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REPORTS FOR THE YEAR 1918 FROM THE EAR
AND THROAT DEPARTMENT OF THE ROYAL
INFIRMARY, EDINBURGH.

UNDER CARE OF A. LOGAN TURNER, M.D., F.R.C.S.E., F.R.S.E.
PART I.

THE COMPLICATIONS OF CHRONIC MIDDLE EAR SUPPURATION.
INDICATIONS FOR, TECHNIC AND RESULTS OF THE RADICAL
AND MODIFIED RADICAL MASTOID OPERATIONS; DE-
TAILS REGARDING THE LABYRINTHINE AND IN-
TRACRANIAL COMPLICATIONS OF CHRONIC
MIDDLE EAR SUPPURATION.

A Paper Based on an Analysis of 306 Cases of Chronic Middle Ear Suppuration, as follows: Radical Mastoid Operations [Ten Bilateral], 248; Modified Radical Mastoid Operations, 17; Labyrinthitis, 26; Intracranial Complications, 25.*

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This paper is a continuation of one written by Capt. Milne Dickie and the operator (J. S. F.),² or rather of the second portion of that paper (B), which deals with chronic middle ear suppuration and its complications. In the former publications seventy-eight chronic cases were reported, including nine fatal cases (11.5 per cent mortality). In the present paper 306 cases are dealt with and the fatal cases number sixteen (5.3 per cent mortality).

The cases now recorded include all those of chronic middle ear suppuration and its mastoid, labyrinthine and intracranial complications operated on at the Royal Infirmary, Edinburgh.

*Presented at a meeting of the Section, held February 21, 1919.

at Leith Hospital, and in private practice between 1911 and 1918—i. e., the chronic cases operated upon since the publication of the previous paper. The only cases not included are (1) five cases at the Royal Infirmary, of which the records have unfortunately been lost: none of these cases ended fatally. A case of temporosphenoidal abscess operated on six months before the war by an otologist who joined up at once. On admission the patient was suffering from septic edema of the brain and meningitis. The abscess was reopened (J. S. F.), but the patient died soon after admission. A second fatal case not included was one in which the patient suffered from chronic suppurative otitis media (right) with cerebellar symptoms. Autopsy showed that death was due to a cerebellar tumor on this side. (2) Fifteen cases operated upon at the Edinburgh War Hospital, Bangour. These included one recovery from purulent leptomeningitis and one death from metastatic abscess following septic thrombosis of the sigmoid sinus. Total chronic cases not included, 22, with three deaths.

RADICAL MASTOID OPERATIONS: 238 CASES (10 BILATERAL);
248 OPERATIONS.

Sex.—If the 238 patients, 118 were males and 120 were females.

Age (in decades).—1 to 9 years, 25; 10 to 19 years, 92; 20 to 29 years, 74; 30 to 39 years, 27; 40 to 49 years, 13; 50 to 59 years, 4; age not given, 3; average age, 20 years.

Residence.—Edinburgh and district, 104; country, 134.

Side of Operation.—Bilateral, 10 (i. e., 20 operations); right, 106; left, 122; total, 248 operations.

Cause.—The statements of the patients and their relations as to the causation of chronic middle ear suppuration are as a rule very unsatisfactory. Most of the patients have forgotten the date and origin of the discharge. The most common causes appear to be scarlet fever and measles. Not infrequently the aural discharge is attributed to a blow on the ear, but in many of these cases examination of the other ear reveals a dry perforation or a scar in the drumhead, and it is hard to believe that the school teacher, who is usually blamed, has struck the child first on one ear and then on the other and that chronic

middle ear suppuration has resulted on both sides. In only 66 cases did the patients or their relations remember the cause of the ear trouble, as follows: Measles, 26; scarlet fever, 25; pneumonia, 3; whooping cough, 1; mumps, 1; smallpox, 1; teething, 2; cold, 1; injury, 6.

As showing the distribution of chronic purulent otitis media and its complications between the wealthier and poorer sections of the population, it may be of interest to state that out of the 306 chronic cases operated on in the last seven years, and dealt with in this paper, only nine were performed in private practice.

On inquiry, the acting superintendent of the Royal Infirmary informed us that probably about 80 per cent of the population of Edinburgh and the Southeast of Scotland (from which the Infirmary mainly draws its clientele) would come to charitable institutions such as the Royal Infirmary for operations like the radical mastoid operation. According to this calculation 20 per cent of the cases instead of 3 per cent should have been operated on as private patients. It would thus appear that chronic suppurative otitis media is not only absolutely but also relatively more common among the poorer sections of the community than among the more wealthy.

If cases of severe acute suppurative otitis media were properly treated when they arise—e. g., in fever hospitals—there would be very little chronic middle ear suppuration, and consequently the radical mastoid operation would seldom be called for. Unfortunately, public health authorities have so far turned a deaf ear to the remonstrances of otologists in the matter. At the Seventeenth International Congress of Medicine in 1913, the Sections of Laryngology and Otology unanimously carried the following resolution: "That it would be greatly to the advantage of the community if experts in otology and laryngology were attached to the special hospitals for the treatment of epidemic diseases." The resolution was subsequently handed to Dr. Herringham, the General Secretary, by Mr. Arthur Cheate and Mr. Sydney Scott, and by him transmitted to the Permanent Committee of the International Congress.

Duration.—According to the statements of the patients, this varied from five months to twenty or thirty years. Here again

patients' statements were unreliable—e. g., several said that one ear had only been discharging for two or three weeks and denied that the other ear had ever discharged at all, and yet examination showed the results of old suppurative otitis media on the latter side.

Nose.—In 47 cases the condition of the nose was not noted. Of the remaining 191 cases, 63 were normal, 2 showed a dry perforation of the septum, 59 deviation of the septum, 29 acute or chronic nasal catarrh, 28 hypertrophic rhinitis and 6 atrophic rhinitis. One patient had nasal polypi and three suffered from maxillary antrum suppuration. Several of the patients who had deviation of the septum also had nasal catarrh or hypertrophic rhinitis. We had not systematically examined the maxillary antrum and other nasal sinuses in cases of chronic middle ear suppuration at the time of the radical mastoid operation, but we are surprised to note that Bodkin² finds that the antrum is infected in 93 per cent of cases and that one or both antra are full of pus in 16 per cent.

Pharynx.—In 55 cases the condition of the pharynx was not noted. In the remaining 183 the conditions were as follows: Normal, 87; slight adenoids, 21; enlarged tonsils, 25; enlarged tonsils and adenoids, 47 (24 of these had tonsils and adenoids operated upon before the radical mastoid operation). Three patients showed pharyngitis sicca.

Condition of Meatus and Membrane on Operated Side.—Of the 248 operated ears the condition of the membrane could not be seen in 129 instances on account of the presence of a polypus. In 10 cases the meatus was so full of cholesteatoma and so narrow in nine others that the membrane could not be inspected. One case showed hyperostosis of the meatus with a perforation in the lower part of the drumhead. Of the remaining 99 operated ears, 4 showed anterior perforations, 21 showed central perforations, 10 almost entire absence of the drumheads, 37 posterior perforations and 22 attic perforations. Five cases showed more than one perforation. Eighteen cases showed mastoid swelling or abscess and 3 a sinus over the mastoid, while in 6 cases there was a mastoid fistula. Eight patients had previously had Schwartze operations performed on the same side. Six patients had had radical operations performed once; one patient had had the radical oper-

ation performed six times and two others eight times on the same side before coming to the Royal Infirmary.

Condition of Meatus and Membrane on Nonoperated Side.—Of the 228 unoperated ears the condition of 13 was not noted. Normal, 52; evidence of eustachian obstruction, 34; acute suppurative otitis media, 2; chronic suppurative otitis media, 36; chronic suppurative otitis media with polypus or granulations, 12; attic perforations with granulations, 2. In 70 cases the membrane showed results of chronic suppurative otitis media; 6 had previously had mastoid operations performed on this side and 1 other case had also a labyrinth operation performed on this side.

Hearing Before Operation.—In testing the hearing before operation we have found that—speaking roughly—the conversation voice is heard at about three times the distance at which the whisper is perceived. Further, when the good ear is closed with the finger, a patient hears the conversation voice at double the distance he hears it at when the noise apparatus is placed in the good ear. In 16 of the patients the hearing was not tested—usually on account of the age of the patients; three other patients were deafmutes. Of the remaining 219 cases the deafness was severe in 95 (conversation voice at 1 foot or less); moderate in 83 (conversation voice at 1 to 4 feet); 33 had fair hearing (above 4 feet); 8 had good hearing (whisper at 6 feet). (Note: This classification differs from that given in the *Trans. Otol. Sect. Roy. Soc. Med.*, xii, No. 6, p. 33.)

Vestibular Apparatus.—This was tested in 206 cases. In the others it was omitted usually on account of the age of the patient. In cases with a large polypus occluding the meatus only the rotation test was as a rule carried out. Twelve cases showed only slight spontaneous nystagmus and one of these swayed slightly on Romberg's test. One patient showed a spontaneous pointing error. Four patients showed a fistula symptom, though in none of the four was a fistula found at operation. Normal rotation or caloric nystagmus was present in 140 cases. In 58 cases the reaction to the cold caloric test was delayed (in 10 of these cholesteatoma was present and in 28 the external meatus was partially blocked by a polypus). In four cases, one of them a deafmute, there was no reaction

to either test (none of these are included in the section on labyrinthitis).

Indications for Operation.—In several of the cases operated upon, one of the former clinical assistants, Dr. Andrew Campbell, had carried out intratympanic syringing according to the method employed by Siebenmann of Basle and Nager of Zurich. It was found that as long as this treatment was continued the discharge was slight or absent, but soon recurred when syringing was stopped. In several of these cases the subsequent radical operation showed that the attic, aditus and antrum were lined by cholesteatoma. In many cases more than one indication for operation was present. (a) Chronic suppurative otitis media and failure of conservative treatment, 33 cases. In this group 4 patients complained of giddiness and 1 of sickness. (b) Chronic suppurative otitis media with polypi or granulations, 93 cases; 11 of these complained of giddiness, 3 of sickness, and 1 patient showed facial paralysis. (c) Chronic suppurative otitis media with pain, mastoid tenderness and polypi, 57 cases; 9 of these complained of giddiness, 2 of sickness; 1 showed facial paralysis and 1 other showed stricture of the canal. (d) Chronic suppurative otitis media, acute exacerbation and subperiosteal abscess, 10 cases: In this group 1 patient complained of giddiness. (e) Chronic suppurative otitis media, posterior perforation, with or without cholesteatoma, 10 cases: 1 of these complained of giddiness and 1 showed facial paralysis. (f) Chronic suppurative otitis media, attic perforation, with or without cholesteatoma, 24 cases: in this group 6 patients complained of giddiness. (g) Chronic suppurative otitis media with a sinus over the mastoid, 4 cases. (h) Failure of previous mastoid operation, 17 cases. In group (h) 2 patients complained of giddiness and 1 other of sickness.

OPERATION.

Technic.—Since the publication of his paper on the technic of the radical operation in the *Journal of Laryngology* three years ago the operator has entirely given up the method of skin grafting there described and has adopted Mr. Marriage's method. In order to focus discussion on the question of

technic, we invite the opinion of the members on the following questions:

(1) We wish to ask whether, granted that the labyrinth is healthy, is it worth while to remove aural polypi on one or several occasions before proceeding to the radical mastoid operation?

(2) The value of preliminary radiograms of the mastoid processes: During the war it has not been possible to have radiograms taken of our mastoid cases owing to the absence on military service of the late Major Porter and Capt. Gardiner, who were in charge of this branch of Dr. Logan Turner's department.

(3) The line of incision—retroauricular groove or hair margin?

(4) Is it advisable to excise a crescentic piece of skin in order to brace the auricle up and back?

(5) Hemostasis: Is it advisable to adopt any method of local anesthesia—e. g., Neumann's, in addition to general anesthesia? Some American writers advocate the use of adrenalin during the course of the operation.

(6) Method of removal of bone by gouges, curettes or burrs, or by a combination of these three: Some American writers have much to say about necrotic bone found at the radical mastoid operation. In our experience real necrosis is very rare. In the walls of the cavity inflamed and softened bone is often met with, but actual necrosis and sequestrum formation almost never. Bone is very "recoverable" tissue.

(7) Methods of meatal plastic: At what period of the operation should the plastic be performed?

(8) Curettage of tympanic cavity: Use of forceps to remove granulations. Difficulty in dealing with granulations in the region of the oval window and sinus tympani. The operator has found Milligan's labyrinth spoon of service in turning small polypi out of the latter region.

(9) Removal of floor of bony meatus: Richards³ and Bowers⁴ recommend that this removal be so complete that the hypotympanic cavity is entirely exposed to view through the enlarged external meatus.

(10) Removal of convexity on anterior wall of bony meatus: Bowers apparently exposes the capsule of the tem-

poromaxillary joint in some cases in removing this convexity, in order to expose the eustachian tube for after-treatment.

(11) Method of dealing with the eustachian tube: Richards recommends removal of the processus cochleariformis and the tensor tympani so as to convert the muscular and tubal canals into one. Different types of curettes for the eustachian tube? Is it possible to remove all mucous membrane from this region, which, in many cases, includes numerous air cells? Bowers insists strongly on this point, though he admits that the internal carotid artery may be exposed. The jugular bulb also might be opened (J. S. F.). Yankauer claims that 83 per cent of tubes can be closed by curettage with his instruments through the meatus without radical operation, and that in 50 per cent of cases chronic suppuration is cured by this means. Longee, however, finds that only 8 per cent are cured. Unless we succeed in closing the tube at the radical operation we have got a mucocutaneous fistula, and any attack of nasopharyngeal catarrh is liable to be followed by otorrhea.

(12) Skin grafting: Before application of the graft the operation cavity is syringed out with warm sterile salt solution. Method of application—(a) on gauze or worsted packing, or (b) by filling the cavity with lotion and pipetting off the fluid from below the graft. Is it advisable to cut a small hole in the graft so as to leave the window regions exposed? We believe that, in the presence of a normal labyrinth, the hearing power after operation depends on the integrity of the window niches and the mobility of the structures closing the windows. It would appear possible that the skin graft might impair this mobility and also to some extent interfere with free access of air vibrations. Contraindications to skin grafting.

FINDINGS AT OPERATION (248 OPERATED EARS).

Superficial Tissues.—Normal, 207; edema, 2; glandular abscess, 2; subperiosteal abscess, 13; fistula, 10; scar, 14.

Mastoid Cortex.—Normal, 208; deep hollow over site of antrum, 6; cortex eroded, 5; eroded with granulations, 6; fistula, 10; old operation cavity, 13.

Mastoid Process.—Sclerotic, 174; sclerodiploetic, 31; diploetic, 12; cellular, 8; contained fibrous tissue, 15; fistula through

posterior meatal wall, 1; entirely hollowed out by cholesteatoma, 5; Bezold's abscess, 2.

Mastoid Antrum.—Practically healthy, 50; contained only watery, brownish or blackish fluid, 14; mucus or mucopus with swollen mucosa, 61; pus and polypoid mucosa and granulations, 57; contained cholesteatoma, 66.

Sigmoid Sinus.—In 202 cases the sinus was not exposed at operation. In 36 cases it was far forward (exposed by gouge) and found normal; in 2 cases it was exposed by gouge and appeared thickened; in 6 cases it was exposed by disease.

Aditus.—In 32 cases the aditus contained cholesteatoma; in 9 it contained granulations or polypi; in 7 the mucosa of the aditus was swollen and congested; and in 3 there was some growth of new bone.

Lateral Semicircular Canal.—The bony wall appeared thin and eroded, but showed no actual fistula in 8 cases; 1 of these cases showed the fistula symptom; 1 case (previously operated upon) showed new bone formation in the region of the lateral canal.

Ossicles (Malleus and Incus).—Under the conditions in which the radical mastoid operation is performed it is not possible to speak with certainty as to the condition of the ossicles in every case. After the bridge has been removed there is often so much bleeding that, even with the most careful swabbing, it is not humanly possible to observe in every case whether the incus and malleus are present. For this reason we do not wish to be dogmatic as to our findings, but with this reservation the following statement may be made: Both ossicles healthy, 74; malleus healthy but incus diseased (usually long process of incus eroded or absent), 74; malleus eroded and incus gone, 12; malleus and long process of incus eroded, 1; head of malleus eroded or absent and incus absent, 21; handle of malleus eroded and long process of incus gone, 2; handle of malleus eroded, incus healthy, 3; malleus and incus ankylosed, 6; ossicles absent or not found, 55.

Attic.—In 7 cases the attic showed swollen or polypoid mucosa; in 5 it contained granulations; in 53 cases there was cholesteatoma in the attic; in 1 case the attic was partly filled by new bone formation; in 1 case there was a small hole in the tegmen tympani; in 2 cases the facial canal was eroded.

Tympanum.—A note was made of the condition of the tympanum in 156 cases as follows: Swollen or polypoid mucosa, 28; granulations in tympanum, 44; polypus growing from promontory, 69; polypus from attic, 3; cholesteatoma in tympanum, 11; oval window filled by new bone formation, 1.

Tube.—In 246 of the 248 ears the tube was curetted; in two cases it was not curetted as it appeared to have been closed by a previous operation; in 9 cases the tube was curetted and touched with chromic acid. In 24 it was curetted and cauterised with the electro-cautery; (5 of this latter group did not report after operation; of the remaining 19 the cavity was satisfactory in 12, though 6 of the 12 required attention; in 2 the cavity was moist; in 5 the tube was still open).

Flap.—With regard to the flap, the operator continues to be satisfied with the results of the Koerner flap, which has been used in practically all cases.

Skin graft.—Mr. Marriage's method of skin grating was adopted by the operator in June, 1916, and since that time 83 of the operations recorded in this paper have been performed. Of these, however, only 70 have been skin grafted. The remaining 13 were not grafted for the following reasons: (1) The presence of fistula symptoms, 2 cases; in one of these the canal prominence proved normal but the stapes was probably loose; in the second case the bony wall of the canal looked thin. (2) Canal eroded, 1 case. (3) Exposure of the dura mater of the middle fossa, 4 cases. (4) Exposure of the middle fossa, giddiness, and abnormality of the canal prominence, 4 cases. (5) Sigmoid sinus exposed by disease and lateral canal eroded, 2 cases.

Progress.—Of the 238 patients 163 made uneventful recoveries. Seven cases had stitch abscesses. In 19 cases the posterior wound suppurated. In 3 cases the graft came away. Eleven had slight fever after operation, 13 had spontaneous nystagmus to the nonoperated side, 7 suffered from giddiness and nystagmus, 6 suffered from sickness and vomiting. Five patients after operation developed scarlet fever. The operator is of opinion that this "scarlatina" is, at any rate in some cases, a form of mild (probably streptococcal) septicemia resulting from the operation—i. e., it is not caught from another case of scarlatina in the usual way. One case developed erysipelas,

two cases showed slight swelling of the auricle and three developed perichondritis. There was no case of post-operative facial paralysis (i. e., paralysis present on the day after operation), but five patients developed facial paresis from five days to a week after operation; this trouble soon cleared up. One of the two patients who showed facial paralysis before operation was quite cured afterwards. Two patients developed purulent labyrinthitis after the mastoid operation and had double vestibulotomy performed. Both recovered. These two cases are dealt with in the section on labyrinthitis. Two fatalities followed the radical operation:

Case 1.—K. W—, female, aged 44, suffered from chronic suppurative otitis media and aural polypi, bilateral. Labyrinth healthy. First operation (radical mastoid on left side): Pus and granulations found with necrosis of ossicles; skin graft applied; aural polypus removed from right ear. Operated ear did well but discharge from right ear continued. Later, radical operation on right ear showed similar conditions to those on left side, sinus exposed with gouge but appeared normal, skin graft applied. Temperature rose continuously for three days after operation and patient had a rigor. Stitches removed and also skin graft. Patient developed a cough and blood stained expectoration; blood culture showed streptococcus. Intravenous injection of eusol given. Death. Postmortem: Old pleural adhesions, empyema of right side, large infarct in lower lobe of right lung. Cerebral sinuses showed no thrombosis.

Remarks.—This case appears to have been one of septicemia following the exposure of the sinus at the radical mastoid operation. The sinus was not injured and accordingly a skin graft was applied to the operation cavity. It is of interest to note that this patient appeared to have a presentiment of evil before the second operation, and insisted on making her will—a thing she had not done before the first operation.

Case 2.—R. S—, male, aged five, suffered from chronic suppurative otitis media, with acute mastoid exacerbation, enlarged tonsils and adenoids. Radical mastoid operation: Cholesteatoma present. Child fell out of bed on the day following operation and afterwards became unconscious. Operation wound opened up but nothing abnormal found. Lumbar

puncture yielded clear fluid under normal tension. Death on evening following operation. Postmortem refused. Cause of death uncertain—Status lymphaticus? Septicæmia? Acidosis? Injury to skull?

Mortality.—Mr. Heath claims a mortality of 1 in 360 and Mr. Adair Dighton of 1 in 54 for the modified radical operation. Mr. Dighton⁵ writes as follows: "In the chronic cases the risk to life in a Heath's operation is practically nil, whereas the radical mastoid operation boasts a death rate of at least 16 per cent. in these cases ("Report of Ear Department, Royal Infirmary, Edinburgh," March, 1912). We hold that this statement is calculated to give an entirely erroneous impression. If Mr. Heath and his followers intend only to plead for early operation in cases of middle ear suppuration, which do not yield to more conservative measures, few will be found to disagree. If, on the other hand, they wish to indicate that the modified radical operation is safe, whereas the radical mastoid operation is dangerous, we hold that they are misleading the medical profession. They must distinguish between the radical operation as performed in cases of middle ear suppuration alone and the same procedure when carried out en route to the relief of labyrinthine and intracranial complications already present when the patient is admitted. In the first case the radical operation, according to our statistics in this paper has a death rate of 2 in 238 cases, or, if the 52 cases previously reported be included, of 2 in 290 cases. In the second case the mortality is admittedly severe but the fatalities cannot in fairness be attributed to the radical operation. If a patient with extrinsic cancer of the larynx has a preliminary tracheotomy followed by excision of the larynx, we do not attribute his death, should it occur, to the former procedure.

After-treatment.—It is almost superfluous to go back to the methods of after-treatment adopted before the days of skin grafting, according to Mr. Marriage's method. The writers have no experience with the Carrel-Dakin method, which seems to be associated with special difficulty in the after treatment of the radical mastoid operation. French writers have recommended ambrine—a form of paraffin, which is poured into the cavity and in which a wick of gauze is implanted to facilitate removal. This treatment is begun from the fifth to the

eighth day after operation, and is continued for fifteen or twenty days. Guisez recommends Vincent's powder (1 part calcium hypochlorite to 9 parts of boric acid), but again we have no experience with this method. Our own practice in cases which have been skin grafted is to pack the cavity with iodoform worsted at the time of operation and to leave the wound alone for five days. At the end of this time the stitches are removed, including that retaining the meatal flap. The iodoform worsted packing is also removed and the cavity mopped out with sterile gauze. The cavity is then repacked for a further period of two days with iodoform worsted and the dressings reapplied. Thereafter no further packing is employed, and the case is treated by means of syringing until the superficial layers of the graft come away and a dry cavity has, if possible, been obtained. The meatus is left open in the daytime but at night a piece of iodoform gauze is inserted, though the cavity itself is not packed.

The progress of the case after operation appears to depend to a considerable extent upon the general condition of the patient. The operator has noticed that the cases dealt with at the Edinburgh War Hospital, Banguor, have made better recoveries than those in the Royal Infirmary, and attributes this fact to the better physique and general health of the patients in the former institution.

Stay in Hospital.—The average duration of the stay in hospital after operation was twenty-two days. We have often felt that it is rather a waste of hospital space and of nursing skill to keep patients in hospital for several weeks after the radical mastoid operation. If the patient lives in town the question is easily settled, because he can come up once or twice a day for treatment. If, on the other hand, he lives in the country, the question is more difficult. If we send such a patient home we have to entrust the after treatment to a relation or friend who most probably has had no experience of ear work. The patient's doctor, even if he knows anything about after treatment, cannot afford the necessary time. We have often thought that it would be a good thing if, instead of retaining these patients in hospital, some less elaborate and expensive form of lodging could be provided near the Infirmary for country cases which require attention once or twice daily.

Aftercare of the Operated Ear.—Even after the case has apparently made a satisfactory recovery and the cavity has been completely lined with epithelium, some attention is necessary if things are to remain satisfactory. It is our experience that, unless the operation cavity is treated at regular intervals by means of peroxid drops and syringing with lukewarm soda solution, drying and the instillation of spirit and boric acid drops, wax and epithelium accumulate, so that in time the cavity becomes filled with puttylike material in which there is some pus. Printed instructions are now given to all “radical mastoid” patients on leaving hospital, but it is the exception to find that these instructions have been followed. As a rule the patients confess, when they report for inspection, that nothing has been done to their ears since they left the infirmary. In many cases the auricle and mastoid region have not even been washed with soap and water.

RESULTS.

We have found that accounts given by patients concerning the condition of their ears after operation are quite untrustworthy. When they returned to report some patients stated that their ears were quite dry and yet examination showed that discharge was still present. Others told us that their ears were still discharging, though inspection proved that they were quite dry. We accordingly decided not to send out a questionnaire and to depend only on personal examination of our operated ears. Sixty-three per cent. of the cases reported when written for. This is fairly satisfactory considering the difficulty and expense of travel in recent times.

The main point brought out by the examination of the patients who reported was that the persistence of eustachian catarrh or suppuration is the main source of failure after the radical mastoid operation. We have not as yet found an efficient method of closing the eustachian tube. The radical operation does appear, however, to free the patient from the danger of an intracranial complication. We know of no case in which such a complication has arisen after the radical mastoid operation has been performed. Dr. Logan Turner tells us that this is also his experience.

Results in the Nonskinrafted Cases (171) reported on by

Dr. Garretson.—Of 171 patients, 107 presented themselves for inspection at periods of from three months to five years after operation. Three of these 107 were patients who had had both ears operated upon, so that 110 of the 178 operated ears were seen. Of these, 37 appeared to be cured, while 10 others were very satisfactory except that they showed want of care (an accumulation of wax and desquamated epithelium). This gives 43 per cent. of cures. In 24 cases the inner wall of the cavity was moist, but there was no pus. There was still some purulent discharge in 27 cases. In 1 case the cavity was filled with cholesteatoma. In 3 cases a false membrane had formed, almost shutting off the deeper part of the cavity. In 4 cases there were granulations in the operation cavity. Three cases showed a permanent opening behind the ear. One showed a keloid in the mastoid scar and a large amount of debris in the cavity.

Hearing after Operation.—This was tested in 93 cases, as follows: Hearing improved, 35 (38 per cent.); the same, 36 (39 per cent.); worse, 22 (23 per cent.).

Results in the Skin Grafted Cases (reported on by J. S. F.).—Of the 67 patients, 44 presented themselves for inspection at periods of from three months to two and a half years after operation. Two of these were patients who had had both ears operated upon, so that 46 of the 70 operated ears were seen. Of these, 20 appeared to be cured, and 12 others were quite satisfactory except that they showed want of care (70 per cent. cures). In 7 cases the inner wall was red and moist. Four cases still had slight purulent discharge, and one other had foul smelling profuse discharge. Two cases showed membrane formation with a narrow opening through which pus came when the patient performed Valsalva's experiment.

If we add together the results in the nongrafted and grafted cases we get 156 operations with 79 cures, i. e. 50 per cent.

Hearing after Operation.—This was tested in 42 cases, with the following results: Improved, 12; as before operation, 16; worse, 6.

In the previous paper published by the operator and Capt. Milne Dickie it was noted that 26 of the 52 "radical" cases reported. Of these, 17 were dry, i. e. 65 per cent. The hear-

ing was tested in 22 cases, of which 15 were improved, 4 were the same, and 3 worse.

Results Obtained by Other Operators.—Bowers⁶ reports on 107 cases, 84 of which presented themselves for reexamination; 63 of these were dry (75 per cent. cures). The hearing was improved in 60 per cent., remained the same in 34 per cent., and was worse in 6 per cent. There were no deaths, but one partial facial paralysis.

Stucky⁷ reports on 100 cases with 89 dry ears. In the remaining 11 the tube was open and there was recurrent mucoid discharge. The hearing was improved in 19, remained the same in 60, and was worse in 21 cases.

Morisette Smith⁸ showed 10 consecutive cases with dry ears. The hearing was improved in 7 and remained the same in 3.

Dench has recorded 734 cases, with no death. He would be ashamed to show only 50 per cent of cures.⁹

Richards, in discussing Dench's paper, also holds that 50 per cent. of cures is a bad result and is due to inefficient operating. Speaking from memory, we believe that Dench and Richards claim from 70 to 80, or even 85 per cent. of cures.

On the other hand, Harris¹⁰ states that he has examined 24 cases operated upon by other American otologists, and of these 48 per cent. were dry and 52 per cent. were still discharging. The hearing was improved in 8 per cent., remained the same in 20 per cent., and was worse in 20 per cent.

It is needless to point out the divergence between the results claimed by Dench, Richards, Smith, Bowers and Stucky on the one hand, and those reported by Harris on the other. The writers are disposed to believe that the statements of Harris more nearly represent the results obtained by the majority of operators—at least before the days of immediate skin grafting—than do those reported by the group of otologists mentioned above.

We have attempted in the following table to associate the appearances present on otoscopy with the state of the hearing, conditions found at and the result obtained by operation. Although the numbers are small we have given the results as percentages for the sake of clearness.

MODIFIED RADICAL OPERATIONS.

Sex.—Of the 17 cases, 10 were males and 7 were females.

Age (in decades).—One to 9 years, 1; 10 to 19, 3; 20 to 29, 8; 30 to 39, 2; 40 to 49, 2; 50 to 59, 1. Average age, 26 years.

Residence.—Edinburgh and district, 11; country, 6.

Side.—Right, 10; left, 7.

Cause.—This was stated in 6 of the 17 cases, as follows: Scarlet fever, 1; measles, 3; teething, 1; mill accident, 1.

Duration.—As in radical operations.

Nose.—In 5 cases there was no note of the condition of the nose. Of the other 12 cases 4 were normal, 3 showed deviation of the septum, 1 showed hypertrophic nasal catarrh, and 3 showed both deviation of the septum and hypertrophic catarrh; 1 case had nasal polypi.

Pharynx.—In 4 cases the condition of the pharynx was not noted. Of the remaining 13 cases, 10 were normal and 3 had enlarged tonsils and adenoids.

Condition of Meatus and Membrane on Operated Side.—In two of the 17 cases the condition of the membrane could not be seen on account of the presence of a polypus. In 3 others the membrane could not be seen, in 2 owing to sagging of the meatal wall and in the other owing to meatal stenosis. Of the remaining 12 cases 1 showed central perforation, 5 showed posterior perforations, and 5 showed attic perforations; 1 showed a posterior and also an attic perforation.

Condition of Meatus and Membrane on Nonoperated Side.—Normal, 3; evidence of Eustachian obstruction, 7; chronic suppurative otitis media, 1; results of chronic suppurative otitis media, 5; meatus narrowed after an injury, 1.

Hearing before Operation.—Good, 2; fair, 8; moderate deafness, 6; severe deafness, 0; not tested, 1.

Vestibular Apparatus.—This was tested in 15 of the 17 cases; 14 cases showed normal reaction to caloric or rotation tests; the remaining case showed spontaneous nystagmus to the operated side and a well-marked fistula symptom on the operated side.

Indications for Operation.—What are the indications for the modified radical operation in cases of chronic middle-ear sup-puration? Kaufman¹¹ states that the operation is indicated in

cases of disease confined to the antrum and mastoid in which the ossicles are in place. It is difficult to know; however, how he ascertains these data. It is usually considered that Heath's operation is indicated in cases with good hearing. In our experience such cases belong to one of two groups: (1) Cases with "central" perforation in the lower or anterior portion of the drumhead and with a mucopurulent discharge. These cases are really tubotympanic suppurations in which the upper and posterior portions of the middle ear cleft (attic, aditus and antrum) are not seriously involved. We believe that it is useless to open the mastoid antrum in such cases according to Mr. Heath's method. Even the radical operation itself with curettage of the eustachian tube too often fails to stop the discharge. We believe that the best treatment for this group consists in (a) attention to the nose and nasopharynx, especially the removal of a large "posterior end," operation for tonsils and adenoids, treatment of nasal accessory sinus suppuration if present, etc. (b) Syringing the eustachian tube through the eustachian catheter. (c) Syringing the tube by means of an ordinary metal ear syringe with an olivary end which tightly fits the meatus. The fluid passes down the tube and returns by the nose. Argyrol can be applied to the tube by these two methods. (d) Vaccine therapy.

(2) The second group in which hearing is often good consists of cases with attic perforations. In these, cholesteatoma is almost invariably present, and we understand that Mr. Heath at one time regarded cholesteatoma as a contraindication to his operation. If this is still so, we cannot agree with Mr. Heath's view, for we have operated on several cases of attic perforation with cholesteatoma in which a modified operation yielded a perfectly dry ear with the retention of excellent hearing. In these cases the external wall of the aditus and attic were removed, but the lower portion of the drumhead along with the ossicles were not touched.

(3) The only remaining group of chronic middle ear suppuration is that in which there is a perforation in the posterior portion of the drumhead extending to the margin. In many of these an aural polypus is also present. We have found that in the majority of these cases the long process of the incus is absent so that the continuity of the ossicular chain is broken.

The hearing is often poor, but if it is good the modified radical operation should be performed.

Our usual indication for the modified radical in preference to the radical operation was the retention of (1) good hearing in the operated ear or (2) moderate hearing when the other ear was distinctly deaf.

Technic.—As in the radical operation up to the point at which the inner end of the bridge remains. Koerner's flap is then cut and any polypus in the meatus removed with forceps. If an attic perforation is present the inner end of the bridge with the outer attic wall is removed. Special care is necessary to get away all bone chips. Marriage's skin graft is applied to the antrum in the majority of cases.

OPERATION.

Superficial Tissues.—Normal, 13; scar from accident, 1; scar from old operation, 1; subperiosteal abscess, 2.

Mastoid Cortex.—Normal, 14; eroded, 2; old operation cavity, 1.

Mastoid Process.—Sclerotic, 11; cellular, 5; scar tissue, 1.

Mastoid Antrum.—Healthy, 3; contained only watery, brownish or blackish fluid, 2; mucus or mucopus with swollen mucosa, 6; pus and polypoid mucosa and granulations, 3; contained cholesteatoma, 3.

Sigmoid Sinus.—In 5 cases the sinus was far forward (exposed by gouge) and found normal. In no case was it exposed by disease.

Progress.—Of the 17 patients 9 made the uneventful recoveries. Two cases had stitch abscesses. In 2 cases the posterior wounds suppurred slightly. One patient had slight nystagmus to opposite side and another had rotatory and lateral nystagmus to the affected side on the day following operation. One patient had slight fever and some swelling of the auricle, but no redness, and the condition soon cleared up.

RESULTS.

Twelve of the 17 patients reported after operation. Of these, 9 were quite satisfactory. In 3 cases the cavity was still moist.

Hearing after Operation.—This was tested in 12 cases, as follows: Improved, 10; as before operation, 1; worse, 1.

We have attempted to associate the appearances present on otoscopy with the state of the hearing, the conditions found at and the result obtained by operation. The cases have been divided into the following groups:

(1) There was a central perforation in 1 case, with moderate hearing, and the antrum contained only mucus. The meatus was still moist five months after operation.

(2) In 5 cases the perforation was in the posterior superior part, and in 3 of these a polypus was also present. In 1 of the 5 the hearing before operation was good, in 3 it was fair and in 1 moderate. The antrum was practically healthy in 1 case. In a second it contained only brownish fluid. The third contained mucopus. In the fourth there was pus and polypoid mucosa, and in the fifth cholesteatoma. The result is known in 4 of the cases, and in all of these the ear was dry. The hearing was improved in 2 and remained the same in 1 case.

(3) An attic perforation was present in 6 cases, in 2 of these combined with the presence of polypus or granulations. The hearing was good in 1 of the 6 cases, fair in 4 and moderate in the remaining 1. The antrum was healthy in 1 case, but the attic contained cholesteatoma. The antrum contained discolored fluid in 1 case. In 2 the antrum contained mucopus and in 2 cholesteatoma. The result is not known in 2 cases. The ear remained moist in 2 cases, while in the remaining 2 the ear was dry. Of the 4 cases who reported, the hearing was improved in 2 cases, remained the same in 1 and was worse in 1.

(4) In 1 case the meatus was stenosed, so that the position of the perforation was not ascertained. Hearing was not tested. The antrum was healthy. The result as regards condition of the cavity was excellent.

(5) In 2 cases there was sagging of the posterior superior wall of the meatus, preventing inspection of the membrane. In 1 of these the hearing was fair and in the other moderate. In both cases the antrum contained pus and polypoid mucosa. One case did not report, but in the other the ear was dry and the hearing improved.

(6) In the two remaining cases the meatus was occluded by a polypus and the position of the perforation not ascertained. In 1 of these the hearing was good and in the other moderate. In both the antrum contained only mucopus. One patient did not report, but in the other the result was good and the hearing improved.

LABYRINTH CASES.

The labyrinth cases numbered 26, 16 of whom were males and 10 females. The age of the patients varied from 5 to 53 years—as a rule between 20 and 30. It is notable that the average age (25) was considerably more than the average age (19) of the intracranial cases. Eleven of the patients resided in Edinburgh or its neighborhood and 15 came from the country. Cholesteatoma was present in 13 of the 26 cases; granulations and polypi in 21 cases. In 3 cases there was an attic perforation and in 2 cases a posterior marginal perforation could be seen. A subperiosteal abscess was present in 5 cases and facial paralysis before operation in 3.

Symptoms.—Pain in the ear or head, 18 cases; fever in only 2 cases; giddiness, 16 cases; vomiting, 8 cases. Noises in the head formed a marked symptom in 1 case and were so bad that the patient insisted on operation.

Hearing.—Not tested in 2 cases owing to the age of the patients. In none of the remaining 24 cases was the hearing good. Moderate hearing (conversation voice at from 1 to 4 feet) was present in 4, and severe deafness (conversation voice at less than 1 foot) in 8 cases. Total deafness in 12 cases.

Vestibular Symptoms.—Spontaneous nystagmus, 8 cases; pointing error, 2 cases; fistula symptom present in only two instances, although there were 12 cases of circumscribed labyrinthitis. Rotation nystagmus was normal in only 3 of the cases, while it was reduced in 11. In the others it was not tested. Caloric nystagmus was not obtained in 13 cases in which it was examined for. Many of these, however, had cholesteatoma and polypus. Caloric nystagmus was present in 9 cases of circumscribed labyrinthitis.

TYPE OF LABYRINTHITIS, OPERATION PERFORMED AND RESULT.

(a) Of the 26 patients 12 were cases of circumscribed labyrinthitis. In 10 of these the radical mastoid operation only

was performed, and 3 of them were skin grafted. All of the patients recovered. In 4 of the 10 the hearing was improved, in 3 the hearing remained the same, in 3 the hearing was not tested after operation. In one of the remaining cases double vestibulotomy was performed in addition to the radical mastoid operation. The patient recovered but had no hearing on the operated side. In the last case Neumann's labyrinth operation was performed in addition to the radical mastoid operation. This patient recovered, but was also deaf on the operated side.

(b) Diffuse purulent labyrinthitis (manifest)—3 cases—following the radical mastoid operation. In 2 of these a fistula was present in the lateral canal at the time of the radical operation. In 1 case the radical mastoid operation alone was performed. The patient recovered with loss of hearing. In 2 cases vestibulotomy was done when the patients developed labyrinth suppuration. Both patients recovered, with loss of hearing.

(c) Latent labyrinth suppuration, 8 cases; in 6 of the 8 cases the radical mastoid operation and double vestibulotomy were performed. All 6 patients recovered but with the total loss of hearing. In 2 cases the radical mastoid operation, plus Neumann's operation, was performed. One of these patients recovered and 1 died.

(d) Spontaneous cure of labyrinth suppuration, 2 cases. In both of these the radical mastoid operation only was performed. Both patients recovered.

I. Oticoscopic appearances.	Total	II. Hearing before operation. (Percentages.)					III. Condition of antrum at operation. (Percentages.)					IV. Result of operation (Percentages.)					V. Hearing after operation. (Percentages.)	
		(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)
		(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)
Drumhead seen.																		
Anterior perforations (central perforations).....	4	—	50	—	50	—	75	—	25	—	—	25	—	—	25	50	—	50
Posterior perforations.....	21	5	14	33	29	19	5	5	43	33	14	14	33	19	19	10	14	24
Attic perforations.....	38	3	18	53	23	3	21	6	37	13	23	18	34	8	18	13	29	18
Multiple perforations.....	22	9	36	27	23	5	18	5	14	9	54	27	36	14	18	9	5	14
Total loss of drumhead.....	5	40	—	—	60	—	—	—	20	40	40	40	40	20	40	20	—	40
	10	—	10	20	50	20	40	20	—	10	30	30	30	—	50	—	—	30
Drumhead not seen.																		
Polypus without cholesteatoma.....	122	2	10	33	44	11	20	6	22	30	22	10	26	12	16	11	30	19
Polypus with cholesteatoma.....	7	—	14	29	57	—	29	—	14	43	29	14	14	14	29	29	—	29
Cholesteatoma blocking meatus.....	10	—	40	10	50	—	20	—	20	10	50	20	40	20	20	—	30	30
Stenosis of meatus.....	9	—	22	22	34	22	22	—	34	—	44	11	34	11	22	22	22	11
	148	2	13	30	45	10	20	5	23	26	26	11	27	13	17	11	30	20

II. Hearing before operation:

- (1) Good hearing (whisper at 6 ft.).
- (2) Fair hearing (C.V. 4 to 12 ft.).
- (3) Moderate deafness (C.V. 1 to 4 ft.).
- (4) Severe deafness (C.V. 1 ft. or less).
- (5) Not tested.

III. Condition of antrum at operation:

- (1) Antrum healthy.
- (2) Bony walls healthy; antrum contained watery fluid.
- (3) Antrum contained mucopus, or the mucosa was swollen or congested.
- (4) Pus or granulation tissue present.
- (5) Cholesteatoma.
- (6) In these cases the antrum was practically healthy, while the aditus or attic contained cholesteatoma.

IV. Result of operation:

- (1) Good result: operation cavity dry.
- (2) Cavity satisfactory, but showed want of care.
- (3) Cavity moist: tube open with mucoid discharge.
- (4) Poor result: pus present with granulations or false membrane formation.
- (5) No report.

V. Hearing after operation:

- (1) Hearing improved.
- (2) Hearing same as before operation.
- (3) Hearing worse.
- (4) Hearing not tested after operation.

Details of two fatal labyrinth cases:

Case 3.—W. A——, male, aged 5. Admitted March 6, 1913. C. O. M. S., right, for two years. Pain and swelling behind right ear for two days. Patient is stated to have pulmonary tuberculosis. Temperature 100° F., pulse 118. Total deafness in right ear. No spontaneous nystagmus or Rombergism. Cold caloric reaction absent on right side. Radical mastoid and labyrinth operation; antrum contained pus; lateral canal prominence flat and reddish; fistula into cochlea; promontory softened; dura of triangular area exposed and separated from posterior surface of petrous; free removal of bone, however, failed to show any trace of posterior or lateral canals; these had evidently become filled up by new bone formation. Facial twitchings on two occasions. On following day signs of meningitis became evident. Death four days after operation.

Postmortem.—Basal meningitis; edema and congestion of brain; no perforation of dura of posterior or middle fossæ; caseous areas at root of lung; subsequent microscopic examination of the inner ear showed that the canals had all been obliterated by new bone formation, while the vestibule and lower part of the cochlea contained granulation tissue.

Remarks.—The operator found that while curetting the promontory towards the close of the radical operation the spoon passed into the cochlear cavity, which contained pus and granulation tissue. It was therefore considered best to perform Neumann's labyrinth operation. The case was evidently one in which spontaneous cure of labyrinthitis had occurred in the semicircular canal region while the vestibule and cochlea still contained pus and granulation tissue.

Case 4.—M. G——, female, aged 26. Admitted August 4, 1911. C. O. M. S., bilateral, after scarlet fever and diphtheria at the age of 5 years. The right ear has for years been completely deaf. Four weeks before admission she received a blow on the left ear and suffered from giddiness and vomiting for two days. The left ear has now become quite deaf and she has had pain and noises in it since her accident. On both sides the drumhead is absent, and the inner wall pink and moist. No spontaneous nystagmus or fistula symptom. Cold caloric reaction absent on right side but on left produced nystagmus in 20 seconds. Conservative treatment adopted but

failed to benefit the noises. Patient insisted on operation, though told it was not free from danger. Radical mastoid operation on left ear; cholesteatoma present; inner wall cleansed with peroxide and painted with iodine; lateral canal opened; external wall of vestibule and cochlea removed, and modiolus curetted; cavity packed with iodoform worsted. In the evening patient sick and giddy with marked nystagmus to the right. External objects appeared to move from right to left. Dressings soaked with cerebrospinal fluid. Patient reports the noises have gone. During the next few days signs of meningitis developed—fever, headache, Kernig, stiffness of neck. Lumbar puncture evacuated turbid fluid under tension. Second operation: Bone removed from triangular area and dura of posterior fossa opened. Drain inserted. Later, patient became comatose, with Cheyne-Stokes' respiration. Death 18 days after the first and eleven days after the second operation. Permission for autopsy refused.

Remarks.—This patient declared that she would "go mad" unless something was done to relieve her noises, and it certainly appeared that she spoke the truth. It would have been better, however, if the radical operation alone had been performed in the first place, so as to obtain if possible a clean, dry cavity. If in spite of this the unbearable noises had continued, the removal of the cholea could then have been performed with less risk.

INTRACRANIAL COMPLICATIONS.

These cases number 25, of whom 17 were males and 8 were females. The average age was 19 years. All the patients were under 30 years of age.

The Edinburgh Royal Infirmary draws from a very large area, including Fifeshire, the Lothians and the border counties. In fact the majority of the patients dealt with in this report came from districts outside Edinburgh and Leith. Fifteen of the 26 labyrinthine and 17 of the 25 intracranial cases came from the country. Many of the cases with intracranial complications were not sent in for several days or even for one or two weeks after grave symptoms had developed. For this reason it is not surprising that there is a considerable mortality associated with operations for the relief of intracranial lesions.

Up till comparatively recently the course on "diseases of the nose, ear and throat" has not been compulsory, and many general practitioners fail to realize the serious nature of symptoms arising as a result of middle ear suppuration. The majority of practitioners have now learned to send in to hospital without delay cases of appendicitis, strangulated hernia or ruptured gastric or duodenal ulceration, but they still retain cases of suppurative otitis media associated with headache, vomiting, giddiness, rigors, etc., and treat them by means of sedative powders or counter irritation.

In 8 of the intracranial cases there was delay in operation. As a rule this was the fault of the patient or his friends, who refused operation, but in one or two cases the intracranial complication occurred between the time at which the patient was first seen (when no urgent symptoms were present) and that at which there was a vacant bed ready in the Department. Such occurrences are almost bound to happen in the presence of a long "waiting list." Four of these 8 cases ended fatally.

Cholesteatoma was present in 18 of the 25 cases.

In most instances more than one intracranial complication was present.

(1) Extradural Abscess.—Eighteen cases, 9 recoveries and 9 deaths. A perisinus abscess was present in 15 cases and an extradural abscess in the middle fossa in 1 case. In 1 case both perisinus and middle fossa abscesses were present. In 7 cases extradural abscess was the only intracranial complication present; all of these cases recovered.

(2) Labyrinthitis.—Seven cases associated with intracranial complications and not included in previous part. (a) Circumscribed labyrinthitis, 3 cases—1 recovery and 2 deaths. Of the 2 fatal cases 1 had sinus thrombosis and the other had purulent meningitis. (b) Diffuse labyrinthitis, 1 case, recovery. (c) Latent labyrinthitis, 3 cases—1 recovery and 2 deaths. Of the 2 fatal cases 1 had sigmoid sinus thrombosis and meningitis and the other had cerebellar abscess.

(3) Sigmoid Sinus Thrombosis.—Twelve cases—6 recoveries and 6 deaths. In 3 of the 6 fatal cases purulent leptomeningitis was already present on admission to hospital and 1 other developed purulent leptomeningitis after admission.

(4) Temporosphenoidal Abscess.—Four cases—1 recovery

and 3 deaths. In 2 of the 3 fatal cases rupture into the lateral ventricle had probably occurred before the admission of the patient to hospital. In the remaining case rupture occurred after admission.

(5) Cerebellar Abscess.—Three cases—1 recovery and 2 deaths. One death occurred from septic edema of the brain, spreading from the walls of the abscess; the other was associated with meningitis.

(6) Leptomeningitis.—Thirteen cases. (a) Serous meningitis, 3 cases—all recovered. (b) Purulent meningitis, 10 cases—1 recovery and 9 deaths. In all the fatal cases other complications were present, as follows: Circumscribed labyrinthitis, 1; latent labyrinthitis and cerebellar abscess, 1; sigmoid sinus thrombosis, 4; temporosphenoidal abscess, 3.

Summary.—Of the 25 cases 13 recovered and 12 died.

DETAILS REGARDING THE 25 CASES OF INTRACRANIAL COMPLICATION OF CHRONIC MIDDLE EAR SUPPURATION.

Case 5.—C. O. M. S.; Acute Mastoid Exacerbation with Bezold's Mastoiditis; Perisinus Abscess; Sinus opened, but no Clot; Graft of Fascia applied; Slight Fever for a Few Days; Plastic Operation; Complete Recovery.—No. 407. M. K—, female, aged 9, first seen August 30, 1916, with a history of discharge from the left ear of two years' duration after scarlet fever. Tonsils and adenoids were removed a year before admission, but otorrhea continued. Three days before admission the left ear became very painful, and on the following day a swelling appeared in the neck and behind the left ear. Examination: Right drumhead retracted; left meatus full of pus. There was a large edematous swelling over the left mastoid, extending into the neck for a distance of about one and a half inches below the tip of the mastoid. The child held her neck rigidly, with the head inclined to the left. Temperature 100.4° F., pulse 100. Child too ill for functional examination of ear. August 13: Radical mastoid operation left side. Superficial tissues edematous; mastoid process large and cellular, the cells being full of pus; sigmoid sinus exposed by disease and large extradural abscess present in posterior fossa. A Bezold abscess was present internal to the tip of the mastoid. Sinus wall presented a greenish appearance. The sinus was

opened with a knife, but no thrombus present. A postage-stamp graft of fascia was therefore applied. Operation cavity was packed and the wound left open. September 2: Temperature 101.4° F.; at 8 p. m. pulse 100. Yesterday the temperature only reached 100° F. In other respects the child doing well. September 3: Temperature again 101.4° F., pulse 120. Veins of ocular fundus engorged, but disc otherwise normal. September 4: Temperature subnormal, pulse 90. Child vomited once. She has complained of pains over the region of the appendix, but a general surgeon saw no necessity for interference. September 5: Temperature 99.2° F. On September 6 the temperature came down to normal and remained between 97° and 98.4° F. until the patient's discharge. On September 28 plastic operation performed to close the wound behind the left ear. Patient was discharged on October 17 with the wound entirely healed and operation cavity quite dry.

Remarks.—This case was apparently one of mild chronic suppurative otitis media in which an acute exacerbation had occurred, involving the air-cells of the large pneumatic mastoid, and resulting in an extradural perisinus abscess and in a Bezold abscess beneath the tip of the mastoid. The appearance of the sinus at operation led one to open it, but apparently no thrombosis was present. A graft of fascia was therefore applied. For the next three or four days the condition of the patient gave rise to some anxiety, but thereafter the temperature fell to and remained normal. It is quite possible that some sinus thrombosis was present, if not before operation, at least after the sinus had been opened. The ultimate result, however, justified the policy of nonintervention during the short period of fever succeeding the operation.

Case 6.—C. O. M. S. with Polypus: Labyrinth Healthy; Conservative Treatment Failed; Acute Mastoid Exacerbation; Perisinus Abscess and Bezold's Mastoiditis; Radical Mastoid Operation; Uninterrupted Recovery.—No. 401. D. B.—, male, aged fifteen, came to the Infirmary December 18, 1915, with a history of discharge from the right ear of more than one year's duration. On examination the left drumhead was indrawn, while the right meatus showed a polypus surrounded by pus. With the noise apparatus in the left ear the patient could hear the conversation voice at one foot. Tuning

fork tests showed middle ear deafness. Fistula symptom absent. Cold syringing of the right ear caused nystagmus to the left in thirty seconds. The aural polypus was removed under ethyl chlorid anesthesia, and it was then seen that the right drumhead had almost totally disappeared, and that the promontory showed a raw area from which the polypus had apparently originated. Bezold's conservative treatment was begun January 21, 1916, by Dr. Andrew Campbell and continued till May 31. The discharge, however, remained fetid. The patient returned August 8, complaining of pain behind the right ear of two weeks' duration and of mastoid swelling for one week. August 10: Radical operation on right ear; edema of superficial tissues; small periosteal abscess at the mastoid tip; the mastoid process was one large abscess cavity; the sinus was exposed by disease and a perisinus abscess was present in the posterior fossa; the antrum showed cholesteatoma, while the malleus and incus were absent or not found. Only the upper part of the wound was stitched, the lower end being drained. August 11: Temperature, which was normal before operation, has only risen to 99° F., pulse 80, patient doing well. August 12: Wound closed. August 27: Conversation voice at 18 inches by right ear. Operation cavity satisfactory. September 2: Discharged.

Remarks.—This case illustrates the fact that even the most careful intratympanic syringing, with drying and the insufflation of boric acid, fails to cure cases with cholesteatoma in the attic, aditus and antrum. Bezold's treatment was carried out daily for four months, so that it got every chance. In August the patient had an acute exacerbation with an extradural perisinus abscess, calling for the radical mastoid operation. Unfortunately he did not report in 1917 or 1918, so that the ultimate condition of the operation cavity cannot be stated.

Case 7.—Synopsis of Case.—No. 263A. G. L.—, male, aged nine, first seen February 19, 1914. C. O. M. S., right with recent earache and stiffness of neck. One rigor before admission. Evening fever of 102° F. Cerebrospinal fluid slightly turbid and under great tension. R. M. T. red and bulging, with small posterior perforation. Conversation voice heard at 4 ft. with noise box in left ear. Spontaneous nystag-

mus to left and spontaneous pointing error to right and considerable drowsiness. Vestibular apparatus reacted to cold caloric test. Patient deviates to right on walking with eyes shut. Schwartz operation: Large, foul perisinus abscess evacuated; sinus wall showed granulations; sinus opened accidentally and bled freely; pressure applied. Next day cerebrospinal fluid clear but still under pressure. Nystagmus and pointing error continued. Extensor response on Babinski's test. Kernig's sign present. Within a week all signs of meningitis disappeared, but a few days later patient developed scarlet fever and was removed to City Hospital. On dismissal, right drumhead healed though retracted. Whisper heard at 4 feet. This case was recorded in full in *Edinburgh Medical Journal*, January, 1915.

Case 8.—Synopsis.—G. P——; male, aged seven. C. O. M. S., right, after whooping cough. Pain in right ear for one week, with drowsiness; vomiting for one day. Cholesteatoma in right meatus. Functional examination impossible but no spontaneous nystagmus present. Lumbar puncture—cerebrospinal fluid under great tension but clear; no growth. Rigor, with temperature of 104° F. on day after admission. Operation revealed a large extradural perisinus abscess with healthy red granulations on sinus wall; cholesteatoma in attic. Sinus not opened. Vestibular apparatus responded to caloric test under anesthetic. Temperature 104° F. on night of operation, pulse 128, Kernig doubtful. No stiffness of neck. Temperature fell to subnormal and pulse to 60. All signs of meningitis disappeared. Uneventful recovery. Case recorded in full in *Edinburgh Medical Journal*, January, 1915.

Case 9.—C. O. M. S.; Extradural Perisinus Abscess; Erosion of Posterior Canal; Radical Mastoid Operation followed by Acute Labyrinthitis; Neumann's Labyrinth Operation; Recovery.—No. 168. W. F——, male, aged thirteen, first seen August 28, 1912, with a history of discharge from the right ear of three years' duration. During the last three years he has complained of deafness and noises in the right ear, and eighteen months ago he commenced to have attacks of giddiness. For the last three days he has had pain in the right ear.

Examination: Nose and throat healthy. Left drumhead normal. After the foul smelling pus had been syringed out,

the right drumhead showed a perforation in the posterior part, with granulations. No mastoid swelling or tenderness. Cochlear apparatus: Left ear—whisper at 9 feet +. Right ear—whisper at 1 foot. Middle ear deafness right side. Vestibular apparatus: No spontaneous nystagmus or Rombergism. No fistula symptom. Rotation to right produces nystagmus to left for thirteen seconds; rotation to left produces nystagmus to right for seventeen seconds. Cold syringing left ear produces nystagmus in thirty-five seconds; cold syringing right ear—no nystagmus in two and a half minutes.

August 29: Patient's temperature rose to 101° F. last night, pulse 100. Tenderness present today over right mastoid antrum. First operation: Radical mastoid operation by house surgeon, assisted by J. S. F. Cortex normal; mastoid process diploetic; foul pus in antrum; small perisinus abscess; bone in roof of antrum diseased, but dura of middle fossa healthy; lateral canal intact; considerable bone disease on inner wall of antrum in region of posterior canal.

August 30: Temperature normal, pulse 92. Marked vomiting. Third degree nystagmus to sound side and patient lies on this side. Slight pointing error to the right. Slight facial paresis on right side. In view of the findings at operation and of the presence of acute labyrinthitis after operation it was decided to open and drain the inner ear spaces. Second operation at 1:30 p. m. (J. S. F.) Neumann's labyrinth operation performed. It was found that the posterior canal had already been opened at the first operation. Facial nerve exposed for about a quarter of an inch. It appeared red and swollen, but had not been cut through. Vestibule freely opened in front of facial nerve. Operation cavity lightly packed and wound left open. In the evening the temperature was 98.2° F. and the pulse 96. Nystagmus as before. Patient states that he feels as if he were whirling round. August 31: Temperature 98° F., pulse 84. No vomiting since 6 p. m. yesterday. Sensation of rotation has passed off. September 3: Temperature and pulse normal, very slight nystagmus. Facial paresis as before. No giddiness or sickness. Wound behind ear stitched up. September 11, 1912: Rotation to right produces nystagmus to left for fifteen seconds, whereas rotation to left produces nystagmus to right for only five seconds. September

29: Operation cavity is becoming covered with epithelium. General condition satisfactory. Patient discharged, to attend in outpatient department. October 22: Facial paralysis passing off. Operation cavity almost healed. November 16: Facial paralysis practically cured. No discharge in operation cavity.

Case 10.—Synopsis.—No. 379. R. W——, male, aged six. First seen October 8, 1910, suffering from C. O. M. S. (right), with polypus. Patient admitted, but as he cried his mother refused to leave him. Boy brought back six years later, with pain in right ear and history of rigors, headache, drowsiness and delirium. Head flexed. Complete deafness in right ear. Radical mastoid operation; cholesteatoma present; sinus exposed by disease and injured during operation, with resulting profuse hemorrhage; lateral canal opened by cholesteatoma. Neumann's labyrinth operation performed. Next day temperature rose to 104° F. Sigmoid sinus opened and clot turned out; jugular not ligatured. Fever continued and two days later a third operation was performed (jugular ligature). Intravenous injections of eusol. Recovery. Case recorded in full in *British Medical Journal*, 1917, Pt. I, p. 357.

Case 11.—C. O. M. S., with Cholesteatoma; Acute Exacerbation; Perisinus Abscess; Uninterrupted Recovery.—No. 300. J. W——, male, aged eight, first seen May 19, 1915, suffering from discharge from the left ear for some years. A mastoid operation was performed on the right ear last autumn. For three weeks patient has had pain in the left ear and for one week there has been some swelling behind the ear. For three nights the boy has been unable to sleep on account of the pain.

On examination, the left auricle was projecting markedly and over the region of the mastoid tip the swelling appeared to be pointing. The left meatus contained much pus, and on clearing this away granulation tissue was observed. Temperature 100.4° F., pulse 120.

Functional Examination: Cochlear Apparatus.—Raised voice heard at only 6 inches by left ear, and with the noise box in the right ear patient can only hear the raised voice ad concham. Weber lateralized to the left. C32 to C256 not heard by left ear. Vestibular apparatus.—Slight spontaneous

nystagmus to the right; no giddiness. Patient too ill for rotation and caloric tests.

May 20, 1915: Radical mastoid operation left ear (J. S. F.). Large foul smelling subperiosteal abscess opened. Mastoid cortex eroded. First gouge cut released a quantity of foul pus. Perisinus abscess present. Sinus covered with granulations. Dura of posterior fossa internal to the sinus appeared normal. Antrum and aditus contained cholesteatoma. Malleus and incus absent, or at least not found. Tympanum contained granulations. Radical operation completed. Cold lotion applied to inner wall at end of operation at once produced conjugate deviation of eyes to the right. Posterior wound closed. May 25: No fever since operation. Posterior wound healed. All stitches removed today. Cavity looks satisfactory. June 13: Patient dismissed to convalescent home. June 29: Doing well.

Case 12.—Synopsis.—No. 362. J. M——, male, aged sixteen, first seen January 25, 1916. C. O. M. S. (right). For five days before admission headache on right side, with shivering and vomiting. Labyrinth healthy. First operation (radical mastoid).—Cholesteatoma present: large extradural perisinus abscess (*staphylococcus aureus*). Sinus split up, but jugular not ligatured. Later, pain developed in right lumbar region; exploration of chest negative. Second operation.—Ligature of internal jugular; intravenous injection of eusol; marked tenderness over right ilium; incision here evacuated pus (*staphylococcus aureus*). Fever continued. Operation on right ilium by general surgeon (Mr. J. W. Struthers). Large abscess between inner surface of ilium and iliocostalis muscle. Recovery. Case recorded in full in *Brit. Med. Journ.*, 1917, Pt. I, p. 358.

Case 13.—Synopsis: No. 269. M. S——, female, aged thirteen, first seen January 14, 1915. C. O. M. S. (right) after measles; for one week fever, earache, vomiting and retraction of head; meningitis present on lumbar puncture. First operation (radical mastoid). Later, symptoms of septic sinus thrombosis developed. Second operation.—Sinus opened and right internal jugular vein ligatured. Later still, symptoms of cerebellar abscess. Third operation.—Cerebellar abscess

opened and drained. Recovery. Case recorded in full in *Edin. Med. Journ.*, November, 1915.

Case 14.—Synopsis: No. 278. R. T——, female, aged twenty. C. O. M. S. (right). Patient first seen October 16, 1914, and name entered for operation, but patient not admitted for operation till February 17, 1915. First operation (radical mastoid) revealed erosion of lateral canal. Skin graft, however, applied. Ten days after operation fever developed, with headache and vomiting. Cerebrospinal fluid normal. Signs of labyrinthitis present. Second operation.—Neumann's labyrinth operation performed. Later, symptoms of sinus thrombosis developed. Blood culture showed streptococcus. Third operation.—Sinus opened and jugular vein ligatured. Septic symptoms, however, continued, and jugular bulb (fourth operation) performed. Recovery. Case recorded in full in *Edin. Med. Journ.*, November, 1915.

Case 15.—C. O. M. S. (Bilateral); Radical Operation, Right Ear; Cholesteatoma; Perisinus Abscess; Accidental Rupture of Sinus above the Clot: Packing; Sinus Opened and Anterior Wall Excised: Secondary Suture of Wound: Recovery.—No. 279. T. J——, female, aged seventeen, first seen at the Royal Infirmary in March, 1915. She has had discharge from her left ear of unknown causation for at least six years. The right ear has also been deaf for a number of years, but has not discharged. Of late she has had severe attacks of pain in the left ear and two months ago had an attack of sickness and vomiting which lasted eleven days. She is always giddy when she first gets up in the morning and also feels sick.

Examination.—Left meatus full of pus and shows granulations. R. M. T. shows a perforation of Shrapnell's membrane.

Functional Examination: (1) Cochlear Apparatus.—Watch heard at 1 inch on the right side, but only on contact on left. Watch heard well on both mastoids. Whisper at 1 foot right ear and conversation voice at 1 foot left ear. Schwabach lengthened. Weber lateralized to the right (better) ear. Low tones not heard by left ear. (2) Vestibular Apparatus.—Rombergism doubtful. Rotation to right and also left produced after-nystagmus of thirty seconds' duration. Cold syringing of each ear induced nystagmus in sixty seconds.

First operation, March 27, 1912. Radical mastoid operation on left ear by Dr. Logan Turner.

July 22, 1913: Patient reports. Left (operated) ear dry, but right ear discharging. February 20, 1915: Patient returns, complaining of severe pain in her right ear for the last five days. During the last day or two she has vomited and has been unable to sleep at night.

Examination.—No rigidity of neck. Kernig's sign absent. No spontaneous nystagmus or giddiness. Watch heard on right mastoid and raised voice heard at 1 foot by right ear. Weber still lateralized to the right. On cold syringing of the right ear nystagmus to the left is produced in two minutes.

Operation on Right Ear (J. S. F.), February 22, 1915.—Mastoid cortex normal. Process sclerodiploetic. Large foul smelling perisinus abscess is opened (pure growth of pneumococcus obtained on culture). Anterior wall of sigmoid sinus grayish green and sloughy. Antrum full of cholesteatoma. Only remnants of the ossicles found. The sinus was now further exposed in a backward direction, and in doing this the vessel was ruptured and a very free flow of blood was obtained from the torcular end. The wound was plugged and left open. February 23: Temperature 97 to 98 degrees F., pulse 84, respirations 24. Patient fairly well. February 26: Headache and vomiting through the night. Temperature 97° F., pulse 60. The tongue is covered by dry brown fur. No nystagmus. February 27: Temperature and pulse as yesterday. Ear dressed. The cavity looks well. The packing was removed from the sinus and no bleeding occurred. The anterior wall of the sinus was removed with forceps and scissors and the cavity was found to contain dark red clot and some granulation tissue. In spite of the subnormal temperature, the slow pulse and the condition of the tongue the patient looks well, so that it has been decided to wait and not to operate further in the meantime. March 1: Temperature 98° F., pulse 76. The tongue is now clean and moist and the mastoid cavity satisfactory. In view of the satisfactory condition of the patient the retroauricular wound was closed today with stitches. March 6: Temperature 98° F., pulse 76. Wound healing fairly well. The mastoid cavity is satisfactory. March 21: Patient dismissed, to report once or twice weekly. The

wound behind the ear is healed and the mastoid cavity looks well.

Case 16.—C. O. M. S. (left); Rigors; Sigmoid Sinus Exposed by another Surgeon, but appeared healthy; Hectic Fever Continued; Blood Culture showed Streptococcus. Second Operation by J. S. F.; Jugular Vein ligatured; Sigmoid Sinus full of Septic Clot; Drowsiness Present after Second Operation and some Return of Fever but Second Blood Culture negative. Third Operation: Plastic Closure of Wound; Recovery.—No. 473. C. K—, female, aged twenty-five, was brought to the Infirmary December 10, 1917, complaining of pain in the left ear, headache, vomiting and loss of sleep. The patient had a rigor ten days before admission. She was admitted to the wards of another surgeon who found tenderness over the left mastoid, temperature 100° F., marked neck rigidity and middle ear deafness in the left side. Patient was operated upon by the surgeon shortly after admission. The mastoid cortex was normal and there was no pus in the antrum. The dura of the middle fossa was exposed and appeared healthy. Lumbar puncture at the end of the operation yielded clear fluid under tension. The case did not do very well after operation and there were daily elevations of temperature, which in the afternoon reached 100° F., 102° F. and finally 105° F. on December 16th. As the surgeon who had operated was absent on holiday the patient came under the care of J. S. F.

December 17: Examination showed a dry, brown tongue. Patient appeared hectic. There was no headache, vomiting, giddiness or nystagmus. With the noise box in the left ear patient was quite deaf. A blood culture was made. (The report issued on December 19 was to the effect that a Gram positive streptococcus was present which showed chains up to 80.) December 18: Second operation (J. S. F.) The left internal jugular vein was ligatured above the junction with the common facial. At this point the vein appeared healthy. The vein was divided but both ligatures were left on. The sigmoid sinus was then exposed towards the torcular for an inch and a half. The anterior wall was slit up and the vessel found full of red clot. Microscopic sections of the vein wall and clot showed Gram positive diplostreptococci in great num-

bers. The clot was turned out and the anterior wall excised. Slight bleeding was obtained from the torcular end but none from the bulb end. The anesthetist now reported that the patient was rather collapsed, and accordingly no further attempt was made to get beyond the clot towards the torcular. In the afternoon the temperature rose to 103° F., pulse 120. Salines were given per rectum. December 19: Fairly good night. Wound dressed; no bleeding from torcular end of sinus. Worsted drain inserted into cavity of sinus. Ligature removed from bulb end of jugular vein but attempt to wash through from the sinus to the neck failed. December 20: Temperature now much lower—98 to 99.6 degrees F., pulse 92 to 104. Some reaction in wound. No bleeding from either end of sinus; no rigors; patient rather flushed. She has been drowsy till today, but is now brighter and takes food better. December 23: Temperature has come down to normal; pulse 104. Wound looks well. Bleeding today from torcular end of sinus. December 26: For the last three days there has been a recurrence of fever in the afternoon, temperature rising to 101° F. and the pulse to 120. Patient is still rather drowsy. A second blood culture was made on the 24th, but shows no growth. December 29: Temperature normal for four days; pulse 92. No packing in either end of sinus. Neck wound stitched today. January 14, 1918: Plastic operation was not a great success, but the wound is decidedly smaller than before. February 14: Wound behind ear is healed. The operation cavity looks well except for the continuance of discharge from the eustachian tube.

Remarks.—Case appears to have been a fairly typical one of septic thrombosis of the sigmoid sinus. The only remarkable feature in the case was the patient's drowsiness—a condition one does not often meet with in sinus thrombosis. The case, however, presented no other symptoms of brain abscess. It is possible that the drowsiness may have been associated with the condition of the lateral sinus. The operator was aware that he had not obtained free bleeding and reached healthy brain wall when the operation had to be stopped on account of the condition of the patient. The progress of the case after the operation, however, was fairly rapid towards recovery.

Case 17.—C. O. M. S. with Cholesteatoma; Extradural Perisinus Abscess; Lumbar Puncture Showed Meningitis; Sinus Thrombosis present but Jugular not ligatured; Later, Cerebellar Abscess Evacuated; Death.—G. D——, male, aged eight. C. O. M. S. (right) for three years, since scarlatina. Sudden onset of earache, shivering, giddiness and vomiting. Edematous swelling over mastoid. Marks of old glandular abscess in neck. Right ear not deaf. Rotatory nystagmus to right. At first operation mastoid cortex whitish gray, foul pus in mastoid (*B. coli*). Extensive extradural perisinus abscess; antrum full of cholesteatoma; incus absent. Respiration stopped on three occasions during operation. Lumbar puncture showed cerebrospinal fluid under pressure. Polymorphs and organisms present. Hectic temperature for three days after operation; occasional vomiting. Second operation.—Sinus opened and thrombus removed; free bleeding from both ends of sinus; jugular not ligatured; cerebellar dura opened and gauze drain inserted. Kernig's sign developed and optic neuritis. Two days later (third operation) cerebellar abscess evacuated. Eight days after third operation temperature rose to 103° F.; vomiting present. Meningitis became more marked and patient died from coma twelve days after third operation.

Postmortem.—General purulent meningitis; large abscess in right lateral lobe of cerebellum; right internal jugular vein not thrombosed. Microscopic examination of labyrinth showed organization of thrombus in roof of jugular bulb; meningitis in internal meatus; cochlea normal; engorgement of vein accompanying aqueduct of cochlea and also of vessels of fossa subarcuata; no perforation of windows; vestibular structures normal; erosion of bone of lateral canal exposing endosteum, but no circumscribed labyrinthitis. Posterior canal showed circumscribed labyrinthitis, the erosion having occurred from the extradural abscess in the posterior fossa.

Case 18.—C. O. M. S. with Cholesteatoma; Acute Exacerbation, with Rigors, Vomiting, and Signs of Meningitis; Extradural Perisinus Abscess but no Sinus Thrombosis; Death apparently from Meningitis; Postmortem refused.—E. R——, female, aged twelve. C. O. M. S. (right). Sudden onset of earache and headache. Wilde's incision by patient's doctor. Hectic temperature with rigors and vomiting for a fortnight.

Diplopia for two days. Examination: Temperature 104.5° F.; dry, brown tongue; retraction of head; photophobia; paralysis of right external rectus; Kernig's sign present; marked but not complete deafness in right ear. Patient too ill for functional examination. Immediate operation.—Mastoid cortex whitish gray; large extradural perisinus abscess with foul pus; dura greenish and sloughy; cholesteatoma in antrum; ossicles absent; tympanum full of granulations; sinus opened and free bleeding obtained. Lumbar puncture: fluid under slightly increased tension but apparently clear. Excess of white cells but no organisms. Temperature continued high for two days, pulse 140, respirations 44. Moist sounds at base of lungs. Meningitic cry developed. Death three days after operation. Postmortem refused.

Case 19.—C. O. M. S. (bilateral); Patient a Deafmute as the Result of Old Labyrinth Suppuration on both Sides; Recent Acute Exacerbation of Middle Ear Suppuration on Right Side, with Commencing Meningitis; Radical Mastoid Operation; Perisinus Abscess and Sinus Thrombosis; Jugular Ligated; Rigors Continued. Intravenous Injection of Eusol; Metastatic Abscesses in Lung with Empyema; Death.—No. 454. C. S——, a male, aged ten, seen at the Royal Infirmary on January 5, 1917. Patient came from the Deaf and Dumb Institution at 54 Henderson Row, Edinburgh. Unfortunately very few details were obtainable. The mother was in prison and was seen only after the death of the patient. The father was absent in France on active service. The mother herself was rather deaf and stated that her deafness came on after the birth of her second baby. She suffered from tinnitus. The mother stated that she had never had any miscarriages, but her fifth pregnancy resulted in the birth of a stillborn child. Of her twelve children only the patient was deaf. She stated that the boy had never spoken and had not had otorrhea as a baby. He was late in learning to walk—two years and eight months. The patient had been in the Deaf and Dumb Institution since the age of eight. The discharge only began just before he went to the Deaf and Dumb School. Note.—It is doubtful whether much importance is to be attached to the mother's statements.

On examination the right external meatus was filled with

discharge, and, after syringing, an attic perforation was observed, from which some cholesteatoma protruded. The left drumhead was retracted and showed an adherent scar in the posterior superior part. Functional examination was impossible, as we were not able to communicate with the boy. The radical mastoid operation was advised, but, as has been explained above, there was some difficulty in obtaining permission.

June 20: Patient admitted as an urgent case for operation. About June 16 the boy began to be feverish, the temperature rising to 101° or 102° F. each afternoon. The right external meatus was now found to contain a polypus. It was again found that functional examination was almost impossible. When the sounding tuning fork was placed on the patient's vertex he only nodded his head and smiled. Apparently he did not hear any of the tunings forks by air conduction on either side and did not respond to vowels spoken in a loud voice close to his right ear. When the left ear was tested in the same way he nodded his head as if he heard something (?). Vestibular apparatus.—No Rombergism, no spontaneous nystagmus, no fistula symptom; rotation to left and to right produced no nystagmus; cold caloric test was negative on both sides. The temperature rose at 8 p. m. on the day of admission to 106° F., but there was no shivering or vomiting. The boy, however, became cyanosed and drowsy. There was apparently slight pain on pressure on the neck.

June 21: Temperature 101.8° F., pulse 116, at 8 a. m. The medical managers of the infirmary were communicated with and decided that operation should be performed at once in spite of the lack of permission from the parents. 12 noon: Operation.—Chloroform, followed by ether. Lumbar puncture performed on the table; cerebrospinal fluid clear and not under tension. (Microscopic examination showed some increase of cells, mainly polymorphs and a few diplostreptococci. No growth on culture.) The usual incision was made for the radical operation, behind the right ear. The superficial tissues and mastoid cortex were normal, the process was sclerodiploetic. The antrum contained foul smelling pus under tension. The long process of the incus had disappeared and the malleus had granulations adhering to it. The bone over the sinus was

removed and the perisinus abscess evacuated. Direct films from the pus were swarming with organisms. A Gram positive diplostreptococcus, Gram positive bacilli and two types of a Gram negative bacillus. Cultures showed the Gram positive diplococcus and the Gram negative bacillus. The sinus wall was grayish green and necrotic. A horizontal incision was made in a backward direction towards the torcula for two and a half inches, and the bone removed until healthy sinus wall was reached. The sigmoid sinus was slit up and found to be full of a blackish green clot. Free bleeding was obtained from the torcular end, which was plugged. The sinus was then exposed towards the bulb, but it was impossible to reach a healthy part. (The anterior wall of the sinus was excised and a subsequent microscopic examination showed a thrombus adherent to the wall. The thrombus contained masses of cocci in pairs and chains.) The right internal jugular vein was accordingly ligatured below the common facial, which was tied off. The upper end of the internal jugular vein was found to be clotted. As the lower end was also clotted at the point of ligature a further dissection was carried out in a downward direction for about an inch until a nonclotted portion of the vein was reached. By this time the child was very pale and the pulse feeble. The bulb end of the internal jugular vein was stitched to the skin; the operation wounds were lightly packed and left open. The patient was returned to bed, the limbs bandaged and the foot of the bed raised. Duration of operation nearly two hours. Saline solution was given intravenously, and later, pituitrin. 8 p. m.: Patient cyanosed, cold and clammy. Pulse not countable. Saline given per rectum and brandy by the mouth. Saline also given intravenously. Temperature 103.6° F. June 22: Patient has had a bad night. Temperature 96.6° F. this morning, pulse 92, respirations 26. Boy is taking some nourishment. Evening temperature 98.8° F., pulse 84. June 23: Patient has had a better night; slept fairly well. Temperature 98.8° F., pulse 106. At 12 noon, however, the boy had a rigor with cyanosis, followed by sweating. Wound dressed at 1 p. m. The posterior wall of the sigmoid sinus looks sloughy. Bulb washed through, but no pus washed out. Free bleeding obtained from torcular end when packing removed. In view of the urgent need of the

case Prof. Lorrain Smith was consulted regarding intravenous injection of eusol, and on his advice at 5 p. m. 50 c. c. were given under chloroform anesthesia. About an hour later the boy became cyanosed and had a rigor, with feeble pulse and rapid breathing. Later in the evening he vomited and the temperature rose to 103° F. June 24: Patient had a good night. Temperature 98.2° F., pulse 100. June 25: Temperature rising today from 100 to 102 degrees F., pulse 120. The boy is very emaciated and is not taking his food well. There is no reaction in the wound. The jugular bulb again washed through and only clear fluid returned. On June 26 the patient had a fairly good day, and on the 27th the temperature again rose to 104° F. The patient's breath has a sickly sweet odor and the wound is very inactive. There is no bleeding now from the torcular end of the sinus. Prof. Lorrain Smith advises against a further injection of eusol. June 28: Patient has now developed a short cough and there is a suspicion of friction on the right side in the postaxillary line. The wound shows slight signs of reaction. June 30: There have been daily risings of temperature to 102 or 103 degrees F.; pulse varies from 110 to 160; respirations 36 to 44. The wounds in the head and neck show slight reaction, but the arm wound shows none. Examination of the chest reveals feeble breath sounds. The right base was explored, but no fluid obtained. The mental faculties are clear, but the patient is bothered by coughing fits. July 2: Rigor at midnight last night. Temperature 105° F., pulse 152. Today second intravenous injection of eusol given under chloroform anesthesia, the vein again being exposed by dissection. (Blood culture showed no growth on the first and second day, but on the third a Gram positive staphylococcus was noted—probably a contamination from the skin.) July 4: Temperature rose to 103.8° F. at 8 p. m., pulse 148. Patient taking his food better, but the head wound is still very inactive and the cerebellar dura looks sloughy, while the cut edges of the bone are blackish. The lungs were examined by a physician, who found dullness at both bases but no signs of fluid. July 6: Patient has got weaker and thinner and the eyes are becoming sunken. The wounds show no reaction. There is dullness at the left base, but the physician reports no signs of fluid. There is now some

incontinence of urine and feces. There are daily risings of temperature varying from 101 to 104 degrees F., the pulse from 120 to 160, and the respirations have been as high as 58. Patient has been getting nuclein for the last day or two and also champagne and beef juice. July 8: Conditions as regards temperature, pulse and respirations much the same. Anti-streptococcus serum given. Patient is rapidly going downhill. July 12: Patient died at 7:15 p. m. today.

Postmortem.—Postmortem clot in superior longitudinal sinus; soft thrombus in the right lateral sinus. The left pleural cavity showed much purulent effusion. Left lung collapsed. On section the left lung showed multiple abscesses. Right lung edematous and congested and on section shows one or two small abscesses. Liver large, pale and fatty. Kidneys pale, soft and friable. Spleen enlarged, pale and soft. There was a small focus of suppuration at the point of the ligature of the right internal jugular vein, but below this the vein appeared healthy.

Remarks.—We were somewhat handicapped in dealing with this case owing to the fact that the father was absent on military service and the mother in prison. The value of the history subsequently obtained from the patient's mother is more than doubtful, and the probability is that the patient had discharge from both ears early in life and that the deafmutism was due to labyrinthitis following an extension of the middle ear suppuration on both sides. Subsequent microscopic examination of both inner ears has shown the accuracy of this opinion, but details must be held over at present. If we had been able to admit and operate on the child when he was first seen in January, 1917, it is probable that a good result would have been obtained—at least as regards the life of the patient—but unfortunately permission for operation could not be got at this time. When the boy was brought back in June of the same year he already had an intracranial complication—i. e., extradural abscess and septic thrombosis of the sigmoid sinus. Again, there was slight delay in operating on account of the difficulty in getting permission. The operation revealed cholesteatoma, perisinus abscess, thrombosis of the sigmoid sinus and upper portion of the right internal jugular. The condition of the patient at the end of operation was grave, and various

restorative measures were employed. The case did not do very well after operation, and about a week later developed a cough. At first it was thought that there was dullness at the right base and this was explored. As will be seen from the postmortem report the left pleural cavity was full of purulent fluid and the left lung collapsed. Had this condition been discovered during life it is at least possible that the result would have been different. In view of the condition of the chest it is not surprising that the various methods of treatment adopted—e. g., saline transfusion, stimulants, intravenous injection of eusol, antistreptococcus serum, etc., were without result. It is true that the postmortem showed a soft clot in the right lateral sinus and a small area of suppuration in the lower end of the right internal jugular vein, just at the point of ligation, but the operator is of opinion that the small amount of sepsis in these situations would not have led to death had the chest condition been diagnosed and treated.

The moral would appear to be that in cases of sinus thrombosis with chest symptoms too much reliance must not be placed upon the physical signs and the opinion of the physician. We should be ready to explore both sides of the chest with a large needle and syringe, in order to make sure that there is no accumulation of pus in the pleural cavity.

Case 20.—Chronic Suppurative Otitis Media (Bilateral); Cholesteatoma and Circumscribed Labyrinthitis (Fistula) on Right Side; Septic Thrombosis of Right Sigmoid and Lateral Sinuses. First Operation: Extradural Abscess (R.); Radical Operation Performed; Sigmoid Sinus Opened and Internal Jugular Ligatured; Rigors Continued; Second Operation on Jugular Bulb; Death. Postmortem; Extensive Thrombosis of Cerebral Sinuses; Infarcts in Lungs and Bronchopneumonia; Septic Changes in Internal Organs.—No. 250. A. B—, female, aged fifteen, came to the Royal Infirmary August 24, 1914, with a history of discharge from the right ear since the age of five years. For two weeks she has had pain and noises in the ear. For two days the pain has been so severe that the girl has been kept in bed. At first the pain was situated behind the ear and in the neck but on admission the patient also had frontal headache. For a month or two she has complained of giddy attacks and has vomited frequently during the

last four days. For two days patient has had shivering attacks.

Examination.—Patient is somewhat drowsy but answers questions distinctly. Temperature 98.6° F., pulse 100, respirations 20. She is slightly cyanosed and the tongue is dry and furred. There is no irritability but the cheeks have a hectic flush. There is no loss of memory and the patient readily recognizes articles which are shown to her. No facial paralysis. The patient is so deaf that one has to shout to her. Pupils are equal and contracted. Eye movements normal. No photophobia. Pressure on eyeballs rather painful. Cutaneous hyperesthesia present and slight dermatographia. Knee jerks not active. Kernig's sign present. No retraction of abdomen. No optic neuritis. Ears: Right meatus full of pus and debris. After syringing it is seen that the tympanic membrane has disappeared and that cholesteatoma is present in the upper part of the tympanum. There is tenderness on pressure below and behind the mastoid. Patient objects to her head being moved. The left meatus is also full of debris, and after syringing a pulsating spot of light can be seen.

Functional Examination: Cochlear Apparatus.—The conversation voice is not heard by either ear. Even a shout cannot be heard by the right ear, but by the left ear the raised voice is heard at 6 inches. The watch is not heard by air or bone conduction on the right side, but on the left it is heard at one-half inch by air conduction and is also heard on the mastoid. Weber lateralized to the left (better ear). Rinne negative on the left side and absolutely negative on the right. No tuning forks are heard by the right ear by air conduction, but the upper forks are heard by the left ear and the upper tone limit on this side is normal.

Vestibular Apparatus.—There is slight spontaneous nystagmus to the left, but no spontaneous pointing error. Fistula symptom is positive on the right side and produces giddiness. Cold syringing of the right ear produces no nystagmus even after two and a half minutes. The caloric test was not carried out on the left side, as the patient was not well enough.

Lumbar puncture evacuated fluid under great tension but not turbid. No increase of cells observed and no organisms

found after centrifuging. On culture only staphylococcus albus obtained (contamination?).

First operation on day of admission. A large extradural perisinus abscess was evacuated. The process contained some gas. The dura of the sinus and of the posterior fossa around it was gray and sloughy. The radical operation was performed. The perisinus abscess appeared to be quite cut off from the cholesteatoma in the antrum. The malleus and incus were absent. A fistula was found in the posterior part of the lateral canal prominence but was not further investigated and the labyrinth operation was not performed. A transverse incision was now made and the lateral sinus exposed in a backward direction for about 2 inches. The sinus was slit up and a firm reddish brown clot removed. (Small Gram negative organism, coccus or bacillus?) The clot extended backwards towards the torcular. Free bleeding was obtained from the torcular end. The sinus was now traced downwards and was found to be in a collapsed condition. The superior petrosal sinus was also clotted. As no free bleeding was obtained from the bulb end of the sigmoid sinus the right internal jugular vein was exposed and ligatured above the junction of the common facial. The upper end of the divided jugular was not opened at the time of operation. Both wounds were lightly packed but not stitched. An attempt to obtain blood from an arm vein for culture failed owing to the collapsed condition of the veins. Saline injections were given at the end of operation, which lasted about two hours.

August 25, 1914: Temperature 98° F., pulse 108. Patient looks fairly well and tongue is cleaner. August 26: Rigor at 2 a. m. and another at 11 a. m. Wound dressed and upper end of vein in neck opened. Attempt to wash through the bulb not successful. August 27: Temperature 101° F., pulse 120. Vein washed through. Patient has been vomiting. August 29: Temperature has remained about 101° F. and pulse 120 for the last two days. Patient has been restless but has had no more rigors. There has, however, been sweating. The packing was removed yesterday from the torcular end of the sinus but had to be replaced owing to hemorrhage. September 1: Temperature has been lower for the last two days (about 100° F.) but today it has risen to 104° F. and patient has

had a rigor with sweating. The sinus has been washed out daily and a lot of pus has been obtained from the bulb end. September 3: Patient had two rigors yesterday with temperatures of 104° and 105° F. It was accordingly decided to give her the chance of operation on the jugular bulb after the matter had been fully explained to her parents.

Second Operation.—Further removal of bone of posterior cranial fossa so as to expose sinus behind the facial nerve. The cerebellar dura was raised with Stacke's protector. There was no facial twitching. The jugular bulb was reached without much difficulty and a soft catheter passed down through it into the vein in the neck. September 4: Temperature 99° F. since last operation but pulse 130. The wound is fairly clean but shows very little reaction. September 7: The temperature reached 106° F. yesterday and the rigors have recurred. The wound shows no reaction. September 10: Rigors have been of frequent occurrence, temperature reaching 105° and 106° F. on several occasions and the pulse varying from 140 to 170. Optic neuritis is now distinct on the right side. September 11: Death.

Postmortem.—Organized adherent clot present in the torcular end of the right lateral sinus and also in the superior longitudinal and straight sinuses. The lumen of these has been partially restored. In the superior longitudinal sinus there is some softening of the clot. There is no meningitis and only slight congestion of the pia. The brain on section shows only edema.

The lower part of the right pleura shows slight recent pleurisy. There are several pale areas in the lungs showing commencing fibrosis, and towards the surface there are well defined infarcts with pleurisy over them. Scattered throughout the lung there are small patches of bronchopneumonia. Generally the lungs show edema and congestion while the lower lobe of the right lung is collapsed. The heart is dilated but there is no endocarditis.

There are old caseous glands in the mesentery. The liver and kidney show well marked cloudy swelling. There are no infarcts in the spleen but the organ is enlarged and of a uniform pink color.

Microscopic examination of right middle and inner ear: The inner wall of the tympanic cavity is covered by squamous epithelium (cholesteatoma); membrane of the round window thickened; the facial nerve on the inner wall of the tympanum is surrounded by fibrous tissue. The ampullary end of the posterior canal and aqueduct of the vestibule have been opened at the operation on the jugular bulb. There is considerable organization of clot in the jugular bulb. The cochlear opening of the perilymph aqueduct contains pus cells. It is remarkable that in this case the scala media contains semipurulent exudate and the membranous structures are hardly recognizable. The fundus of the internal meatus contains a little pus. The lateral canal shows a fistula (circumscribed labyrinthitis); both perilymph and endolymph spaces of the lateral canal contain pus.

Case 21: C. O. M. S. (Bilateral); Operation Performed on Left Ear (Dr. Turner); Cholesteatoma; recovery. Later, Operation done on Right Ear by Clinical Assistant under Supervision (J. S. F.); Dura Middle Fossa Exposed; Skin-graft Applied. Subsequent Condition Unsatisfactory; Headache, Drowsiness, Dilatation of Right Pupil, etc. Third Operation (J. S. F.); Temporosphenoïdal Abscess Evacuated; Slow Recovery.—No. 455. J. M.—, male, aged seventeen, came to the Infirmary on February 2, 1917, complaining of discharge from both ears since childhood. On admission there was a swelling behind the left ear, which had been incised by his own doctor on three occasions. The fistula was still discharging on admission. Examination showed cholesteatoma in the external meatus. The left canal was narrow. Hearing-tests showed middle-ear deafness on both sides. With the noise-apparatus in the left ear the patient heard raised voice at 3 feet, and, with the noise-box in the right ear, he heard the raised voice at 2 feet. Rotation both to right and to left gave an after-nystagmus of normal duration (twenty-five seconds). Cold syringing of the right ear produced nystagmus after two minutes, but on syringing the left ear there was no response after three minutes (external meatus very narrow).

February 7: First operation (Dr. Logan Turner).—Left mastoid cortex eroded. Process sclerotic; antrum contained cholesteatoma; inner end of posterior meatal wall entirely de-

stroyed; roof of antrum also gone. Ossicles not found; labyrinth wall healthy. Graft applied. Patient made a good recovery after the operation on his left ear and left the hospital on March 10.

June 1: Patient readmitted for operation on the right ear. June 4: Second operation by clinical assistant, supervised by J. S. F. Radical operation on right ear. Mastoid cortex healthy; process diploic; antrum small; sinus far forward; middle fossa low; dura exposed here for an area of about $\frac{1}{2}$ inch square; antrum contained pus; malleus and body of incus ankylosed; tube curetted; Koerner flap; cavity skin-grafted and wound behind ear closed. June 8: First dressing. Stitches removed; graft in position; temperature has been slightly elevated in the evening since the operation. June 11: Temperature about 100° F. for last two days, pulse 84 to 100. Posterior wound healed; ear clean; graft in position. First degree nystagmus to left. June 14: Vomiting. June 17: Patient very drowsy; complains of frontal headache; vomiting continues; no rigidity of neck, but slight suspicion of Kernig's sign; knee-jerks normal; plantar flexion. June 18: Temperature 98° F., pulse 60. Slight spontaneous nystagmus to right (side of recent operation). No pointing error; patient hears conversation-voice at 18 in. with left ear closed with finger and raised voice at 1 foot with noise-box in left ear. Prompt response to cold syringing of right ear. Patient is becoming thinner. Conclusion come to was that there were no signs of labyrinthitis or of cerebellar abscess or of thrombosis of the sigmoid sinus, but that there might be some meningeal irritation or possibly an abscess of the temporosphenoidal lobe.

June 18: Third operation at 12 noon (J. S. F.). Old incision, which had firmly healed, was opened up; skin-graft removed. Wound cavity appeared satisfactory. Nothing further done; cavity packed with hypertonic saline gauze; urotropin given. Lumbar puncture performed, fluid clear, films showed a few polymorphs and a marked increase in the lymphocytes, but no organisms. No growth on culture. The reaction of the fluid was alkaline; sugar absent; albumen and globulin increased.

June 19: Temperature 98° F., pulse 56; pupil of right side

dilated; twitching of limbs, especially on left side; no vomiting; facial contractions on right side. 6 p. m.: Fourth operation.—Vertical incision made downwards through right temporal muscle; large area of squama removed with gouge and forceps; dura of middle fossa bulging markedly and not pulsating. Dura incised, and also brain; foul-smelling abscess evacuated. (Film of the pus showed innumerable organisms, mainly Gram negative bacilli, Gram negative diplococci, with some Gram positive bacilli. Cultures showed Gram positive diplostreptococcus, Gram positive bacillus, and also a diphtheroid and a Gram negative motile bacillus. The latter organism was regarded by Miss Fitzgerald as characteristic of brain abscess cases when found in the cerebrospinal fluid.) Cigarette drain inserted. June 20: Temperature 97° F., pulse 56, respirations 20; no vomiting; patient has had a better night. Pupils equal and moderately dilated. Wound dressed; slight hernia cerebri, painted with 10 per cent formol. Two small tubes inserted into brain abscess. June 21: Temperature 97.6° F., pulse 64. Patient looks better and is not so resistive as formerly; tongue dirty and furred; muscles of right side of face still contracted. He yawns frequently. June 23: Temperature 97° to 97.6° F., pulse 64. Patient's memory very defective. He is again noisy and resistive; tries to get out of bed. Lumbar puncture evacuated clear fluid under normal pressure. June 27: Mental condition still the same; patient has struck the nurses. Hernia cerebri as before. Tongue is now clean and his appetite good. Temperature remains between 97 and 98 degrees F. and the pulse about 64. July 2: Patient considerably better. Temperature 98.4° F., pulse 86. Hernia cerebri smaller. Mastoid wound shows reaction. Mental condition improved. July 21: Since last report temperature has varied between 97° F. and normal, and patient has been doing well, but in the last two days temperature has risen to about 100° F. in the evening and pulse to 106, and the patient has vomited and been drowsy. Hernia cerebri increased. Foul smelling pus evacuated on exploring abscess. Herpes on lips has developed. August 25: Since last report condition has been satisfactory. Tube removed three days ago from brain abscess. Patient discharged, but is to come up daily for dressings. February 26, 1918: Both ear cavities satisfactory

except that eustachian tube is open in both sides Brain abscess region completely healed.

Remarks.—The first operation on this case calls for no comment. The second operation was performed by one of the clinical assistants under the supervision of J. S. F. The only possible error appeared to be the application of a skin graft to the operation cavity after the dura of the middle fossa had been accidentally exposed. The patient showed no symptoms of temporosphenoidal abscess on admission before the second operation, and the conclusion came to was that the abscess was the result of this operation. It was remarkable that the wound healed so well and that the operation cavity appeared satisfactory. The temperature, however, became elevated and vomiting set in, followed by subnormal temperature and mental symptoms. There were no signs of labyrinthitis, sinus thrombosis, or cerebellar abscess, and the diagnosis lay between meningeal irritation—the symptoms of which are often anomalous—and abscess of the temporosphenoidal lobe. Lumbar puncture excluded meningitis, and the onset of dilated pupil on the right side, with twitchings of the left side of the body, convinced us that a temporosphenoidal abscess was present. This was confirmed at the last operation. The further progress of the case was slow, and was interrupted about a month after the last operation by retention of pus in the brain abscess. This, however, was relieved by improving the drainage. The patient was a Celt from the far north and was of rather a melancholy disposition. His mental condition after the development of the brain abscess was interesting: from a shy, quiet youth he became resistive and sometimes violent, and this maniacal tendency passed off slowly. The convulsions of the opposite side of the body quickly subsided after the evacuation of the abscess, but the facial contracture on the same side continued for a considerable period. The fact that the patient had a recurrence of the symptoms of brain abscess almost five weeks after the abscess had been opened and drained points to the necessity of keeping these cases of brain abscess under observation for a very considerable period. The writer has known cases which have been operated upon and discharged as cured being brought back to hospital six months and more after the operation, with a recurrence of

the symptoms of brain abscess, and dying from septic edema of the brain in spite of prompt opening of the old abscess cavity. We must admit that the healing power of the brain tissue is very feeble, if, indeed, it can be said to exist at all.

Case 22.—C. O. M. S.; Cholesteatoma; Temporosphenoidal Abscess; Radical Mastoid Operation and Opening of Brain Abscess; Later, Rupture of Abscess into Lateral Ventricle; Meningitis; Death.—No. 230. N. S.—; female, aged eleven, first seen April 17, 1914, complaining of discharge from both ears for five years following scarlet fever and diphtheria. Patient has had occasional pain all these years and for the last three weeks has been vomiting off and on and has not been able to sleep on account of severe headache. No giddiness. Patient's doctor reports that the vomiting was of gastric origin and that there was no tenderness on pressure about the ears. The headache was controlled by phenacetin.

Examination.—The patient looks ill—more so than a stomach condition would warrant. Her eyes are listless and her mental processes dull. The external meatus on both sides contains yellowish green foul smelling pus. After syringing right tympanic membrane is seen to be almost completely destroyed but there is no mastoid tenderness on the right side. Details of left tympanic membrane cannot be made out, but there is marked mastoid tenderness on the left side. Temperature 97.8° F., pulse 60. Tongue furred and dry. Functional examination.—Cochlear apparatus: Watch heard on forehead, on both mastoids and on contact by both ears. Schwabach lengthened. Weber not lateralized. Rinne negative both ears. C32 and C64 not heard by either ear by air conduction. C128 heard by both. Vestibular apparatus: No spontaneous nystagmus; no Rombergism; no pointing error. Patient too ill for rotation and caloric tests. Child can name a penny, pencil, knife and watch, but cannot name keys or a hand-bag. She named a handkerchief very slowly. There is no pain on tapping the skull or pressing on the head. April 18: Child lies on the diseased side. Temperature 96.6° F., pulse 58. Patient has slept badly and yawns a great deal today. She vomited in the early morning and now complains of headache over the left frontal and temporal regions. There is no restlessness, irritability or photophobia. No pain on pressure on eyeballs;

no cutaneous hyperesthesia and no stiffness of neck, but there is distinct tenderness on percussion of the left temporosphenoidal region. Knee jerks absent. Superficial reflexes present. Grasps equal. Sensory aphasia more marked. Pronation and supination tests normal. Optic fundus perfectly normal. The rough test shows no limitation of the field of vision. Leucocytosis 11,000.

Operation.—Slight edema of superficial tissues, especially over posterior part of left temporosphenoidal region. Cortex normal. Mastoid contains scattered cells with greenish brown lining membrane. The antrum showed cholesteatoma (streptococci, Gram positive diplococci, Gram negative bacilli—*B. proteus*). Sinus exposed and found healthy. Malleus and incus absent. Attic cavity very large and full of cholesteatoma. Dura of middle fossa exposed and showed granulations over a small area. Dura opened and temporosphenoidal lobe explored in upward and backward direction. Foul smelling abscess evacuated (Gram positive diplococci and *B. proteus*). Finger passed in and found large smooth walled cavity. Piece of brain removed to provide better drainage. Cavity packed with bismuth gauze. Wound left open. April 19: Patient got heroin at 11 p. m. and thereafter had a good night. No vomiting. Temperature 98.4° F., pulse 76. Tongue clean and moist. Wound dressed and showed a lot of discharge. Patient can now name scissors and a book, but again could not name the key, though she said it was "for opening doors." Headache absent. April 20: Temperature 98.2° F., pulse 76. Patient looks well. She can name all articles shown to her this morning. Abscess cavity draining satisfactorily. No headache or vomiting. April 21: Patient sitting up in bed and anxious to get up. Temperature 98° F., pulse 76. No pus from brain abscess today. Bony wound looks healthy. April 25: Patient has continued to do well. Examination of fundus shows edges of discs slightly hazy. April 27: For the last two nights temperature has been up to about 101° F., pulse 120. No headache or vomiting. Tongue clean and moist though patient has been rather constipated. Brain abscess apparently draining well, but there is a considerable amount of hernia cerebri and the discharge has rather an offensive odor. April 30: Temperature normal for the last two days,

but today it was noted that the dressings were soaked with cerebrospinal fluid. May 3: Discharge of cerebrospinal fluid continues. Temperature normal but pulse 116. May 6: Temperature last night 103° F. Frequent vomiting and severe headache. Patient cries out "My head." Retraction of head and stiffness of neck present. Child is frightened and restless and wants to know what is wrong. Abscess opened up with forceps which easily passed in for a considerable distance—probably into the lateral ventricle. Profuse flow of turbid cerebrospinal fluid. May 8: Temperature up to 103° F., pulse 140. Severe headache and marked retraction. Dry furred tongue. Sordes on teeth. Photophobia present. Child restless and excited and complains of great thirst. May 10: Temperature 104° F., pulse 120. Child alternates between delirium and coma. Tendency to Cheyne-Stokes respiration. Marked hernia cerebri with foul odor. May 13: Complete coma. Temperature normal, pulse 112. Twitchings of face have developed. Lumbar puncture evacuated greenish, slightly cloudy fluid under increased pressure. Oscillating movements of eyes noted. May 15: Death.

Postmortem.—Dura tense. Pus along sulci in a patchy fashion over vertex. Large amount of yellowish green fibrinous pus in interpeduncular space and extending down the spinal cord. The left temporosphenoidal lobe contains a large abscess cavity with grayish green sloughy walls.

There is a small antemortem thrombus the size of a split pea in the left sigmoid sinus.

Remarks.—The result in this case was very disappointing, as the patient continued to do well for ten days after operation. There was, however, considerable amount of hernia cerebri, and the discharge remained offensive. Rupture into the lateral ventricle occurred and thereafter signs of meningitis developed, though less rapidly than usual. Death only took place seventeen days after the rupture.

Case 23.—C. O. M. S. (Right) with Recent Exacerbation; Wilde's Incision before Admission. Radical Mastoid Operation; Cholesteatoma with Extradural Abscess in Middle Fossa; Later, Headache, Rigor, Stiffness of Neck and Optic Neuritis; Slow Pulse and Coma. Second Operation: Temporosphenoidal Abscess Opened but Apparently it had already

Ruptured into Lateral Ventricle; Meningitis; Death.—No. 500. W. R——, male, aged twenty-nine, came to the Infirmary April 3, 1918, complaining of discharge from the right ear of twelve years' duration. Discharge came on during an attack of measles. Three weeks before admission patient had pain in the right ear and a swelling formed behind the ear. His own doctor lanced the swelling a few days before admission. On the day before admission he had a shivering attack. There was, however, no headache, vomiting or giddiness. Temperature 98° F., pulse 72.

Examination of the left ear showed a retracted scar in the posterior part of the drumhead. The right meatus contained pus, and there was marked sagging of the posterior superior wall, which occluded the canal. The mastoid region showed an old scar. The incision made by the patient's own doctor was just below this old scar. Functional examination of the cochlea showed middle ear deafness. Weber lateralized to the right (worse ear). With the noise apparatus in the left ear patient could not repeat spoken words even in a loud tone. He stated, however, that he could hear something. Vestibular apparatus: There was no spontaneous nystagmus; no Rombergism; rotation both to right and to left caused after-nystagmus of normal duration. The caloric test was not carried out on account of the narrowing of the meatus. April 4: Radical operation on right ear (J. S. F.). The old incision was opened up and a small hole found in the mastoid cortex. The antrum was full of cholesteatoma. Malleus and incus were absent or were not found. There was a small extradural abscess in the middle fossa, but as there was no fever present on admission the sinus was not exposed. The cavity was not grafted but the walls were smeared with B. I. P. P. The wound was closed at the upper end but drained at the lower end. April 5: Temperature at 8 p. m., 100° F. Patient was restless and got a hypodermic of heroin. April 6: Patient complains of headache. There has been no vomiting and the pupil on the right side is not dilated. Wound dressed and stitches removed. No pus present but the cavity looks rather inactive. Temperature at 8 p. m., 101.6° F., pulse 84. April 7: Patient looks ill, anxious and frightened. There is great headache and stiffness of the neck. Kernig's sign present.

Examination of the eyes shows congestion and swelling of the right disc. Lumbar puncture evacuated only a little blood stained fluid not under increased pressure. Cultures showed no growth. With the noise box in the left ear patient is still able to hear a little. On examination of the wound it was found that the dura of the middle fossa was not bulging. At noon the patient had a "cold feeling." At this time the pulse was 65, but the temperature 103° F. Patient gradually became comatose during the afternoon. He had, however, received 1/12 gr. of heroin at 4 p. m. on account of the restlessness and pain.

April 7, 1918 (continued): Second Operation, 9 p. m.—Sigmoid sinus exposed and found healthy. Large area of middle fossa exposed. The dura was now found to be tense and not pulsating. A crucial incision was made, and foul, watery pus with bits of brain tissue evacuated. A finger was introduced and the walls of the abscess found to be very soft. Cigarette drains were put into the abscess cavity.

April 9: For the last two days patient has been getting worse and has not slept at all, even after heroin. He was restless yesterday, but today is very drowsy. There has been a free flow of cerebrospinal fluid mixed with pus and brain tissue on dressing brain abscess, which seems to show that the abscess had already burst into the lateral ventricle. The temperature, which has hardly been raised for thirty-six hours, rose in the evening to 101.4° F.

April 12: Patient gradually became weaker and died at 6:45 a. m. Just before death the temperature rose to 104° F. and the pulse to 130.

Postmortem.—The base of the brain was covered with foul suppurative exudate, and there was extensive general congestion of the meninges. A large abscess cavity was found in the white matter at the site of the optic radiation on the right side. The abscess had ruptured into the lateral ventricle and spread forward into the anterior horn and also over to the left lateral ventricle. The abscess appeared to be an acute one.

Remarks.—In this case there is room for some doubt as to whether the abscess was already present on admission. The patient had suffered from a shivering attack on the day before coming to hospital, though he had had no headache. There

were no other signs or symptoms leading one to suspect a brain abscess, and operation revealed only a small extradural abscess in the middle fossa. In view of this the operation cavity was not grafted and the wound was drained at the lower end. Patient did not do well after operation and suffered from severe headache. As is well known, the symptoms of temporo-sphenoidal abscess on the right side are very obscure and diagnosis is correspondingly difficult. There was, however, no dilatation of the pupil on the right side. Lumbar puncture did not give the usual result obtained in cases of meningitis, and blood culture was negative. At the second operation the sinus was exposed and found healthy, but a large abscess of the right temporosphenoidal lobe was evacuated. The discharge from the abscess was foul and watery, and it is almost certain that at this time the abscess had already ruptured into the lateral ventricle. Thereafter the history of the case was that of a purulent meningitis.

Case 24.—C. O. M. S. (Bilateral); Recent Exacerbation on Right Side, with Headaches, Vomiting and Rigors; Kernig Present; Lumbar Puncture proved Meningitis. Radical Operation: Sinus Exposed but appeared Normal. Rigors Continued; Jugular Ligatured; Headache and Signs of Meningitis Became more Marked and Patient Died from Coma. Postmortem: Right Temporosphenoidal Abscess present which had Ruptured into Lateral Ventricle.—No. 514. D. H.—, male, aged twenty-three, admitted June 16, 1918. Patient has had discharge from both ears for many years. Two weeks before admission he complained of headache and vomiting and his temperature was 101° F. Two rigors before admission. Patient treated by his doctor for biliousness and sent to the medical side of the Infirmary as a case of biliary colic.

Examination.—Patient obviously ill and slightly delirious. Tongue dry and furred. Head retracted. Kernig's sign present. Marked nystagmus both to right and to left. Patient not quite deaf in right ear with noise box in left. Marked mastoid tenderness on right side but no swelling. Immediate operation: Lumbar puncture evacuated turbid fluid under great tension (films showed Gram positive diplostreptococci, also numerous degenerated white cells). Radical mastoid operation right ear (J. S. F.). Mastoid sclerotic. Antrum con-

tained foul pus under pressure (diplococcus). Whitish area of bone over sinus. Sinus exposed and found normal. Wound left open. June 17: Quiet night but rigor at 5:30 a. m. Tongue dry and furred. Kernig's sign present.

Second Operation.—Ligature of right internal jugular vein after facial had been tied off. June 18: Rigor at 8 a. m. (Blood culture done on admission now reported negative.) Patient restless and rather noisy; complains of intense headache. Heroin given at 8 p. m. Temperature 101° F. June 19: Fairly good night. Temperature 97 to 98 degrees F. To-day there is marked head reaction. Operation cavity looks very inactive. Lumbar puncture evacuated purulent fluid under great tension. Rigor at 3 p. m. Temperature 103° F. (Report on cerebrospinal fluid shows numerous organisms—Gram positive diplococcus; Gram negative bacillus, *B. proteus* or *B. coli* group; slender Gram positive bacillus.) (Second blood culture has also proved negative.) June 20: Rigor at 1 p. m. Temperature 103° F. June 23: Rigors continue. Patient comatose. Death at 1 p. m.

Postmortem.—Marked general leptomeningitis. There was a small hole on the under surface of the right temporosphenoidal lobe which communicated with an abscess about the size of a large walnut. The abscess had thick walls and contained greenish pus and had ruptured into the right lateral ventricle. Both lateral ventricles contained purulent fluid. The right sigmoid sinus contained recent red clot with no sign of suppuration.

Remarks.—The probable sequence of events was as follows: Chronic middle ear suppuration on both sides with a recent exacerbation on the right side. This was followed by temporosphenoidal abscess on the right side accompanied by headache, vomiting and rigors. As meningitis was present on admission it was probable that there was already some leakage from the abscess at this period. It seems likely, however, that gross rupture of the abscess into the lateral ventricle occurred only about three days before death. The vomiting, which was so marked before admission, was not prominent afterwards, and the symptoms were rather those of sinus thrombosis than of meningitis. As already noted in the previous case an abscess of the right temporosphenoidal lobe is very difficult to diag-

nose. One can only suppose that the absorption of pus from the abscess gave rise to the repeated rigors. It may be of interest to note that the patient's uncle died in Klondyke from a brain abscess.

Case 25.—Chronic Suppurative Otitis Media (left); Latent Labyrinth Suppuration and Cerebellar Abscess (left): Radical Mastoid Labyrinth Operation.—Cerebellar Abscess Opened (Sigmoid Sinus Injured). Death. Postmortem: Edema of Brain round Cerebellar Abscess.—No. 200. J. B—, male, aged twenty-seven, was first seen at the Victoria Hospital for pulmonary tuberculosis August 25, 1913. He gave a history of discharge from the left ear of many years' duration. About three weeks ago, after a cold in the head, he complained of pain in the left ear, associated with vomiting and giddiness. The latter was so severe that he could not stand and he was confined to bed until his removal to the Victoria Hospital two days ago. Vomiting has been frequent. The writers are indebted to Dr. Power, resident physician, Victoria Hospital, for the following notes of the case: The patient was examined at a North of England infirmary some days ago. He was then complaining of pain in the lower dorsal region between the scapulæ and also of pain in the legs which had lasted for five days. The case was diagnosed as one of influenza, and the patient was treated at home for ten weeks. About three weeks ago pain began in the left ear and after three days spread to the frontal, temporal and occipital regions. On August 13 the patient vomited immediately after taking food. There had been no previous stomach pain and the vomited food was unchanged. The vomiting continued and also the headache. For the last three weeks the patient has slept badly and has lost much flesh. He has also suffered from constipation. Dr. Power examined the patient August 21, and found a normal knee jerk on the right side, but a greatly diminished one on the left. The optic discs appeared to be blurred. Patient stated that he had had discharge from the left ear for fifteen years following scarlet fever.

Examination by J. S. F. at Victoria Hospital, August 25. Temperature and pulse subnormal. Patient lies on his back in bed. He complains of headache, which at times is so severe as to make him call out. The left meatus contains foul

smelling pus and cholesteatoma, but there is no mastoid tenderness. With the noise apparatus in the right ear patient is quiet deaf. Weber lateralized to the right (good) ear. There is spontaneous horizontal nystagmus both to right and left, but none on looking straight forward. The pointing test shows a deviation to the left at the left wrist and shoulder joints. With the right hand the patient points almost correctly. Cold syringing of the left ear produces no increase in the spontaneous nystagmus to the right. Patient too ill for Romberg test. The grasp by the right hand is much stronger than that of the left, but the patient is a right handed man.

The case was regarded as one of chronic suppurative otitis media in which a recent attack of labyrinthitis had occurred and in which cerebellar abscess was probably present. The patient expressed his willingness to submit to operation and was accordingly removed to the Royal Infirmary.

Operation, August 25.—Radical mastoid operation, left ear. Cortex sclerotic. Antrum large and filled with cholesteatoma. Malleus and incus absent. Sinus exposed and found healthy. Dura of posterior fossa separated from the bone in an inward direction towards the internal meatus. Neumann's labyrinth operation performed, opening up the posterior and lateral canals; vestibule freely opened behind the facial nerve. Promontory removed. Dura of triangular area split up and cerebellar abscess evacuated just behind the position of the mastoid antrum. As the drainage obtained through this opening did not appear to be sufficient a transverse incision was made backwards from the original incision and the cerebellar dura exposed behind the sinus. In doing this the sinus was accidentally opened and the bleeding greatly interfered with further attempts at operation. The idea of a counter opening behind the sinus was therefore abandoned. The cerebellar abscess was lightly packed with strips of bismuth gauze and the operation cavity left open.

The patient died in the evening after operation from interference with respiration. Towards the end the pulse rate rose from 70 to 130, but the temperature continued subnormal.

Postmortem.—Skull cap very thin, convolutions flattened. The small abscess in the left lobe of the cerebellum has been drained, but there is marked edema around it. The brain as

a whole is very edematous—the pons Varolii being markedly affected. There is no apparent meningitis.

Microscopic Examination.—Cholesteatoma is seen on the inner wall of the attic and aditus. The most interesting feature of this case is the presence of thrombosed vessels passing through the fossa subarcuata from the inner wall of the antrum to the posterior fossa. The facial nerve is intact throughout. The cochlea appears healthy. The vestibule has been opened up and contains blood and chips of bone. The internal meatus shows little signs of meningitis. The lateral semicircular canal has been opened up by the operation. In the superior canal the perilymph space contains pus and blood.

Case 26.—C. O. M. S., with Cholesteatoma. Labyrinth apparently Healthy, but Meningitis probably Present on Admission. Radical Mastoid Operation; Extradural Abscess in Middle and Posterior Fossæ; Symptoms of Meningitis Increased and Translabyrinthine Drainage therefore Carried out; Coma; Death.—No. 457. W. G——, male, aged nineteen, was first seen on August 10, 1917, suffering from deafness in and discharge from the left ear since measles in childhood. Patient joined the army in 1914 and had been in four hospitals on account of his ear condition. He was discharged from the army in January, 1916. He has all along refused to have his ear operated upon. One week before admission earache and headache began.

On admission temperature 99° F., rising to 103° F. in the evening; pulse 90 to 100; respirations 26. The left meatus was blocked by a polypus surrounded by pus. There was slight projection of the left auricle. The right meatus contained wax. Patient could only hear raised voice close to the left ear with noise box in good ear, but tuning fork tests showed only middle ear deafness. Marked spontaneous nystagmus to the diseased side and also upwards, but no pointing error and no giddiness; no fistula symptom. Tongue moist, but furred. No vomiting; Kernig's sign absent; knee jerks present; plantar response to Babinski's test. Patient mentally bright and could recognize and name at once objects shown to him.

August 11: Operation.—Lumbar puncture performed first of all. Cerebrospinal fluid under great pressure, but clear.

(Report from Pathology Department. Small number of polymorphs, but no organisms seen. No growth on culture.) Radical operation on left ear: Cortex normal; mastoid sclerotic; emissary vein far forward and apparently thrombosed. Antrum large and full of cholesteatoma and pus; pus in cells between sinus and antrum, also between bone and dura in middle fossa. Ossicles markedly eroded; tympanum full of granulations; lateral canal healthy; cholesteatoma in attic. Vestibular apparatus did not respond to cold lotion on operating table. Dura of middle fossa showed some granulations. Anterior wall of sigmoid sinus also appeared red, rough and thickened, but no obvious perisinus abscess. Operation cavity packed with hypertonic saline gauze; wound left open.

August 12: Temperature 100° F., pulse 60, respirations 20. Nystagmus to left (diseased side still continues, but upward nystagmus absent; no vomiting. Superficial dressings changed. August 13: Patient not so well. Headache and vomiting present. Pulse 68, temperature 99° F. Patient had to have heroin last night. Lumbar puncture performed today under ethyl chlorid general anesthesia; cerebrospinal fluid under great tension and almost purulent (films showed diplococci; no report on culture).

Second operation at 12 noon today. Dura of middle and posterior fossæ further exposed; labyrinth operation with drainage of internal meatus; silver wire inserted; foul, purulent fluid came from internal meatus. Dressings applied. 10:30 p. m.: temperature 100.6° F., pulse 78, respirations 30. Third lumbar puncture: 10 c. c. of antistreptococcal serum injected. August 14: Temperature 100.4° F., pulse 70, respirations 28. Patient has required frequent injections of morphia during the night. Wound dressed. Pus flowing from opening into internal meatus; facial paralysis present; dura covering left temporosphenoidal lobe incised to relieve tension. Patient became unconscious at 5 p. m. Temperature rose to 103° F. at 8 p. m., pulse 104, and patient died at 10:45 p. m. Unfortunately the parents refused permission for a post-mortem.

Remarks.—This case again illustrates the danger of delay in operation on cases of chronic foul smelling middle ear suppuration. From 1914, when the patient joined the army at

the age of sixteen years, up to January, 1916, when he was finally discharged from the army, he was on four occasions in hospital on account of his ear condition, but always refused an operation. It was only after he had suffered from pain and headache for one week that he came into the Royal Infirmary. Examination on admission showed chronic suppuration on the left side, with polypus, but an apparently healthy labyrinth. The patient's general symptoms, however, pointed to meningitis—e. g., headache, spontaneous nystagmus to the diseased side, and a cerebrospinal fluid under tension and containing polymorphs. Operation showed cholesteatoma in the attic and antrum and pachymeningitis in the middle and posterior fossæ. The labyrinth appeared healthy. Unfortunately the radical mastoid operation was not followed by improvement, the symptoms of purulent meningitis rapidly developed and lumbar puncture showed that the cerebrospinal fluid had become purulent. Translabyrinthine drainage evacuated foul smelling pus from the internal meatus. The patient rapidly became comatose and died. As permission for an autopsy was refused it was not possible to determine the route of infection. All along the symptoms did not point to a septic thrombosis of the sigmoid sinus or to brain abscess, but it is impossible to state with certainty that these conditions were not present.

. Case 27.—C. O. M. S. (Bilateral); Recent Injury to Occipital and Mastoid Region on Left Side, Followed by Headache; Vomiting and Giddiness; Radical Mastoid Operation on Left Side; Extradural Perisinus Abscess found; Later, Symptoms of Meningitis or Cerebellar Abscess Developed, Followed by Coma. Second Operation: Left Sigmoid Sinus Found to be Thrombosed and therefore Slit up; Dura Covering Cerebellum opened and Pus Evacuated from Surface; No Abscess of Cerebellum. Death. Postmortem.—No. 403. A. W—, male, aged eighteen, railway porter, was admitted August 6, 1916, with a history of discharge from both ears of at least two years' duration. A week before admission patient got a blow on the left side of his head in the occipital region from a piece of coal and was unconscious for a time afterwards. He did not vomit on recovery but some hemorrhage from the left ear was noted at the time. Since this accident the patient has

complained of headaches and has vomited occasionally. He has also complained of giddiness and states that external objects have appeared to rotate. No history of rigors was obtained.

Examination.—Temperature 99.4° F., pulse 80. Patient holds his head inclined to the left side and there is marked mastoid tenderness on this side. The external meatus on both sides contains pus, and on the left side a polypus is present. The right drumhead shows a perforation in the posterior part through which cholesteatoma protrudes.

Functional Examination.—Cochlear apparatus: Schwabach lengthened. Weber not lateralized. Rinne negative on both sides. Conversation voice heard by the right ear at 15 inches. With the noise apparatus in the right ear the patient can hear the raised voice at 10 inches. Vestibular apparatus: No spontaneous nystagmus; no pointing error; no Rombergism; rotation and caloric tests not carried out on account of the patient's condition.

There is slight spasticity of both legs, especially the right one. The right knee jerk is exaggerated and ankle clonus is present on this side. There is narrowing of the fields of vision in the upper and outer quadrant on both sides.

First operation at 3 p. m. on day of admission. Radical operation on left ear. Cortex normal. Mastoid sclerotic. Cholesteatoma in antrum. Large foul smelling extradural abscess in posterior fossa around the sigmoid sinus. Films from the pus showed many organisms: Gram positive diplococci predominate, but there are also Gram negative diplococci and bacilli. On culture Gram positive and also Gram negative diplococci along with Gram positive and Gram negative bacilli were obtained. The perisinus abscess had no direct connection with the antrum. The radical operation was completed: the malleus and incus were removed and found to be eroded. The tympanum was full of granulations but the prominence of the lateral canal and also the promontory appeared healthy. The wound was lightly packed and left open. Lumbar puncture was performed at the end of the operation and showed cloudy cerebrospinal fluid under great tension. In films many polymorphs were seen along with a few Gram positive and Gram negative diplococci, both intra- and extra-

cellular. No growth was obtained on culture. A blood culture was also taken at the end of the operation but no growth was obtained in this. August 7: Temperature 98° F., pulse 76. Patient appears to be doing well. August 10: Temperature 97° F., pulse 60. Patient has had a restless night and complains of headaches. He attempted to get out of bed during the night and had to get heroin. August 11: Temperature 97° F., pulse 54. The tongue is dry and brown. Patient again had a restless night and frequently broke into song. The head is retracted and optic neuritis is well marked today. There is marked rotatory nystagmus to the left (side of operation). At 5:30 p. m. the breathing developed the Cheyne-Stokes character. Patient almost comatose. Incontinence present. Marked tache cerebrale. Kernig positive. Lumbar puncture evacuated turbid fluid under pressure. Films showed many degenerated cells and a Gram positive diplococcus along with a Gram positive bacillus. No growth was obtained on culture.

Second Operation.—Almost no anesthesia was required but artificial respiration had to be kept up during the earlier part of the operation. An incision was made backward and downward from the center of the retroauricular wound. The dura of the cerebellar fossa was exposed by further removal of bone and slit up. The sigmoid sinus, which was found to be thrombosed, was included in the incision. Two teaspoonfuls of pus were evacuated from the subdural space, but, on incising the cerebellum, pus was not obtained. After the relief of pressure natural respiration restarted. August 12: The patient died at 9 a. m.

Postmortem.—Congestion of meninges and flattening of convolutions. There is a purulent infiltration on the surface of the left lateral lobe of the cerebellum at the junction of the superior and posteroinferior surfaces. This superficial abscess was adherent to the dura, which was covered by a layer of fibrin. The pus in the abscess had a foul odor. The thrombosis of the sigmoid sinus did not extend beyond the mastoid. The pus from the superficial abscess of the cerebellum yielded on culture a Gram positive diplostreptococcus and a Gram negative motile bacillus. The cultures had a foul odor.

It is unfortunate that the postmortem report does not state whether there was a fracture of the occipital bone just below

the level of the lateral sinus in the position of the superficial purulent infiltration of the cerebellum.

Microscopic Examination.—The cochlea is healthy as are also the membranous structures in the vestibule. There is no meningitis in the internal meatus. There is hemorrhage in the perilymph space of the posterior canal just at the ampullary end. This hemorrhage appears to have come from the jugular bulb and to have extended from the ampullary end of the posterior canal into the perilymph space of the vestibule, and also along the smooth end of the posterior canal into the crus commune. It is possible that the condition of the labyrinth was due to injury at operation on the large extradural abscess in the posterior fossa around the sigmoid sinus. There is a recent clot in the jugular bulb.

Remarks.—In the operator's opinion this case was not one of cerebellar abscess, but rather of circumscribed purulent meningitis in the posterior fossa following injury in the presence of middle ear suppuration with cholesteatoma. Death was due to the circumscribed meningitis becoming general.

Case 28.—C. O. M. S. (Right); Complicated by Recent Injury and followed by Giddiness and Vomiting. Temporo-sphenoidal Lobe Trephined by General Surgeon, but no Abscess; later, Rigors; Right Labyrinth Functionless and Facial Paralysis Present. Radical Mastoid Operation (J. S. F.). Fistula in Lateral Canal; Extradural Abscess in Posterior Fossa. Neumann's Labyrinth Operation; Sinus Opened, but no Obvious Thrombosis; later, Double Optic Neuritis and Rigors, with Signs of Cerebellar Abscess. Third Operation: Cerebellum Explored with Negative Result; Right Internal Jugular Ligatured; Slow Recovery; Three Months later Cerebellar Hernia Ruptured. Fourth Operation: Cerebellum Investigated with Negative Result; Death from Meningitis.—No. 192. T. M——, male, aged thirty, first seen by J. S. F. in a general surgical ward April 17, 1913, with a history of discharge from the right ear for fifteen years. Seven weeks before admission patient, who is a miner, met with a head injury in the pit. The next day the discharge stopped and frontal headache began. Patient also had pain in the right ear and right occipital region. He continued to work for about seventeen days, but then sickness and vomiting set in

and the headache became worse. Three days later he became giddy and tended to fall forward. He was admitted to one of the general surgical wards (Royal Infirmary, Edinburgh), March 28, and four days later the right temporosphenoidal lobe was trephined, but nothing was found (first operation). The headache improved after this until four days ago (April 13), when patient began to complain of pain in the right ear with giddiness and nausea. Last night he had a shivering attack and this morning he vomited. For the last four days his temperature has been elevated.

Examination.—Right external meatus contains foul smelling blood stained discharge. After syringing there is bulging of the posterior meatal wall, beyond which granulations can be seen. Mastoid tenderness present. Slight facial paresis on right side. Temperature 97.8° F., pulse 68.

Functional Examination.—Cochlear apparatus: Weber lateralized to left (good) ear. Rinne absolutely negative on right side. Tuning forks not heard by air conduction by right ear. With noise apparatus in left ear patient is quite deaf. Vestibular apparatus: Slight nystagmus to left and also to right, normal (?) Rombergism towards the right and backwards. No fistula symptom. Cold caloric test negative on right side after three minutes. Rotation not tested.

April 20: Patient admitted to Ear and Throat Department today. Temperature 101.4° F. at 8 p.m. Pulse 100. Patient lies on his back and is mentally bright. He sleeps well and answers questions promptly. Memory good. No restlessness. No headache. Pupils equal, react to light and accommodation. No signs of meningitis. Grasp equal on both sides. Pronation and supination test good. Smell and taste normal. No pain on percussion of skull or spine. Slight emaciation. No jaundice or enlargement of spleen.

Second Operation (J. S. F.).—Right mastoid cortex presented deep hollow filled with fibrous tissue. Antrum small and deep, contained mucoid pus. Malleus and incus not found. Lateral canal markedly eroded and facial nerve hanging free for a short distance. Oval window found empty. Neumann's labyrinth operation performed. In exposing sinus extradural abscess opened. Sinus wall showed granulations. Sinus traced

back till healthy wall reached and slit up; no obvious thrombosis. Jugular vein not ligatured.

April 22: Temperature last night 99.4° F., pulse 76. Today, temperature and pulse normal. Patient lies on left side. Slight nystagmus to left. The facial paralysis is now complete. April 25: Temperature subnormal. Nystagmus to left continues. Vomiting has passed off. Wound dressed today. No bleeding from sinus. Good reaction in wound. April 28: Vomiting continues; frontal headache; nystagmus to left and slight giddiness. Coordination good. Emaciation more marked. April 30: Temperature about 101° F. for last three days, pulse 68. Rigor this afternoon. Temperature 103° F. Dr. Sym reports double optic neuritis. Tenderness and swelling along right sternomastoid. Tongue dry and brown. Patient refuses consent to further operation. Frontal headache continues. May 3: Headache and vomiting continue. Rigors on May 1 and 2. May 7: Patient rather better, but evening temperature still elevated. Rigor on May 5. Today patient examined by Dr. Edwin Bramwell, who found some incoordination of right upper extremity. Nystagmus to left. Grasp equal on both sides, though patient is right handed. Slight tremor of the right hand. Dr. Bramwell considered that these signs were suggestive of cerebellar trouble.

Third Operation (J. S. F.).—Free bleeding obtained from torcular end of sigmoid sinus. No bleeding from bulb end. Tip of mastoid removed and sinus slit up almost to the bulb, but only slight bleeding obtained. Right internal jugular vein ligatured, the portion above the common facial being thrombosed and thickened. Crucial incision in cerebellar dura through the posterior wall of the sinus. Some turbid fluid with a slightly foul odor escaped. (*Staphylococcus aureus* and a diphtheroid bacillus on culture.) Right lobe of cerebellum explored with negative result. May 8: Temperature 101.8° F. last night after operation, pulse 124. Patient had a good night. No rigor. No vomiting today. May 10: Temperature last night 102.4° F. No headache or vomiting. Wound dressed. Free bleeding from torcular end of sinus and a little from the bulb end. Slight hernia cerebelli. May 15: Temperature rises each evening to about 102° F. Attempt to syringe through bulb not successful. Patient com-

plains of frontal headache. Cerebellar hernia larger. Lumbar puncture shows clear fluid not under tension. May 20: Headache persists and is only relieved by heroin. Patient vomited thrice last night. During last four days temperature has fallen to normal. Pulse 94. Hernia cerebelli still increasing. May 25: Evening temperature has risen to about 100° F. during the last five days, but vomiting and headache have been absent. Appetite good. Tongue clean and moist. Patient is getting brandy and says that it is doing him good. May 31: After being normal for four days temperature rose to 102° F. yesterday. Patient, however, feels well. June 12: Temperature between 97 and 98 degrees F. since last report. Patient has been up for a week. The hernia cerebelli is smaller and the neck wound is healed. The wound behind the right ear is doing well. July 23: Both wounds are now quite healed. Patient sent to Convalescent House. August 3: Patient sent back from Convalescent, as he had a bad night after a supper of salmon, cheese and hot jam! Patient vomited and had a slight rise of temperature. On admission today temperature 98° F., pulse 60. There is slight bulging of the wound behind the right ear. August 8: Doing well. No headache or vomiting. The cerebellar wound does not bulge. August 15: Patient discharged. August 29: Patient reports, complaining of dizziness but no vomiting. His appetite is good and he sleeps well. On standing with eyes shut he tends to fall to the diseased side. There is no spontaneous nystagmus, but there is a pointing error to the right with the right hand, and there is considerable bulging over the cerebellar scar. No signs of meningitis. Field of vision normal and fundus normal on both sides.

October 5: Patient again reports. There is now a hole in the thin skin over the cerebellar hernia and from this clear cerebrospinal fluid drips. Patient states that this condition has been present for five days. Patient is getting fat and has been contemplating returning to his work in the mine. He was advised to come in for observation, but refused to do so. October 8: Patient admitted. Temperature 99.6° F., pulse 92. Violent fit of shivering this afternoon. Severe pain over right side of head. Temperature 102.8° F., pulse 100. Great flow of fluid from the cranial wound. Slight nystagmus to

diseased side. Fundus normal on both sides. No stiffness of neck. No Kernig. Patient very excited.

Fourth Operation.—Lumbar puncture showed clear fluid under slightly increased tension. No increase in cells and no organisms. Right lobe of cerebellum investigated with negative result. October 10: Temperature remains about 102° F. Patient is restless and vomits frequently. He is getting morphia. October 12: Death.

Postmortem.—Convulsions flattened. Vessels congested. Thick, creamy exudate at the base and extending down cord. Right lobe of cerebellum somewhat disintegrated, but no abscess.

Microscopic Examination.—The cavity formed by the radical mastoid operation is lined by squamous epithelium. The facial nerve is incorporated in the fibrous tissue on the inner wall of the tympanum. The hollow spaces of the cochlea contain pus and granulation tissue, with some new bone formation. The saccule and utricle are not to be seen and the vestibule is filled with granulation and fibrous tissue. The meningitis in the internal meatus has passed into the stage of granulation tissue formation in which the nerves are embedded. The bone surrounding the labyrinth is very vascular (paralabyrinthitis). The jugular bulb is thrombosed; the thrombus has become organized into fibrous tissue.

Remarks.—Although the symptoms and signs in this case pointed to the presence of a cerebellar abscess, this condition was not found. The patient apparently had localized leptomeningitis in the posterior fossa in addition to extradural abscess and probably sinus thrombosis. After the third operation he made a slow recovery. The septic condition of the posterior cranial fossa on the right side had, however, not been completely eliminated, and the patient returned with leakage from the cerebellar hernia. He was urged to stay in hospital, but refused to do so. Death was due to the spread of an apparently hitherto localized meningitis.

Case 29.—Chronic Middle Ear Suppuration (Right). Radical Mastoid Operation: Extradural Abscess in Middle Fossa; Circumscribed (?) Labyrinthitis; Serous Meningitis with Organisms in Cerebrospinal Fluid; Thrombosis of Superior Petrosal and Cavernous Sinus; Bacteremia; Sigmoid Sinus

Explored; Temporosphenoidal Lobe Investigated; Death. Postmortem: Meningitis, Abscess in Lung and Empyema.—No. 322. J. W——, male, aged ten, admitted August 14, 1915. The patient has had discharge from the right ear for years. A week ago the discharge stopped, and the patient complained of earache and headache and held his head tilted to the right side. For two days he has suffered from shivering and vomiting.

Examination.—Temperature 104.3° F., pulse 160, respirations 44. Patient is rather drowsy. The tongue is dry and furred. Left drumhead indrawn and opaque. Right external meatus full of fetid pus. Schwabach lengthened. Weber to right (worse) ear. Rinne negative right side. Patient can hear with his right ear; noise apparatus in left ear. No spontaneous nystagmus. Vestibular tests not carried out, as patient is too ill.

First operation a few hours after admission. Right mastoid abscess sclerotic. Foul pus under pressure in antrum. Large extradural abscess in middle fossa with granulations on dura. (Films of the pus showed Gram positive and also Gram negative diplococci. In addition there were Gram positive and also Gram negative bacilla.) Sinus exposed with the gouge and appeared healthy. Radical operation completed. Malleus and incus absent. Bony wall of external canal eroded. No reaction to cold lotion under the anesthetic. Labyrinth operation not performed in view of retention of cochlear function. Lumbar puncture at the end of the operation evacuated fluid which was almost clear but under slightly increased tension. (Cultures from the fluid yielded Gram negative diplococcus and a Gram negative bacillus.)

Progress.—At 8 p. m. on the day of operation temperature 102.6° F., pulse 120, respirations 18. Patient lies with legs drawn up. No restlessness or irritability but Kernig's sign present on both sides, and the boy complains of pain if the head is moved or if pressure is made on the cervical spine. The left eye is prominent and pressure on the eyeball causes pain. The left pupil is larger than the right. August 15: At 8 a. m. temperature 102.8° F., pulse 116, respirations 26. Margins of right optic disc are indistinct. There is divergence of the right eye and also slight horizontal and rotatory nystagmus

to the left. August 16: Temperature 101.4° F., pulse 128, respirations 60. The patient is more drowsy. The spleen is not enlarged, but there is dullness at the left base. A blood culture was taken, and the report (received two days later) stated that films showed diplo- and streptococci and bacilli. No growth was obtained.

Second Operation.—The right temporosphenoidal lobe explored on account of condition found at first operation. Negative result. The sigmoid sinus was split up but was found to contain only fluid blood. August 17: At 8 a. m. temperature 101.4° F., pulse 120, respirations 44. Patient in statu quo. At 8 p. m. temperature 103° F. August 18: Temperature 102° F. at 8 a. m., pulse 160, respirations 60. There is marked edema of the eyelids on the right side with ptosis and dilatation of the right pupil. The boy cries out at times and then relapses into a comatose condition. Death at 8 p. m.

Postmortem.—Septic thrombosis of superior petrosal and cavernous sinus on the right side. Early stage of same condition on left side. Leptomeningitis limited to base of brain. No abscess of brain. Examination of the chest showed multiple abscesses in the lung with double empyema. Toxic changes were observed in the heart, kidneys, liver and spleen. Early pericarditis was noticed.

Remarks.—The operator believes that before the admission of the patient to hospital, meningitis and septicemia were already present in addition to extradural abscess and circumscribed labyrinthitis, or, in other words, that the case was hopeless. Symptoms of cavernous sinus thrombosis were already present before the second operation, during which the portion of the sigmoid sinus below the upper knee was found to contain fluid blood. Septic thrombosis of the superior petrosal and cavernous sinuses may have been due to infection via the veins from the petrous bone. Unfortunately the condition of the jugular bulb does not appear to have been investigated at the postmortem. In view of the condition of the lungs, pleural cavities and pericardium, it would appear probable that there was septic thrombosis of this region.