SOCIETIES' PROCEEDINGS

ROYAL SOCIETY OF MEDICINE—SECTION OF OTOLOGY.

May 6, 1932.

President—Mr. NORMAN PATTERSON, F.R.C.S.

Labyrinthitis, a Complication of Middle Ear Suppuration: A Clinical and Pathological Study—A. LOGAN TURNER, Edinburgh, and J. S. FRASER, Edinburgh.—This paper is published in the *Journal of Laryngology and Otology*, Vol. xlvii., p. 657, October 1932.

DISCUSSION.

Mr. SYDNEY SCOTT showed some of his own slides, including several which he had shown more than twenty years previously, when some aural surgeons had scarcely met with a single case of labyrinthitis.

He related some experiences in which the symptoms had been mistaken for those of other diseases; on one occasion for those of cerebral hæmorrhage, or cerebellar abscess, so that unnecessary exploration of the brain was undertaken. As many cases terminated in meningitis, the symptoms caused by labyrinthitis had formerly been attributed to the early symptoms of meningitis.

Mr. Scott said that even in recent years the giddiness and sickness had been mistaken for signs of gastric influenza. The distress from vertigo in some patients had been mistaken for hysteria until the rapid onset of signs of meningitis led the observer to correct his diagnosis too late.

On the other hand, post-operative labyrinthitis might be overlooked, especially in children, if the possibility were not kept in mind.

Labyrinthitis, if limited to the vestibule and canals, did not necessarily cause profound deafness, and Weber's test lateralised sometimes to the diseased side in spite of otitis interna.

He believed that the use of translabyrinthine drainage for leptomeningitis was limited to those cases in which the meningitis was a sequel to labyrinthitis, and was not indicated in cases of leptomeningitis unless the labyrinth had been the path of infection. He still believed in practising repeated lumbar puncture as well as translabyrinthine drainage.

Dr. DAN MCKENZIE said that the most striking fact which emerged from the present enquiry was the lowness of the mortality from labyrinthitis, a rate at which he was surprised. It was marvellous that there should have been 97 per cent. of recoveries; even in the acute and purulent cases and in the latent cases, the fatalities were not more than 5 per cent. or 6 per cent.

He did not claim that his own results were any better than those of the Edinburgh workers, but when a number of experts were doing a particular

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operation for a particular disease, the rate of case recovery was practically the same for all. So it could be said that the results achieved by otological surgeons in general for labyrinthitis were good.

The great difficulty about labyrinthitis from the clinical point of view was to know when to interfere, or whether to interfere operatively at all.

Another point was as to the suspicion or the occurrence of saccus empyema in a case of "dead" labyrinth. In the case he was showing to-day the labyrinth operation had been performed, but a particular kind of vertigo continued. It created in the patient a feeling of uncertainty as to what would happen if she suddenly turned a corner; a momentary staggering occurred, after which she became all right again. Another symptom which was present was occipital pain on the homolateral side. He had hesitated as to whether the posterior fossa should be opened in order to reach the saccus, but decided not to do so.

Mr. WATKYN-THOMAS said it was admitted that labyrinthitis could be spontaneously cured, but if one compared the results when the labyrinth was left to itself with those in which the condition was dealt with surgically, there were twenty-three spontaneous cures, in fifty patients who came with intracranial complications. The mortality was 5 per cent. when surgical treatment was obtained, 26 per cent. when it was left to cure itself. The logical conclusion was that labyrinthitis was a definite surgical condition and needed surgical treatment; it should not be left to cure itself.

The second point was the high death-rate in the induced post-operative labyrinthitis. He did not know whether any evidence had been found as to what the method of immunising the labyrinth was, but there must be some means by which the labyrinth could protect the meninges, probably by blocking of the internal auditory meatus and of the aqueduct of the cochlea. He believed that the high mortality of induced labyrinthitis in acute otitis media was due to the failure of this blocking.

On one point he was not clear, on Mr. Fraser's reading, namely, whether he accepted the equal nystagmus in both directions (Ruttin's reaction) as an indication of cure of a dead labyrinth.

Did the authors of the paper think that a radical mastoid operation was always necessary in circumscribed labyrinthitis? He (the speaker) had seen three cases of fistula of the external canal which healed after an extended Schwartze operation.

Mr. THACKER NEVILLE said that he had found bulbocapnine to be of value in acute labyrinthitis. In a boy, aged 14, he was compelled to expose the cerebrum and the cerebellum. In exposing the latter there was very little room, and he opened the posterior canals. He could see the openings as at the Neumann operation. The boy was put back to bed and had nystagmus to the opposite side, and vomiting. He could not take food. He (the speaker) injected bulbocapnine, whereupon the vomiting ceased and the giddiness was greatly reduced. He wondered whether in that case Mr. Fraser would have performed a complete labyrinth operation?

After a month a Kisch muscle-graft was inserted into the wound. The boy was now well, except that pressure on the external auditory meatus resulted in giddiness. When a large wound was left after a labyrinth operation, a Kisch temporal muscle-graft with pedicle was a convenient

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and quick way of closing it. Such a muscle-graft ought not to be applied after a labyrinth operation until the wound was lined with granulations. In the ordinary way a large wound might take from four to six months to heal well, but the Kisch procedure reduced the time to two weeks. In a recent case he (Mr. Thacker Neville) had performed labyrinthectomy in a case of tinnitus; this had cured the tinnitus but left a facial paralysis. A fascia lata graft which surrounded the eye was very successful in keeping the eye closed. A graft was also put to the upper lip, the corner of the mouth and the lower lip; this was a more successful procedure than nerve anastomosis.

Mr. J. F. O'MALLEY said that he had been struck by the greater number of radical mastoid operations than those in acute cases. In the last few years he found that the number of acute mastoids he did was ten to one against the radical. That might be because the ear conditions in the last twenty-five years were more efficiently attended to, and many of the cases did not reach the stage when they needed a radical mastoid operation, as compared with those a number of years ago. With regard to the diagnosis of serous labyrinthitis, he had long regarded this term as one of the weak points in the nomenclature of labyrinthitis. He could visualise the pathological change going on in a circumscribed labyrinthitis; he regarded it as an inflammatory process without any serous or purulent fluid addenda. In the more diffuse labyrinthitis, involving the whole labyrinth, the classification made was "diffuse serous labyrinthitis" and "purulent labyrinthitis"; and, apparently, the diagnosis was not verified completely until the result of the case was finally known. It was assumed, when a case went on to a satisfactory result, leaving a certain modicum of function in the labyrinth, that it was serous, but when the labyrinth was blotted out it was purulent. From the pathological point of view, however, that was not a satisfactory way of looking at it. It might be that what was regarded as serous was an acute inflammatory condition which had not produced anything beyond inflammatory engorgement, and that the more severe one had gone on to suppuration. The same remark applied to meningitis: text-books now described a serous meningitis and a purulent one. Boenninghaus, forty years ago, was responsible for that classification, but he (the speaker) found it difficult to get the evidence on which that nomenclature had been based. Perhaps Mr. Fraser would elaborate the point in his reply.

Mr. ERIC WATSON-WILLIAMS asked what was the proportion of spontaneous recoveries in ordinary labyrinthitis. He understood that the danger of serious complications was very great, and therefore when the diagnosis was confirmed he operated.

With regard to induced labyrinthitis, what should be done if one inadvertently opened the labyrinth during an operation? Personally he favoured leaving things alone; but in view of the high death-rate in induced labyrinthitis, was this view correct?

As to fistula, what proportion of these cases could be diagnosed before operation? In only half of the cases he had seen was the fistula sign evident before operation.

If fistula was present in the external canal, how should one deal with it? Should the vestibule be eviscerated? The teaching was to leave the

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fistula alone, but whereas the patient who had undergone a rapid vestibulotomy lost his vertigo, the patient in whose case the fistula had been left alone often continued to suffer from vertiginous attacks for a long time. The essential step to prevent vertigo after labyrinthotomy was a careful curettage of the ampullae and saccule. If the sensory end-organs were completely destroyed there was no vertigo the next day when the patient was at rest, and at the end of ten days the patient was able to walk with his eyes shut.

Vertigo, or even a little nystagmus, after a radical mastoid operation, did not necessarily imply the existence of labyrinthitis; it might be due to too tight a dressing. His own plan was to make sure that the patient could turn over in bed without becoming giddy; if he could do this he was not suffering from labyrinthitis.

Upon what features should one rely in deciding to proceed to translabyrinthine drainage? Many cases of meningitis following labyrinthitis seemed capable of recovery after vestibulotomy alone; and cistern drainage entailed certain obvious risks. In making this decision one could not depend on the presence or absence of living organisms in the lumbar puncture fluid, as this was not known until the next day, by which time the opportune moment for intervention might have passed.

Mr. A. D. SHARP asked what was the correct procedure in traumatic labyrinthitis. Most members must have had under their care children whose labyrinths had been damaged by over-zealous parents attempting to remove a foreign body from the ear. Two months ago a child was admitted to hospital under his care, with all the symptoms of labyrinthitis—violent vertigo, vomiting, nystagmus, etc. Two days before admission, the mother had attempted to remove a bead from the ear, using a knitting needle. The bead was pushed through the membrane, damaging the inner wall of the middle ear. Under conservative measures the child recovered, except for the damage to the hearing.

Did Dr. Fraser advocate operation in all cases in which there was evidence of a damaged labyrinth?

Dr. LOGAN TURNER, in reply, said that the 216 cases of labyrinthitis diagnosed formed 1·5 per cent. of the cases of middle ear suppuration, but they did not represent the total cases of labyrinthitis. There were two reasons for this. (1) In 1907-8 these cases were only just beginning to be diagnosed. With the necessary apparatus, diagnostic precision had been achieved in regard to the cochlea, but the caloric response and the rotatory responses were not always tested. Hence at that period a definite proportion of cases of labyrinthitis must have escaped attention. (2) In the middle of the 25 years period some of these cases were diagnosed by the microscope but not clinically. In a large number the patients had died from intracranial complications present on admission. At that time Mr. Fraser was very active in his microscopical examinations and the type of labyrinthitis was recognised only after death.

Mr. J. S. FRASER, in reply, said that with regard to Dr. McKenzie's remark concerning saccus empyema, he, the speaker, did not recognise this as a clinical entity. He had made microscopical sections of about forty inner ears in cases of suppurative otitis media and labyrinthitis, and in only two was saccus empyema present.

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In reply to Mr. Watkyn-Thomas, he accepted equal nystagmus after rotation to the right and rotation to the left (Ruttin's compensation phenomenon) as an indication of the spontaneous cure of labyrinthitis. Further, he believed that at least a radical mastoid operation was indicated in cases of circumscribed labyrinthitis. As stated in the paper, he thought that the Hinsberg labyrinth operation was advisable in those cases of labyrinth fistula in which the hearing was bad.

He wondered how long the vomiting had continued in the case described by Mr. Thacker Neville. Possibly Mr. Thacker Neville gave the bulbocapnine when the acute symptoms, *e.g.* vomiting and giddiness, were, in the normal course, passing off.

His colleague and himself had certainly had three cases in which patients with a fistula symptom, who had had only a radical operation, complained, after the operation, that giddiness on turning and stooping still continued—in other words, that little or no good had been done by the operation. In those instances a second operation was indicated, to destroy the labyrinth. If the hearing in the affected ear was not good, the patient relied on his sound ear. By the Hinsberg operation, which was nearly free from danger, one could destroy the function of the vestibular portion on the affected side, and so free the patient from giddiness on turning and stooping.

Mr. O'Malley had remarked on the large number of radical operations which he, the speaker, had performed, and the comparatively small number of Schwartze operations. The explanation was, not that more radical than Schwartze operations were performed in the Department, but that most of the latter were performed by the assistant surgeon, the clinical tutor and, occasionally, by clinical assistants under supervision. The Sister in the department knew that he (Mr. Fraser) was keen on the radical mastoid operation and therefore reserved such cases for him.

He agreed with what had been said as to serous labyrinthitis. In the specimen which he was showing, the middle and apical coils of the cochlea were occupied by curdled lymph (serous labyrinthitis) which he regarded as the early stage of acute purulent labyrinthitis. If the inflammation became worse, pus would be present in all the coils of the cochlea; but if the disease stopped at the serous stage, the patient might recover with some hearing.

In answer to Mr. Watson-Williams' question as to operation for acute suppurative otitis media with labyrinthitis, the speaker did not on the whole recommend operation in those cases. If a patient was admitted with acute middle ear suppuration, nystagmus to the sound side, giddiness, etc., such a patient was kept at rest in bed and closely watched for three or four weeks. If, however, such a patient required a mastoid operation, not only the radical operation—but also the Hinsberg operation—must be performed.

As to what should be done if the labyrinth was opened accidentally at operation, he recommended the Hinsberg operation. If the stapes had been loosened or had come away, the safest course was to go on and drain the labyrinth by double vestibulotomy.

In reply to Mr. Sharp's question he would say, "Don't interfere, watch the case carefully." If the function of both parts of the inner ear was lost, it was safer to operate. If it was only a question of a knitting-needle passing through the tympanic membrane and injuring the inner wall, he

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would not be prepared to operate at once on the labyrinth. (The President—"In the event of unexpected damage to the semicircular canal at the operation?") He did not remember injuring the lateral canal at the radical mastoid operation, but he would consider his answer to that question. The same procedure would apply: Watching the case carefully, employing the noise-box and, if deafness was absolute, performing double vestibulotomy.

Post-Operative Labyrinthitis. Subsequent Meningitis. Recovery after Vestibulotomy without Meningeal Drainage.—DAN MCKENZIE, M.D.

Female, aged 45. Chronic suppuration left middle ear. After five years' simple treatment, radical mastoid operation for headache, some vertigo and increasing discharge. Tympano-mastoid spaces very small and cramped, but no important structures exposed. No labyrinth fistula found. Grafted. Twenty-four hours after operation (23rd January 1929) signs of labyrinthitis: violent vertigo, vomiting, spontaneous nystagmus, and temperature 101° F. Symptoms all subsided within four days. But a fortnight later signs of meningitis appeared: headache, vomiting, mental dullness, cervical rigidity and temperature up to 103° F. Immediate double vestibulotomy after diagnostic lumbar puncture (cerebrospinal fluid showed leukocytosis and bacteria). The internal meatus was not opened nor were the meninges otherwise drained. Rapid recovery from the meningeal symptoms, but subsequent progress was very slow.

After the patient left hospital there was vertigo on sudden movement, together with occasional occipital headache which persisted for two years. The presence of saccus empyema was feared, but after consultation during her acute illness with Dr. C. O. Hawthorne, and later with Dr. C. P. Symonds, it was decided not to explore. A small eroded sequestrum was extruded from the meatus twelve months ago, and thereafter discharge became less. The ear is now dry.

Fistula Symptom in Simple Acute Otitis Media.—DAN MCKENZIE, M.D.

Girl, aged 14, seized with double earache during a cold. Pyrexia for over a week. No ear discharge. Three weeks later the left ear had recovered but the right remained deaf, with an occasional twinge of pain, and there was dull, occipital headache at night. One day the patient was seized with vertigo so violent that she had to go to bed. Giddiness, more or less severe, lasted five days, with occasional vomiting and continuous nausea. When she was in this state she could make the vertigo violent by "putting her finger in her ear."

When first seen by the exhibitor five weeks after the onset of the trouble, the membrane of the right tympanum was congested round the margin, in Shrapnell's area, and down the handle of the malleus. The membrana vibrans was yellowish in colour and showed

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meandering blood vessels. There was no sign of perforation, recent or old, and no bulging. The mastoid region was not tender and there was no œdema. Temperature 99° F. No cerebellar or meningeal signs. The deafness was "obstructive" in character, but the fistula symptom was pronounced. Increase of air-pressure in the right meatus caused an immediate dart of the eyeballs upwards and to the right, together with forced movement of the head to the left.

The mastoid was opened and drained, and paracentesis performed the same day. The bone was highly vascular; the lining of the cells was œdematous, but no pus was seen.

Slight spontaneous nystagmus was noted for a few days after operations, but rapid recovery followed, with healing of the membrane and restoration of hearing to normal.

Chronic Suppurative Otitis Media with Cholesteatoma: Acute Labyrinthitis and Meningitis. Recovery after Radical Mastoid Operation.—T. B. JOBSON, M.D.

12.4.32.—R. L., male, aged 24, admitted to hospital with meningitis. Onset of symptoms four days ago, after eating some sausages, when he had nausea, vomiting, diarrhœa and headache. The aural condition was recognised and he was transferred from the medical to the aural side.

His left ear had discharged since he was 7 years old and had never been treated.

On admission.—Throbbing pain in back of head; earache of three days' duration; vomiting; giddiness — falling to left on standing. Definite head retraction and pain in neck-muscles on trying to bend the head forward, superficial and deep reflexes normal. Marked nystagmus on turning the eyes to the right. No hearing in left ear with Bárány control. Temperature 99°. Pulse 104.

Cerebrospinal Fluid—

The fluid is turbid with white cells and a good many red cells. Total cells, 7150 per c.mm. *Differential count:* Polymorphonuclear leucocytes, 72 per cent.; lymphocytes, 20 per cent.; endothelial cells, 8 per cent.

Direct Films.—Pus is present in large amount (+++) but bacteria are not seen.

Cultures.—No growth on inspissated egg or on hæmoglobin agar.

Operation (same day).—Radical mastoid. The meatus was full of foul pus and cholesteatoma. No external redness or swelling. The bone over the mastoid was acellular. The antrum was small and well forward. The lateral sinus close to the antrum was exposed and found healthy. Dura exposed; also healthy. Middle ear full of cholesteatoma. Fistula seen in external canal. Pus welled up when the antrum was opened, as if under pressure. The patient

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improved rapidly after operation although the temperature rose to 103° on the third day. Giddiness, headache and head retraction lessened daily. Nystagmus remained marked for over a week. The patient finally made an excellent recovery.

Cerebrospinal Fluid (14.3.32)—

A slightly opalescent fluid with some white clotted material.

Total cells	2267 per c.mm.
Differential Count—	
Polymorphonuclear leucocytes .	92 per cent.
Lymphocytes . . .	5 „
Endothelial cells . . .	3 „

Total proteins.—150 mgrms. per 100 c.c. *Dextrose content.*—Very much reduced. *Chlorides.*—740 mgrms. per 100 c.c. *Organisms. Direct films.*—A *very* occasional pair of pneumococci is seen. A few staphylococci. No streptococci. *Cultures.*—There is no growth on inspissated egg or on hæmoglobin agar.

16.3.32.—The specimen is slightly turbid. Alkaline.

Total cells	105 per c.mm.
Differential count—	
Polymorphonuclear leucocytes .	65 per cent.
Lymphocytes . . .	33 „
Endothelial cells . . .	2 „

Total proteins.—100 mgrms. per 100 c.c. *Dextrose content.*—Much reduced. There is practically no reduction of Fehling's solution. *Organisms. Direct films.*—The direct films show only a very occasional pair of pneumococci and a few staphylococci. *Cultures.*—Both inspissated egg and hæmoglobin agar give an occasional colony of pneumococci and a few colonies of *Staphylococcus albus.* A very poor growth on all media.

Blood-count (18.3.32).—R.B.C. 4,470,000; Hb. 90 per cent., C.I. 1·0; W.B.C. 8000. *Differential.*—Polys. 68 per cent.; Eosinos. 2 per cent.; Large monos. 16 per cent.

It will be noted that this patient recovered from a definite attack of labyrinthitis with meningitis after a free radical mastoid operation, without operation on the labyrinth.

Mr. J. F. O'MALLEY said that Dr. Jobson was to be congratulated on the excellence of the result in this exceedingly interesting case, inasmuch as there had been labyrinthitis and meningitis of a purulent nature, and yet the patient had recovered, though merely a mastoid operation had been performed. The view had steadily become general that when meningitis was a sequela of labyrinthitis it was desirable to open the labyrinth. But here was a case in which the labyrinth had not been opened, and yet the patient had survived. It was interesting that in the examinations of the cerebro-spinal fluid the polymorphonuclear leucocytes were diminished on the second occasion, and the lymphocytes increased; this feature was now beginning to be regarded as a good prognostic sign.

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Mr. F. WATKYN-THOMAS asked whether any note had been made of the chlorides present at the first examination of the cerebro-spinal fluid ; it was not stated in the printed notes. He noticed that at the examination on 14th March the chlorides were 740 mgrms. per 100 c.c. ; this was above the danger figure for suppurative meningitis, which was accepted as 680 mgrms. per c.c.

Dr. JOBSON, in reply, said that in the small number of cases in which he had opened the labyrinth he had not experienced success, and he was pleased when this case showed signs of improvement immediately after the mastoid operation, and it was not necessary to open the labyrinth.

No note was made as to the chlorides present at the first examination.

Although the cultures were sterile on 14th April, yet on 16th April the direct film showed pneumococci and staphylococci, and the cultures on egg albumen and agar gave pneumococci and a few colonies of staphylococci. It was curious in this case that certain features in the cerebro-spinal fluid seemed to develop after the operation, and showed a delayed appearance. The organisms were found four days after the mastoid operation, at which time the patient was showing definite improvement. The dextrose content, even on 16th April, was much reduced, so that there was practically no reduction of Fehling's solution. He believed that the amount of sugar in the cerebro-spinal fluid was considered to be a very early sign of meningitis, preceding the finding of micro-organisms in the fluid. But here, four days afterwards, there was practically no dextrose, and the patient was considerably better than before the first examination. He was too ill for the caloric test to be applied, and the labyrinth was "dead," so probably there would have been no response to that test. With the Bárány box in the right ear, a loud shout could not be heard in the left (the affected) ear.

Cholesteatoma which performed a Radical Operation.—N. ASHERSON, F.R.C.S.

Patient, a woman, aged 25, has had a chronic discharge from both ears for many years.

She has not had any operation, and the right ear shows, on examination through the speculum, extensive destruction of the posterior meatal wall, showing the same effect as though a radical operation had been performed.

The ear is perfectly dry and there are no symptoms except deafness.

Keloid in Post-aural Scar treated with Radium. Cure.—HAROLD KISCH, F.R.C.S.

The cortical mastoid operation was performed 19th May 1930. The keloid developed gradually later; it measured $3\frac{3}{4}$ by 4 in. by $\frac{3}{4}$ in.

Radium was inserted in one milligramme needles under gas-anæsthesia. The doses were as follows:—

28.1.31, 2 needles 35 mgrm. hrs.	25.3.31, 4 needles 480 mgrm. hrs.
11.2.31, 3 needles 79 mgrm. hrs.	29.11.31, 2 needles 182 mgrm. hrs.

Mr. HERBERT TILLEY said that post-aural keloid scars had been successfully treated at the Radium Institute for many years by the application

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of a radium varnish. The results were no better than those in which Mr. Kisch had employed radium needles, but the former might be more easily obtained than the latter.

Mr. SYDNEY SCOTT said that occasionally keloids were cured spontaneously.

Mr. W. M. MOLLISON said that he had seen extraordinarily good results from treating keloids with X-rays. The ethmoid scar, when it became thick, could be made practically invisible by applying X-rays.

Mr. W. STUART-LOW agreed that these scars might be improved for a time, but ultimately they became bad again. He had had such scars excised, and the cases had done well.

Mr. J. F. O'MALLEY said that if, to assist the healing of a mastoid operation wound, it was exposed a few times to ultra-violet rays the scar was an unusually good one.

The PRESIDENT said that the application of X-rays to scars must be carried out with care. In a large number of cases of lupus treated with X-rays at a time when dosage was not understood, epithelioma had developed.

A Case of Simultaneous Bilateral Labyrinthitis.—J. S. FRASER, M.B., F.R.C.S.Ed.

William I., aged 70, seen 27.2.29, complaining of pain and difficulty in swallowing. An operation on the left tonsil had been performed by another surgeon in July 1928. There was a history of left-sided otorrhœa in December 1928, and the patient still complained of some pain in the left ear.

Examination showed the region of the left tonsil to be occupied by a hard, ulcerated mass which extended downwards towards the pyriform fossa. Otoscopy showed mild otitis media in the left ear.

12.3.29.—Throat sprayed with cocaine and six radium needles inserted: external application of radium plaque over enlarged glands in the neck. 15.3.29.—Needles removed. 16.3.29.—Patient discharged but re-admitted 24.3.29 complaining of earache, giddiness and profound deafness; both ears discharging; drumheads bulging; slight bilateral mastoid tenderness; no fever; slight nystagmus both to right and to left (? normal). 27.3.29.—Headache: temperature 100° F. 28.3.29.—Temperature 103° F.; no rigor, no giddiness and no vomiting; complete deafness in both ears. Lumbar puncture released cloudy, almost purulent fluid under great tension. (W.R. of cerebrospinal fluid negative: *Streptococcus hæmolyticus* on culture.) Operation considered hopeless. 29.3.29.—Death.

Post-Mortem.—Extensive purulent lepto-meningitis, more marked over the vertex than at the base.

Microscopic Examination of Right Ear.—Middle ear cleft: there is pus in the Eustachian tube. The tympanic membrane is markedly

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thickened, the lining mucosa being infiltrated and engorged. There is a double perforation of the anterior part of the drumhead. The head of the malleus and body of the incus are surrounded by swollen, engorged, infiltrated mucous membrane. The tympanum itself is full of pus. The round window niche is filled with pus, as is also the sinus tympani. The secondary tympanic membrane is perforated. The mucous membrane of the niche of the oval window is also swollen and infiltrated with pus cells. The stapes is slightly loose in the oval window and pus is entering the vestibule around the footplate. There is spongification of the bone in the anterior margin of the oval window. The vessels of the fossa subarcuata are engorged and there are small cells surrounding the vessels, which are probably pus cells. The lining membrane of the mastoid and perilabyrinthine air cells is swollen, engorged and infiltrated (Figs. 1 and 4).

Cochlea.—There is a large collection of pus in the scala tympani just internal to the perforated secondary tympanic membrane. The cochlear end of the perilymphatic aqueduct is full of pus. There is more pus in the scala tympani than in the scala vestibuli of the basal coil. On the whole there is more pus in the cochlear than in the vestibular part of the labyrinth. The modiolus and spiral ganglion are infiltrated with pus; indeed pus from the internal meatus is infiltrating into the scala tympani of the basal coil in the region of the spiral vein of the cochlea. In the scala media one can still see remains of Corti's organ, but the membrana tectoria is separated from Hushke's tooth. The middle and apical coils of the cochlea contain only curdled lymph (Figs. 3 and 4).

Vestibule.—Pus is infiltrating into the vestibule through the annular ligament, both anteriorly and posteriorly. The utricle is ruptured. The cavity of the saccule is full of pus. There is well-marked purulent infiltration in the perilymph space of the vestibule and there is also some pus in the ductus endolymphaticus.

Canals.—The semicircular canals are less affected than other parts of the labyrinth. There is a little curdled lymph in the endolymphatic space of the ampullary end of the superior canal. The epithelial cells of the cristae of the superior and lateral canals are desquamating and there is a small abscess in the branch of the vestibular nerve to these canals. The convexities of the superior, lateral and posterior canals are practically normal (Fig. 2).

Internal Meatus.—The subarachnoid space of the internal meatus is crammed with pus cells. The nerves in the internal meatus are surrounded by pus (Figs. 2 and 3).

Microscopical Examination of Left Ear.—Middle ear cleft. There is great swelling and engorgement of the drumhead, affecting not only the mucosal but also the epidermic layer. The latter is desquamating. There is a small perforation of the lower part of the tympanic membrane,

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the edges of which are epithelialised. It is noteworthy that the cells from the tympanic mucosa, *i.e.*, those of hypoblastic origin, extend to the outer edge of the perforation, *i.e.*, there is no invasion of epiblastic cells into the tympanum. The Eustachian tube, the tympanum and the window niches show much the same condition as on the right side (Figs. 7 and 8).

Cochlea.—There is less pus in the cochlea on this side. The scala tympani of the upper part of the basal coil shows marked purulent infiltration, which appears to have passed along the cochlear nerve from the internal meatus. The scala tympani just internal to the round window membrane is full of pus, which has burst upwards through the basilar membrane and the scala media into the scala vestibuli.

The vestibule and semicircular canals show almost the same conditions as on the right side (Fig. 5).

Internal Meatus.—The internal meatus is full of pus; indeed the purulent infiltration within the subarachnoid sheath almost amounts to abscess formation (Fig. 6).

Commentary.—The case was a hopeless one of malignant disease of the tonsil and lateral wall of the pharynx. When the patient was re-admitted after radium treatment it was found that he had bilateral acute suppurative otitis media and bilateral purulent labyrinthitis. It is of interest that, though there was complete bilateral deafness, vestibular symptoms were almost absent, *i.e.*, there was only a slight nystagmus to right and to left—equal and normal. This phenomenon —or rather absence of phenomenon—in a case of simultaneous acute bilateral labyrinthitis appears to correspond to the condition observed when both ears of a normal individual are syringed at the same time with equal quantities of cold lotion, *i.e.*, there is no nystagmus.

(*In regard to the microscopical examination of this case and the reproduction of illustrations, the writer begs to acknowledge a grant from the Carnegie Trust Research Fund.*)

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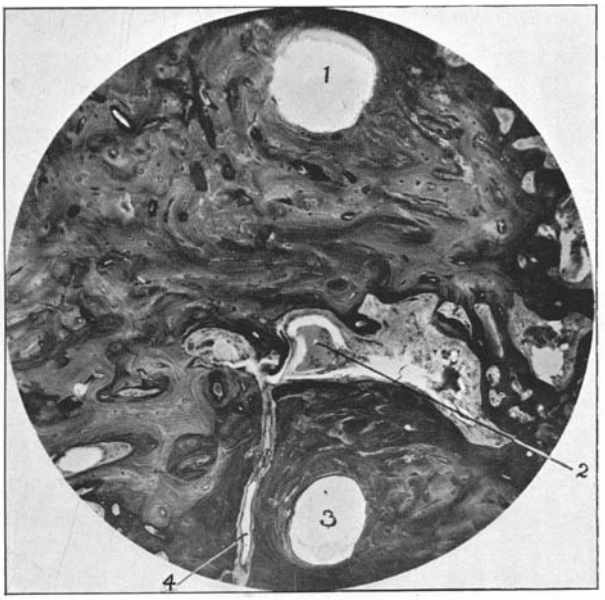


Fig. 1.—W. I., male, aged 70. Horizontal section through right ear, No. 30. (1) Ampullary end of superior canal. (2) Pus in fossa subarcuata. (3) Smooth end of superior canal. (4) Vessel in fossa subarcuata which in this case turns directly inwards and backwards—a possible route of meningeal infection.

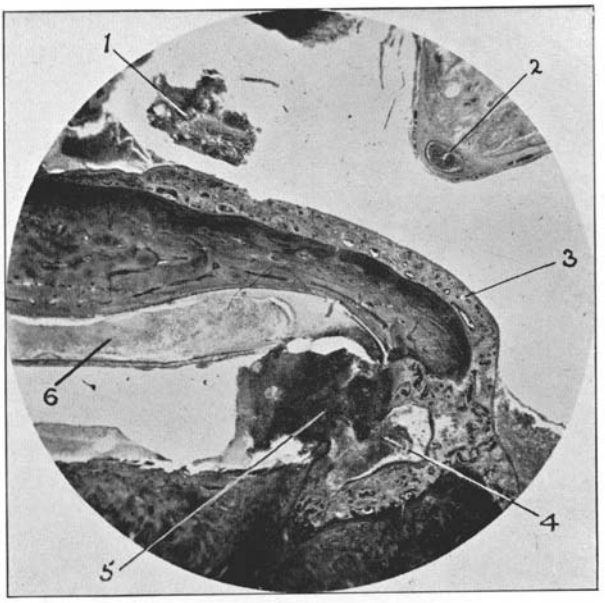


Fig. 4.—Horizontal section through right ear, No. 216. (1) Pus in tympanic cavity. (2) Handle of malleus attached to swollen, infiltrated drumhead. (3) Engorged mucosa of promontory. (4) Pus in niche of round window. (5) Purulent exudate breaking through round window membrane. (6) Pus in scala vestibuli and cochlear canal. Reissner's membrane has disappeared.

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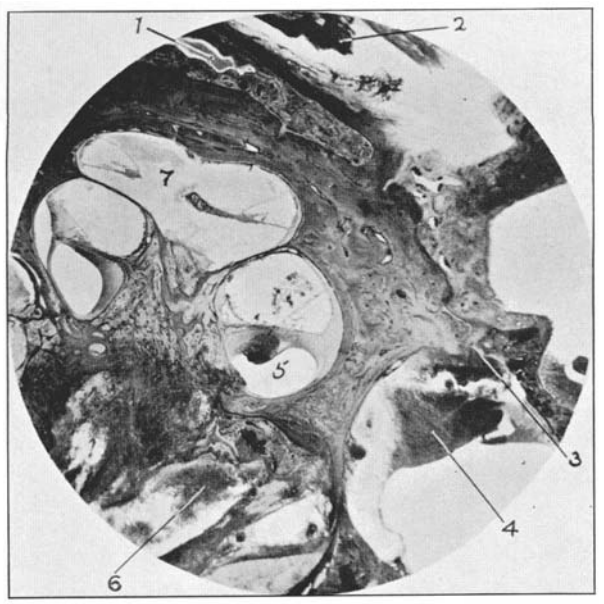


Fig. 3.—Horizontal section through right ear, No. 152. (1) Pus in tympanic end of Eustachian tube. (2) Tensor tympani. (3) Pus entering vestibule through anterior margin of oval window. (4) Pus in vestibule. (5) Scala tympani of basal coil with purulent exudate. (6) Meningitis in internal meatus.

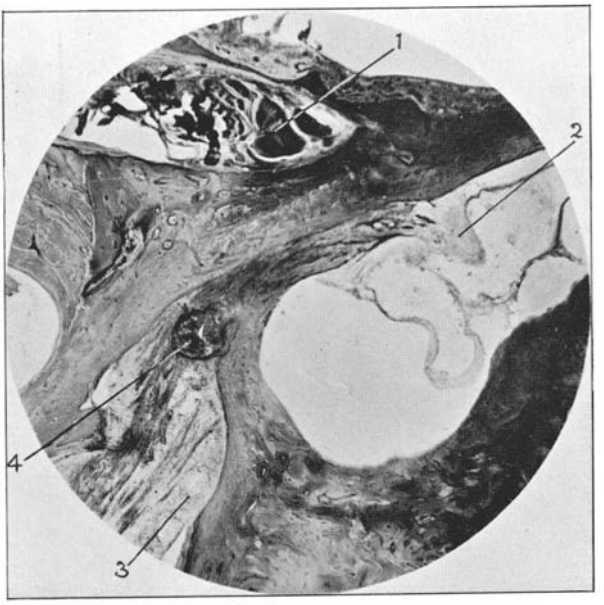


Fig. 2.—Horizontal section through right ear, No. 105. (1) Facial nerve. (2) Desquamating crista of lateral canal. (3) Meningitic infiltration within arachnoid sheath in internal meatus. (4) Abscess in branch of vestibular nerve to lateral canal.

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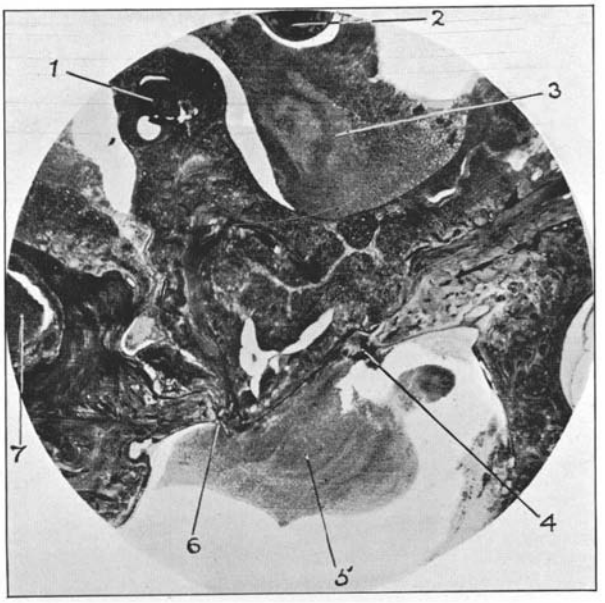


Fig. 5.—Horizontal section through left ear, No. 145. (1) Long process of incus. (2) Handle of malleus. (3) Pus in tympanic cavity. (4) Pus entering vestibule through anterior margin of oval window. (5) Pus in vestibule. (6) Pus entering vestibule through posterior margin of oval window. (7) Facial nerve.

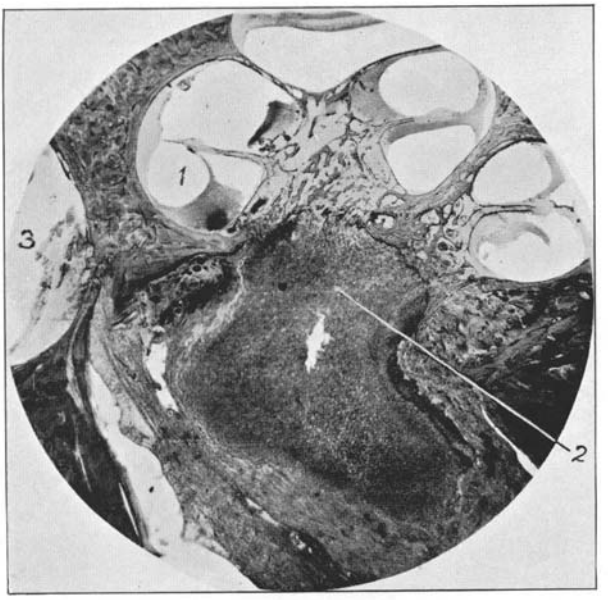


Fig. 6.—Horizontal section through left ear, No. 145. (1) Purulent exudate in scala tympani of basal coil: note connection between this and (2) the abscess formation in the fundus of the internal acoustic meatus. (3) Vestibule.

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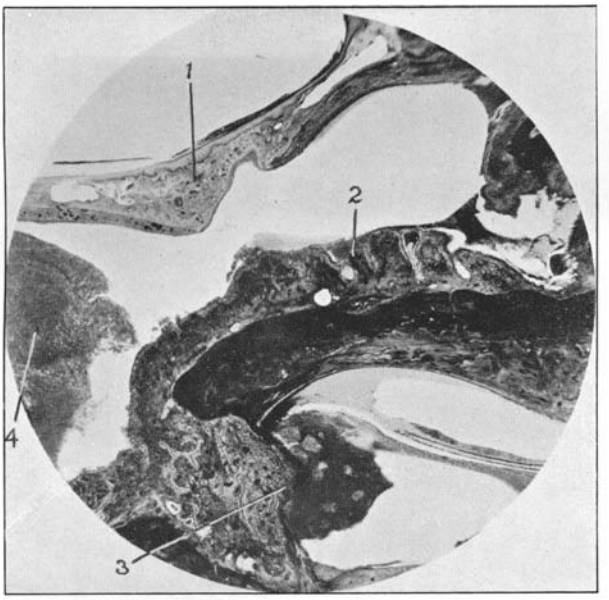


Fig. 7.—Horizontal section through left ear, No. 220. (1) Thickened, engorged, infiltrated drumhead. (2) Swollen, almost polypoid mucosa of promontory. (3) Pus breaking through secondary tympanic membrane into scala tympani. (4) Pus in tympanic cavity.

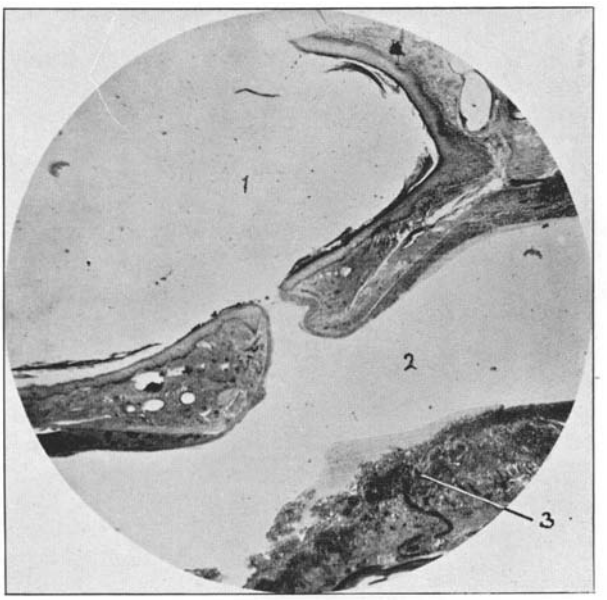


Fig. 8.—Horizontal section through left ear, No. 232, shows the perforation of the left drumhead. (1) External meatus. (2) Tympanic cavity. (3) Engorged and infiltrated mucosa of promontory. Note that the squamous epithelium of the outer surface of the drumhead is not invading the tympanum. The margins of the perforation, indeed, are covered by mucosa which has grown from the medial or deep surfaces of the drumhead.

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