

Labyrinthine fistula: a complication of chronic suppurative otitis media

D. S. GREWAL, M.S., F.A.C.S., BACHI T. HATHIRAM, M.S., D.N.B., ASHWANI DWIVEDI, M.S.,
LOVNEESH KUMAR, M.S., KAUSHAL SHETH, M.S., SHOBHIT SRIVASTAVA

Abstract

A labyrinthine fistula is a frequent complication of long-standing unsafe chronic suppurative otitis media. It is characterized by a slowly progressive erosion of the bony labyrinth. In this paper we present our observations regarding the diagnosis and management in 50 patients with unsafe chronic suppurative otitis media with labyrinthine fistula.

Key words: Labyrinth; Fistula; Otitis Media; Suppurative

Introduction

Sir William Wilde's famous statement in 1853 'so long as otorrhea is present we can never tell how, when and where it may lead to' may have lost much of its impact in many parts of the world. It is true that there have been dramatic advances in the management and outcome of patients with chronic suppurative otitis media. However, a review of patients managed in our hospital revealed that there was no room for complacency and the dangers of this disease are as real in our era as they were in Sir William's time. Labyrinthine fistula is a consequence of slowly progressive erosion of the bony labyrinth by long-standing ear disease. As the endosteum of the exposed bony labyrinth is continuously threatened by suppurative labyrinthitis, urgent management of this condition is required.

We have studied 50 patients with labyrinthine fistula secondary to unsafe chronic suppurative otitis media in a series of 436 patients with unsafe chronic suppurative otitis media who underwent tympanomastoidectomy. They were studied with respect to clinical features, diagnosis and management.

Materials and methods

Our study comprised 436 patients with unsafe chronic suppurative otitis media undergoing tympanomastoidectomy who were studied over a period of five years for the presence of labyrinthine fistula. Out of these, 50 patients had intra-operative findings of pre-existent labyrinthine fistulae that were closed by various techniques. They were followed up for one to two years. The investigations performed included complete haemogram, blood sugar, electrocardiogram, X-ray mastoid (Schuller's view), pure

tone audiometry, ear swab (for culture and antibiotic sensitivity), high resolution computerized tomography (HRCT) of the temporal bone and histopathological examination of the granulations from the middle ear and mastoid.

All patients underwent a canal wall down tympanomastoidectomy with complete removal of the disease (cholesteatoma and/or granulations) from the middle ear, attic, aditus, antrum and mastoid air cell system. Diseased ossicles were removed. The presence of a fistula over the semicircular canals or promontory or stapes footplate was carefully looked for under high magnification. Removal of cholesteatoma or granulations from the fistula site was performed and the fistula was sealed. The granulation tissue from the middle ear and mastoid was sent for histopathological examination.

Post-operatively, the patients were given intravenous antibiotics such as ampicillin, cloxacillin and metronidazole for the first seven days along with oral antivertiginous drugs. The dressing was changed on the second post-operative day and suture removal was performed on the seventh day. Patients were discharged on the seventh day on broad-spectrum antibiotics. They were called at weekly intervals and antibiotic-steroid eardrops such as beclomethasone-neomycin eardrops were started after 15 days and continued until the ear was dry. The patients with tuberculous granulation tissue were further treated with anti-tuberculous treatment for nine months. Each patient was followed up for one to two years.

Results

Various aspects such as clinical features, incidence and management of labyrinthine fistula in 50 patients

TABLE I
PRESENTING FEATURES

Total no. of patients	Mean duration of otorrhoea	Tinnitus (% cases)	Giddiness (% cases)	Otalgia (% cases)
50 cases	8 years	9 (38)	16 (32)	13 (26)

TABLE II
EXAMINATION FINDINGS AND INVESTIGATIONS

Nystagmus (% cases)	Positive fistula test (% cases)	Ear microscopy (% cases)	Pure tone audiometry (% cases)
9 (18)	18 (36)	1) Cholesteatoma 34 (68) 2) Granulations 6 (12) 3) Polyp 9 (18)	1) Conductive HL 18 (36) 2) Sensorineural HL 14 (28) 3) Mixed HL 18 (36)

*HL – hearing loss

TABLE III
SURGICAL MANAGEMENT AND RESULTS

Site of semicircular canal fistula (% cases)	Type of surgery (% cases)	Histopathology (% cases)
1) Lateral 48 (98)	1) CWD with staged tympanoplasty 35 (70)	1) Non specific granulations 29 (58)
2) Posterior 3 (6)	2) CWD with type III tympanoplasty 15 (30)	2) Tuberculous granulations 6 (12)
3) Superior 4 (8)		

TABLE IV
MANAGEMENT OF LABYRINTHINE FISTULA

Size of fistula	Method of closure of fistula	% Cases
Small size (1 mm)	Connective tissue covered with temporalis fascia	30 (60)
Moderate size (1 to 2 mm)	Bone dust covered with temporalis fascia	12 (24)
Large size (more than 2 mm)	A) Two layers of temporalis fascia	3 (6)
	B) Periosteum covered with temporalis fascia	3 (6)
	C) Perichondrium covered with temporalis fascia	2 (4)

out of 436 cases of unsafe chronic suppurative otitis media were studied and our observations are mentioned in Tables I to IV.

Discussion

Labyrinthine fistula is a frequent complication of chronic suppurative otitis media of the unsafe type. The incidence of labyrinthine fistula in our series (11.46 per cent), is slightly more than that of Palva¹ (eight per cent) and Ostri² (10 per cent) but almost similar to Vartiainen³ (10 per cent) and Sanna⁴ (12.5 per cent). This is probably due to the fact that in India more cases of unsafe chronic suppurative otitis media with granulations and cholesteatoma are seen when compared with western countries and also most of our patients present late due to poor socio-economic conditions and illiteracy. Due to the absence of any specific cardinal symptoms associated with labyrinthine fistula, every case of chronic suppurative otitis media of the unsafe type should be considered to have labyrinthine fistula unless proved otherwise.⁵

In our series, the highest incidence (18 patients i.e. 36 per cent) of labyrinthine fistula was found in the second decade of life (11–20 years of age). Incidence in both sexes was nearly the same with a slightly higher incidence in males (26 patients i.e. 52 per cent) in our series. Every patient had otorrhoea of long duration with an average of eight years. This is comparable to 7.5 years found in the study of Thakar *et al.*⁶

Pre-operative giddiness and nystagmus were infrequent symptoms of labyrinthine fistula occurring in 16 (32 per cent) and nine (18 per cent) patients respectively (Tables I and II). Both symptoms were absent in the study of Thakar *et al.*⁶ These symptoms are poor diagnostic indicators of labyrinthine fistula. Tinnitus, usually of the high-pitched type was present in 19 (38 per cent) patients in our series, which is higher than that seen in the series by Thakar *et al.*⁶ (12.5 per cent incidence). Its presence is generally correlated with cochlear damage. There was a 26 per cent (13 patients) incidence of blood stained otorrhoea from the granulation in the middle ear. Otalgia is another uncommon complaint (13 patients i.e. 26 per cent) occurring generally due to otitis externa, otomycosis and complications of chronic suppurative otitis media such as post-aural abscess and sigmoid sinus thrombosis. The fistula test was positive in 18 (36 per cent) patients of our series. This is lower than the 53 per cent positive results seen in the series of Palva and Ramsay.⁵ However, false negative results may occur due to the cholesteatoma or granulations obstructing the transmission of pressure changes to the middle ear. None of the patients presented with facial palsy in our series, which matches the studies of Thakar *et al.*⁶ and Palva and Ramsay.⁵ Four (eight per cent) patients presented with post-aural abscess. The abscesses were drained and the patients were given intravenous antibiotics for seven to 10 days after which a tympanomastoidectomy was performed.

On pure tone audiometry there was an equal incidence of conductive and mixed hearing loss (18 patients each i.e. 36 per cent) with a slightly low incidence of sensorineural hearing loss (14 patients i.e. 28 per cent) (Table II). Pre-operatively deaf (profound sensorineural hearing loss) patients in our series were 28 per cent (14 patients) comparable to a 25 per cent incidence in the study of Palva and Ramsay.⁵ On examination under the microscope either aural polyps in nine patients (18 per cent), cholesteatoma in 34 (68 per cent) or granulations in six (12 per cent) of retraction pockets of the attic/posterosuperior region of the pars tensa were found.

A canal wall down tympanomastoidectomy was performed in all patients. The intra-operative findings were mastoid cortex fistula in 10 (20 per cent) patients, dural plate erosion in four (eight per cent) patients and sinus plate erosion in 13 (26 per cent) patients. The cases of sinus plate erosion included two cases of sigmoid sinus thrombosis (four per cent). All the patients had extensive cholesteatoma in the region of the attic, aditus, mastoid antrum and middle ear and special care was taken in its removal from common sites of fistulae such as the semicircular canals. The most common site was the dome of the lateral semicircular canal (Figure 1(a)). In our series 96 per cent (48 patients) of fistulae were on the lateral semicircular canal and the rest were on the superior and/or posterior semicircular canal (Table III). Two cases had fistulae in all three semicircular canals. The size of the fistulae ranged from 1 mm (small size) to 2 mm onwards (large size). In none of our cases, was the endosteum of the bony labyrinth found to be eroded.

Cholesteatoma/granulations were removed from all areas of the ear except the suspected sites of fistula. After this, under high magnification, the cholesteatoma matrix was gently removed along the plane of cleavage between the matrix and endosteum (of the bony labyrinth). We strongly believe in removing the cholesteatoma matrix rather than preserving it. The reason being that there are proteolytic enzymes such as acid phosphatase, collagenase, interleukin 1- α and tumour necrosis factor- α , secreted by the basal and sub-epithelial layers of the cholesteatoma matrix that can cause osteoclastic resorption of the bony labyrinth. One of these enzymes tumour necrosis factor-alpha (TNF- α) causes the release of a 'factor' by osteoblasts.⁷ This factor enhances the collagenase activity, exposing the mineral of the bone surface to the osteoclastic bone resorption. TNF- α also stimulates keratin production that may act as an inflammatory stimulus leading to the formation of granulation tissue.⁷ This process of bone erosion is based on the 'enzymatic theory of bone erosion' by cholesteatoma.⁸ Due to the above process there will be continuing bone erosion hence the preservation of matrix is not recommended in the management of labyrinthine fistula. Moreover, in our experience we have seen that cholesteatoma is easily separable from the bone underlying it, as there is always a zone of separation between the two. We advocate separation using a

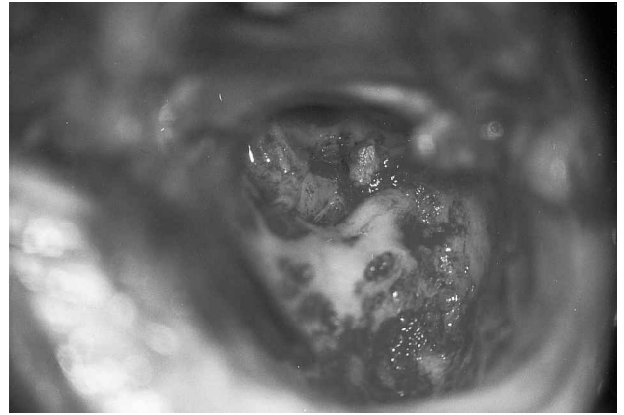


FIG. 1(a)

Intra-operative photograph of the mastoid cavity of a 49-year-old male patient showing a moderate-sized labyrinthine fistula involving the dome of the lateral semicircular canal.

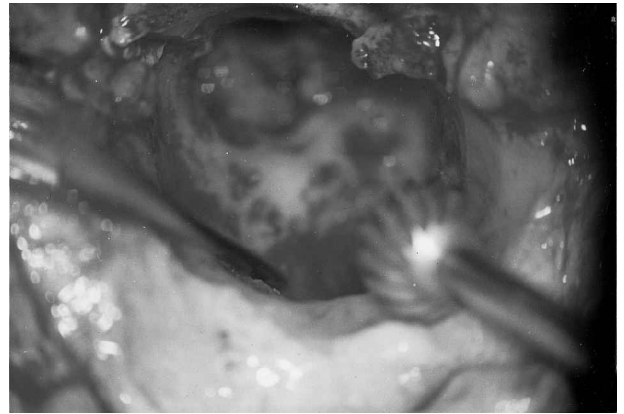


FIG. 1(b)

Intra-operative photograph of the mastoid cavity of the same patient showing drilling of the mastoid bone by a cutting-burr. The bone dust is later removed with the help of a side-knife.

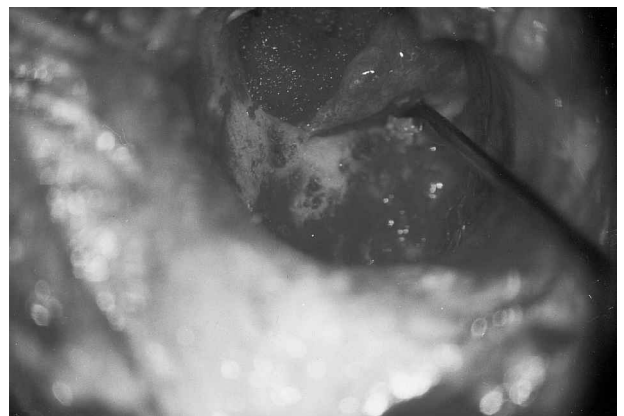


FIG. 1(c)

Intra-operative photograph of the mastoid cavity of the same patient showing the temporalis fascia graft in position with an absorbable gelatin sponge placed over it. After placing the graft, the fistula is sealed with bone dust.

cotton ball dipped in saline-adrenaline or using a fine suction tip with a sickle knife/side knife. Also, irrigating the mastoid cavity with saline results in the edges of the cholesteatoma matrix floating that helps in the identification and removal of the small remnants.

After the removal of the cholesteatoma matrix from the fistula site, the size of the fistula was judged. Based on its size, the fistula was sealed as follows (Table IV).

- (1) Small sized fistulae (1 mm in size). These were found in the majority (30 patients i.e. 60 per cent) of cases and were sealed with connective tissue covered with temporalis fascia.
- (2) Medium sized fistulae (1–2 mm in size). These were sealed with bone dust covered with temporalis fascia (Figures 1(b) and 1(c)).
- (3) Large sized fistulae (more than 2 mm in size). These were closed by either
 - (a) two layers of temporalis fascia (three patients i.e. six per cent), or
 - (b) a layer of perichondrium (tragal or conchal) covered with a layer of temporalis fascia (two patients i.e. four per cent), or
 - (c) a layer of periosteum (harvested from the mastoid cortex) covered with a layer of temporalis fascia (three patients i.e. six per cent) (Figure 2).

We do not recommend the use of bone dust in large-sized fistulae. The reason being that as the fistula is large in size it requires a greater amount of bone dust for sealing, which may sink into the fistula. This leads to unwanted diffusion of bone dust particles to other areas of the membranous labyrinth, causing persistent post-operative giddiness in patients.

Dehiscent facial nerve in the tympanic segment was seen only in four (eight per cent) patients. There was no dehiscence in the mastoid segment of the facial nerve. The incus was found necrosed in all the cases, whereas the malleus and stapes suprastructure

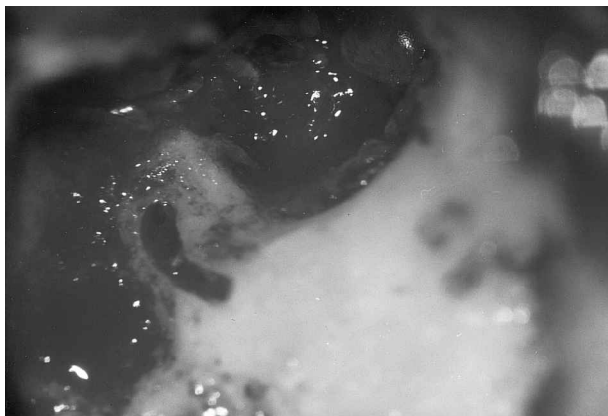


FIG. 2

Intra-operative photograph of the mastoid cavity in a case of tuberculous otitis media showing a large sized lateral semicircular canal fistula. It was sealed with a layer of periosteum covered with temporalis fascia.

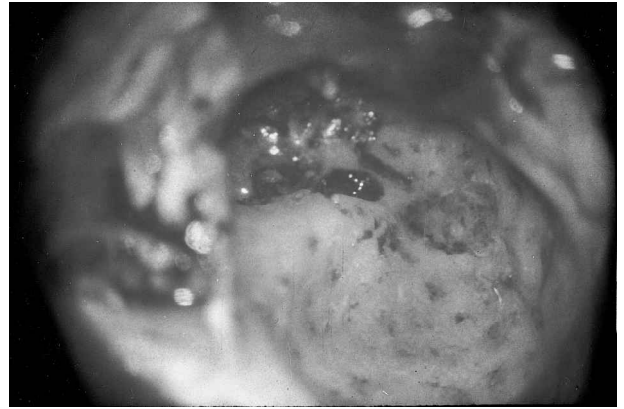


FIG. 3

Intra-operative photograph of the mastoid cavity of a 38-year-old female patient showing a moderately-sized fistula over the dome of the lateral semicircular canal. It was sealed with bone dust covered with temporalis fascia.

were necrosed in 38 (76 per cent) patients and 35 (70 per cent) patients respectively. The malleus and incus were removed in all cases followed by Type III tympanoplasty or staged tympanoplasty depending upon the status of the stapes suprastructure. Histopathology of granulation tissue from the middle ear and mastoid cavity showed non-specific inflammation in 29 (58 per cent) patients and tuberculous infection in six (12 per cent) patients (Figure 3). Patients with tuberculous otitis media were further treated with anti-tuberculous treatment for nine months.

All the patients had a dry cavity at one to two months. The patients were followed up from one to two years for the assessment of hearing status and symptomatic improvement. On follow-up, the patients had relief from giddiness, in cases when it was present pre-operatively. None of the patients had a deterioration in the bone conduction threshold post-operatively and some even had improvement in the bone conduction thresholds. Those patients who had profound hearing loss pre-operatively did not develop any hearing improvement but had a post-operative dry and safe ear.

Conclusions

Even with the development of new antibiotics labyrinthine fistula remains an important complication of extensive cholesteatoma and of tuberculous mastoiditis in tropical countries. Removal of the cholesteatoma matrix from the fistula and its repair depending on its size performed in two layers with an outer layer of temporalis fascia and inner layer of bone paté or periosteum or perichondrium is the safest and most effective management strategy and antituberculous drugs are given in tuberculous mastoiditis.

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Address for correspondence:

Dr D. S. Grewal, Professor and Head,
Department of ENT, No. 28,
T. N. Medical College and B.Y.L. Nair Ch. Hospital,
Mumbai Central, Mumbai 400 008,
Maharashtra, India.

Fax: 022-23075243 (Attn. Dr Grewal, ENT)

Dr D. Grewal takes responsibility for the integrity of the content of the paper.

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