

## Current Practice

### THE SPECIAL SENSES

#### Deafness and Chronic Otitis Media

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*British Medical Journal*, 1970, 2, 95-97

In the last decade the operating microscope has transformed ear surgery. Stapedectomy for otosclerosis, the most common cause of severe deafness, is now so well established that an improvement in hearing can confidently be offered to the patient. The second commonest cause of severe deafness is chronic otitis media,<sup>1</sup> and here too the operating microscope has enabled the surgeon to give his attention to reconstruction of the sound-conducting mechanism in addition to eradicating the disease.

#### Types of Chronic Otitis Media

In any chronic infection the processes of tissue destruction and healing are occurring simultaneously. Chronic otitis media is no exception. If healing predominates the disease may be arrested. If the patient is lucky the perforation in the tympanic membrane will close, and the hearing will be preserved. However even in such *healed chronic otitis media* there may be deafness if there has been irreversible damage to the ossicles, or if there has been such extensive fibrosis during the healing process that *adhesive otitis media* has occurred, in which the structures of the middle ear are immobilized by fibrous adhesions. Alternatively, the disease process may be arrested but the perforation may remain open. Such a state of *inactive chronic otitis media* clearly runs a risk of reactivation because of the defect in the drum.

If the disease process predominates over the healing process the patient will continue to suffer from *active chronic otitis media*, with an intermittent or continuous purulent discharge from the ear. The structures of the middle ear may become progressively more damaged or immobilized by *tympanosclerosis*, an abnormal deposition of calcium in the middle ear, so that a severe conductive deafness develops insidiously. Furthermore with repeated infections a perceptive deafness also develops, for reasons which are poorly understood but which may be associated with the release of bacterial toxins.

Though the disease is chronic and may have been present for many years before the patient presents, treatment may be urgent. Two main clinical types are recognized independent of the activity. In the *unsafe ear* the infection is situated in the attic region, with a perforation in the pars flaccida of the drum or the posterosuperior part of the pars tensa (Fig. 1a). Infection in this region is anatomically dangerous because of the proximity of the facial nerve, the labyrinth, and the cranial fossae; and because it is associated with the formation of cholesteatoma, a type of acquired epidermoid cyst, in which keratinizing squamous epithelium reaches the attic region either by ingrowth from the margins of a perforation, or by metaplasia of the normal pavement epithelium, or, more probably, by indrawing of a dimple of pars flaccida. Despite its name, cholesteatoma is not a tumour, but it behaves very like one in that as the desquamated keratin collects it causes the sac of epithelium to expand into the mastoid antrum and tympanum. The position of the cholesteatoma makes it particularly prone to erode the ossicles and cause deafness, and if

allowed to progress its effects may be even more serious since the erosion may allow infection to spread outside the ear and mastoid bone causing labyrinthitis, facial nerve paralysis, or intracranial complications.

By contrast, in a *safe ear* the perforation is central or anterior (Fig. 1b). Recurrent infections are associated with a copious mucopurulent discharge arising in the tympanum and Eustachian tube, which contrasts with the thin offensive discharge from the unsafe ear. This type of *tubo-tympanic disease*

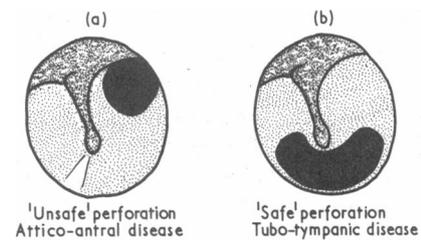


Fig. 1

is unlikely to lead to complications, nor is it a threat to life, but in the long-term a progressive deafness may develop and the ear is a burden and embarrassment to the patient.

All these types of disease tend to develop and present in childhood or early adult life, though even today many years may pass before the patient seeks medical advice. Their incidence has probably fallen with the advent of antibiotic therapy for acute otitis media. It is only in the last few years, however, that the high incidence of *chronic secretory otitis media* (serous otitis, "glue ear," exudative otitis) in children has been appreciated, yet this may also progress to the other types of chronic otitis media. There is an accumulation of high or low viscosity fluid in the middle ear, which leads to intermittent mild earache and chronic slight deafness. The appearance of the eardrum is extremely variable, and the child rarely complains of deafness, so that recognition of the disease has been difficult even when deafness has been detected at an audiometric screening test at school. With the development of impedance audiometry the situation has changed so that a definitive diagnosis is now possible without myringotomy. The impedance audiometer measures the amount of sound reflected from the ear drum as the pressure in the external auditory meatus is altered. The presence of fluid produces a characteristic change from the normal pattern. Using this technique Brooks<sup>2</sup> tested the ears of children at the time of entry to school and found that 20% had fluid in the middle ear, a much higher proportion than previously suspected.<sup>3</sup>

#### Management

There are two main aims in the management of chronic otitis media. Firstly the risk of serious complications must be eliminated, and secondly the patient should be relieved of his

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deafness and otorrhoea. Unfortunately, if radical surgery is undertaken to make the ear safe there may be little hope of reconstructing the sound-conducting mechanism. Since eradication of active or dangerous disease must precede reconstruction the methods of achieving it will be discussed first.

### Eradication of Active and Dangerous Disease

In chronic otitis media the disease is not confined to the ear. In the case of tubo-tympanic disease the discharge arises also in the Eustachian tube, and the source of the infection may be the naso-pharynx. Often the ear discharges with every acute upper respiratory tract infection and then settles again. Medical treatment must be directed to clearing nasal sepsis at the same time as the aural sepsis. To this end an infected pad of adenoids may have to be removed in children, or chronic sinusitis or bronchiectasis may need treatment in an adult. Treatment with an appropriate systemic antibiotic may help, and topical antibiotic drops are of value if an adequate toilet of the ear precedes their use—as long as the head is positioned so that they have a chance of passing through the perforation.

By means of such treatment 70% of ears can be freed of discharge.<sup>4</sup> Of these a further 70% will remain inactive for 6 months. Until recently only such cases, representing about half the total number, were considered suitable for surgical grafting of the drum, and then only if patency of the Eustachian tube could be demonstrated. Thus surgery was of use only in those cases which were relatively easy to control anyway. It is now becoming clear that it is worthwhile grafting even the difficult cases, which are actively discharging.<sup>5</sup> Furthermore Sharp<sup>6</sup> has shown that when a membrane is grafted successfully the Eustachian tube may become functional even though its physiological function could not be demonstrated preoperatively. Thus reconstructive surgery should now be considered for those patients with tubo-tympanic disease who were previously rejected because of continuous discharge.

When there is cholesteatoma present medical treatment is doomed to failure; surgical removal of the cholesteatoma is essential. Sometimes a small cholesteatoma can be removed through the perforation, but more often the mastoid needs to be opened for its complete removal.

The *radical mastoidectomy* was introduced in the late nineteenth century and combined complete surgical exposure with permanent exteriorization of the diseased areas by converting the external meatus, tympanum, and mastoid into one common cavity (Fig. 2a). The operation is still done when the cholesteatoma affects the tympanum extensively, but it became clear that in many cases the tympanum could be preserved and the inevitable deafness which followed the radical operation could be avoided. This type of *modified radical mastoidectomy*, now more common than the radical procedure, still necessitates a large cavity incorporating the mastoid, external canal, and attic (Fig. 2b). Such cavities create problems of their own, being liable to incomplete epithelization and accumulation of cerumen, and in 20% giving rise to continuous otorrhoea. Furthermore the loss of the bony annulus of the tympanic membrane precludes the more refined techniques of reconstruction.

Because of these problems attention has been given to performing radical surgery without leaving a cavity, and one way this may be achieved is by obliterating the cavity with a graft. Various tissues have been used, but the most generally accepted is a pedicled temporalis muscle flap as advocated by Thorburn.<sup>7</sup> Such a flap (Fig. 2c) has the advantage of bringing its own blood supply, thereby promoting healing; and it can be modified to contribute to reconstruction of the tympanic cavity. The problems of a mastoid cavity can also be prevented by the technique of combined-approach tympanoplasty.<sup>8</sup> This consists of preserving the bony meatal wall and the bony

annulus so that the position of the drum and the depth of the middle ear space are maintained. It is called a combined approach because the disease is cleared partly through the ear canal and partly through the mastoid (Fig. 2d). In addition an

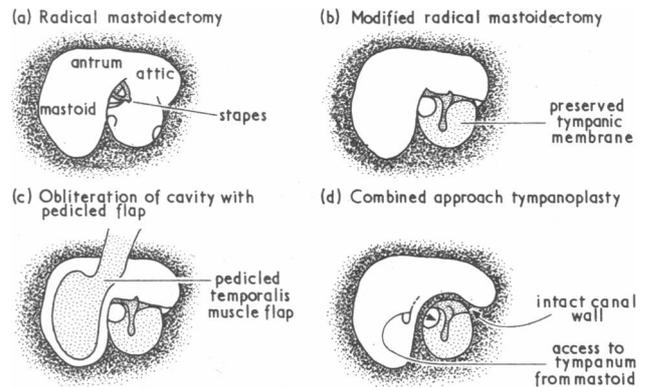


Fig. 2

opening can be made from the mastoid cavity into the tympanum just lateral to the facial nerve without destroying the annulus, which not only assists in clearing the disease but also gives access to the structures of the middle ear even with the tympanic membrane or graft in position. However, at the end of the operation the mastoid (with any residual cholesteatoma in it) is closed off, which is why the technique remains controversial. Smyth emphasizes that by painstaking surgical technique with the aid of the operating microscope cholesteatoma can be cleared, and in a series of 339 cases he has had to reopen only 8 for recurrence. The other point of view was expressed by Shambaugh<sup>8</sup> at the end of the Third Workshop on Microsurgery of the Ear at Chicago: "It may be possible in some cases to remove every vestige of cholesteatoma matrix with the operating microscope without taking the canal wall down. This has not been proven, and it will take five to ten years before we know how many of these cases will get a recurrence. I venture to predict that the recurrence will be worse than the initial disease because they will have a large cavity to start with. . . . Until we have had a long-term follow-up study this new method should be left to a few experts, giving them a chance to follow their cases for a long period of time. The standard safe method for cholesteatoma continues to be exteriorization."

### Reconstruction of the Hearing Mechanism

The term tympanoplasty, introduced by Wullstein<sup>9</sup> in 1953, is applied to any surgical procedure designed to reconstruct the middle ear hearing mechanism. Considerable experimentation with both materials and techniques has taken place since that time and only the more successful will be described.

### Tympanic Membrane

Small central perforations may be persuaded to heal by freshening the edges with cautery and applying an external splint such as a piece of thin paper. Juers<sup>10</sup> reported an 88% success rate in perforations affecting up to 65% of the drum, but often a number of treatments are necessary.

Temporalis fascia and canal skin have emerged as the best materials for grafting the drum.<sup>5, 11</sup> The meatal skin is removed in continuity with the epidermis of the tympanic membrane leaving a denuded area of bone and fibrous membrane to act as bed for the fascia graft (Fig. 3a). The fascia is removed from the outside of the temporalis muscle, either through the mastoid incision or a separate incision, and allowed to dry to make it easier to handle. After covering the defect with the fascia the meatal skin is replaced as a free graft (Figs. 3b and 3c). A 98% success rate can be achieved by this technique, though initial successes will sometimes break down as a result of renewed infection.

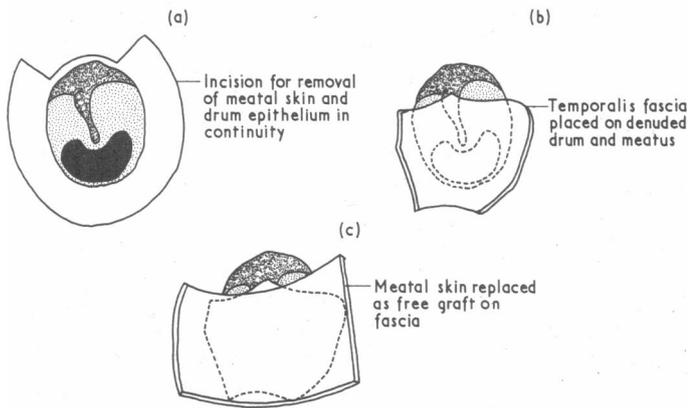


Fig. 3—Myringoplasty (type I tympanoplasty)

### Ossicular Chain

The incus is damaged more frequently by infection than the other ossicles, and the most common defect is an erosion of the long process (Fig. 4a). This lesion can be overcome by transposing the body of the incus on to the head of the stapes so that it makes contact with the malleus and tympanic membrane (Fig. 4b). The body of the incus is just the right size for this purpose; if it is totally absent or diseased many surgeons use a homograft incus instead, which appears to be well tolerated. Others use a piece of bone removed from the mastoid cortex to fill the gap. Such operations are highly successful in eliminating the conductive hearing loss<sup>12</sup> since they fulfil the basic physiological requirement of a mobile tympanic membrane connected to a mobile stapes footplate, with sound protection for the round window. If the superstructure of the stapes is also destroyed by disease the incus may again be transposed so as to form a columella from the malleus to the footplate of the stapes. The transposed incus is not always as satisfactory in this position; some surgeons use cartilage autograft or homograft.<sup>13 14</sup> An additional advantage of such a cartilage prosthesis is that it can be shaped to support the tympanic membrane when the malleus is also absent (Fig. 4c).

Tympanoplasties performed for adhesive otitis and tympanosclerosis, which often occur together, tend to be disap-

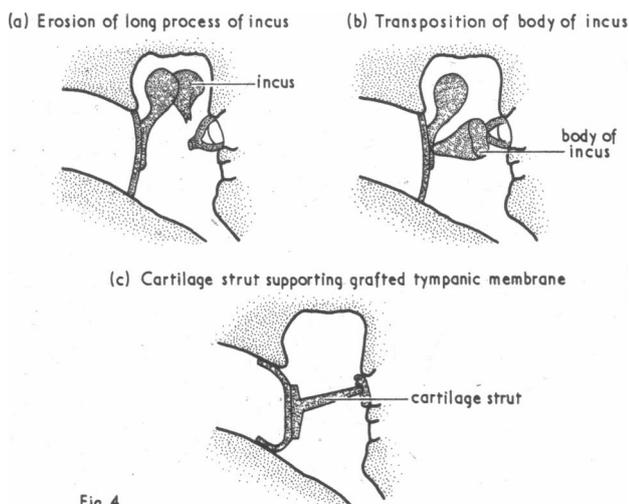


Fig. 4

pointing. In the case of adhesive otitis the adhesions tend to reform, though the insertion of Silastic film into the middle ear may help to retain drum mobility. In tympanosclerosis the calcium deposits are often widespread, but it may be possible to mobilize a fixed stapes or perform a stapedectomy if the tympanic membrane is intact or has been repaired as a preliminary stage.

Before leaving the subject of tympanoplasties it is worth mentioning that in some centres more extensive homografts are used. Depending upon the extent of the defect, cadaveric drum, drum and malleus, or drum with malleus and incus are transplanted. There is insufficient evidence at the moment to decide whether such a technique is going to be worthwhile, though Morrison comments<sup>1</sup> that current results fully justify its adoption. Smyth and Kerr<sup>5</sup> found homograft tympanic membranes less successful in closing perforations than temporalis fascia.

### Chronic Secretory Otitis Media in Children

At the time of school entry 20% of the children in an urban environment have fluid present in their middle ears, giving rise to intermittent mild earache and deafness, which though usually slight may nevertheless be enough to slow their progress in school. For this reason alone most otologists feel that the condition should be treated, even though spontaneous remission may be expected in the majority of cases.

The aetiology is poorly understood, though it is generally agreed that abnormal function of the Eustachian tube plays a part. Whether the abnormal function is due to enlarged adenoids, allergy, retrograde infection, or the inadequate use of antibiotics in acute otitis media is not decided and treatment is therefore necessarily empirical. Archard<sup>15</sup> has shown that remissions occur after adenoidectomy—which is usually carried out on children with persistent secretory otitis. Myringotomy and removal of the fluid by suction is often followed by reaccumulation within a matter of days, and so small plastic tubes are often placed through the drum incision. These tubes (grommets, Shephard's drains) will be extruded after a period of weeks or months, but while they are in position aeration of the middle ear is restored and the hearing is brought back to normal. Such a period of normal pressure in the middle ear may allow the Eustachian tube to regain its function, particularly if combined with therapy for any co-existing allergy or sepsis. Conclusions cannot, however, be drawn until there is evidence available from long-term studies.

Though the relief of deafness in school children is enough to justify active treatment of the condition, it may be just as important for other reasons. Harrison<sup>16</sup> comments "From clinical observation it is my belief that cases of chronic suppurative otitis media, sometimes with accompanying cholesteatoma and at other times without it, result from chronic exudative otitis media in which marked 'collapse' of the tympanic membrane has occurred."

It may be that if we can solve the problems presented by this condition, find the cases and treat them adequately, all the complex surgical techniques for reconstruction will become redundant.

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