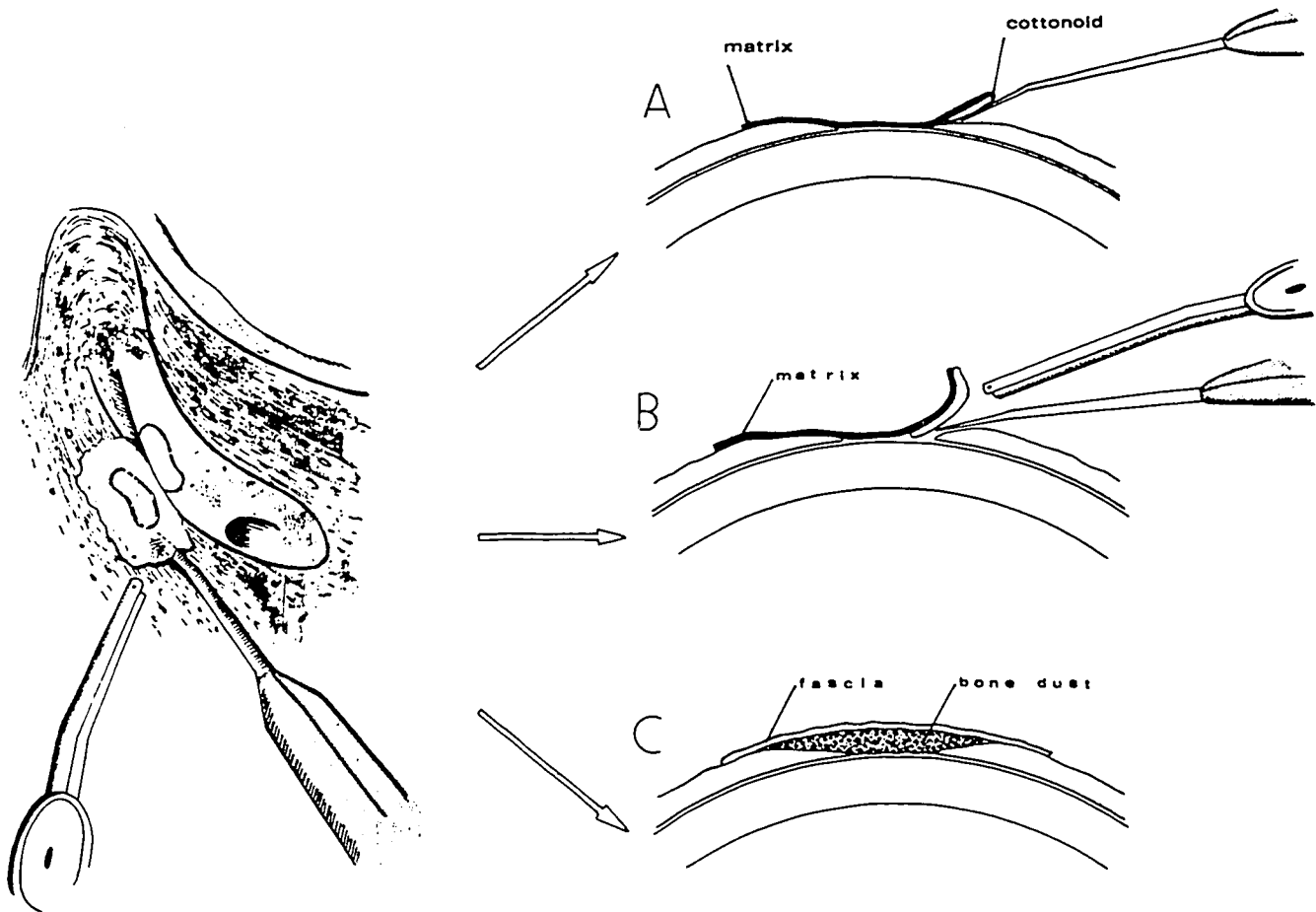


Figure 1. Removal of the matrix and treatment of the fistula.

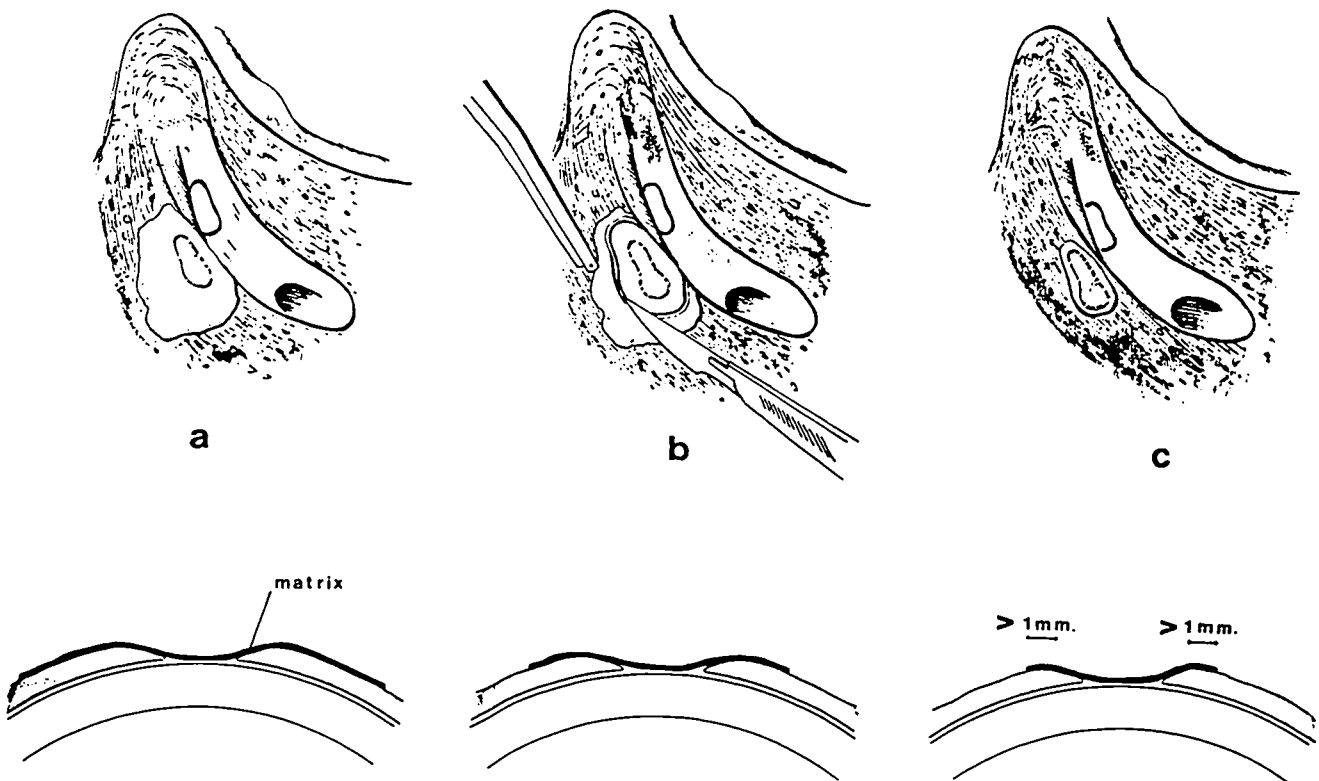


Figure 2. Treatment of the matrix.

Table 7. Closed Tympanoplasty Matrix in situ (37 Cases)

	No.		No.
Matrix not found	25/37 (67.6%)	Bony closure	16/25 (64.0%)
Residual cholesteatoma	12/37 (32.4%)	Bony closure	4/12 (33.3%)

Table 8. Results in Open Procedures (79 Cases)

	Open Tympanoplasty (26 cases)	Classic or Modified Radical Mastoidectomy (53 [37] cases*)	Total (79 [63] cases)
Bone conduction level unchanged	25 (96%)	28 (75.7%)	53 (84.1%)
Bone conduction level deteriorated	—	4 (10.8%)	4 (6.4%)
Dead ear	1 (4%)	5 (13.5%)†	6 (9.5%)

*Sixteen patients with preoperative total hearing loss are not considered.

†Three labyrinthectomies.

Table 9. Results in Closed Tympanoplasties (79 Cases)

	Matrix in situ (37 [35] cases*)	Matrix Removed (42 [40] cases†)	Total (79 [75] cases†)
Bone conduction level unchanged	34 (97.1%)	36 (90%)	70 (93.4%)
Bone conduction level deteriorated	1 (2.9%)	2 (5%)	3 (4.0%)
Dead ear	—	2 (5%)	2 (2.6%)

*Two patients with cochlear fistula are not considered in the results.

†Two patients with preoperative total hearing loss are not considered in the results.

was left in place. The removal of the matrix carries a greater risk of worsening the inner ear function or even causing a dead ear. This risk must be carefully weighed in the presence of medium or large fistulas. We have no explanation for the increased incidence of bone conduction deterioration that occurred in our series of radical mastoidectomies compared with open tympanoplasties.

Regardless of the way the matrix is handled, several authors recommend the use of an open technique for the ear with a labyrinthine fistula. Law et al,⁸ Sheehy, and Sheehy and Brackmann,^{9,10} and Sanna et al^{12,13} use the closed tympanoplasty even in presence of large fistulas. In the treatment of aural uncomplicated cholesteatoma, we favor the intact canal wall tympanoplasty. The same applies to a chronic cholesteatomatous ear with a labyrinthine fistula, even medium or large ones: in the latter case, the matrix is trimmed to cover only the bony defect and it is left in place. A preplanned second-stage procedure is done 6 months later to reinspect the fistula site. This is true even though our present series shows a nearly equal number of closed and open procedures, because it included several only-hearing ears with fistula in which we usually perform a radical mastoidectomy to avoid unnecessary risks for the inner ear. Furthermore, some patients are referred and have already undergone previous procedures elsewhere. They are best managed with an open tympanoplasty.

An only-hearing ear with fistula, an ear with a wide defect of the posterior canal wall, the occurrence of multiple labyrinthine fistulas, and a fistula ear in an elderly patient should be treated with a

classic radical mastoidectomy or a canal down tympanoplasty, with preservation of the matrix over the fistula. Multiple fistulas involving the posterior labyrinth in a patient with a normal contralateral ear require radical removal of the disease with opening of the involved inner ear: a canal down tympanoplasty is then performed (if the resulting cavity is not too large); otherwise, a closed procedure, with obliteration of the petromastoid cavity with abdominal fat and cul de sac closure of the external ear canal, is preferred.

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