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President: TERENCE CAWTHORNE, F.R.C.S.

February 6th, 1959

SHORT PAPERS

CAUSATION OF DEAFNESS IN CHILDHOOD*

By KENNETH HARRISON (Manchester)

DEAFNESS in childhood is rarely an obvious defect and it can easily be missed, particularly in infancy.

It presents many special problems and it is better to study them as a team. In recent years, members of the Department of Otolaryngology and Education of the Deaf of Manchester University have collaborated together to study some of the problems.

In a Ministry of Health report, published in *December, 1957*, it was estimated that not less than one child in every thousand births had a profound congenital deafness and would never be able to hear speech. Also, another two children per thousand had a sufficient hearing loss, resulting in lack of ability to hear unaided, a teacher's voice in an ordinary classroom.

In our collaboration, 354 children were personally examined. The ages ranged from 10 months to 16 years. There were 66 children of pre-school age and 288 of school age.

In early investigations of the causes of deafness, many cases were classified as congenital when, in actual fact, they were acquired. As early as 1894, Mygind recognized this error in classification.

Since that time, with ever-increasing knowledge of how disease may affect hearing, there has been a greater degree of accuracy in determining causation.

Children in the pre-school age group are usually referred because normal speech has not developed. School children are sent by medical officers who have seen them for routine checks. In most cases, deafness has not been suspected or noticed by the parents. At school, they are often assessed as dull and backward and it is only rarely that the teacher has suspected deafness as a possible cause for their lack of progress.

The important points in the clinical history are as follows: Has deafness

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ever been suspected, if so, at what age? I have found that a keen and experienced mother—that is one who has older children—will sometimes detect hearing loss at a very early age, even during the first year.

Questions are asked about the family and pre-natal histories. Also, the details of the birth and account of any childish illnesses. Finally, it is essential to know about the child's general, speech and social development.

The family history concerns any question of hearing impairment in any collateral branches. The parents must be questioned about each individual member. The ideal would be to test each one but this, of course, is impossible.

The pre-natal history is concerned with diseases occurring during pregnancy. Of particular interest is German measles or other virus infections occurring the first three months. Also, is there any evidence of toxæmia? It is always important to know the rhesus blood group of the mother and the details of earlier pregnancies, particularly if any previous miscarriage has occurred.

Premature delivery may occur and this may result in abnormalities in the new-born. It is important to know if any abnormal appearances were noted in the infant at birth, for example—cyanosis, jaundice, paralysis or any congenital defect.

CLASSIFICATION OF CAUSES

1.	Prenatal	77 cases
2.	Neonatal (First week or so of life)	24 cases
3.	Post natal	148 cases
4.	Unknown	105 cases (almost 30%)

TYPES OF DEAFNESS

1.	Perceptive	261 cases (74%)
2.	Conductive	93 cases (26%)

A more detailed classification of the prenatal causes will now be presented.

1. Hereditary
2. Diseases of pregnancy:
   (*a*) German measles
   (*b*) Other virus illnesses in the first 3 months
   (*c*) Toxæmia
3. Abortifacients
4. Prematurity
5. Hazards of labour:
   (*a*) Anoxia
   (*b*) Birth trauma
6. Congenital anomalies

Hereditary deafness

This is defined as deafness occurring in a family with other deaf born members. In this series, there were only 12 cases. Johnsen (1954) considered that deafness of genetic origin was the commonest congenital cause. It results

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from an arrest of development of the cochlea and there is a resulting defect of the organ of Corti. The degree of hearing loss present depends on the amount of damage to this peripheral end organ.

A few workers have examined the central cochlear nuclei and also found an arrest of development.

The audiometric patterns were of the following types:

(*a*) A flat identical curve for both ears at about 65 decibels or more;

(*b*) Steep sloping identical curves with marked loss in the high tones.

German measles

Gregg (1941) first attracted attention to the association of German measles occurring in pregnancy and congenital abnormalities, when he reported a case of cataract formation in the new-born.

Carruthers (1945) later reported cases of deaf mutism associated with this disease.

It is now accepted that German measles occurring between the sixth and twelfth weeks of pregnancy can produce devastating effects on the cochlea with resulting profound perceptive deafness. At this period, the still undifferentiated cells of the developing cochlea may be easily damaged.

Lindsay (1953) examined both inner ears from 4 cases exposed to maternal rubella—one case definitely had severe bilateral deafness. There were pathological changes in both the saccules and cochleas. The evidence suggested that the virus reaches the developing sensory structures by way of the blood vessels and the endolymph.

There were 17 cases in this group. Some of them had multiple congenital defects. Audiometric tests were done but there was no uniformity of pattern. Fisch (1954) in a series of 69 cases described a flat audiometric curve.

In a more recent article (1958) Fisch found the incidence of deafness to be approximately 30 per cent., in a third of the cases the deafness was unilateral. He advised that children, whose mothers give a history of Rubella in early pregnancy, should be followed until such time as audiometric tests can be done, otherwise deafness may be missed.

In three other cases, measles, glandular fever, and mumps occurring during the early weeks of pregnancy were thought to be causal factors.

Toxæmia

There were eight cases which were thought to be due to toxæmia of pregnancy. In each case, the toxæmia was sufficiently severe to warrant hospitalization. In this affection, damage of the placenta may occur with subsequent effect on the fœtus. Audiometric tests showed flattish identical graphs at a 70 to 90 decibel level.

Abortifacients

In two cases, quinine had been used in large doses in unsuccessful attempts to induce abortion in early pregnancy. Taylor (1937) reported the danger of quinine as an abortifacient and how irreparable damage to the cochlea could occur.

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Prematurity

In the series, there were 19 premature births, that is, babies with a birth weight of 5 pounds or under.

Accurate audiometric tests were done on 12 cases and in 8 there was a steep sloping curve with marked high frequency loss.

Johnsen (1952) reported that perceptive deafness was more frequent among premature babies than children born at term.

A premature fœtus is exposed to extra risks during labour and, in neonatal life, faces numerous hazards. Calkins (1955) reported that the lower the birth-weight of premature infants, the higher the incidence of breech delivery, thus exposing the fœtus and the new-born to added risks from mechanical or asphyxial injury with consequent possibility of brain damage.

Aidin (1950) stated that the tissues of a premature infant are fragile and very susceptible to anoxia and this may be a prime factor predisposing to the damage of nerve cells. It is thought that permanent damage of the cochlear nuclei may occur with resulting deafness.

Hazards of labour

A premature baby is usually frail and its respiratory efficiency is often less than that of a normal baby, thus anoxia may result.

There were 11 cases thought to be due to anoxia at birth.

It is an accepted fact that anoxia in a new-born baby lasting more than a few minutes may result in permanent damage to the nuclei of the brain stem and basal ganglia.

Audiometric tests were done in seven cases and six of them showed a steep sloping curve with marked high frequency loss.

Congenital anomalies

There were eight cases of complete congenital meatal atresia with accompanying microtia. Six of them were bilateral. In each case, there was an accompanying conductive deafness of variable degree.

Three of these cases were operated upon. The findings were very similar. There was no tympanic membrane, it being replaced by bone known as the atresia plate. On removal of this bone, the anatomy of the middle ear could be easily recognized. In each case, the malleus and incus were malformed and, in two, were united. The stapes was normal in each case and quite mobile. In none of the cases was there any evidence of abnormality of inner ear function.

The anatomical picture of the middle ear may be more complicated than this. Gill (1958) in a recent communication to the North of England Society, reported 28 patients with this anomaly. He was unable to find the middle ear in seven cases and, in another three, it was so deformed as to be hardly recognizable.

NEO-NATAL CAUSES

(First week or so of life)

1. Kernicterus of rhesus incompatibility.
2. Kernicterus of prematurity.
3. Acute infections.

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Kernicterus or nuclear jaundice may result from both rhesus incompatibility and prematurity. In this study, we saw more of the former group.

Kernicterus is associated with the deposition of bilirubin in the nerve cells, especially those of the basal nuclei.

This staining of the basal nuclei was first described by Orth (1875) and called nuclear jaundice. Later, in 1904, Schmörl coined the term Kernicterus.

Levine (1941) stated that rhesus incompatibility was responsible for hæmolytic anæmia and jaundice of the new-born. Some of the cases of jaundice develop neurological complications resulting from yellow staining of the basal nuclei.

Claireaux (1950) put forward the hypothesis that in kernicterus of rhesus incompatibility, cells of the nuclear masses are markedly affected by anoxia resulting from severe anæmia. This increases the cell permeability to bilirubin and gives rise to the typical yellow staining.

Coquet (1944) reported the first case of severe deafness associated with kernicterus.

In 1950, Crabtree and Gerrard in this country, and Goodhill in America, published papers on deafness in the new-born due to kernicterus of rhesus incompatibility. Cavanagh (1954) presented an excellent paper to this section and predicted that eventually there will be few such cases.

Aidin (1950) carried out post mortem examinations on 24 premature babies. They all showed a typical kernicterus. Serological tests were done and there was no question of rhesus incompatibility. He, too, thought that oxygen deficiency may be a prime factor predisposing to brain cell damage and thus to increased permeability of certain groups of cells to bile pigment.

Crosse (1958) stated that there are about 500 cases of prematurity kernicterus in England and Wales each year. The cause is thought to be due to hepatic immaturity. In these infants, the serum bilirubin is considerably raised.

The brain changes due to kernicterus appear to be the same whether caused by rhesus incompatibility or prematurity.

Gerrard (1952) carried out post mortems on two cases of kernicterus. The cochlear nuclei showed degeneration of the nerve cells. The cochleas themselves appeared to be within normal limits.

Bevis (1956) found that in kernicterus, the concentration of both bilirubin and oxyhæmoglobin are considerably raised in the blood serum and, in these circumstances, it is possible that the bilirubin leaks through and produces its damage by direct action on the basal nuclei.

There were 17 cases in the rhesus incompatibility group. In 9 of them, there was an accompanying cerebral palsy.

It was only possible to do audiometric tests in a very small number. Four of them showed a steep sloping curve with high frequency loss.

Twelve of these children had exchange transfusions after the jaundice had actually developed. Treatment had never been carried out as a prophylactic measure.

Two of the cases were very interesting. They were twin brother and sister aged $2\frac{1}{2}$ years, both rhesus positive, and their mother was rhesus negative. The sister was transfused within 1 hour of birth and developed no complications.

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The little boy was transfused 2 days after development of neonatal jaundice and he is profoundly deaf.

Bevis (1956) noted that the concentration of bilirubin and oxyhæmoglobin in liquor amnii and umbilical cord blood serum give an indication of the severity of the hæmolytic process in the baby and may be used as an indication of the necessity for therapy.

Kernicterus of prematurity

There were three cases of deafness resulting from kernicterus of prematurity. In only one case was audiometric test possible and this showed a steep sloping graph with increasing loss in the high tones.

POST-NATAL CAUSES OF DEAFNESS

1. Infectious diseases:
   (*a*) Measles.
   (*b*) Mumps.
2. Meningitis:
   (*a*) Meningococcal.
   (*b*) Pneumococcal.
   (*c*) Influenzal.
   (*d*) Tuberculous.
3. Familial perceptive deafness.
4. Chronic suppurative otitis media.
5. Secretory otitis media.
6. Infections of the upper respiratory tract (tonsils and adenoids).
7. Pyrexia of unknown origin.
8. Miscellaneous.
9. Unknown.

Infectious diseases

It is interesting to examine the records of McLeod Yearsley. In his very comprehensive monograph (1934) presenting the causes of deafness in over 4,000 children, the infectious diseases were very high on his list of causes. Measles was responsible for the highest number, followed by scarlet fever, diphtheria and whooping cough.

Another interesting point in his series is that 187 cases were due to congenital syphilis. As far as our records go, we have found no cases due to this infection.

Measles. There were 8 cases which were thought to be due to measles infection. In this series, it appears to be the only troublesome infectious disease.

Perceptive deafness may result from involvement of the cochlea. Lindsay (1958) described a bilateral case in which the inner ear was examined histologically. There was an endolymphatic labyrinthitis resulting from direct invasion of the endolymphatic system by the virus by way of the stria vascularis.

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Conductive deafness may also result from otitis media, complicating this infection.

Mumps. Was considered responsible in only an odd case. In Yearsley's very large series, there were only 7 cases due to this infection.

Meningitis

In this series the following cases of meningitis were seen:

	No. of cases
1. Tuberculous	11
2. Meningococcal	10
3. Pneumococcal	4
4. Influenzal	1

There was profound perceptive deafness in all the cases and the audiometric patterns were very variable.

In the last two years, no case of deafness following tuberculous meningitis has been seen. There were only 6 cases reported to the Medical Officer of Health in Manchester during 1957.

Familial perceptive deafness

There were 12 cases in this group.

In these cases, deafness commenced at varying ages in infancy and childhood. It is pretty certain that there was no deafness present at birth. There were only two cases in which it was difficult to understand the speech.

The children were seen some years after the deafness was first suspected.

There was always a strong family history and, in the members affected, the deafness had started at variable ages.

These children will require a long-term observation to note if the deafness is progressive. Audiometric tests were done in each case and 8 of them, that is two-thirds, showed a steep sloping curve flattening out at a 70 to 80 decibel level. The graphs were identical in each ear. Four of the cases had flattish audiometric curves which were quite variable.

It is my belief that these cases come into the classification of heredo-degenerative nerve deafness as reported by Cawthorne and Hinchcliffe (1957).

One has seen similar cases in adults who have been referred with a diagnosis of otosclerosis and, after close examination, it has been realized that the deafness is of a familial perceptive type and quite unsuitable for surgical treatment.

Chronic suppurative otitis media

There were 52 cases of conductive deafness (14 per cent.) resulting from chronic suppurative otitis media. Twenty-three of the cases were active, that is, with the presence of discharge, and 29 were inactive.

This number appears to be unusually large but it is probably true to say that in large industrial communities this infection is still quite prevalent in childhood.

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Secretory otitis media

Secretory otitis media produces a conductive hearing loss. If it is not recognized and successfully treated, it may produce irreversible hearing loss.

Stevens (1958) in a very recent report, found 53 cases of this type in 1,000 children attending his out-patient clinic over a period of three years.

Unknown group

In the unknown group, there were 105 cases (almost 30 per cent.) in which no cause was found.

There was nothing in the history to give a lead as to causation. This possibly results from the inaccuracy of retrospective enquiries and poor historians.

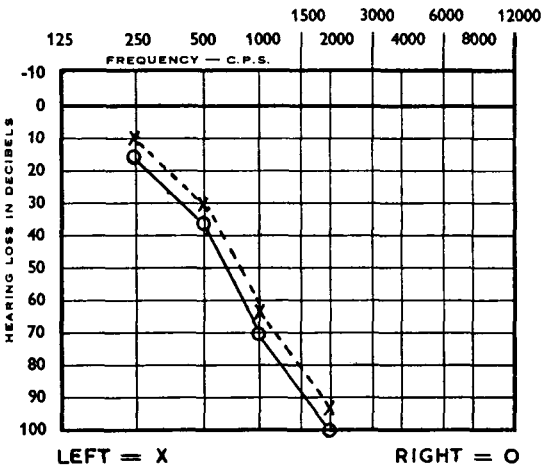


FIG 1

All types of audiograms were seen in this group but this did not help to elucidate the cause. Johnsen (1957) stated that inherited deafness gives chiefly a graph sloping gradually towards the high frequencies. He concluded that cases with this type of audiogram in his unknown group were hereditary.

Summary

Three hundred and fifty-four deaf children have been studied—there were 261 cases of perceptive deafness and 93 cases of conductive deafness.

In the last 20 years, great progress has been made in more accurate diagnosis. In the pre-natal group, the effects of diseases of pregnancy, premature birth and anoxia at birth are more fully understood.

In the neo-natal group, a great deal has been learned about kernicterus of rhesus incompatibility and prematurity and this is now preventable. Observation during pregnancy, the carrying out of tests on the liquor amnii in the later months and serological tests on the umbilical cord blood at birth can help to determine the severity of the hæmolytic process in the rhesus cases.

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Similarly, estimation of the serum bilirubin in premature babies is an important guide as to whether jaundice and resultant kernicterus may develop.

Kernicterus can be prevented by an early exchange transfusion.

The audiogram of particular interest was the steep sloping curve with high tone loss (Fig. 1) which was found in cases of kernicterus, prematurity and anoxia at birth. Oxygen deficiency may play a major role in each of these conditions.

It is a known fact that in kernicterus, the cochlear nuclei are damaged. Also, premature births and the hazards of labour that occur may, too, produce defects within the basal nuclei.

In 1954, Fisch described a similar type of audiogram in cases of kernicterus and anoxia and thought it was a nuclear deafness.

In the post-natal group, measles still remains a problem with regard to complications producing deafness.

Before this investigation, I personally was unaware of the cases of familial perceptive deafness occurring in children. It is a group that requires further study and the cases must be followed over a long period to determine how progressive it is.

In this series, deafness resulting from chronic suppurative otitis media is still quite a problem.

There is too great a number in our unknown group—105 cases, or nearly 30 per cent. It is often very difficult to determine accurate facts in a retrospective enquiry, particularly when many years have passed from when the deafness was first suspected. I feel sure that if we saw deaf children at an earlier age, we would be able to obtain more accurate histories and possibly reduce this large number. As a result of the pioneer work of Lady Ewing in the screening tests of babies at Welfare Clinics, there is a much greater chance of earlier diagnosis.

During the last twenty years, great advances in surgical techniques have helped to conquer much conductive deafness. As a result, the minds of otologists are more focused on the problems of perceptive deafness. It is my belief that, with further team work with our colleagues in the field, more of these problems may well be solved.

I wish to thank Professor Victor Lambert for his help and encouragement with this study. I am also deeply grateful to Professor Sir Alexander Ewing and Dr. T. J. Watson for all their most valuable help in carrying out the audiological part of this investigation.

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THE PLACE OF THE BÉKÉSY AUDIOMETER IN CLINICAL AUDIOMETRY

By KENNETH McLAY (London)

IN 1947 Békésy described his new audiometer, which automatically plots a threshold audiogram through a frequency range of 100 to 10,000 cycles per second.

During the 15 minutes required to cover this range all frequencies between 100 and 10,000 cycles are tested.

The intensity of the sound is increased by a motor at a rate of 2 decibels per second. As soon as the patient hears the sound, he presses a button which decreases the intensity at the same rate. Immediately the tone disappears, the button is released and the intensity again increases. In this way the sound intensity oscillates about the threshold of hearing and a fluctuating line is written on the audiogram.

This method has several advantages over conventional audiometry:

1. Being automatic the recording is not influenced by the examiner.
2. It records the threshold continuously throughout the frequency range of the audiometer, in contrast with the usual octave and half octave fixed frequencies.

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3. The Békésy audiogram also produces a measure of the intensity difference limen at threshold. The amplitude of the pen excursions around the auditory threshold is determined by the patient's reaction time and by the reaction time of the apparatus. Both of these are small and constant during the test. The main variation is due to change in the intensity

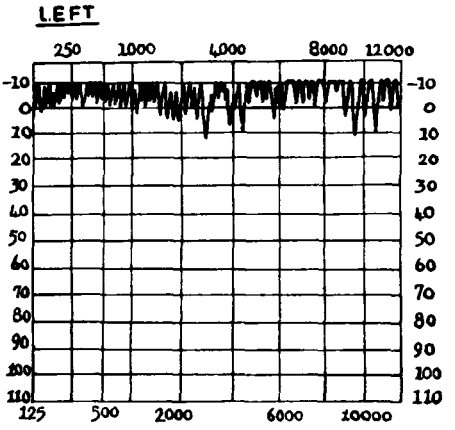


FIG. 1.

Normal subject. Age 23.

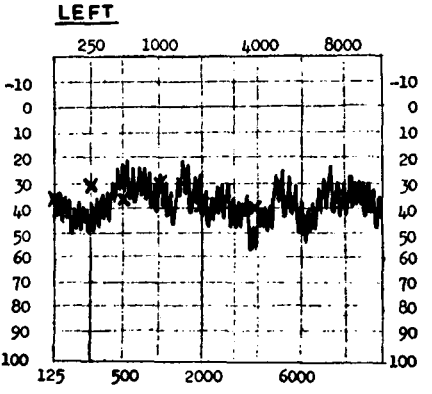


FIG. 2.

Conductive deafness. Conventional pure tone audiogram is superimposed.

difference limen. The intensity difference limen can be used as an indirect indication of the presence of recruitment. Where recruitment is not present, the threshold intensity difference limen falls within a range of 6 to 10 decibels. Where recruitment is present, the difference limen is reduced to less than 3 decibels.

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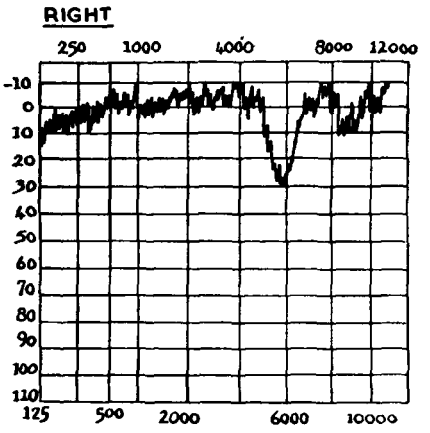
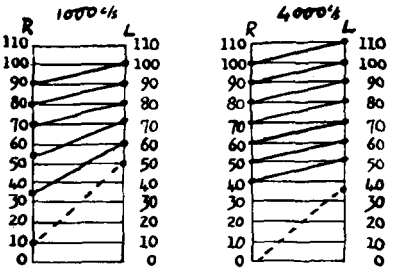


FIG. 3.
Early occupational deafness.



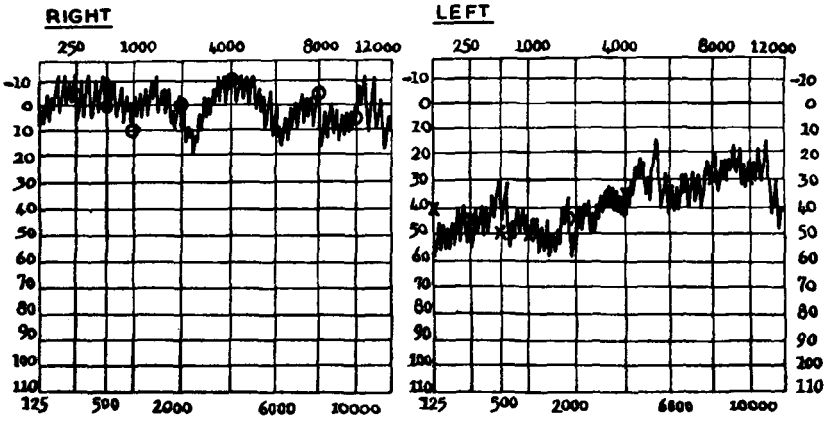


FIG. 4.
Case of perceptive deafness where loudness balance shows no recruitment. Békésy difference limen is not reduced. Right ear masked.

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The most comprehensive review of the Békésy audiometer in diagnosis has been that of Lundborg who has demonstrated its value in the localization of the lesion in cases of perceptive deafness. In his series, 25 cases of acoustic trauma all showed marked reduction of the difference limen.

In 26 cases of Ménière's disease, 24 showed marked reduction of the difference limen, the remaining 2 showed a moderate decrease.

The pathology in these two groups is in the end organ. In 21 cases of verified

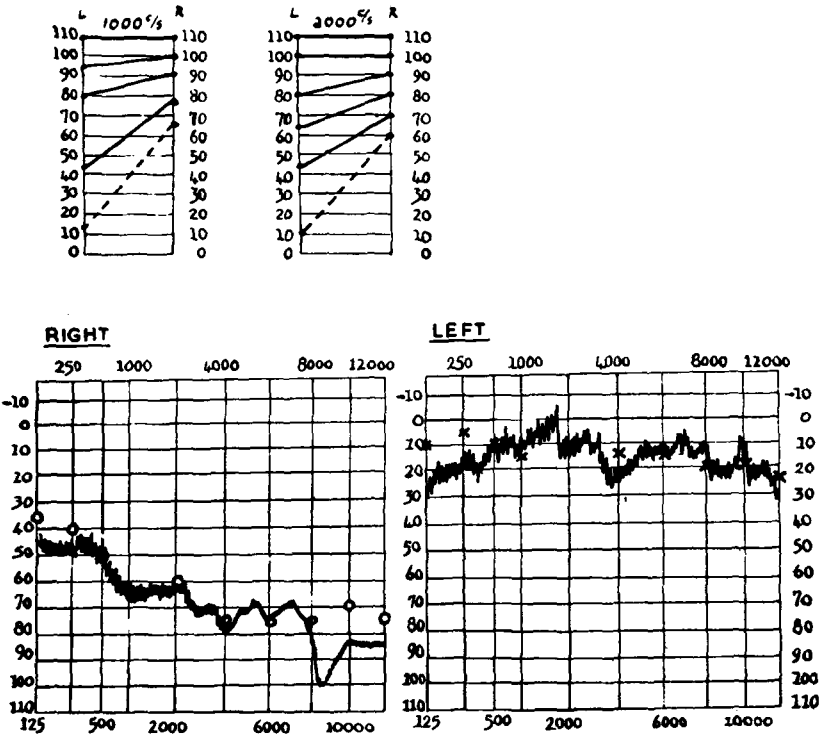


FIG. 5.

Ménière's disease—loudness balance shows total recruitment. Békésy difference limen is reduced. Left ear masked.

disease of the auditory nerve, 18 showed no reduction of the difference limen. The remaining 3 showed slight reduction.

These findings are comparable to those obtained by the direct loudness balance test for recruitment.

The Békésy audiometer, however, has the advantage that it can be used when the deafness is bilateral. It can also be used where unilateral deafness is too severe to permit a satisfactory loudness balance test. From over 300 such audiograms carried out at the Institute of Laryngology and Otology, 52 have been selected for comparison with the loudness balance test. These were selected because the deafness was unilateral, the loudness balance test was quite reliable

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and conventional pure tone audiograms had been carried out on an audiometer with identical calibration. In 41 the loudness balance and Békésy audiograms agreed. Of the remaining 11, 9 showed recruitment with the loudness balance test but no reduction of the difference limen. This means that if the Békésy difference limen is reduced, recruitment is almost certainly present. If the difference limen is not reduced the result is not so certain, but recruitment is probably not present.

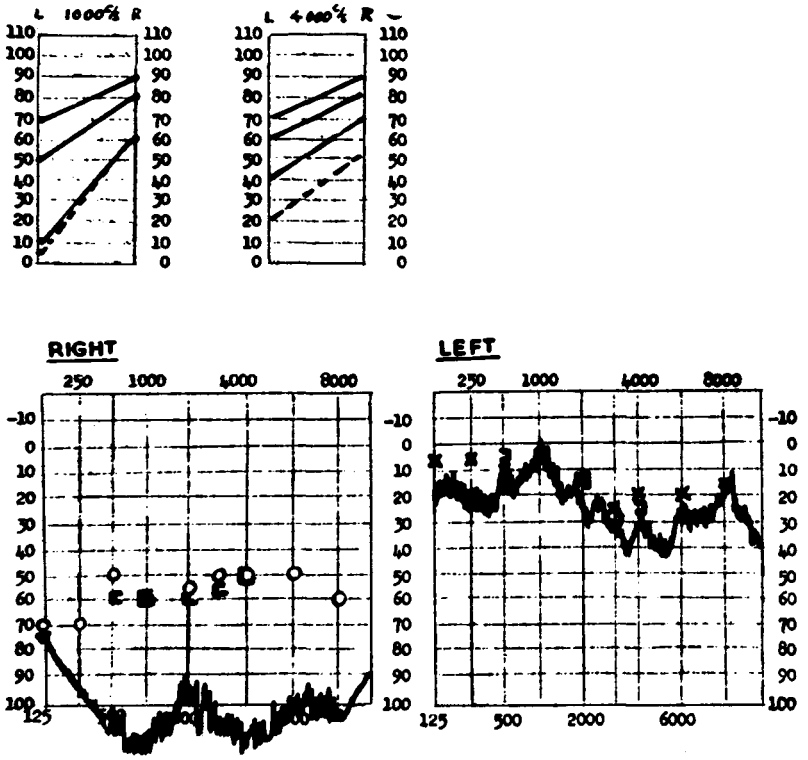


FIG. 6.

Acoustic tumour. Loudness balance shows lack of recruitment. Difference limen is not reduced. Békésy threshold is 50-60 decibels higher than conventional pure tone audiogram. Left ear masked.

In a considerable proportion of patients, it is found that the threshold obtained by Békésy audiometry is higher than that obtained by conventional audiometry.

This raising of the threshold is due to adaptation, as can be shown by interruption of the test tone for a few seconds, after which the Békésy threshold immediately falls to that of the conventional audiogram. However, it returns quickly to the fully adapted level. Carhart has shown that this abnormal adaptation can be eliminated by interrupting the Békésy tone three times per second. In this series, of 25 cases where recruitment was present, abnormal

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adaptation was present in 14, absent in 11. In 16 cases where recruitment was absent, abnormal adaptation was only present in 4.

Abnormal adaptation does not seem to run parallel with the presence of recruitment. Only 2 cases of acoustic tumour were examined; both showed marked adaptation. Carhart has recently reported identical findings in 3 cases of acoustic tumour.

The audiometer used in this series was a Peters SPD3 Audiometer which

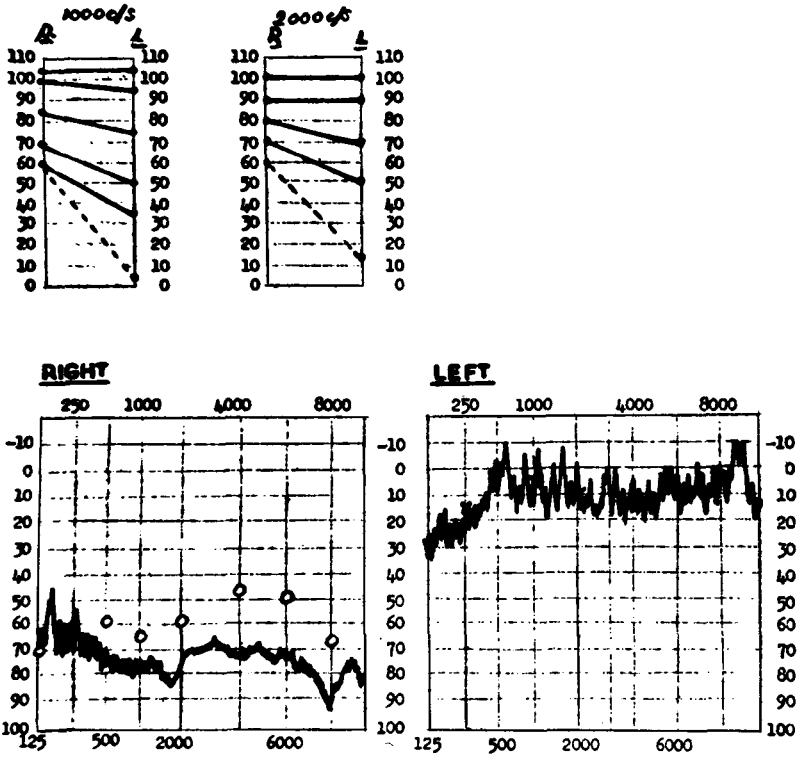


FIG. 7.

Ménière's disease. Loudness balance shows total recruitment. Difference limen is reduced. Békésy threshold is 15-25 decibels higher than conventional pure tone audiogram. Left ear masked.

has continuously variable frequency and intensity controls. To these were connected suitably geared motors and a writing unit. This precision engineering was carried out by M. F. Madigan and K. C. D. Needham of the Institute of Laryngology and Otology.

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Royal Society of Medicine

SUDDEN PERCEPTIVE DEAFNESS IN YOUNG PEOPLE*

By T. J. WILMOT, M.S.(Lond.), (Omagh, Northern Ireland)

DURING the past 6 years I have seen a total of 47 patients under the age of 40 with sudden perceptive loss of hearing. In 25 of these the deafness was associated either with a fever (6 cases), meningitis (6 cases), or followed mumps (13 cases), but in 22 cases the condition appeared to be a spontaneous one and it is to this group that I wish to call attention.

Before 1956 only about 100 cases of sudden deafness had been recorded in world literature—since then, however, a number of papers have appeared although these have been in other countries. Thus Hallberg in 1956 described a large number of patients seen at the Mayo Clinic of which 89 were of the type I shall describe. He thought that this group was vascular in origin and that emotional factors were of some importance in initiating the attacks. In 1950 Fowler of New York had described 26 cases and had also stressed the importance of emotional episodes in the ætiology. A series of 100 cases described by van Dishoeck and Bierman in 1957 contained a number clearly secondary to virus infection. In the remainder of their cases, however, they too thought that emotional tension and vascular spasm were of ætiological significance. Also in 1957 Svane-Knudsen of Copenhagen described 21 cases which he ascribed to neuritis of the VIIIth nerve. Fowler considered that vascular spasm with secondary blood "sludging" in the cochlea was the pathological mechanism involved, but produced no pathological evidence in favour of this. Other authors have described small series of cases recently, where virus infection appeared to be the cause of deafness.

With the exception of Fowler, who found that 77 per cent. of his cases were under the age of 40, none of these papers have stressed the age factor. In Svane-Knudsen's series the average age was 45.

It thus seems likely from a study of this literature that three or more factors may be responsible for cases of sudden deafness which can occur at any age. Thus virus infection, vascular spasm, vascular disease and VIIIth nerve neuritis may all be factors. It is, however, the group of cases of apparently spontaneous deafness in people under 40 which I have singled out for your attention. Like Fowler I believe that this condition is commoner in the young.

The clinical picture described by Fowler of the sudden—often dramatically sudden—onset of deafness with vertigo and tinnitus, in most cases in a healthy young adult, is repeated in my own series. Fowler stated that half of his cases were seen a considerable time after the onset of deafness. Out of my cases only 3 reached my consulting room in less than a month, 8 in under 3 months, and the rest in over 3 months from the date of onset. That so dramatic a form of deafness has attracted so little attention in this country is surprising. The general public, however, do not consider sudden hearing loss an urgent matter and the medical profession do not always realize how important delay can be.

The only case of sudden deafness to reach me relatively early, was a young

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woman of 23 who was sent up with a diagnosis of acute eustachian tube obstruction. She had woken up deaf in her right ear four mornings previously. There was slight tinnitus and she had been very giddy that day and had had to spend the rest of the day in bed. She had had nausea but no actual vomiting. Her vertigo had settled partially although she still felt insecure. Her deafness was typically perceptive in type.

It is perhaps of significance that, with the exception of one case in which recovery occurred spontaneously, this is the only case where, as the result of treatment, really good recovery of function took place. The onset of her deafness is typical of most of my cases, although an exact description was difficult to obtain in the younger age group.

Of my cases 13 were females and 9 males (whereas Fowler had 13 males and 6 females). The youngest in my series was a child of 8 who had gone suddenly deaf in both ears a year previously. There was one other child under the age of 10 and seven children between the ages of 10 and 20. There were also 7 adults between the ages of 20 and 30 and 6 between the ages of 30 and 40.

Five patients were bilaterally affected—2 being totally deaf in both ears. Seven of the unilateral deafness cases were also totally deaf in the affected ear. In those partially deaf, different audiometric patterns presented, although by far the greatest number showed a loss of all frequencies. Reduced or absent vestibular function was present in all cases where caloric tests were done.

Altogether 3 awoke deaf and in all the other cases the onset was described as sudden, although it was not always clear whether this referred to a few minutes or a few hours, or even a day or two. Tinnitus was present in 77 per cent.

Because of the associated vertigo (55 per cent. in this series), with nausea or vomiting, a gastro-intestinal cause may be suspected by the general practitioner and valuable time lost in making the correct diagnosis. A middle-ear deafness may be, and often is, diagnosed, unless the significance of the false negative Rinné test is kept constantly in mind.

I have very little to contribute towards an exact scientific understanding of the ætiology of this condition. Three of my patients had poor peripheral circulations and one of these became deaf during a spell of cold weather—one patient became deaf while being treated for osteomyelitis—one when working for a short period in a very noisy stone quarry—one a month or so after a head injury and two following an influenzal cold. In all the others no physical factors seemed to enter the ætiological field. The condition, however, does not appear to me to occur in phlegmatic individuals and I think that vascular spasm produced by emotional episodes as described by Fowler may well be responsible for the majority of these cases.

Prognosis and Treatment

These are, I believe, closely linked. Two of my series recovered good function, one spontaneously 3 days after onset—the other after intensive treatment. Partial recovery occurred in four other cases and there was no recovery in the remainder (73 per cent)—this was not surprising in view of the late diagnosis.

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In my opinion the early cases should be treated by immediate stellate block repeated daily, or at more frequent intervals for 3 or more days and supplemented by the most effective vasodilator drug which I believe to be buphenine hydrochloride "perdilatal" in doses of at least 6 mg, four times a day. The latter should be continued for a fortnight or longer. In the early case I have already described this treatment resulted in a 50-60 decibel improvement in the middle frequency range of her hearing. On the same principle Monlonguet and Bouche in 1952 restored the hearing of a young doctor, deaf for 4 days, by the intravenous use of sodium nicotinate.

Although spontaneous recovery has been reported in this condition even after deafness lasting several weeks, it is very rare and the general prognosis of the untreated case is bad. In the bilateral case it is tragic. I believe that this is an emergency and that energetic measures to retain the blood supply to the inner ear are imperative.

Conclusion

Sudden perceptive deafness is by no means a rare condition. I believe that by treating every *early* case on the lines I have suggested restoration of hearing will result in some patients otherwise condemned to permanent loss of hearing.

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ROSEN'S OPERATION IN DIAGNOSIS

By WILLIAM S. McKENZIE (London)

THERE are various ways of considering this operation. First, it might be discussed in relation to other methods of diagnosis of deafness, and it must be confessed that when these are considered they are really small in number and not very elaborate.

To take middle-ear deafness without active suppuration or a perforated drum—the only points in the history which would seem helpful are the age of the patient, the character of the onset, the aggravation with a cold, and the vague tinnitus which is not localized to one frequency. In a population where the standard of living is high, the constant use of a hearing aid is helpful in diagnosis, and so is the fact that the telephone can be used on the deaf ear.

A history of chronic ear infection in childhood, or evidence of suppuration in the opposite ear should always arouse suspicion that the deafness is due to

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damage to the middle ear or ossicles by infection. I think every one who has been using Rosen's approach for diagnosis must have been surprised sometimes by the appearance of the middle ear in these cases. I have lifted a whole drum to find that the incus and both crura of the stapes have disappeared, and that the footplate alone remains, and moves quite normally on pressure.

In examination, a normal drum would suggest that the deafness is not due to past infection, but an example will be given where a scarred drum was misleading. In passing, it has always struck me as odd that there have been no reports in the literature of active chronic suppurative otitis media associated with proven otosclerosis.

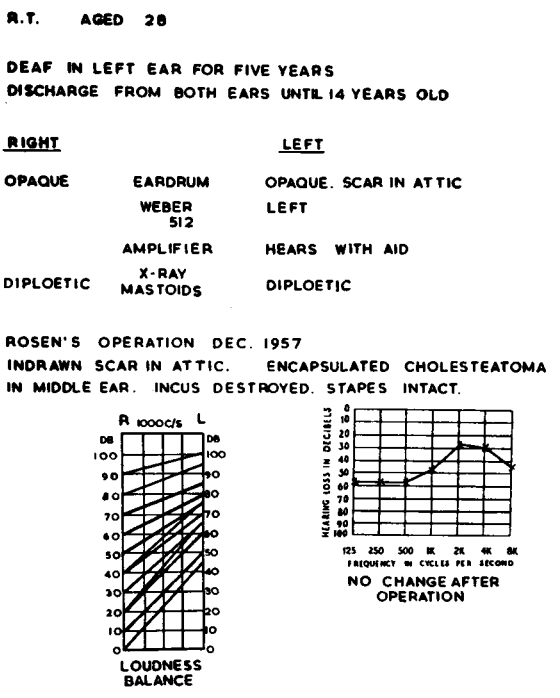


FIG. 1.

Plate J.50. Encapsulated cholesteatoma.

In examination of the drum the Zeiss microscope may be considered by itself, for there is no doubt that the microscope plays a large part in making the correct diagnosis in middle-ear deafness, apart from the exposure of the middle ear by Rosen's method. We have frequently been surprised by the appearance of the drum when it is examined on the operating theatre table before a mastoid operation. Some people may say that there should be no surprise, for the drum should be fully examined beforehand, but I wonder how many of us have a Zeiss microscope always available in an out-patient clinic? At my hospital, I have reckoned that for this we should need six microscopes, and I think no one here would contemplate asking their finance committee for six Zeiss microscopes at once! Incidentally, I hope that there may be comments, from my

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colleagues, on the Zeiss microscope itself. It is a superb instrument, and far better than any loupe or headlight yet manufactured; yet one cannot help wondering whether it will not be obsolete in a few years' time. Its great virtue is the lens system and lighting, and its defect is the awkward bracket which makes the surgeon prefer to move the patient, for a better view, rather than the instrument itself. I cannot, myself, see the virtue of the high magnification of 25 or 40 in our work.

The archaeologists use various kinds of lighting in examination of their specimens, and it has occurred to me that we might do the same through the

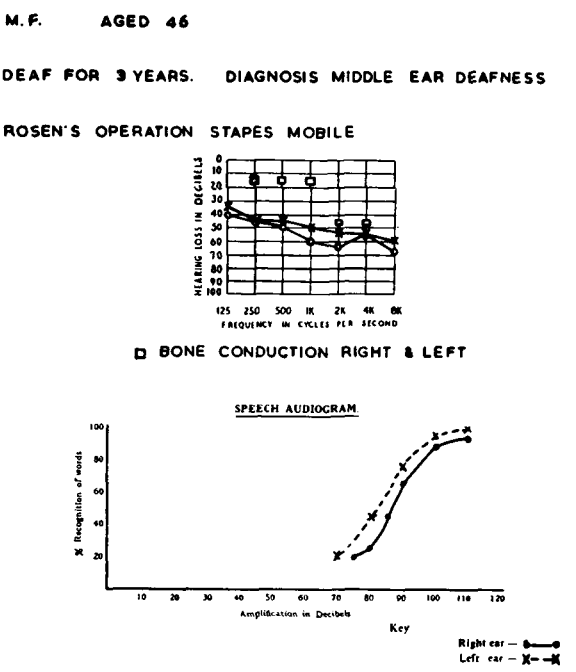


FIG. 2.

Plate J.51. Middle-ear deafness suggesting otosclerosis. Mobile stapes.

Zeiss microscope, besides the green and blue light which the makers provide. Ultraviolet light, for example, has sometimes shown remarkable contrasts when an object is examined. To return, however, to the methods of diagnosis, most of us I think would use a tuning fork of 512 cycles to do the Rinne test. Now Bunch showed, many years ago, that a negative Rinne test was only diagnostic of middle-ear deafness in certain conditions. If the hearing loss is less than 35 decibels by air conduction at 250 cycles, the Rinne in middle-ear deafness may be positive, and Bunch suggested that the same difficulty may occur at higher frequencies when the Rinne test is used, although the positive Rinne is only likely when the air conduction loss is less than 35 decibels.

When the air conduction loss is greater than 60 decibels the Rinne is difficult to establish. The difficulty of masking the other ear in examining unilateral

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deafness is considerable, and there has been striking evidence of this recently. For many years a negative Rinne in acoustic neuroma was thought to be due to a conductive element in the deafness; yet Hallpike and Dix have recently shown that if the normal ear is elaborately masked, the deaf ear no longer gives rise to a negative Rinne.

The other frequently used test is the Weber, and I do not think there is anything to be said about this, except that if the Weber is referred to the deaf ear it is suggestive, of course, of middle-ear deafness. I have never found the Weber test of much help in bilateral deafness.

The audiograph is, of course, a great help in middle-ear deafness, but we have always found difficulty in obtaining an accurate graph of bone conduction. Accurate bone conduction is, of course, essential if middle-ear deafness is to be

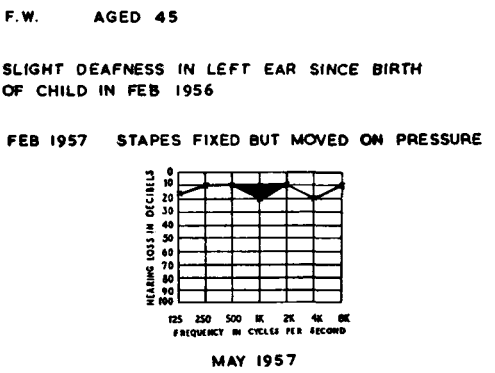


FIG. 3.

Plate J.53. Early otosclerosis. Black area shows amount of gain in hearing after operation.

guessed by the audiograph alone, although an air conduction audiograph which shows better hearing for high notes than for low, is more often to be found in conductive than in perceptive deafness.

Of the other special tests, there remain the differential caloric test, the loudness balance test, the speech audiograph and the mastoid X-ray.

The differential caloric test is helpful in diagnosis of the middle-ear deafness if the result on both sides are the same. The difficulty arises, of course, when the result shows a difference between the two sides, and the other tests suggests a middle-ear deafness.

The loudness balance test has been a great help to us, but only certain degrees of deafness give reliable results, as in the Rinne test. If the difference in hearing between the two ears lies between 15 decibels and 50 decibels at 500 cycles the result is reliable, but for greater or lesser amounts of deafness the test may be less helpful, and we have found it less helpful if the higher frequencies are used.

The Lüscher difference limen test sometimes gives definite evidence of middle-ear deafness, if the hearing loss is symmetrical, but again it is less reliable at frequencies higher than 500 cycles.

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The mastoid X-ray is most helpful when it shows a normal cellular mastoid in a patient who has been shown to have a middle-ear deafness, and in whom the drum is normal. A sclerotic mastoid would support the diagnosis of middle-ear deafness from infection, but it is not conclusive, for I think everyone who has done a fenestration operation has had to work through a sclerotic mastoid process.

The speech audiograph has been helpful to us in distinguishing between cochlear deafness and middle-ear deafness. I would say that to me it is most helpful when it gives clear signs of an internal-ear deafness. When the speech audiograph has a curve suggestive of a middle-ear deafness, it should be read with more reserve.

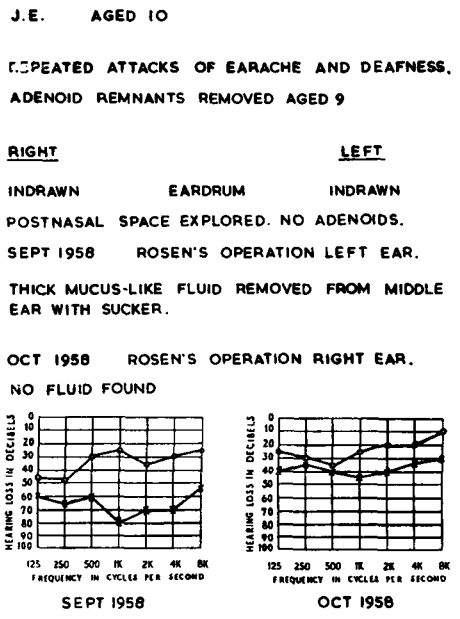


FIG. 4.
Plate J.52. Fluid in the middle ear.

Rosen's operation, then, is the last of the methods of diagnosis which can be used. Whether it should be used for diagnosis alone is a moot point, for most of us, I think, would only use it if we thought that we might improve the hearing thereby. If Rosen's operation is to be used for diagnosis only, one must, of course, be prepared for a negative result.

My colleague Peter Leeson has suggested that one day we may use the approach in diagnosis of internal-ear deafness, and not only of middle-ear deafness, but so far I have not been enterprising enough to do this. It might be used, however, in certain kinds of deafness which have a conductive and a perceptive element, and Paget's disease springs to mind. I think it would be interesting to have a report or an examination of a case of fragilitas ossium, by Rosen's method (for the early description of the operation was by ordinary

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clinical diagnosis and fork tests alone. In the only case I have explored the operation was so difficult that I could say very little about the state of the middle ear.).

If Rosen's operation is to be used in diagnosis alone, it is proper to consider the risks. These are small, but hæmorrhage and infection are not completely absent, and anyone who has discussed this operation with those surgeons in America who have done a large number, will know that the risks must be considered by the otologist, even if they are not to be recounted to the patient.

I must speak from my own limited experience, but I have had one case which developed an acute otitis media after operation and a perforation resulted. I should think that a traumatic permanent perforation is also a possibility, and I have experience of such profuse venous bleeding after raising the

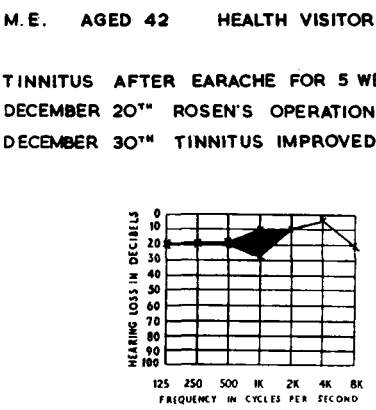


FIG. 5.

Plate J.54. Early otosclerosis. Black area shows amount of gain in hearing after operation.

edge of the drum that further work was impossible. Damage to the chorda tympani with disturbance of taste is a possible complication, even if the nerve is only stretched or injured. My own experience in the first cases I did, and where I deliberately cut the chorda tympani when I wanted, was that disturbance of taste was the rule and that it did not improve with time. Damage to the facial nerve itself seems to be rare if the operation is done under the Zeiss microscope, although temporary paralysis from the local injection may be rather alarming.

A more serious and frequent complication is the formation of adhesions in the middle ear after a Rosen operation. The cause of these is not well understood, although it seems that hæmorrhage, and not infection, is the probable cause. The risk of adhesions will sometimes stop the surgeon from operating at all, and will certainly limit the number of times the same middle ear can be opened. It is these risks which make for hesitation in opening a middle ear purely as an investigation. For example, I have had a number of cases of unilateral deafness, where a Rosen's operation on the deaf ear has displayed a fixed stapes, and the hearing has improved afterwards. I think it quite likely that the hearing ear may also have a fixed stapes, but I have not felt justified in exploring the better ear after an operation on the deaf ear.

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I should say that my own technique differs very little from that described by Rosen. I use a small incision in the top of the meatal opening and I insert a retractor, tethering the lobe of the ear to the neck. This makes one independent of the size of the meatus, for the field is the same whether the meatus is large or small, and the onlookers can easily see through the microscope, an advantage in a postgraduate hospital. The distance of the meatal incision from the drum is a matter for consideration. I do not propose to consider the use of Rosen's approach in detail as a preliminary to a tympanoplasty, but Zöllner uses it in this way, and the meatal incision is kept at a fair distance from the drum so that

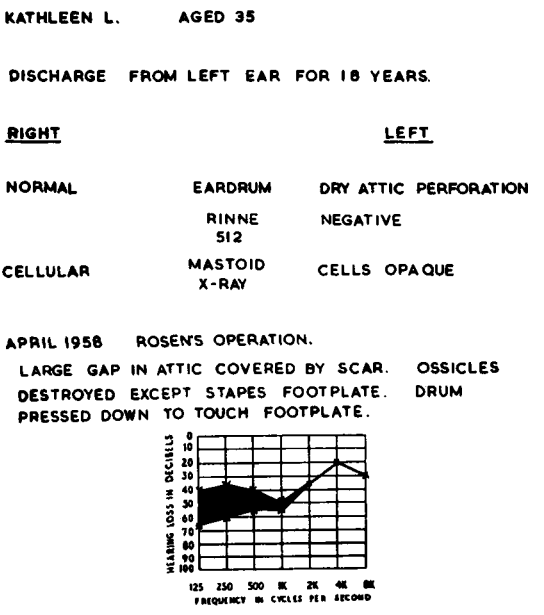


FIG. 6.

Plate J.49. Destruction of ossicles by disease. Drum intact. Black area shows amount of gain in hearing after operation.

the resulting meatal flap, which hinges on the drum, is long and can be used to line the mastoid cavity. Wullstein criticizes this, because, he says, it interferes with the tension of the drum membrane, but a practical objection, to me, is that I have difficulty in tucking away the long meatal flap in order to deal with the middle ear. I think in most cases, anyway, inspection of the surface of the drum alone with the microscope immediately before the mastoid is explored, will often give the information needed.

The use of local anæsthesia in Rosen's operation cannot be criticized, but I sometimes wish the operation had been developed in England, for if it had, we would all have used general anæsthesia. I prefer general anæsthesia for any operation, and I think I am not alone in this. General anæsthesia is, of course, a necessity if one is to explore the middle ear in children.

I propose to give examples of the use of Rosen's operation in diagnosis, but

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before doing so, I would like to discuss various conditions in which it might be a help. The first and most obvious is exploration in a case of otosclerosis. When the fenestration operation was the only possible treatment, most people found that there was little to see in the middle ear beyond a fixed stapes. In an active or in an advanced case there might be hyperæmia, or an obvious bony outgrowth, but on the whole reliance was placed on a fixed stapes as proof of diagnosis and we were never able to repeat Simson Hall's work on the bone histology.

It was a fact that during the time we recommended the fenestration operation for otosclerosis we were seldom wrong in our diagnosis, if a fixed stapes is to be considered proof of otosclerosis. Perhaps the reason for this lay in our anxiety to make no mistake, for we did not operate on patients with slight deafness, nor with severe deafness, nor did we explore a middle ear which was thought to be damaged by infection.

If the middle ear is normal except for a fixed stapes, I would still consider a diagnosis of otosclerosis reasonable, although it would not seem possible at present to comment on the actual distribution of the otosclerotic foci in the labyrinth. I think of the interesting cases of obvious perceptive deafness which one sees from time to time where there is a strong family history of clinical otosclerosis, and I wonder if some form of Rosen's operation might make the pathology of this variety of the disease more clear.

Apart from otosclerosis, the first example I would take is deafness due to fluid in the middle ear. Bateman gave a full account of this condition at the summer meeting of the Section of Otology in 1958, but it is sometimes difficult to distinguish fluid in the middle ear from an early case of otosclerosis. In two cases I have explored, the drum was too thick for the fluid to be seen through it with an aural speculum, and the fluid itself was too sticky for it to be drawn through the sort of incision which has been recommended for treatment of the condition. I described a case, some time ago, when fluid in the middle ear was found in a man of 25, and the deafness was cured by removal of the adenoids. Rosen's operation would also be helpful for the occasional case of persistent hæmotympanum which one encounters.

The next example—I am sure members will supply many others—is deafness associated with deformities of the cleft palate. I have explored one of these cases, and I found the middle-ear cavity reduced in size by a spreading mass of hard tissue growing from the upper part and including the ossicles. I imagine that this condition is allied to Paukensklerose, and I must admit that the diagnosis is made equally well by the use of the microscope alone, once one is familiar with the condition.

PRELIMINARY EXPERIENCE WITH THE VEIN GRAFT OPERATION FOR OTOSCLEROSIS

By I. SIMSON HALL (Edinburgh)

THE re-discovery of the mobilization of the stapes operation has led to many variations of technique designed to reconstruct the ossicular chain and restore its mobility.

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One of the most interesting of these is the operation performed by Dr. John Shea of Memphis, Tennessee.

The President very kindly afforded his colleagues the opportunity of seeing this technique carried out. The operation seemed a logical and reasonable procedure, and this morning the method will be described in detail and some results recorded.

Only a small number of cases has been operated upon. Statistics are therefore of no value and are not given, but some conclusions can be drawn regarding the usefulness of this operation and its place in the treatment of otosclerosis.

Throughout all these operations it is essential to recall the high degree of success which can be achieved with the standard fenestration operation and

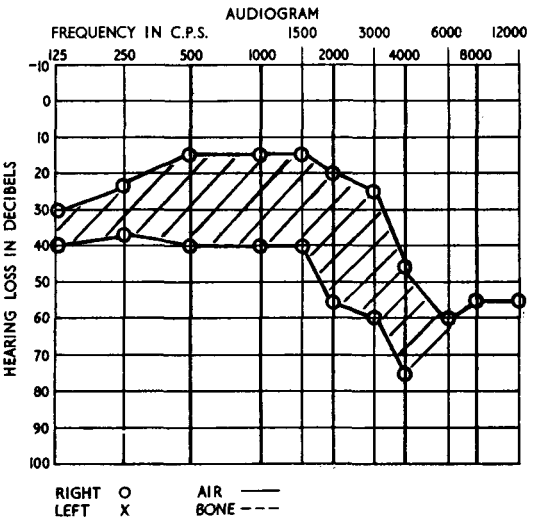


FIG. 1.

Miss D. W. 45. Post-operative.

until we have more knowledge and experience it would seem unwise to carry out any procedure which renders the standard fenestration impossible at a later date.

The various operations should be regarded as stages in the treatment of otosclerosis, the final and most advanced being the fenestration.

It is into this context that the vein graft operation should be fitted, and it is with these considerations in mind that the writer has used this technique.

The steps of the procedure are best illustrated by coloured slides and have been fully described by Dr. Shea elsewhere. Briefly they include the usual preparation, sedation, and anæsthesia which are now familiar in the mobilization technique.

The incudo-stapedial joint is opened and the tendon of the stapedius muscle divided. This permits removal of the head and crura of the stapes without disturbance of the incus. The mucoperiosteum is cleared from the bone surrounding the oval window, over the area which is to receive the graft.

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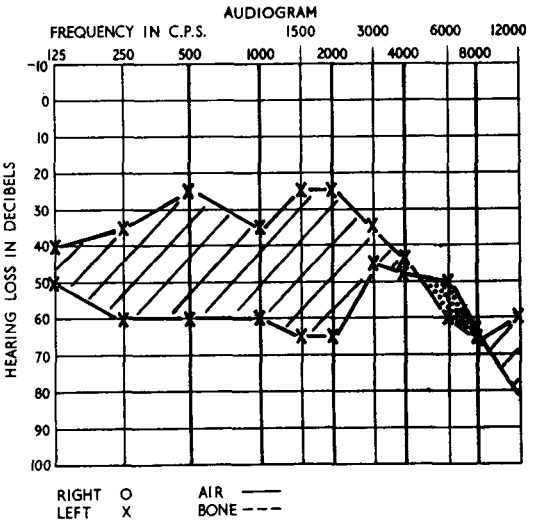


FIG. 2.

Mrs. J. C. 47. Post-operative cross-hatched area indicates improvement.

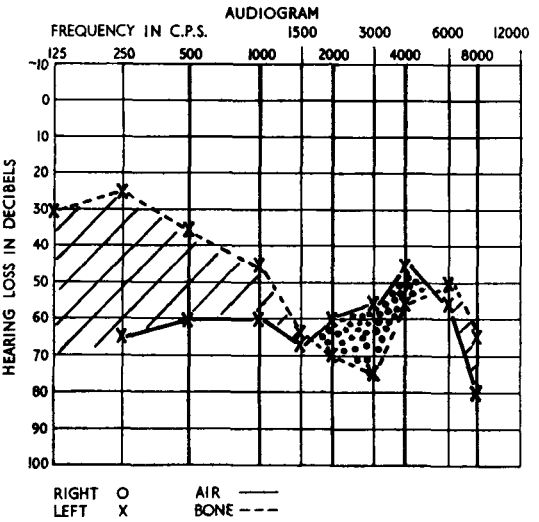


FIG. 3.

Mrs. J. H. 49. Post-operative cross-hatched area indicates improvement.

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The graft is removed from a convenient site in hand or arm, and a portion about one-half of a centimetre is taken. This is carefully denuded of any fibrous tissue or fat and is split lengthwise. It is then spread over the promontory with the intima outwards, and in this position it is convenient for use when the time comes.

Perforation of the footplate is the next step and about 60 to 80 per cent. of the area of footplate is removed leaving the vestibule open. Obviously under such circumstances hæmostasis is of the utmost importance. As soon as possible after opening the labyrinth the graft is slid from its position on the promontory over the oval window to seal the gap. It is pushed gently into the window niche and carefully spread over the surrounding bone.

A length of very fine polythene tubing is then taken and under the microscope it is cross hatched at one end and divided in an oblique direction at the other so that the total length of the prosthesis is about 3·5 to 4 mm. This is then inserted into the oval window with the wedge end inwards and the cross hatched end is gently teased under the lenticular process of the incus which fits snugly into the end of the tube. The drum membrane is replaced and this completes the operation.

Some of the results have been outstanding and three audiograms are shown, Figs. 1, 2 and 3. It will be seen that nerve deafness was an outstanding feature of these cases and they were considered unsuitable for fenestration for various reasons. The patients shown in Figs. 1 and 2 had a positive Rinne test at 1,024 cycles, the third patient, Fig. 3, was considered a very bad risk for a major operation.

The patients operated on, ten in all, were admitted for standard mobilization, but for one reason or another, such as gross thickening of the footplate or fracture of the crura, were unsuccessful. It is on this type of case that at present the operation is finding its greatest usefulness, for it fills a gap in our treatment, and gives renewed hope in those cases in which fenestration is considered an unjustified risk and in which mobilization fails.

The technical difficulties must not be underestimated for this can be a most trying and frustrating procedure which may tax to the full the skill and patience of the most experienced surgeon.

TOWARDS A DRY EAR

By CHARLES SMITH (York)

THE complications of chronic otitis media are so serious that they are never likely to be forgotten when operations are being designed for the irradication of infection in the temporal bone. We have perhaps in the past failed to realize the possibilities of improving the hearing in the chronic ear, but this is not so today. However, with the current emphasis on the plastic repair of the sound conducting apparatus we may overlook the importance to the patient of procuring a dry ear.

I have attempted to follow-up all patients who had classical or modified radical mastoidectomies at St. Thomas' Hospital during the years 1949, 1953,

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1956 and 1957. These years have been selected for several reasons. By following up patients operated upon in 1949 I hoped to obtain a 10-year survey of post-operative results. Unfortunately it was impossible to contact many of the patients. Up until 1955 a split skin graft was not used in many operations and by studying patients operated upon in 1953 it was possible to obtain a series

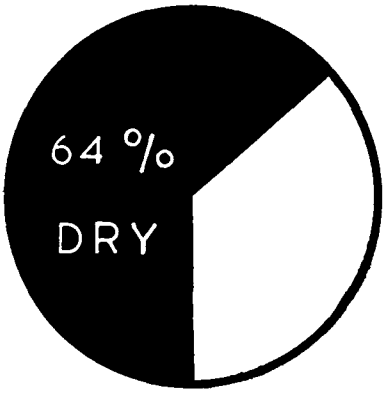


FIG. 1.
196 Radical and modified radical operations.

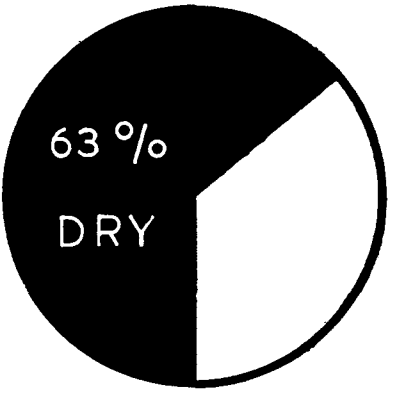


FIG. 2.
59 Radical operations.

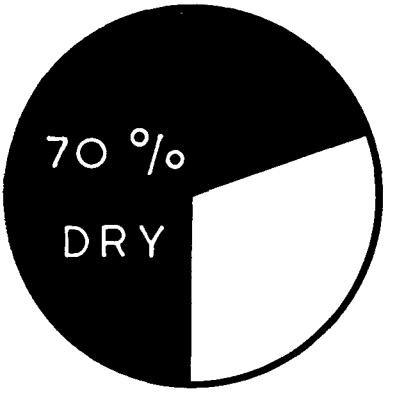


FIG. 3.
98 Modified Radical operations.

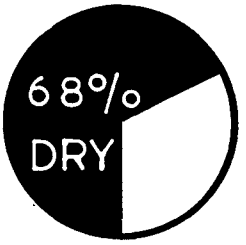


FIG. 4.
38 Ungrafted ears.

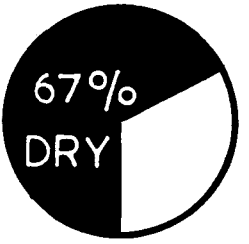


FIG. 5.
61 Grafted ears.

of ungrafted ears. The results of these operations could then be compared with those performed in 1956 and 1957, in a large proportion of which a skin graft was used.

There are a number of questions which have to be answered. These include:

1. How many ears operated upon become completely dry?
2. Is the ear more likely to be dry after a modified or a classical radical mastoidectomy?
3. What is the value of using a split skin graft?
4. What is the place of parenteral and local antibiotic therapy?

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How many ears become dry?

One hundred and ninety-six operations were followed up for more than one year and 76, or 64 per cent., became completely dry (Fig. 1). Thorburn (1954) found that a similar percentage of ears (62 per cent.) became dry in a series of 177 cases reported by him in 1954. However, in 1956 Gordon Mowat and Higgins were able to report 80 per cent. of 46 ears dry in three months.

Is the ear more likely to become dry after a modified or a classical radical mastoidectomy?

Of the 196 operations, in 59 a classical radical mastoidectomy was done, and in 98 a modified operation with the removal of the incus and the head of the malleus and the preservation of a normal remnant of tympanic membrane. In 32 cases a previously performed classical or modified radical mastoidectomy was revised. Of radical operations, 63 per cent. became dry (Fig. 2) compared with 70 per cent. of the modified radicals (Fig. 3). This suggests that there is roughly an equal chance of obtaining a dry ear in both groups. Thorburn's figures tend to confirm this although in his series the number of modified radical mastoidectomies in which the ear became dry was significantly higher (70 per cent.) than with the radical operation (55 per cent.). I consider that this is nearer the truth. Only 50 per cent. of the 32 operations for revision of a previously performed radical became dry.

What is the value of a split skin graft?

Reading (1953) states that faulty handling of the soft tissues is more often the cause of delayed healing of the ear than defective bone work. Cawthorne (1953) recommends the use of a split skin graft and Mr. Mill has, as far as I know, always used one. However, Gordon Mowat and Higgins (1956) in their impressive series in which a "blown plastic insert" was used, found skin grafting was not practical, and Denny considers that grafted ears tend to break down more easily than ungrafted ones.

For some years prior to 1955 Mr. Bateman did not use a skin graft, but since then he has been doing so. It is therefore possible to compare a series of cases using both methods. I have chosen to compare only the results of modified radical operations, as I believe this should be more significant. Of 38 ungrafted ears 25 or 68 per cent. became dry (Fig. 4), and of 61 grafted ears 42 or 67 per cent. became dry (Fig. 5). Although this suggests that there is no greater likelihood of obtaining a dry ear by using a skin graft, the technique has advantages. The first dressing done after six days is painless and unaccompanied by bleeding, and therefore of the risks of fibrous tissue webs forming across blood clot in the cavity. Furthermore, the risk of meatal stenosis is reduced. This risk is further minimized by the use of a modified form of McGuckin flap of meatoplasty. This ensures a fairly large meatus which we believe has many advantages.

I should like to illustrate briefly the technique used for inserting the skin graft and performing the meatoplasty.

Plate 1. The rectangular section cut out of the edge of the pieces of board

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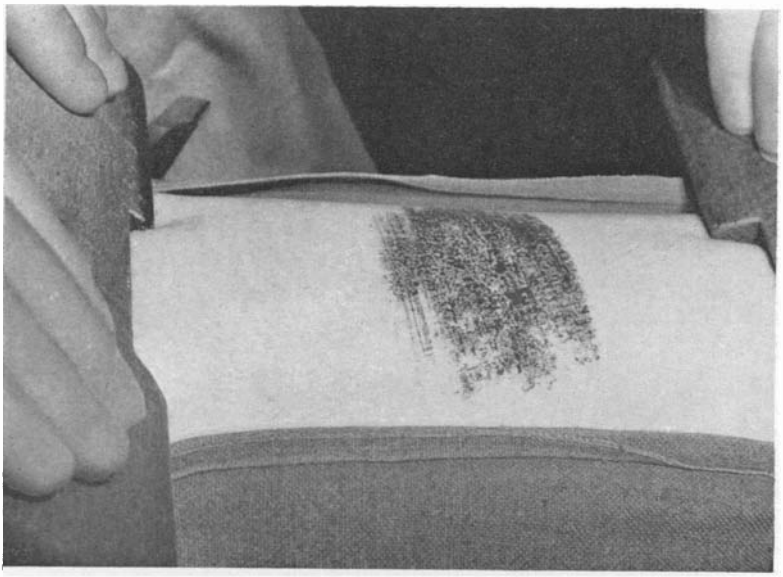


PLATE 1.

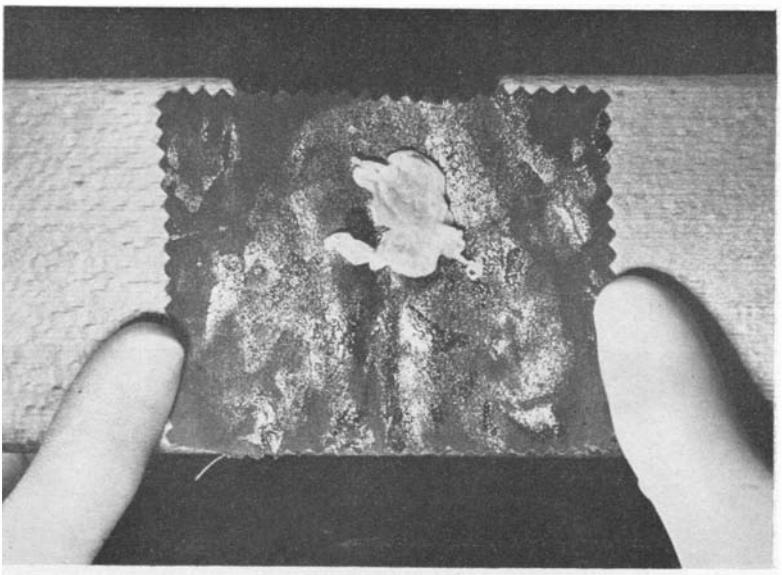


PLATE 2.

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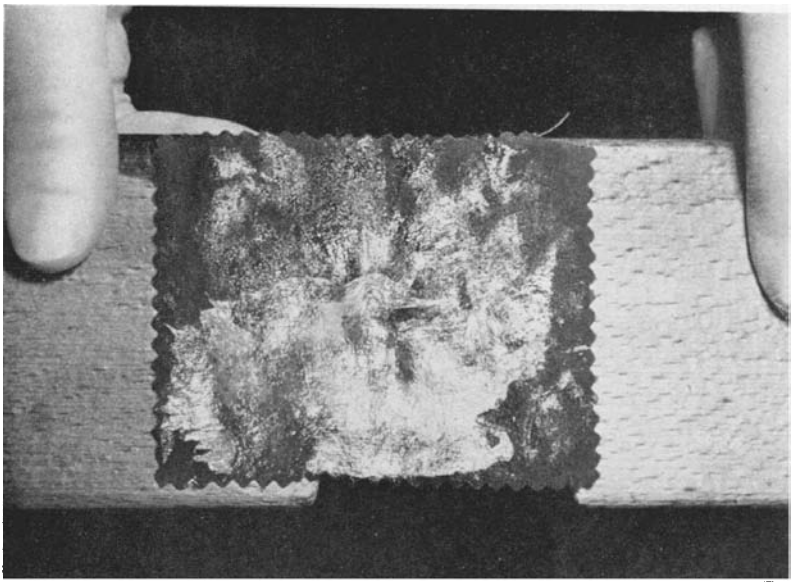


PLATE 3.

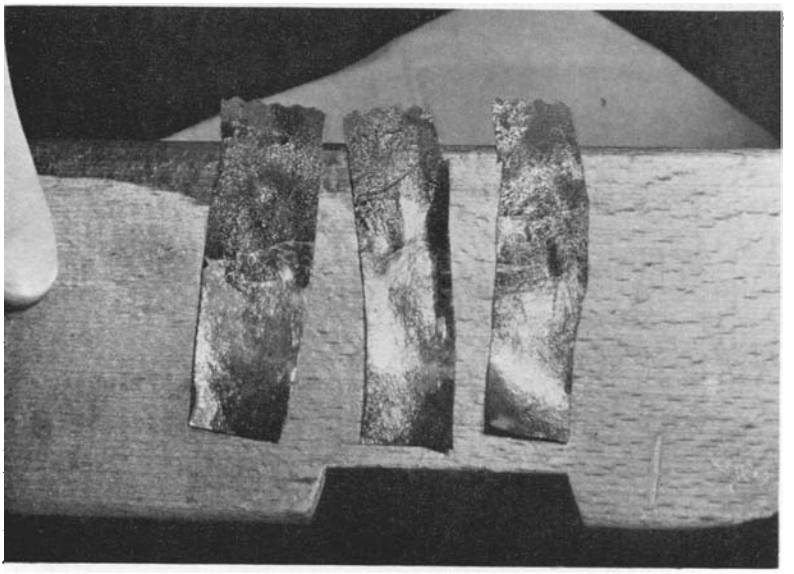


PLATE 4.

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helps to produce a narrow graft about 1½ inches square, which is all that is required. I have to thank Mr. Carruthers for this suggestion.

Plate 2. We do not think that the graft can be cut too thin.

Plate 3. It is mounted on poplin on which there is a thin layer of vaseline.

Plate 4. Three strips are cut, one to cover the anterior attic and the middle ear if necessary, one to cover the antrum and sino-dural angle, and one to run down the length of the facial ridge.

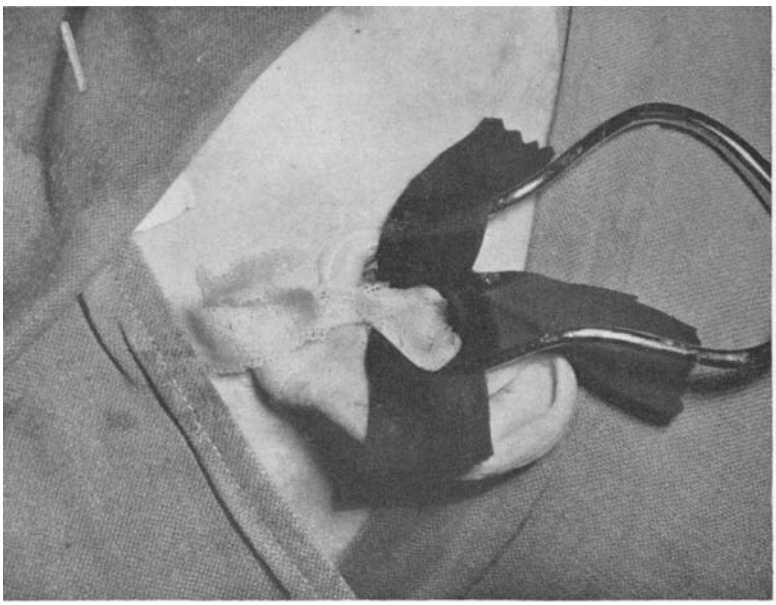


PLATE 5.

Plate 5. Small sponges may be used to provide pressure on any particular area but for most purposes continuous ribbon gauze soaked in liquid paraffin is satisfactory and is the more easily removed.

Plate 6. As the incision is closed the poplin is bent over so that the graft comes in contact with the raw soft tissue and meatal margin.

The technique of the meatoplasty is illustrated by the following diagrams. These are only intended to illustrate the construction of a skin flap from the outer half of the meatus and its use for reconstructing the meatal opening at the end of the operation. Conclusions drawn from the diagrams about the technique used in the deep meatus will be misleading.

Diagram 1. The usual endaural incision is made.

Diagram 2. The tube of meatal skin is skeletonized and partially separated from the bony meatus. A rectangular flap is then cut as shown. This still leaves enough deep meatal skin to fashion a fenestration type flap if necessary.

Diagram 3. At the end of the operation the flap is anchored to the posterior limb of the incision.

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Diagram 4. It is secured by a stitch which passes through its deep surface.

Diagram 5. This also serves to close the lower end of the incision.

Diagram 6. The enlarged meatus can now be compared to a pair of pincers with the blades open.

I have only considered as completely dry those ears which on inspection have remained bone dry for more than three months. Over the years a number of these have broken down for varying periods, usually three or four weeks, and then become dry again. This has occurred in 12 out of 57 ungrafted ears and in 8 out of 68 grafted ears. This suggests that there is little difference in the two types of case.

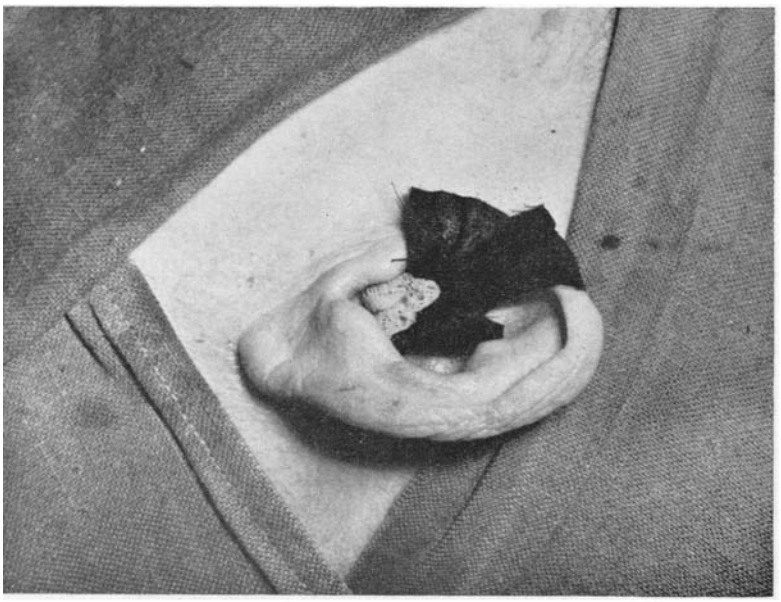


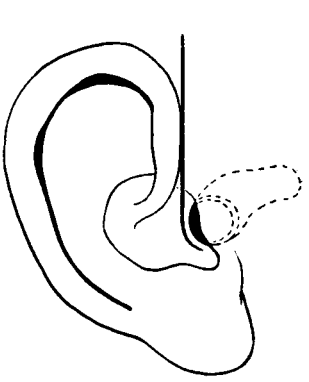
PLATE 6.

What is the value of antibiotic therapy?

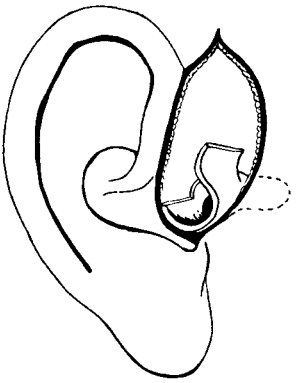
There is no evidence in this series of cases that the daily injection of penicillin for 5 days after the operation promotes healing, prevents the rare cases of perichondritis or encourages the ear to become dry. Perhaps the sensitivity to particular antibiotics of any pus present should be discovered and a course of the appropriate drug given. If marked secondary infection occurs in the cavity soon after the operation, the insertion of a ribbon gauze dressing soaked in neomycin, hydrocortisone and polymixin is very effective.

The incontinent ear with its offensive odour and tendency to irritate or break down into an established otitis externa is often the patient's chief concern. The fact that at least one out of every three operations fails to remove this disability is not satisfactory. It remains to be seen whether tympanoplasty will help to solve the problem or to aggravate it.

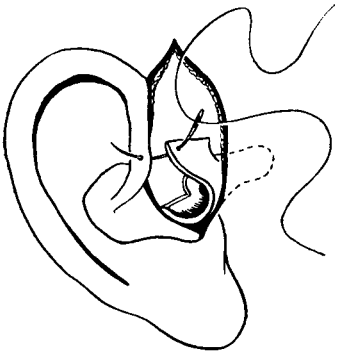
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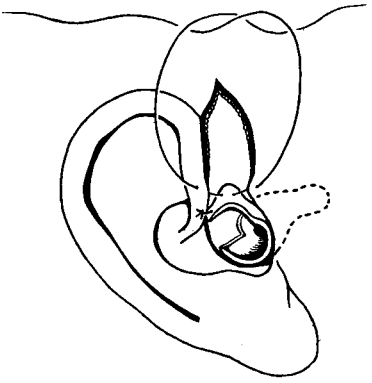
Diag. 1.



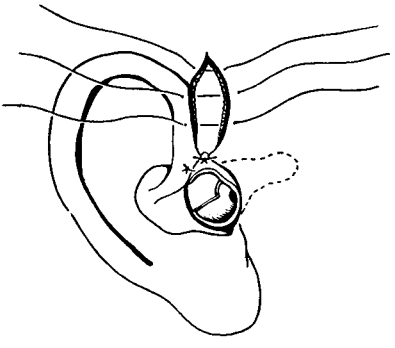
Diag. 2.



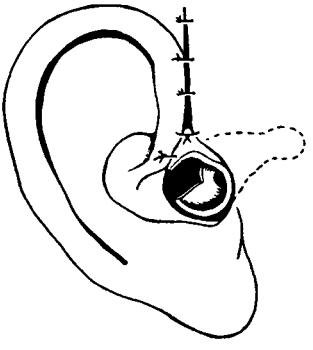
Diag. 3.



Diag. 4.



Diag. 5.



Diag. 6.

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I am very grateful to Mr. D. F. Neilson, Mr. W. A. Mill, Mr. G. H. Bateman and Mr. M. O. Carruthers for allowing me to carry out this investigation into cases admitted under their care.

Miss Dews, the St. Thomas' Hospital Medical Artist, kindly made the diagrams and Mr. Brandon of the Photographic Department photographed them. The photographs illustrating the skin grafting technique were taken by Miss N. Lowater of St. Thomas' Surgical Unit by kind permission of Professor J. B. Kinmonth.

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Discussion

MR. I. A. TUMARKIN referring to Mr. McLay's paper pointed out that the practice of starting the Békésy audiogram at the low frequencies and working up to the high frequencies was liable to result in such fatigue in the high frequencies as to invalidate the test. He suggested that this effect could be avoided by starting the test at the high frequencies and working downwards.

MR. MARTIN stressed the importance of diagnosing deafness in babies at the earliest possible moment, so that treatment could be started without delay; especially as the period between six months and $2\frac{1}{2}$ years is the time of election for appreciating sounds.

Mention was made of testing babies' hearing with percussion sounds, by striking a tin lid, or a child's drum. Alternatively, blowing down a tube, or a toy saxophone, which would give varying notes.

MR. WILLIAM MCKENZIE suggested that some of Mr. Wilmot's cases, at all events, might have suffered from Ménière's disease. Ménière's disease was well known to come on suddenly and to be heralded by deafness, and, furthermore, Ménière's disease might occur in young adults, although it was, of course, mainly a disease of middle and old age.

MR. STUART MAWSON: With regard to Mr. McKenzie's observation that the Rosen approach might be useful in Fragilitas Ossium, a recent experience would tend to show the inadvisability of attempting to mobilize the ossicles in such cases. Approaching a recent middle-ear deafness associated with blue sclerotics in this way, reflection of the flap at once revealed fractures through both crura with the medial fragments attached to a mobile footplate. These fractures and the footplate mobility were believed to have been caused while displacing the tympanic membrane through inadvertent leverage. The case had been intended for footplate mobilization but in view of the encouraging results with stapedectomy and the vein graft technique, this might in future

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here be the operation of choice. Shortly after this incident Dr. Shea gave his demonstration on stapedectomy and vein graft at King's College Hospital. In a paper published in the *Annals of Otology* (**66**, 932) he recommends the operation (1) if it is not possible to free the entire stapes when the circumference of the oval window is reduced by dense, otosclerotic bone, and (2) if the crura have been fractured. Recently, while attempting to mobilize the stapes in a case of otosclerosis, in which the diagnosis had been confirmed previously at fenestration operation on the other ear, both crura fractured. As this seemed to be the right occasion for using the vein graft operation it was undertaken there and then. The technical difficulties were considerable and gave rise to much anxiety, especially during removal of the footplate by morcellement. The initial result, however (audiogram shown), seems to have justified the attempt and it will be interesting to watch the development of this operation and its long-term results.

MR. H. J. GROVES referred to the problem of nomenclature raised in Mr. McKenzie's paper. He suggested the term "permeatal tympanotomy" for any diagnostic exploration of the middle ear in which the approach described by Rosen for stapes mobilization is used.

MR. SIMPSON wished to support Mr. Bateman's contention in regard to the value of endomeatal tympanotomy as a diagnostic procedure.

He had had a case of middle-ear deafness suggestive of serous otitis that had not responded to repeated tympanic puncture. Exploration had revealed a tumour which resembled a mass of small multiple polypi in the middle ear. On section this proved to be a meningioma—a very rare tumour in this situation.

MR. P. N. BEALES: I would like to refer to the paper by Mr. Charles Smith, "Towards a Dry Ear". In my experience the operations of tympanoplasty have not made much difference to the problem of healing of the mastoid cavity.

During the last 18 months I have had experience of a new technique which aims at a complete lining of the mastoid cavity and of soft tissues after operation with a large vascular flap of skin. I shall be describing this technique in detail at the next meeting of the Section and so far the results of using this method have shown a very marked improvement over the older techniques.

MR. W. A. MILL: Mr. Smith's paper is very interesting. I have skin grafted radical and modified mastoid cavities for many years. I have always thought that the best chance of obtaining a completely dry cavity is when cholesteatoma is found at operation. I wonder whether Mr. Smith could go through his cases to find out whether the presence of cholesteatoma makes a completely dry ear more likely.

In reply DR. SIMSON HALL said that the question of durability of the polythene prosthesis had been carefully debated, but enquiry of his orthopædic colleagues had been reassuring. Provided no great weight bearing was demanded there seemed no reason to doubt the permanence of such substances within the human body.

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