trical treatment in cases of nerve deafness for Mr. Cumberbatch, Dr. Dundas Grant, and others with results which, as might be expected, had been conflicting. The various causes of nerve deafness accounted for this. Of the power of controlling the state of nutrition in sensory end organs by electricity not very much was yet known. The nerve trunks, on the other hand, appeared to respond well to electrical treatment, and neuritis in ordinary mixed nerve was certainly improved by electricity. The favourable cases which occurred from time to time in electrical treatment of disease of the optic and auditory nerve made it probable that a similar useful effect could be produced in the nerves of special senses. He had had a few successful cases. The deeply-seated position of the auditory nerve made it difficult to reach by electrical currents, for the current might already be felt very strongly at the surface, and yet be so diffused before reaching the nerve as to be practically ineffective there. The battery current should be used, and not the induction coil; a bifurcated electrode resembling a binaural stethoscope should be employed; and perhaps it was as well to treat both ears at once, even if one were much more affected than the other. By doing that the patient was made less giddy, and bore the treatment better. The cathode should be applied to the ears. By using large pads of wet cotton-wool, 10 or 15 milliamperes could be borne, and the auditory nerve be appreciably influenced. The current should be half the strength when interruptions or reversals of current were to be employed. These were, in his opinion, useful. With a more perfect classification of the various kinds of nerve deafness it would probably be possible to sort out from the mass cases favourable and cases unfavourable for electrical treatment. Certainly, in electricity there was a good means of profoundly influencing the state of nutrition of a part.

The PRESIDENT (Sir William Dalby) laid considerable stress on the fact that this occasion gave the opportunity of an expression of opinion which was really of a most weighty and important character. Two points stood out in unusual prominence, namely, that the injection of pilocarpin in the opinion of those present was condemned as useless and unjustifiable; and secondly that the result of the treatment of nerve deafness by electricity in the present condition of our knowledge was most discouraging.

Dr. MACNAUGHTON JONES, in reply, said that he first employed pilocarpin for deafness in 1878 in a case of Ménière's labyrinthine vertigo following syphilis. It had done good in that particular instance. He soon found that its clinical benefits in nerve deafness were very limited. He considered its use altogether unjustifiable in a large proportion of the cases in which it had been used. In recent intralabyrinthine effusions, in cases of hypertension of the membranous labyrinth, with increase of either endolymph or perilymph, in recent syphilitic cases, in recent apoplecticiform seizures, and in leukæmic cases, it was of service. We might take the effect of pilocarpin in glaucomatous and other states of the eye as an indication of what we might expect from it in nerve deafness. With regard to galvanism, he would rather attach importance to its proper application as a diagnostic test of nerve involvement than as a means of treatment. He would insist on the fact that many cases of so-called "nerve deafness" were functional. This accounted for the surprising recovery in certain instances. On the other hand a large proportion of these patients had gross middle-ear changes, and were also subject to tubal complications, the treatment of which was followed by considerable improvement. He thought that a large class of mental sufferers from nerve deafness were most benefited by simple hygienic treatment, specially adapted to the particular source of the mental disturbance. He believed in the treatment of early syphilitic cases by timely specific remedies, with pilocarpin, and subsequently iodide of potassium, or other iodides. With regard to what Dr. Warden had said in reference to India and quinine, he would point to intermittent fever and malaria as most potent causes of either primary or secondary nerve deafness, and the doses of quinine, from the known effects of the drug on the circulation of the labyrinth, was a matter for careful consideration in its administration.

THE number of workers now engaged in original research at the Conjoint Laboratories of the Royal Colleges is fifteen.

TUBERCULOUS DISEASE OF THE MUCOUS MEMBRANE OF THE MIDDLE EAR AND ITS ADNEXA; AN EXPERIMENTAL INVESTIGATION.¹

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TUBERCULOUS disease of the mucous membrane of the middle ear and its adnexa may present itself either as a primary or as a secondary affection. The paths along which tubercle bacilli may travel to reach the middle ear are: (1) along the Eustachian tube, (2) along the blood vessels and lymphatic channels of the tympanic mucous membrane, (3) through a previously-existing perforation in the membrana tympani.

The Eustachian tube probably acts frequently as the channel along which bacilli are conveyed. It may act in a mechanical manner merely as the path along which they pass, or its mucous membrane being itself the site of tuberculous infiltration, may affect the middle ear secondarily as the result of the extension of the morbid process. Tuberculous affections of the middle ear are probably most frequently secondary affections, secondary, for example, to tuberculous disease of some internal organ, for example, of the lungs or larynx.

In such cases invasion of the tympanic mucosa may take place either as an acute or as a chronic process. In the former rapid cellular infiltration, followed by equally rapid necrosis and caseous disintegration of the mucosa occurs while tubercle bacilli may be found in the discharges from the middle ear in considerable numbers.

In the more chronic form miliary tubercles, which may at times be seen with the naked eye, are deposited within the substance of the mucous membrane. These deposits at an early stage of their existence become caseous and form superficial ulcers. Fresh inoculation takes place in the deeper layers, with the result that it becomes gradually thickened, and may, by a process of fibrous tissue formation, bring the morbid process to an end. More usually, however, extension to the bone takes place, producing a rapid cario-necrotic condition with subsequent opening up of the cavity of the internal ear, extension to the mastoid process or to intracranial structures.

It must not be assumed, however, that every case of suppurative middle-ear disease occurring in a patient already the victim of tuberculous disease elsewhere is necessarily therefore of a tuberculous nature; nor, on the other hand, must it be taken for granted that because tubercle bacilli are not found in the discharges from the middle ear in any given case that therefore the affection is non-tuberculous in nature. Most observers have found it extremely difficult to detect bacilli in pus coming from the cavity of the middle ear, and my own observations fully bear this out. Nathan,² in an examination of 40 cases of purulent middle-ear disease, found tubercle bacilli 12 times. In but 3 of these cases were there no signs of pulmonary phthisis, but in these 3 carious processes were present. According to Habermann³, in certain cases of undoubted tuberculous disease of the middle ear no bacilli were found. Thus, in an examination of the ears of 21 patients suffering from tuberculous lesions of internal organs he could only distinguish the tuberculous nature of the ear affection in 5 cases. In these 5 the mucous membrane of the middle ear was swollen, and studded with occasional groups of giant cells containing bacilli. That a primary tuberculous affection of the middle ear may occur is admitted, although it is usually looked upon as of comparatively infrequent occurrence. It is extremely important, however, both from a scientific and from a clinical point of view, to be able to state definitely whether any given case is or is not of a tuberculous nature. Clinically the co-existence of certain symptoms goes far to prove that certain cases are tuberculous in origin. For example, the sudden onset of a purulent discharge, unaccompanied by any of the usual symptoms of a sthenic inflammation, and the occurrence of a perforation covered by a creamy secretion in the centre

¹ Read in the Section of Otology at the Annual Meeting of the British Medical Association, held in London, July-August, 1895.

² *Deutsch. Archiv für klin. Med.*, 1884.

³ *Zeitschrift für Ohrenheilk.*, Bd. vi.

of a pale, œdematous, and uninfamed membrana tympani should always excite suspicion. In addition, the general appearance of the patient, the family history, and the possible presence of other tuberculous lesions may help in establishing an opinion as to the real nature of the inflammatory process. Scientific accuracy is, however, still wanting, although even the surgeon may have a strong suspicion that the case is really one of tuberculous disease.

The great practical difficulties encountered in finding bacilli, either in the discharges from the middle ear or in the tufts of granulation tissue so frequently present in such cases, probably accounts for the few published records of well-authenticated cases. The quest for the bacillus of tuberculosis has proved frequently so tedious and so discouraging that I have in preference selected the method of subcutaneous inoculation as practised by Villemin and Delépine with a view to ascertain, if possible, the real nature of a certain class of case frequently met with in both hospital and private practice. If, with the proper precautions to be presently detailed, artificial tuberculosis can be set up in animals, the inference which one may fairly draw is that the material used for inoculation was itself of a tuberculous nature. The various observations to be presently described have been carried out in the Pathological Laboratory of the Owens College, and I desire to take this opportunity of thanking Professor Delépine for many valuable suggestions and for his kindly assistance.

As the result of a large number of inoculation experiments Professor Delépine⁴ has come to the following important conclusions:

1. That the inoculation method is a method of diagnosis capable of giving results free from any ambiguity.
2. That the negative results obtained from it are nearly as valuable as the positive results.
3. That the positive results give more definite information than the discovery of the bacillus tuberculosis.
4. That definite results should easily be obtained within two or three weeks.

He has also shown that if proper precautions be taken the accidental production of tuberculosis can be definitely excluded. For this purpose his first set of experiments consisted in the subcutaneous and intraperitoneal inoculation of sterilised products (including paper), the animals being kept in cages identical with those used for other experiments and disinfected in the same way. In no case was tuberculosis produced, even after keeping the animals for several months under observation.

Secondly, subcutaneous, submucous, intraperitoneal, and intraocular injections were made of non-tuberculous material, including (1) inflamed tissue from the floor of an ulcer and also portions of an enlarged lymphatic gland; (2) pus; (3) degenerated adrenals; (4) sputum; (5) cultivations of other bacteria. Nothing resembling tuberculosis was obtained in any of these experiments. The material used for inoculation in the following cases has been obtained from scrapings of bone taken from the interior of the mastoid process of patients who from the presence of certain symptoms were probably suffering from tuberculous disease of the middle ear and its adnexa. The investigations have also been carried on in cases which clinically at any rate might fairly be regarded as instances of primary middle ear tuberculosis. For the most part, they have occurred in infants and young children. In every case the most careful examination has failed to detect any evidence of tuberculous disease in the chest or abdomen.

Schwartz⁵ declares that primary tuberculosis of the middle ear or of the mastoid process is an eminently rare affection, in the diagnosis of which we cannot be too reserved or distrustful. Zaufal⁶ has described two cases of primary tuberculous disease of the ear. In the one a localised mass of tubercle was found in the pars petrosa of the temporal bone, in the second the internal auditory meatus was blocked by a mass of tuberculous tissue. Knapp⁷ has also described a case of primary tuberculosis of the mastoid process occurring in a patient aged 5 years, where both tympanic membranes

and both middle ears were perfectly normal as far as physical examination could discover. In this case, however, the diagnosis was made upon purely clinical grounds.

Few published records of undoubted primary tuberculous lesions of the ear are found in literature, but may not this be due to the omission either of special bacteriological investigation or to the performance of inoculation experiments?

In the following experiments guinea-pigs were used for the purpose of inoculation. The left hind limb was carefully shaved, washed with sublimate lotion, and then gently singed with a flat platinum knife at a white heat. A small pocket was then made under the skin at about the level of the knee-joint with a freshly sterilised knife, and into this pocket a scraping of bone from an affected mastoid was introduced with freshly sterilised forceps. A piece of plaster was then placed over the wound, and the guinea-pig put back into its cage and closely watched for from three to six weeks, during which time the animal was well looked after and well fed. The greatest possible care was also taken to perform the mastoid operation with the most rigid aseptic precautions. Freshly sterilised instruments were always employed. The skin around the ear having been well washed, the diseased mastoid was opened in the ordinary way, and a scraping of bone taken from an area where disease was seen to be advancing was removed, and immediately placed in a sterilised tube. The inoculation of the guinea-pig was performed upon the same day as the operation, or at the latest upon the following day, the sterilised tube being meanwhile kept in a cool place. Throughout the investigation every precaution was taken to avoid any accidental contamination of instruments or of material.

The results obtained are somewhat striking, and prove, I think, that primary tuberculous disease of the middle ear is a much more frequent condition than is usually supposed to be the case. Thus, of the 10 cases to be described, 8 (or 80 per cent.) were of a tuberculous nature; 2 (or 20 per cent.) were non-tuberculous.

The clinical picture presented by most of the cases consisted in the sudden and apparently painless onset of discharge from one or both ears, the early involvement of the glands around the auricle and the frequent presence of facial paralysis.

The amount of discharge was usually fairly profuse, was at times sanious, and at an early stage became markedly foetid. In addition flabby granulation tissue blocking the external auditory meatus, and evidently connected with a rapidly disintegrating bone, was found in 9 out of the 10 cases. The rapid and marked implication of the glandular structures around the ear suggested something more than a simple inflammatory process, while the early involvement of the facial nerve, in my experience at any rate, a by no means usual symptom in recent cases of simple inflammatory origin, appears to me to be a symptom worthy of consideration.

Cases presenting such symptoms, although they may be looked upon as being probably of a tuberculous nature, require for confirmation either the discovery of the bacillus tuberculosis in the aural discharges, or the establishment of a general tuberculosis in animals inoculated with material from the affected ear.

CASES.

1.—J. C., male, aged 10 months, was brought to hospital on account of the presence of an offensive discharge from both ears. According to the mother's statement the discharge was first noticed when the child was 4 weeks old, and apparently both ears had become simultaneously attacked. When first seen the following notes were made: Right and left meati full of foul-smelling pus. After syringing examination showed both meati blocked with pale and unhealthy-looking granulations. Palpation with the probe showed that the posterior meatal wall was bare and eroded, and exposed bone was felt in the depths of the ear. The glands immediately beneath the auricle were enlarged and tender. No external appearances of mastoid disease were apparent, no œdema, no tenderness. The child was pale and ill-nourished, perspired a good deal at night about the head, and was usually very restless.

Family History.—Father and mother alive and healthy. Family consists of three children; the two eldest have always enjoyed good health; the third child, the patient, has never been strong, both ears having commenced discharging shortly after birth.

Operation was advised. A few days afterwards the child was put under chloroform, and the usual mastoid incision was made. After retracting the two sides of the incision, and so exposing the mastoid cortex, a fistula the size of a threepenny-bit was immediately brought into view. With a small spoon a considerable amount of cheesy debris was scooped out, and a large cavity in the mastoid process thus exposed. This was carefully curetted until all diseased tissue was considered to have been cleared

⁴ BRITISH MEDICAL JOURNAL, September 23rd, 1893.

⁵ *Ueber die Ohrenheilk.*, 1893, Bd. ii, p. 797.

⁶ *Archiv für Ohrenheilk.*, ii, 174.

⁷ *Archiv. of Otolaryngology*, vol. xxiii, p. 64.

out. The bridge of bone separating this cavity from the external meatus was now broken down, and so the cavity in the mastoid process, the cavity of the middle ear, and the external meatus were thrown into one. The parts were then carefully dried, dusted freely with iodoform powder, and packed with iodoform gauze. The usual dressings were then applied.

The macroscopic appearances of the part were such as to make one suspect the presence of a tuberculous process. The left ear was accordingly during the following fortnight simply syringed with plain warm water, and a fortnight subsequently the child was again put under chloroform and the left mastoid process opened. All the instruments used during this second operation were most carefully sterilised, and were in fact removed straight from the steriliser for the immediate necessities of the operation. When the edges of the incision were retracted a precisely similar condition of affairs was seen as had been found to exist upon the right side. After the removal of some of the more superficial *débris* small scrapings were taken from the bone at three different levels. These scrapings were immediately placed in sterilised test tubes. The same afternoon three guinea-pigs were inoculated with this material, the inoculation being made in each case into the subcutaneous tissues of the left hind limb at above the level of the knee-joint. A fortnight afterwards each of the three guinea-pigs was found to have distinctly enlarged superficial inguinal glands.

Dissection of guinea-pig to show enlargement of the glands following subcutaneous inoculation with tuberculous material taken from the mastoid process of a child. X indicates the site of inoculation.

Towards the end of the fourth week the ganglia of both fore limbs and also the cervical ganglia were affected. Five weeks after the inoculation had taken place the guinea-pigs were killed and were at once dissected. The accompanying figure shows the glands as they are found five weeks after the subcutaneous inoculation of tuberculous material. Besides enlargement of the inguinal glands, superficial and deep, the popliteal, the sublumbar, the retrohepatic, and the peri-bronchial glands upon the same side as the lesion, were found markedly enlarged. In addition the spleen was found freely studded with tubercles, and a few were scattered here and there in the liver and lungs. (See figure.) Scrapings were taken from the interior of the sublumbar gland and stained for tubercle bacilli according to Neilson's method, with the result that considerable numbers were found in several cover glass preparations. Both mastoid wounds were carefully treated. Iodoform was freely used as the dusting powder, and iodoform gauze as the material for packing. Gradually the cavities began to granulate, until finally complete filling up took place. When last seen, seven months after the operation, a firm, although considerably depressed, mastoid cicatrix marked the site of the original wound upon each side. No pus was found either in the external meatus or in the middle ear. The membrana tympani upon both sides showed a large dry perforation, but no trace of the ossicle could be seen.

11.—J. G., aged 3 months, was brought to hospital with the statement that the right ear had been discharging for a few weeks. The right

external meatus was found full of foetid pus. After syringing, flabby granulations were seen to be present, and examination with the probe detected an extensive area of parietal caries. A large mass of glands was found immediately below the auricle, and careful palpation over the mastoid process made it probable that an area of softened bone existed.

Family History.—Father and mother active and healthy. Father had one brother, who died of phthisis. The family consisted of two children. The elder of the two died when 6½ months old from convulsions.

Operation was advised, and was performed one week later. In the interval the ear was kept as clean as possible by frequent syringing with plain warm water. The usual mastoid incision was made, and the edges having been retracted a small fistula was found upon the surface of the mastoid cortex. This was gradually enlarged by means of a Volkmann's spoon, and a considerable quantity of foul-smelling cheesy *débris* removed. A scraping from the edge of the bone where the disease appeared to be advancing was taken and immediately transferred to a sterilised test tube. The same afternoon a guinea-pig was inoculated with this scraping in the manner previously detailed. Five weeks later the guinea-pig was killed and dissected. The same glands were found enlarged as in the previous case. A scraping was then taken from the deep inguinal gland, stained for tubercle bacilli, and placed under the microscope. Several bacilli were found. The patient was treated just as in the last case, and for a time good progress was made. A large abscess, however, formed round the left hip-joint. This was accompanied by great prostration and considerable rise of temperature. The child was removed to another hospital, where this abscess cavity was laid open. Symptoms indicative of tuberculous meningitis suddenly set in, and the child died partly as the result of marasmus and partly from the effects of frequently repeated convulsive seizures. Unfortunately no *post-mortem* examination could be obtained.

12.—R. B., female, aged 8 months, was seen in consultation on account of a constant purulent and foetid discharge from the left ear. The child had become very restless during the preceding three weeks, and was also emaciating somewhat rapidly. Examination showed that the left external meatus was full of foul-smelling pus. After this had been removed a mass of granulation tissue was detected deep down in the meatus. Palpation with a probe revealed the presence of extensive caries. The glands below the ear were enlarged and tender. No external evidence of mastoid disease was apparent.

Family History.—Father and mother alive and healthy. Of the two sisters, one had suffered from enlarged tonsils, naso-pharyngeal adenoids, and enlarged cervical glands; the other was apparently quite healthy.

Operation was advised and undertaken a week later. The mastoid process was opened in the usual way, and the cavity thus exposed, the cavity of the middle ear, and the external auditory meatus were thrown into one. A considerable quantity of cheesy *débris*, softened bone, and flabby granulation tissue was removed. The parts were well dried, dusted with iodoform powder, and dressed in the usual manner. A scraping from the bone was placed in a sterilised tube, and a guinea-pig was inoculated. General tuberculosis was set up, and after six weeks the animal was killed. Scrapings from several of the glands were taken and examined for bacilli, with the result that considerable numbers were found.

13.—E. B., female, aged 9 months, was seen in consultation with Dr. Byrne of Chorlton-cum-Hardy, on account of a profuse foetid discharge from the left ear. The history given was that the child's ear had begun to discharge when she was 4 months old, and that there had been a continuous discharge ever since. Shortly after the ear trouble had commenced the glands below the ear began to enlarge, and when the child was first seen a large mass of hard indurated glandular tissue was found in this situation. During the preceding three weeks well-marked left-sided facial paralysis had been observed. The child was very restless at night, and perspired freely about the head. On two or three occasions the child had had convulsive seizures. Upon examination the left auditory meatus was found full of granulation tissue, and palpation with the probe revealed the presence of an extensive area of exposed bone. The tissues over the mastoid process were infiltrated, and offered a certain doughy resistance to palpation.

Family History.—Father and mother alive and healthy. Mother has had only the one child. The father's family history was good. The mother's parents are alive and healthy. The family consisted of five sons and five daughters. One son died at the age of 9 years of "decline," and one daughter died at the age of 22 of "tuberculous meningitis." The other sons and daughters are alive and healthy.

Immediate operation was advised. Two days afterwards the child was put under chloroform and the usual mastoid incision made. After the flaps had been retracted, the mastoid process was opened in the usual way, and cheesy *débris* and unhealthy-looking granulation tissue freely removed. The operation was conducted just as in the previously mentioned cases, and a scraping of bone was removed for inoculation purposes.

For the first few days good progress was made. Shortly afterwards, however, the child was again seized with severe convulsive seizures. The temperature rose, and a frequent meningeal cry was heard. At the *post-mortem* examination the lungs, liver, kidneys, and spleen were found to be perfectly normal. The glands around the ear were in a state of early cheesy degeneration. Description of middle ear: The membrana tympani was entirely gone. The stapes was the only ossicle left. The mucous membrane was pale and oedematous, and upon examination with a lens several tubercles were seen.

Upon opening the cranial cavity a small quantity of fluid escaped. The vessels of the pia-arachnoid about the base of the brain were found congested, and several groups of small tubercles were found in the meshes of the pia-arachnoid upon the same side as the diseased ear.

The guinea-pig which had been inoculated with a scraping of bone from this case became rapidly tuberculous, and when killed six weeks afterwards showed involvement of the various glands as seen in the accompanying diagram. Scrapings taken from these glands and stained for tubercle bacilli revealed their presence, and microscopic sections of pieces of liver and spleen showed well-marked giant cells. In addition, two tubes of agar-agar were inoculated with material taken from the diseased glands and pure cultivations of the tubercle bacillus produced.

14.—H. S., male, aged 2 years, was admitted to hospital under the care of my colleague, Mr. Pinder, who was good enough to allow me to see

the case. The history given was that the right ear had commenced to discharge when he was 4 months old and had discharged ever since. Upon admission, the right external meatus was full of foetid pus, and bare bone was readily felt by means of the probe. A fortnight before admission the child had fallen and injured the right hand, which now presented the typical appearance of tuberculous infiltration of the second metacarpal bone. For many months also he had had an enlarged testicle, which during his stay in hospital suppurated.

Family History.—Father and mother alive and healthy. One other child, also healthy. No family history of tubercle.

The right mastoid process was opened under chloroform, and a large quantity of purulent *débris* and necrotic tissue scraped out. A scraping was taken and used for an inoculation experiment. Five weeks afterwards the guinea-pig was killed, and scrapings taken from the diseased glands and stained for bacilli showed their existence in considerable numbers.

VI.—B. A., male, aged 11 years, had suffered from left-sided, purulent, middle-ear disease for many years. When admitted into hospital he was found to have a large subperiosteal mastoid abscess upon the left side, a meatus blocked with granulation tissue, and an extremely offensive discharge from the ear. For some days before admission he had suffered from severe pain in the head, and had had several rigors. Under chloroform the subperiosteal abscess was opened, and a fistula found in the mastoid cortex. After enlarging this a large cavity was found filled with cholesteatomatous and purulent *débris*. When this had all been scraped out the dura mater was found exposed for an area of about the size of a shilling. The surface was dark coloured and sloughy. The cavity was well washed with weak bichloride solution and packed with iodoform gauze. The patient made an uninterrupted recovery. Scrapings taken from the mastoid and placed under the skin in a guinea-pig's left hind limb about the level of the knee-joint produced a localised area of suppuration, and a small abscess formed but quickly healed. Each week the animal was carefully examined, but no enlarged glands could be detected. Six weeks after the inoculation experiment the animal was killed. The organs were found quite healthy. There were no enlarged glands and no evidences of tuberculous deposit anywhere.

VII.—H. C., male, aged 7 months, was brought to hospital with the following history. When 3 months old the left ear began to discharge. Very shortly afterwards the glands below the auricular attachment were found enlarged and painful, and about this time (a month after the commencement of the trouble) complete left-sided facial paralysis developed. Upon examination the meatus was found quite blocked with unhealthy-looking granulation tissue, and extensive cario-necrosis was easily demonstrated to be present. There was no external evidence of mastoid disease.

The family history showed nothing of importance. The child was an only child. The mother came of a healthy family; the father also was healthy, but was addicted to drink. A mastoid operation was performed just as in the previously detailed cases, and considerable quantities of softened bone and caseous *débris* were removed. A scraping of bone taken from the advancing edge of the disease was removed and used for inoculation purposes. Six weeks afterwards the guinea-pig was killed, and found to present the appearances of advanced tuberculosis. The glands were enlarged, and on section were cheesy. The spleen was packed with tubercles; many were also found in the liver, and a few in the lungs and kidneys. Scrapings from the glands stained for bacilli revealed their presence in considerable numbers.

VIII.—G. C. T., male, aged $2\frac{1}{2}$ years, was seen in consultation with Mr. Malim, of Rochdale, on account of the presence of a purulent discharge from the right middle ear, which had persisted for six months. The left ear had also been discharging, but at the time of the consultation was found perfectly dry and the membrane cicatricial. Examination of the right ear showed that Shrapnell's membrane was perforated, and that a small tuft of granulation tissue protruded through the opening. The probe demonstrated the presence of bare bone upon the posterior meatal wall and upon the roof of the middle ear. For a few weeks local treatment was tried. The tuft of granulation tissue was removed, and various astringent and antiseptic lotions were used. No real progress was however made, and as the tissues over the mastoid process became suddenly red and puffy an immediate operation was advised. The patient was put under chloroform, and the usual incision made. Upon opening the process much purulent *débris* and granulation tissue was found. This was all carefully scraped out and the cavity packed with iodoform gauze. At first the patient made good progress, but shortly afterwards the wound became very sluggish and refused to heal. The cavity was accordingly again scraped, and this time finally healed. When last seen a depressed mastoid cicatrix marked the site of the previous operation wound; the middle ear was quite dry, and the membrana tympani showed the existence of a large and dry perforation. No sooner had the right ear healed, however, than suppuration started again in the left middle ear, and was almost immediately followed by the formation of a subperiosteal mastoid abscess. When this was opened a minute fistula was found leading into the interior of the bone. The fistula was at once enlarged, and the operation conducted as in the previously detailed cases.

Inoculation made from scrapings taken from the left mastoid process was followed by the typical development of well-marked tuberculosis.

IX.—J. C., male, aged 5 months, was admitted into hospital on account of suppuration from both middle ears. The history given was that the child had from birth been very fragile, and at one time appeared to be rapidly emaciating. When 2 months old both ears commenced discharging simultaneously, and had discharged constantly until the time of admission to hospital. Upon examination the child was found to be pale and emaciated. Both ears were discharging freely. Upon the right side a subperiosteal mastoid abscess was found, and upon the left the tissues over the mastoid process appeared quite normal. The glands below both ears were found enlarged.

The family history was negative. Father alive; healthy; addicted to drink. Mother alive and healthy. No other children. Grandfather died of consumption.

Under chloroform the fistula leading into the right mastoid process was enlarged and purulent *débris* and caseous material scraped out. A

week later the left mastoid process was operated upon. The surface of the bone was dark coloured and sloughy in appearance. The bone itself was very soft and friable, and when opened the process was found to contain cheesy *débris*. Inoculation made from both mastoids produced typical tuberculosis in two guinea-pigs.

The child never appeared to make any progress after the operation. Severe diarrhoea set in, which no treatment appeared in any way to influence. Symptoms indicative of tuberculous meningitis set in suddenly, and the child died thirteen days after the operation had been performed. No *post-mortem* examination could be obtained.

X.—S. R., female, aged 19 years, had suffered from left-sided purulent middle-ear disease for many years. Examination showed that the left membrana tympani was almost completely destroyed, and bare bone was felt with the probe upon the posterior and superior walls of the middle ear. As ordinary methods of local treatment had been tried without avail, it was decided to perform a mastoid operation according to Stacke's method. This was accordingly done, and a scraping of bone was removed and used for inoculation purposes. The guinea-pig showed no signs of developing tuberculosis, and when killed six weeks afterwards, no enlarged glands and no deposits of tubercle in the liver or spleen could be detected. A slight inflammatory thickening round the site of the inoculation was found.

In the treatment of these tuberculous lesions where considerable destruction of bone has taken place, it is advisable to open the mastoid process at as early a date as possible, to scrape away all softened and caseous *débris*, to make free communication with the cavity of the middle ear and external auditory meatus, and to keep the parts well packed so that the process of granulation may proceed *ab imo*. Free dusting with iodoform powder has seemed to be beneficial. At times, when the granulating surfaces have shown a tendency to become sluggish, swabbing with chloride of zinc (gr. xv to 3j) has materially expedited matters. Great attention must also be paid to the state of the general health of the patient. Tonics such as syr. ferr. iodidi, syr. iodidi, cod-liver oil, etc., should be freely administered, while at the same time plenty of good milk and farinaceous food should be given. When circumstances admit, residence at the seaside or in good bracing country air should be ordered.

THE TREATMENT OF INTRACTABLE SUPPURATION OF THE MIDDLE EAR BY OPERATION THROUGH THE MASTOID,

BASED UPON EIGHT SUCCESSFUL CASES.¹

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THE present paper is based upon eight cases of chronic purulent inflammation of the middle ear, which, after the employment of all the ordinary methods of treatment through the external auditory canal and Eustachian tube, continued for months, and even years, were successfully operated upon through the mastoid. Four of these cases were operated on by Dr. Macewen and four by myself. Two were in the right ear and six in the left. Instead of describing these cases in all their clinical details, I prefer simply to place before you the salient points from which you may be able to judge of their significance:

1. In these eight cases the purulent mischief had been of very long duration. The duration of the shortest was three years, the others extended from fourteen to twenty-two years.

2. In every one, treatment through the external meatus and Eustachian tube had been previously carried out, in no case for less than a year, and in some for as long as seven years.

3. In none of the cases did the secretion before operation ever lose the odour of decomposition.

4. In every case the seat of the purulent formation was without doubt chiefly in the attic or attic and antrum, either with perforation in Shrapnell's membrane, or other clear evidence that the essential mischief was in these regions.

5. In no case were there any objective signs of mastoid complication.

6. In all the attic syringe had been employed, and in three cases the malleus had been removed in order to allow of more efficient treatment of the attic.

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