ments; trauma caused by fine particles of metal in circulating soluble oil; and trauma produced by abrasive particles in moulding sand, refractory materials, etc. The first two causes—and these account for most of the cases—are preventable: the first by the education of the works first-aid departments to avoid the use of sensitizing applications, and the second by strict supervision of the various machines to ensure that all abrasive particles are filtered from the circulating coolants. The education of the works first-aid departments is a real problem, since there has grown up from the days of Lister the desire to “kill germs” at all cost. This desire is fostered both by qualified medical practitioners and by skilful advertising. Many antiseptics are potential sensitizing agents, and, although cases of sensitization dermatitis are uncommon, when they do occur they are tragic. The unfortunate individuals may, in the worst cases, never again return to their former skilled jobs, and, since these cases are preventable, they should never occur. In addition, one feels that, since many of these substances act by coagulating protein, they may also actively delay the process of tissue repair. In my opinion the treatment of relatively trivial injuries should consist in the area being cleaned thoroughly with 1% cetrimide solution and either a sterile dry dressing or a dressing of sterile paraffin applied, the dressing not being disturbed until healing has taken place.

Summary

An analysis is made of the causes of dermatitis occurring in 250 men employed in the steel industry in whom the disability was severe enough to put them on the sick list for a period of at least three weeks. In 34.8% of the cases the dermatitis was directly due to sensitization to some application used in the treatment of a relatively trivial injury. Acriflavine and its analogues and penicillin were the common sensitizing agents. Trauma plays a part in most cases, and, although the incidence of “industrial dermatitis” in the steel industry is low, many of these cases are preventable and the incidence could be made even lower.

SCOPE OF SURGERY IN MANAGEMENT OF DEAFNESS*

BY

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During my professional lifetime—that is, since the 1930's—the scope of surgery in the management of deafness has increased greatly. To-day we face a changed outlook and are offered new opportunities. It may be of interest to consider how this has been achieved.

Let me make a careful distinction at the outset of this paper. I hope to convince you that we have made and are still making substantial progress in the treatment of *conductive* deafness by surgery. In the treatment of established *perceptive* deafness, however, surgery has nothing to offer, and, apart from improved methods for rehabilitation of the deaf, we have made no progress in this field since the 1930's. I would make this exception, that there is a progressive cochlear degeneration associated with most cases of chronic otitis media which may be prevented by successful treatment in the early stages of this disease.

*Read to the Section of Oto-rhino-laryngology at the Annual Meeting of the British Medical Association, Newcastle upon Tyne, 1957.

In the 1930's we were constantly concerned, and with very good reason, about the dangers of uncontrolled infection in the middle ear and mastoid. We tried to assist recovery in the established acute ear infection by providing drainage with a myringotomy or a cortical mastoidectomy. In the chronic cases a radical mastoidectomy was carried out to remove disease and prevent complications. Then, as to-day, we were active in trying to prevent deafness from obstruction of the Eustachian tube or recurrent otitis media by removing tonsils and adenoids in children and by treating nasal and post-nasal infection; this might be followed by a course of politzerization or catheterization of the Eustachian tube.

That left us with many patients deaf from one reason or another whom we could only reassure by telling them that the ears were safe, and that they must compensate for the disability of progressive deafness by using a hearing-aid and by learning to lip-read. I well remember the feeling of despondency and impotence which I experienced when I told this tale to a young woman with early otosclerosis who had become aware of difficulty in hearing soon after the birth of her first baby. And I remember her brave attempt to suppress the tears of disappointment at the bitter prospect of an increasingly silent world.

Faced with such a young woman to-day, we should have much better hopes of being able to help her—and also those deaf from chronic otitis media. The techniques that have opened up these new possibilities are those of fenestration, stapes mobilization, and tympanoplasty. It is these three procedures, in particular the third, that I propose to discuss in some detail.

Fenestration

Already in the 'thirties we were reading with interest about the efforts of Holmgren and Sourdille to overcome the hazards associated with the surgical treatment of otosclerosis. It was well known that an otosclerotic could hear if an opening were made in the labyrinth, but almost inevitably either the opening closed or labyrinthitis supervened. Then in 1938 Lempert startled the less incredulous section of the otological world by devising a one-stage fenestration operation which, he claimed, restored the hearing permanently to a practical level in a substantial proportion of cases.

Curiously enough, the technique which made this operation possible was a development of his considerable experience in the treatment of chronic otitis media and the introduction of ideas of precision surgery using new instrumentation under the control of two-times binocular loupe magnification; that, I venture to suggest, was one of Lempert's more important contributions to modern otology. In his practical course, which I was privileged to take in 1947, Lempert taught not just how to perform a fenestration operation but, more important, how to carry out a complete dissection of a temporal bone. Seeing in this way the detailed anatomy of the normal ear, one began to appreciate more clearly the significance of the pathological changes in chronic otitis media.

Others, notably Shambaugh in America, and Simson Hall, Cawthorne, and Garnett Passe in this country, advocated the use of a microscope giving six to ten times magnification for the actual making of the fenestra. I am sure that this has enabled most otologists to improve their technique and their results with fenestration operations. Indeed, any otologist who has performed a substantial number of these operations has only to compare the results of his first hundred cases with those of his second hundred to demonstrate conclusively the value of an improved technique. My own results, showing the hearing gain one year after operation, certainly bear this out (see Table).

Results One Year After Operation

	Cases 1-100	Cases 101-200
Hearing reached 30 decibels or better (patient rehabilitated)	51	85
Hearing usefully improved but not reaching 30 decibels	24	13
Hearing worse or not usefully improved	22	1
No follow-up available	3	1

Of course, it is not only an improved technique that counts, important though that is; one also learns to choose the favourable case. If anyone doubts the value of this operation, carefully executed in properly selected cases, I can only suggest that he visits a well-conducted fenestration follow-up clinic and asks the patients what they think about it.

Stapes Mobilization

The only happier patients I meet are those who have a good result after mobilization of the stapes. This operation, popularized by Rosen in the past three years, is a safe minor operation in practised hands, and has the advantage that it requires little or no aftercare. It gives good results in about 35% of cases, and some of these are very good indeed. One cannot help having misgivings about the permanence of the result, but if the hearing gain is lost after some months the operation can be repeated; or, if it fails, a fenestration operation can be carried out successfully with the advantage that one knows for certain that the stapes footplate is firmly ankylosed.

Rosen (1956) has also described a method of "fenestrating" the fixed footplate of the stapes when mobilization fails in consequence of fracture of the crura. Basek and Fowler (1956) state that, since the otosclerotic disease involves mainly the anterior part of the stapes footplate, the best method is to excise part of the anterior crus and to fracture the footplate across behind its fixed portion. This leaves the ossicle chain to function through the posterior crus, which it is hoped remains in continuity with a mobile posterior segment of the footplate.

Even though it is claimed that successful results have followed these procedures, I am of the opinion that it is unwise to submit the labyrinth to the risk of trauma from such ambitious manipulations of the stapes footplate. If mobilization fails I submit that it is better to accept the fact that this is an operation with a limited objective, and later to perform an ordinary fenestration operation.

Tympanoplasty

I believe that tympanoplasty is the most important development in functional otology since Lempert described his one-stage fenestration operation. We owe to Zöllner (1951) and Wullstein (1952) the credit for working out the principles of tympanoplasty and demonstrating how they can be applied in a practical way to most cases of chronic otitis media. I like to think of tympanoplasty as a rational development of my own study of hearing results in modified radical and radical mastoid operations (Thorburn, 1954). It explains the varied hearing results in this surgery, and it offers to otology a creative approach to the double problem of controlling disease and conserving or improving hearing in chronic otitis media.

Tympanoplasty is a new word to many of us; it can easily be abused and may even be prematurely discredited if this title is applied to an operation which fails to take account of the fundamental principles on which it should be based.

My understanding of these principles derives, firstly, from observation and discussion during several visits with McGuckin (Newcastle), Marshall (Middlesbrough), and Verhoeven (Antwerp) to Wullstein and Zöllner in Germany, and to Pietrantoni and Bocca in Milan. Secondly, there is the experience gained in gradually putting these ideas into practice during the past three years, and the observation of

the results and difficulties during a careful follow-up. My personal interpretation of the principles of tympanoplasty follows.

Principle 1

Precision microsurgical technique is essential. It literally opens one's eyes to see and do things in the ear which one previously would have thought foolhardy or impractical. I use a Zeiss operating microscope giving four, eight, and twelve times magnification for all work in and around the tympanum. The instruments used must match the opportunities presented and the limitations imposed by working under a microscope. In fact, one requires very few special instruments in addition to those normally employed to carry out a fenestration operation.

Bleeding can be a big handicap and must be controlled. I employ diathermy coagulation for superficial blood vessels, and consider that a dental drill with frequent irrigation and suction provides a satisfactory way to open up the mastoid cavity and to control bleeding from it.

In Germany these operations are performed, for the most part, under local analgesia, which certainly limits bleeding. I prefer to premedicate the patient with chloral, "omnopon," and scopolamine, and then to combine a local injection of procaine 1% in 1 in 20,000 adrenaline with general anaesthesia. The induction is by D-tubocurarine-thiopentone and the continuation by intratracheal gas and oxygen with occasional trichlorethylene. This usually gives a satisfactory bloodless field without the use of hypotensive drugs.

Principle 2

Pathological changes in the tympanum can be assessed as irreversible or reversible under the operating microscope. I owe the idea of irreversible and reversible pathology, like several others in this field, to Mr. Francis McGuckin, of Newcastle.

Irreversible pathology—for example, cholesteatoma or keratinizing squamous epithelium, granulations, or osteitis—must be completely removed. At first I found it difficult to accept that this was possible, or that one can be justified in enclosing the area of the tympanum so dissected with skin grafts to create a new tympanic cavity. This is indeed the crux of the whole problem. It requires a good deal of practical experience to assess and to decide how much you have to do to make the ear safe from recurrence of disease. Even the chronic otitis which has appeared to be healed for many months may contain hidden irreversible changes—for example, dry cholesteatoma—which would make a blind operation, such as myringoplasty, unwise.

Reversible disease is not so difficult and refers mainly to mucosal swelling. To carry out a successful tympanoplasty one must retain a mucous membrane covering over most of the medial tympanic wall. I have recognized for a long time that mucosal swelling in the tympanum is, in part at least, a reactive swelling designed to limit the spread of disease. In modified radical mastoid operations if this mucosal swelling is respected and conserved it will often resolve and later form part of a mobile tympanic membrane.

Where extensive excision of disease has left too little mucous membrane to permit immediate reconstruction there may be a place for a two-stage operation. The mucous membrane may regenerate in a few weeks with suitable antibiotic treatment and a skin graft can then be safely applied. Alternatively, immediate grafting with buccal mucosa may be employed.

Principle 3

Antibiotic therapy helps considerably to control chronic infection provided irreversible pathology has been eliminated. I must admit that in the past I have been a little prejudiced against employing antibiotics in the treatment of chronic otitis media. I used antibiotics mainly to try to limit the risk of complications resulting from local operative trauma. Now I swab the ear before or during the operation, and try to match the predominating organism with an antibiotic to

which it is sensitive. My standard course at present is 500,000 units of penicillin and 0.5 g. of streptomycin twice daily for one week, but it is varied according to the sensitivity of the infection and the tolerance of the patient.

Principle 4

Full-thickness skin grafts provide a satisfactory medium for the plastic reconstruction of a new tympanic cavity. The detail of the reconstruction will vary as defined later. Post-aural skin is accessible and especially suitable, since it contains less elastic fibres than available skin elsewhere. This skin is stripped of all subcutaneous tissue, and a bed for the graft is prepared by removing the outer epithelial layer from the remains of the drum and the skin from the adjacent meatal wall. The new tympanic cavity is usually filled with absorbent gelatin sponge to prevent its obliteration in the early stages of healing and to support the graft in position. It is necessary that mucous membrane shall grow in to line the under surface of the graft where it is to form a functioning tympanic membrane after the gelatin sponge has been absorbed.

Full-thickness skin may also be used to secure quick healing of the mastoid cavity. It is my experience, confirmed by others (North of England Otolaryngological Society, 1957), that quite a large piece of skin used for reconstruction of the tympanum readily survives and retains the normal characteristics of skin. By contrast, the same skin applied over the mastoid cavity tends to degenerate or to necrose, and may be in part replaced by excessive granulations. This is probably due to interference with its nutrition by small hidden collections of blood or serum. To avoid this troublesome feature, I am at present preferring to use full-thickness skin in small pieces as a "crazy paving" supplementing a pedicled meatal skin flap in the mastoid cavity.

Principle 5

Tympanoplasty attempts to apply the basic audiological principles of leverage and phase differential to achieve the optimum transmission of sound waves to the labyrinth. The

Diagram shows the five types of tympanoplasty described by Wullstein and illustrates different ways in which reconstruction can be planned. The new tympanic cavity must be air-containing and in functional continuity with the Eustachian tube. There should be a patent Eustachian tube with no tubal infection.

Preliminary examination by audiometry and tuning-forks should have shown that the cochlear function in the operated ear is adequate to benefit from an improved conduction mechanism. The criteria of adequacy are much the same as we have been accustomed to employ in assessing the suitability of an otosclerotic deaf patient for a fenestration operation.

After removing all irreversible pathology, and before deciding which type of reconstruction is appropriate, one must test the functional integrity of the ossicles and of the oval and round windows. The window function is nicely demonstrated by watching the round window niche or membrane under 12 times magnification, and gently probing the malleus handle, the stapes head, or the footplate. Transmitted movement through the labyrinth of the round window membrane, or of fluid in contact with it, should be very clearly seen if it is to be considered satisfactory.

Types 1, 2, and 3 all retain sound pressure transformation by leverage through the ossicles. Type 1 has an intact ossicle chain protected by a bridge of bone. Type 2 has no bridge,* and there may be slight erosion of the ossicles. Type 3 has reduced leverage, as there is no malleus or incus, the drum being in contact with the stapes. This is equivalent to the columellar hearing found in birds. These three types also have sound protection or a baffle over the round window; this is usually provided by using a skin graft to close the tympanum. Type 4 has no leverage, there being only the mobile footplate of the stapes. All that one can do here is to provide sound protection to the round window by a skin graft creating a small middle ear in functional continuity with the Eustachian tube. In type 5 there is fixation of the stapes, usually by otosclerosis. One provides sound protection or a baffle over the round window by making a closed tympanum, and, at the same time or at a later date, one carries out a fenestration of the lateral semi-circular canal.

Comment

My main concern in writing thus about tympanoplasty has been to try to secure a more general appreciation of what it means and tries to achieve. I believe that the principles on which it is based are sound. To achieve the refinement of technique necessary to carry them out is a challenge which must be accepted by otologists if we are to see any advance in this branch of surgery. It does mean painstaking time-consuming work in the operating theatre, but you are repaid by the essential interest of it, and by the fact that you salvage quite a fair proportion of deaf ears.

A detailed analysis of my hearing results is not presented, since it is only in the last year that I have gathered sufficient confidence to put these ideas into general practice. Individual cases were shown at Blackpool (North of England Otolaryngological Society, 1957) and reported at Newcastle, but

*Wullstein now insists that type 2 shall have a bridge, or at least part of a bridge, to protect the ossicles.

Diagram showing the five types of tympanoplasty. Reproduced by kind permission of Professor Wullstein.

more time must elapse before I feel justified in publishing them. Now I find there are very few cases in which it proves impossible to attempt some useful form of functional reconstruction.

Summary

The advances in the surgical treatment of conduction deafness in the past 25 years are reviewed. The main factors which have influenced progress are an improved instrumental technique under magnification by spectacles or microscope and the control of infection by antibiotics.

The success of fenestration for otosclerosis depends upon technical competence and choice of patient. In my experience the 30 decibel level, or better, was achieved at one year after operation in 51% of my first hundred cases, but in 85% of my second hundred cases. Mobilization of the stapes is reported to give good results in about 35%. If it fails I consider it unwise to risk labyrinth trauma from further dissection to free the stapes footplate and favour a subsequent fenestration operation.

I consider tympanoplasty is a development in functional otology of major importance. It presents a creative approach to the double problem of controlling disease and conserving or improving hearing in chronic otitis media. In order to clarify what it means and tries to achieve I have defined and discussed five fundamental principles as follows: (1) Precision microsurgical technique is essential. (2) Pathological changes in the tympanum can be assessed as irreversible or reversible under the operating microscope. (3) Antibiotic therapy helps considerably to control chronic infection provided irreversible pathology has been eliminated. (4) Full-thickness skin grafts provide a satisfactory medium for the plastic reconstruction of a new tympanic cavity. (5) Tympanoplasty attempts to apply the basic audiological principles of leverage and phase differential to achieve the optimum transmission of sound waves to the labyrinth.

Hearing results are encouraging, but more time must elapse before I feel justified in publishing them.

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According to the Ministry of Health the monograph on phenoxymethylpenicillin (penicillin V) tablets in the *British Pharmacopoeia 1958*, which becomes official on September 1, will quote a dosage of 125 to 250 mg., and will require tablets containing, in each, 125 mg. of phenoxymethylpenicillin to be dispensed or supplied where the prescriber has not specified a strength. This will differ from the requirement of the *British National Formulary*, which is that tablets containing 120 mg. of phenoxymethylpenicillin, or the equivalent amount of one of its salts, shall be dispensed or supplied in the absence of specific directions by the physician. Moreover, there is a tendency for manufacturers to change from strengths of 120 and 240 mg. to those of 125 and 250 mg., and for the same product to be available in both types of strength during the period of the change. Since the tablets are likely to be available in both types of strength for some time, and the difference between these is so slight, the Ministry is advising pharmacists that from February 1 until further notice prescriptions on Form E.C.10 for these tablets may be dispensed from either type of strength.

BRANDT-ANDREWS TECHNIQUE OF DELIVERY OF THE PLACENTA

BY

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Many authorities (Brews, 1948; Gibberd, 1955; *Queen Charlotte's Textbook of Obstetrics*, 1955; Browne and O'Sullivan, 1955) allow fundal pressure on the uterus as a method of assisting the delivery of the separated placenta. Browne and McClure Browne (1955), in discussing guidance of the third stage of labour, permit, when the placenta is known to be separated, gentle pressure on the uterus downwards in the axis of the inlet, or pulling on the cord.

When the placenta is retained various procedures are advocated for its expression. The Credé method is known to every doctor, but, as Browne and McClure Browne point out, it tends to cause shock. It should be gentle and not used often—probably not more than twice. Greenhill (1953-4), in commenting on Hammond's (1952) article, states: "Hammond is one of a small minority, who still believes in Credé's manual expression of the placenta." Greenhill considers this procedure should be forgotten. I am of the same opinion.

Modified Technique

The Brandt-Andrews technique is described by De Lee and Greenhill (1947) and advocated because the Credé manoeuvre has potential and actual dangers. I have modified the technique as described by these authors. Instead of using a hand to grasp the umbilical cord, I use forceps. The modified technique is as follows. A pair of forceps is placed on the umbilical cord as close to the vulva as possible. One hand grasps the forceps and the other hand is placed on the abdomen so that the palmar surface of the fingers is over the anterior surface of the uterus approximately at the junction of the corpus uteri with the lower segment. The uterus is now gently pressed backwards and upwards towards the patient's umbilicus, and at the same time steady but not too strong traction is made on the umbilical cord. If too great traction is made the cord may break. This technique will usually bring forth the placenta and membranes. If it does not succeed, one capsule of amyl nitrite is broken and inhaled by the patient, and the Brandt-Andrews technique is then repeated, usually with success. A second capsule of amyl nitrite has occasionally been used, and this sometimes made the difference between success and failure. Amyl nitrite is used to relax a possible hour-glass contraction ring, which can be diagnosed only by intra-uterine palpation (Browne, 1950). Amyl nitrite is rarely necessary. If the placenta is still retained the patient is anaesthetized and the Brandt-Andrews technique repeated. Should this fail, then manual removal is at once carried out.

Picton (1951) appealed for more widespread adoption of the Brandt-Andrews technique for conducting the normal third stage. He stressed the need for the bladder to be empty. He considered that this was the only method of placental expulsion in which the admittedly rare risk of acute inversion of the puerperal uterus was entirely absent. Furthermore, he pointed out that before inversion of the uterus could be initiated the uterus and cervix should be relaxed. He therefore advised intravenous ergometrine with the birth of the anterior shoulder.

Aristotle remarks that "until the after-burden is brought away, which is sometimes more difficult to do than the child, it is altogether as dangerous if it be not speedily done: therefore as soon as the child is born, lest the womb should close,