SOME
OBSERVATIONS ON THE PATHOLOGY
OF THOSE
AFFECTIONS OF THE EAR
WHICH PRODUCE
DISEASE IN THE BRAIN.

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It was my intention to lay before the Medical and Chirurgical Society some extended researches into the Pathology and Treatment of the Affections of the Ear, which give rise to Disease in the Brain. The reason that has induced me to abandon this intention, and to limit myself to some observations in pathology, is the great extent to which the inquiry has conducted me, and the consequent impossibility to do justice to so important a subject in the limits of a Paper. Being anxious, nevertheless, to submit to the Fellows of this Society some of the results at which I have arrived, in order that those results may be duly considered, I have brought before them certain leading points, which, I trust, will not be deemed unworthy of their attention.

The great frequency of cases in which disease advances from the Ear to the Brain is, unfortunately, too well known to the medical profession, by the almost constant occurrence of fatal instances in which disorganisation of the brain, and its membranes have supervened upon long-standing affections

of the ear. In our own country this subject has occupied the especial attention of some of its most celebrated members, among whom may be named Abercombie, Bright, Watson, and Burne, while, on the continent, it has been investigated by Morgagni, Itard and Lallemand. The results of the researches of these writers, among whom the name of Lallemand may be especially referred to, are of considerable interest; but the want felt by every inquirer into this branch of surgery, is a proper classification of those cases which have thus far been included under the comprehensive term, "caries of the petrous bone ending in disease of the brain." It has been my object to supply this want; and, in the following brief communication, I shall attempt—1st, to point out the nature of the several affections of the ear which produce disease in the brain; and 2d, to show that each of the cavities of the ear has its particular division of the encephalon to which it communicates disease, thus:

1. Affections of the external meatus and mastoid cells produce disease in the lateral sinus and cerebellum.
2. Affections of the tympanic cavity produce disease in the cerebrum.
3. Affections of the vestibule and cochlea produce disease in the medulla oblongata.

In the consideration of this subject I shall examine, *seriatim*:—

1. The affections of the external meatus.
2. Those of the mastoid cells.
3. Those of the tympanic cavity.
4. Those of the vestibule and cochlea.

1. AFFECTIONS OF THE EXTERNAL MEATUS.

Anatomical Observations.

The osseous external meatus is lined by epidermis, the dermis, and the periosteum. In a paper lately published by the Royal Society,¹ I have shewn that these three structures are continuous with the *membrana tympani*,

¹ 'Philosophical Transactions,' Part I, 1851, page 159.

of which, indeed, they form the three outermost laminae. The knowledge of the fact, that the dermis of the external meatus is continuous with, and forms one of the layers of the membrana tympani, is of considerable importance to the surgeon; for it will be seen that disease originating in this lamina is frequently prolonged to the meatus; whence it is liable to progress to the bone and the brain.¹ The dermoid layer of the membrana tympani is well supplied by blood-vessels and nerves, and it adheres by fine cellular tissue to the outer surface of the radiate fibrous lamina. In the meatus, the dermis and periosteum are so intimately connected, that it is almost impossible to separate them, and the blood-vessels which ramify through them have a communication with those in the substance of the osseous meatus. The intimate connection between the dermis of the external meatus and the substance of the bone is therefore very obvious.

The relations of the osseous walls of the external meatus to the cavity of the cranium are of much interest. In the adult, it will be found that the *upper wall* of the meatus consists of a solid lamina of bone, varying from a line to two lines in thickness, which separates the cavity of the meatus from that occupied by the middle lobe of the cerebrum. In some instances, a prolongation of the tympanic cavity is found to extend into the substance of this upper wall of the meatus. The *posterior wall* of the meatus has intimate relations with the sulcus lateralis and the fossa cerebelli, especially at the period of youth, and previous to the age of twenty-five or thirty.² At these periods of life it will be

¹ The circumstance that inflammation, originating in the external meatus from cold or the use of an ear-pick or pin, often rapidly extends to the membrana tympani, causing its partial or complete destruction, may be accounted for by the free communication that exists between the blood-vessels of the dermis and those of the dermoid layer of the membrana tympani.

² In later periods of life, the mastoid cells are developed to so great an extent, as to separate the posterior wall of the meatus from the sulcus lateralis; and disease then occurring in the meatus, unless it is very extensive, is generally confined to the mastoid cells, and does not involve the cavity of the cerebellum.

found that the layer of bone forming the *outer* third of the posterior wall of the meatus, and which separates the cavity of the meatus from that of the sulcus of the lateral sinus, is frequently not more than half a line in thickness; indeed, it is often so thin as to be translucent; this layer of bone is penetrated by numerous orifices for blood-vessels, which extend into its substance, and they communicate with those derived from the dura mater. In instances where the posterior wall of the meatus is thicker than stated above, the blood-vessels ramifying through its substance, and which arise from the membranous meatus, seem, nevertheless, to have a communication with those which enter the bone at its inner surface. The *inner* two thirds of the external meatus has intimate relations with the sulcus lateralis through the medium of the mastoid cells, a very narrow portion of which cells is all that exists between them; not unfrequently, this portion of the osseous wall of the meatus is so thin, as to be translucent, and sometimes portions of it are absent, and a direct communication exists between the meatus and the mastoid cells.

From the above anatomical observations, it will, I think, be apparent, that disease originating in the external meatus during the first half of the period of life, is liable to extend to the fossa cerebelli, and especially to that portion of it which contains the lateral sinus. The result of careful observation has been to show, that as a general rule,¹ whenever disease in the cerebellar cavity supervenes upon an affection of the ear, the external meatus has been the portion of the ear affected.

I shall now proceed to point out the nature of the disease in the meatus which is found most commonly to extend to the bone, and thence to the cavity of the cerebellum. Previous to doing so, however, I may perhaps be allowed the opportunity of stating, that in this paper, and indeed in all my researches into diseases of the ear, I have thought it

¹ To this general rule there are two exceptions, which will be noticed.

desirable to abolish the use of the term *otorrhœa*; when it is known that discharge from the external meatus may arise from as many as seven different sources, it must appear evident to every scientific medical practitioner, that the disease causing the discharge should be specified, instead of using a word which can only be considered as a mask under which is concealed our ignorance of the real nature of the affection.

One of the most common affections of the external meatus is, *chronic catarrhal inflammation of its dermoid layer*; this name I have given to the affection in which the surface of the dermis becomes red, and instead of secreting the epidermis in a continuous layer, the cells composing this structure are thrown off in an early stage of their development and form a mucous discharge. This affection, innocent as it appears, without proceeding to ulceration, is the most frequent cause of disease to the bone and cerebellum. It often persists during many years, all which time the discharge never ceases, or only for short intervals; the surface of the dermis often loses its unnatural redness, but its substance becomes tumefied, and often to so great an extent, as nearly to close the cavity of the meatus. Co-existent with this condition of the dermis, the periosteum becomes soft and detached from the bone, the blood-vessels having become much enlarged, the bone inflames, and caries or necrosis follows; the dura mater is detached from its inner surface, the lateral sinus inflames, purulent matter is deposited on its external as well as on its internal surface, and death occurs as the result of purulent infection. In cases where the lateral sinus is not so deeply involved, the cerebellum in the vicinity of the diseased bone is found to be much softened, in a state of purulent degeneration, or an abscess occupies one of its hemispheres.¹ During the progress

¹ Dr. Watson, in his published Lectures, 3d edition, vol. i, p. 370, makes some very interesting observations on those cases of disease in the ear which terminate in purulent infection. In the subjoined Table I have made a careful analysis of these and of all other fully-recorded cases I have been able to meet with, in which disease has been prolonged from the ear to the brain and has produced death.

of the morbid changes which have been enumerated, there are frequently no symptoms calculated to indicate to the medical man the presence of so formidable a disease, and which may terminate in the death of the patient after an acute attack of a few days' duration.

The patient suffers little, or perhaps no pain in the ear or head; the surface of the meatus presents no appearance of ulceration, even although extensive caries of the bone may be present; the only prominent symptom is the presence of discharge, which, as a general rule, does not disappear, or only during short periods. An examination of the accompanying table is sufficient to show, that the chronic disease of the ear may endure so long as twenty years, or even during the whole of a long life, without the occurrence of any formidable symptoms; and cases of this nature have induced the profession to look upon the symptom of long-persistent discharge, as one of but trifling importance; but the result of my own observations is to show, that as a general rule, if the progress of this affection be unchecked, the bone and cavity of the cranium become slowly diseased, and death is liable to ensue upon the occurrence of any trifling exciting cause, as an attack of influenza, cold, or a blow on the head. In the foregoing observations I have alluded to only one form of disease in the external meatus which is productive of fatal mischief to the cerebellum, viz., *chronic catarrhal inflammation of the dermoid layer*; in the majority of cases which I have examined, death has taken place without the occurrence of *ulceration* in this membrane; but in those instances where a large portion of bone is necrosed, the membranous meatus ulcerates, and through the aperture the necrosed bone is distinctly felt.

I shall now proceed to notice those exceptional cases, to which allusion has already been made, where disease is propagated from the external meatus to the *cerebral* cavity, and where the cavity of the cerebellum is not affected. Previous to doing so, it will be requisite for me to make some observations on the structure and relations of the osseous external meatus during the early periods of life.

At the time of birth, and for the first year subsequent to it, the only rudiment of the osseous external meatus, is the superficial depression, situated in the middle of the outer and lower part of the *pars squamosa*, immediately posterior to the root of the zygomatic process. This depression, to which the name *fossa auditoria* may, with propriety, be applied, has the rudiments of the mastoid process posterior to it; the surface of this "*fossa auditoria*" is more smooth and its substance is more dense, and it contains fewer foramina than the surrounding bone. At the period of birth, the portion of bone forming this fossa is not more than half a line or three quarters of a line thick, and the membranous meatus is attached to its outer, and the dura mater to its inner surface. Its structure is far from being compact and dense; and in its substance the blood-vessels from the meatus communicate with those of the dura mater. The relations of the *fossa auditoria* at the period of birth, and during the first year of life, are shown in the figure, which represents a vertical section of the temporal bone from without inwards in a line through the fenestra ovalis, (fig. 1.)¹ Subsequently to the first year of life, and during the period of youth, the substance of the bone situated between the fossa auditoria and the middle cerebral fossa, so increases in thickness, that the outer and inner surfaces of the cranium are separated by a space varying from a line to a line and a half thick, (fig. 2.) As the bone approaches maturity, the fossa auditoria assumes an oblique position, and forms the upper wall of the external auditory meatus, and it is separated from the cavity of the middle cerebral fossa by a dense layer of bone, into which the tympanic cavity is not unfrequently prolonged, (fig. 3.) In the adult, the fossa auditoria has lost its oblique direction, and forms a horizontal lamina of bone. This position of the fossa auditoria is seen in fig. 4.

A consideration of the above description of the relations of the fossa auditoria will render it evident, that at an early

¹ In this as well as in the two following figures, *a* indicates the fossa auditoria; *b* the inner surface of the fossa auditoria forming part of the outer wall of the middle cerebral fossa; *c* the cavity of the tympanum.

period of life, viz., during the first year, there exists between the membranous meatus and the dura mater of the middle cerebral cavity, only a very delicate layer of bone, through which disease is liable to extend from the meatus to the brain. As the bone is developed, the external meatus is separated from the cerebral cavity by a more considerable space, and the meatus is brought into intimate relations with the lateral sinus; it will, accordingly, be found, that disease which is prolonged from the external meatus to the *cerebral* cavity, originates and affects the bone *within the first year of life*. As a general rule, this disease, if unchecked, destroys life within a few months of its origin; but cases are met with, and of which I have recorded two in the subjoined Table, where death did not occur in childhood, but where nature made vigorous efforts to repair the injury to the bone; but in which the disease had so injured the cerebrum and its membranes, that, although one patient lived eleven, and the other between fifty and sixty years, death ultimately occurred in each from the effects produced during the first year of life. It may at first appear difficult to distinguish between these cases and those of disease occurring in the upper wall of the tympanum, which produce death by exactly the same changes in the brain and its membranes. The distinguishing difference will, however, be found in the fact, that where the disease has originated during early life in the external meatus, the portion of bone which then formed the fossa auditoria, (and which in later life becomes the upper wall of the *meatus*,) is the seat of the disease. Where the disease begins in early life, certain results of the process of reparation are apparent in the form of new bone, which is deposited, not only on the inner, but on the outer surface of the squamous bone and auditory meatus, which results are not met with, in ordinary cases of caries, in the upper wall of the tympanum.

A *second* exception to the rule above laid down, that disease in the cerebellum and lateral sinus originates in affections of the meatus externus, is found in those cases where disease extends backwards from the tympanic cavity,

involves the mastoid cells, and produces caries of their inner wall. These cases appear to be rare; and, as a general rule, the mastoid cells become affected as the result of disease originating in the external meatus.

The pathological conditions produced by the diseases of the external meatus may be summed up as follows:—

1. Coagula in lateral sinus.
2. Pus in lateral sinus.
3. Pus in lateral sinus, and secondary deposits.
4. Pus on the surface of the cerebellum.
5. Abscess in the substance of the cerebellum.

2. AFFECTIONS OF THE MASTOID CELLS.

It will be sufficient for me to indicate here, that in the adult, the posterior surface of the mastoid cells is covered by the dura mater of the cerebellar cavity, and that the lateral sinus is lodged in a sulcus of this wall, in order to render it evident that disease is liable to be propagated from the mastoid cells to the lateral sinus and cerebellum. The source of the diseases of the mastoid cells is generally the external meatus, and they have, therefore, been alluded to in the preceding section; but cases of disease originating in the mastoid cells, and which proceed to the destruction of its posterior wall, the lateral sinus and cerebellum, are sometimes met with, and of one of these I give the particulars.

T. D—, æt. 29, four months previously to his death, complained of great pain in the situation of the right mastoid process; this pain was attended by earache, drowsiness, giddiness, and a discharge from the meatus. Upon examination, the membrana tympani was observed to be entire, but its surface was dull, and it had a milky colour. The surface of the meatus was tumefied, and the discharge originated from it. In spite of all treatment, the head symptoms greatly increased, and stupor supervened. An abscess which formed behind the ear was opened, and a large quantity of purulent matter was discharged without affording any relief.

Post-mortem Inspection.—The external meatus contained a considerable quantity of muco-serous discharge; the surface of its dermoid layer was denuded of epidermis; its substance was much tumefied. The membrana tympani was entire, but of a dull leaden hue, and much softer than natural. The cavity of the tympanum contained a considerable quantity of purulent matter, and its lining membrane was vascular, thick, and flocculent. The incus had disappeared, the stapes retained its position, but was surrounded by bands of adhesion. The bony walls of the tympanum were healthy. The mastoid cells were full of purulent matter; upon its removal, the bony laminae dividing the cells were found to be extensively carious, large portions of them having been removed. The whole of the inner wall of the mastoid cells, usually formed by the floor of the lateral sinus, was completely destroyed, and in the macerated bone the mastoid cells communicated with the cavity of the cranium by an elongated orifice, measuring one inch and a quarter from above downwards, and more than half an inch from before backwards. A circular orifice about the size of a pea existed at the posterior and upper part of the mastoid process, which allowed of the passage of pus into the abscess behind the ear, which was opened during life, and through which, there is no doubt, the incus had been discharged. I had not an opportunity of examining the state of the cerebellum; the membranous lateral sinus was much attenuated. It is interesting to observe that, although the disease in this case was very extensive, it was almost wholly confined to the mastoid cells, in which, no doubt, it had originated. The condition of the mucous membrane of the tympanic cavity, and of the dermoid layer of the external meatus, may be looked upon as the result of sympathetic action.

3. AFFECTIONS OF THE TYMPANIC CAVITY.

Cases of disease originating in the tympanic cavity and extending through its upper wall to the dura mater and cerebrum, are of more frequent occurrence than those which

formed the subject of the last section. The frequency of cases of disease of the cerebrum and its membranes which originate in the tympanic cavity, may be accounted for, *firstly*, by the great liability of the mucous membrane of the tympanum to undergo pathological changes; and *secondly*, by the existence of very intimate relations between this membrane and the dura mater.

Anatomical Observations.

The intimate relations between the mucous membrane of the tympanum and the dura mater, to which allusion has just been made, occurs at the upper wall of the tympanum, which will be found to consist of a lamina of bone extending from the angle of union between the squamous and petrous bones to the vestibule and semicircular canals, and from the mastoid cells posteriorly to the eustachian tube anteriorly. This lamina is about an inch in length, and at its middle part, which is widest, about a third or half an inch in breadth. The structure of the upper wall of the tympanum varies very much in different persons. It may be described as being generally from a quarter to half a line thick, but it is very often so thin as to be translucent; and it is far from being an uncommon occurrence, that this lamina is deficient in parts so as to admit of the mucous membrane of the tympanum being in contact with the dura mater. It will readily be conceived, that disease attacking the mucous membrane of the tympanum is liable to implicate the upper osseous wall, and dissection shows that this wall is the one usually affected whenever the bone has become diseased.

The affections of the mucous membrane of the tympanum which usually give rise to disease in the brain, are acute inflammation, chronic catarrhal inflammation, and ulceration, but of these the one most frequently occurring is chronic inflammation. Chronic catarrhal inflammation of the mucous membrane of the tympanum, one of the affections which has been comprised under the term *otorrhæa*, most frequently originates at the period of childhood, and an attack of cold, scarlet fever, scarlatina, measles, or low fever, is generally the

exciting cause. The predisposing cause may almost always be traced to a tendency to glandular enlargement; and although this affection of the mucous membrane of the tympanum occurs sometimes where the tendency above alluded to does not exist, still I think it will be found that in these cases, it does not remain longer than a few weeks, and that it never terminates in disease of the bone. This affection, at its origin, consists in a hypertrophy of the mucous membrane lining the tympanum; this thickening is accompanied by an increased secretion of mucus with which the tympanic cavity becomes completely distended. The inner surface of the membrana tympani is thus pressed upon, and it becomes slowly atrophied, and a portion of it is removed by absorption; an orifice in the membrana tympani is thus produced through which the mucus, secreted in the tympanum, is discharged into the meatus externus. Upon removing the discharge from the meatus and tympanum, the tympanic mucous membrane can be distinctly observed through the aperture in the membrana tympani; it is generally found to be so thick as to fill up a considerable portion of the tympanic cavity, of a bright red colour, and its surface shining. The discharge differs from that secreted in chronic catarrhal inflammation of the dermoid meatus in consisting of portions of viscid mucus, which float in water without mingling with it; sometimes these portions are so small as to appear like pieces of fine string or thread. Chronic catarrhal inflammation of the mucous membrane of the tympanum may continue during many years without the occurrence of any ulcerative process, but its presence is very commonly the cause of disease in the petrous bone and in the cerebrum. In some cases the irritation of the mucous membrane of the tympanum appears to be sufficient to originate disease in the cerebrum, and an abscess is developed in its substance, without the occurrence of any morbid condition in the bone or dura mater. The usual result of a prolonged continuance of this affection is, that the mucous membrane lining the upper wall of the tympanum becomes detached from the bone, while the dura mater, at the same

time, loses its adhesion to its upper surface; the substance of the bone having thus lost its supply of nutrient fluid, becomes carious, purulent matter is secreted around it, and the two investing membranes ulcerate, the disease spreading from the dura mater to the substance of the brain. The pathological changes produced in the brain and its membranes by the affection of the ear, now under consideration, may be thus enumerated:

1. Inflammation of the dura mater, and its separation from the surface of the petrous bone by serum.

2. Ulceration of the dura mater, and its complete detachment from the petrous bone.

3. An abscess in the substance of the cerebrum.

4. Undefined suppuration of the substance of the cerebrum.

From an examination of cases, it appears that chronic catarrhal inflammation of the mucous membrane of the tympanic cavity, may exist as many as twenty or more years without the production of any disease beyond it, or, at least without the existence of any symptoms by which the presence of such disease can be diagnosed; nevertheless, in the great majority of cases, vital structures become sensibly affected in a much shorter period. It is not in my power to enter here into the details of cases belonging to this class; but those desirous of obtaining further information will refer to the accompanying Tables, which contain the leading facts of importance pertaining to many well-authenticated cases.

4. THE LABYRINTH.

Cases in which disease is propagated from the cavities of the vestibule and cochlea to that of the cranium, are of much more unfrequent occurrence, than those which have been previously referred to. To those who are aware how directly the auditory nerve establishes a communication between the two cavities above named and the medulla oblongata, it may be well conceived, that disease occurring in them, is liable to be prolonged to the medulla, and to the membranes investing it. This communication may take place without the presence of any disease of the bone, the small orifices at

the floor of the internal auditory meatus, through which the fine filaments of the nerve take their course, being quite sufficient to allow of the transmission of the disease from within outwards. The affection which is the source of the disease in the medulla oblongata, so far as my experience has gone, appears to originate in ulceration of the mucous membrane of the tympanum; this affection having proceeded to the destruction of the fibrous investment of the tympanum, the stapes is detached from the circumference of the fenestra ovalis, and is discharged from the external meatus, or the membrane covering the fenestra rotunda is destroyed. Sometimes both of these changes take place; sometimes only one: under either circumstance, the lining membrane of the labyrinth partakes of the diseased action which originated in the tympanum, the labyrinth becomes filled with purulent matter, the expansion of the auditory nerve is destroyed by ulceration, and its trunk becomes inflamed; the inflammation extends through its substance as far as the medulla oblongata, the membranes of which are implicated in the disease, and death ensues from an effusion of pus or serum.

I shall not lengthen this paper by entering into a more minute consideration of this branch of the subject, but will refer to the following analysis of three cases of—

Disease in the Cerebral Cavity, extending from the Labyrinth.

Age.	Duration of chronic symptoms.	Acute symptoms causing death—their duration.	Post-mortem appearances.	By whom the case was reported.
22	Not stated.	Toothache; fever; cerebral irritation. Five weeks.	Auditory nerve in a state of suppuration; pus in labyrinth; pus on the surface of cerebrum and cerebellum.	Itard, 'Traité des Maladies d'Oreille,' tom. i, p. 254.
42	Thirty-five years.	Pain in head; coma. Five days.	Pus in tympanum and labyrinth, and around the medulla oblongata.	Mr. Streeter, Med. Gazette, 1834, p. 553.
17	For twelve years, discharge from left ear.	Pain in head and ear. Twenty-two days.	Pus in tympanum and labyrinth; auditory nerve of a dark colour; purulent matter deposited on the surface of the medulla oblongata, crura cerebri, and pons varolii.	Mr. Avery, MS. notes and preparation, to Author.

Conclusion.

The preceding observations, together with the report of cases, as detailed in the Tables, appear to show that chronic catarrhal inflammation affecting the dermoid layer of the membrana tympani, the dermoid meatus, or the mucous membrane lining the cavity of the tympanum, if allowed to proceed unchecked or uninfluenced by the aid of remedial measures, is liable to produce results fatal to life. These fatal results may occur within the first few months of the existence of the disease, or they may be deferred so long as ten, twenty, or even fifty years; in some cases patients die at an advanced period of life from disease quite independent of that in the ear. The result of my investigations, nevertheless, tends to show, that the affections above named cannot exist during many years, without causing a greater or less amount of disease in the bone, dura mater, or brain; and it is evident from the inspection of cases, in which some disease irrespective of the ear has caused death, that a very trifling exciting cause would have been sufficient to give origin to fatal disease in the brain. It is important, therefore, to bear in mind, that the bone, dura mater, and substance of the brain, may be slowly undergoing disorganisation without the presence of any other symptoms, calculated to reveal to the medical man the existence of formidable disease, than the presence of a discharge from the external auditory meatus. From the facts cited above and in the following Tables, I think it may be laid down as a rule, that *no person suffering from chronic catarrhal inflammation of the dermoid layer of the meatus, the membrana tympani, or of the mucous membrane of the tympanum,*¹ *can be assured that disease is not being prolonged to the temporal bone, the brain, and its membranes; and that any ordinary exciting cause, as an attack of fever or influenza, a blow on the head, &c., may not induce the appearance of acute symptoms, which, as a general rule, are speedily fatal.*

¹ In these three affections are included the great majority of cases hitherto styled—*otorrhæa*.

TABLE I.—*Cases of disease of the Dura Mater and Brain, originating in affections of the Tympanic cavity.*

Age.	Duration of discharge.	Acute symptoms and their duration.	Post-mortem appearances.	By whom reported.
21	No discharge . . .	None complained of . . .	Dura mater covering the petrous bone vascular, and separated from the bone by a small quantity of serum.	Author, MS. notes.
17	No discharge previous to fever.	Typhus fever, great dullness of hearing, discharge from left ear four or five days. Nine days.	Upper wall of tympanum vascular, the dura mater separated from it by a small quantity of serum.	Author, MS. notes.
16	No disease previous to fever.	Typhus fever seven weeks, dullness of hearing.	Dura mater scarcely adherent to the upper wall of tympanum.	Author, MS. notes.
60	Many years from both ears.	None complained of . . .	Dura mater covering upper wall of tympanum, soft and thin; petrous bone carious.	Author, MS. notes.
Adult.	Subject to discharge from the left ear.	Fever, cerebral excitement.	Dura mater covering the upper wall of tympanum thick, and but slightly adherent to bone; bone carious.	M. Lallemand, 'Recherches Anatom. Patholog. sur l'Encéphale,' tom. ii, p. 121.
11 months.	From the right ear from birth.	Great tenderness, swelling and sloughing around the ear; cerebral irritation, great debility. Four months.	The dura mater lining the inner surface of the squamous bone near to its junction with the petrous bone, was very thick, and separated from it by pus; a large portion of squamous bone destroyed by necrosis.	Mr. Willing and Author, MS. notes.*
26	Not stated . . .	Violent pain in the ear and cerebral excitement, delirium, stupor. Seven days.	Dura mater detached from the upper wall of the tympanum, and separated from it by a gelatinous fluid.	Hard, 'Traité des Maladies d'Oreille,' tom. i, p. 193.
3	A year and a half from left ear, acute pain at times.	Pain in the ear and head, stupor. Few days.	Dura mater disconnected from the upper wall of tympanum, and adherent to the arachnoid; tympanic mucous membrane, very thick, soft, and red.	Author, MS. notes.
10 months.	Five months from left ear.	Pain in the ear, abscess above and behind it, extreme debility. Six weeks.	Caries of squamous bone above meatus externus; dura mater thick and soft, separated from the bone by serum.	Author, MS. notes.*

1.—Dura mater inflamed and detached from the bone.

2.—Dura mater thick and detached from the bone.

* These are exceptional cases, where disease is propagated from the meatus to the cerebral cavity.

9	For a long period from left ear.	Fever, cerebral irritation, coma. Ten days.	Dura mater sloughy and separated from petrous bone by lymph; mucous membrane of tympanum thick.	Dr. Hutton, 'Lancet,' Dec. 26, 1846.
65	For many years ear-ache and dullness of hearing.	Not known	Dura mater thick, ulcerated, and detached from upper wall of tympanum, which is carious; mucous membrane of tympanum thick.	Author, MS. notes.
30	Prolonged, dull of hearing.	Not known	Dura mater ulcerated; mucous membrane of tympanum thick.	Author, MS. notes.
44	Twenty-four years from right ear.	Paralysis of the muscles of the right side of face a few days before death.	Dura mater covering the upper wall of tympanum, thick, and ulcerated; bone carious; mucous membrane of tympanum ulcerated.	Dr. Kingston and Author, MS. notes.
16	Most probably for a long period from left ear.	Hæmorrhage, profuse discharge, coma. Twenty-six days.	Dura mater covering the upper wall of tympanum, ulcerated; bone carious.	Mr. N. Ward, 'Proceedings of the Pathological Society of London,' 1846-7, p. 11.
20	Not reported . . .	Headache, cerebral irritation. Three weeks.	Lower part of middle cerebral lobe in a state of suppuration, above it an abscess; petrous bone carious; dura mater discoloured and separated from the bone in parts by coagula.	Dr. Bright, 'Medical Reports,' vol. i, p. 149.
18	A considerable period.	Headache, vomiting, stupor, partial coma. Eight days.	The right cerebral hemisphere was reduced to a mass of fetid pus.	Dr. Abercrombie, 'On Diseases of the Brain,' 3d ed., p. 92.
18	Many years . . .	Rigors, headache, slight coma, great depression.	The whole of the left cerebral hemisphere was a mass of undefined suppuration; petrous bone carious; dura mater spongy.	Dr. Abercrombie, loc. cit., p. 93.
18	Several years from right ear.	Fever, great cerebral irritation. Nine days.	The right cerebral hemisphere was in a state of suppuration; upper wall of tympanum wholly destroyed; dura mater gangrenous.	Mr. Oubé and Author, MS. notes.
4	Three years from the left ear.	Pain in the forehead and eyes, convulsions, insensibility, hemiplegia.	The greater portion of the left cerebral hemisphere in a state of suppuration; dura mater covering the upper surface of petrous bone, vascular; upper wall of tympanum of a dark colour.	Author, MS. notes.

3.—Dura mater ulcerated and detached from the bone.

4.—Undefined suppuration of the cerebrium.

Age.	Duration of discharge.	Acute symptoms and their duration.	Post-mortem appearances.	By whom reported.
21	Discharge from right ear, with occasional intermissions, for fourteen years.	Violent pain in the ear and head, pain in the back and body, curvature of the neck backwards, delirium. Five weeks.	A large abscess in right middle cerebral lobe, tympanic cavity full of pus.	Dr. Duncan, 'Edinburgh Medical and Surgical Journal,' vol. xvii, p. 332.
Aged.	Since youth.	Intense headache, stupor. A short time previous to death.	An abscess in the corresponding cerebral lobe, upper wall of tympanum carious.	Dr. Duncan, loc. cit., p. 335.
23	Not recorded.	Pain in right ear, and headache; great cerebral irritation. Fourteen days.	An abscess in the inferior part of right middle cerebral lobe; upper surface of petrous bone dark; pus in tympanic cavity.	Dr. Williams, 'Anatomy, Physiology, and Pathology of the Ear,' pp. 169, 170.
28	From left ear for some years.	Intense pain in the head, following a blow, delirium, coma. Three weeks.	An abscess in the left anterior and middle cerebral lobes; dura mater partially separated from the upper wall of tympanum, which presented a small carious orifice.	Mr. Caesar Hawkins, 'Medical Gazette,' vol. xvii, page 156.
Girl.	Subject to discharge from the left ear.	Cerebral irritation, convulsions. Thirty days.	An abscess in the centre of left cerebral hemisphere.	M. Pichot, 'Lancet,' vol. x, p. 460.
23	Fourteen years from the left ear.	Pain in the top of the head, followed by cerebral irritation. Ten months.	An abscess in the left middle lobe of cerebrum; the dura mater detached from petrous bone; the latter soft and carious.	M. Lallemand, 'Recherches Anatomico-Pathologiques, sur l'Encephale, 1823,' tome ii, p. 91.
Not stated.	A piece of paper in meatus externus for some months.	Violent pain in head, fever. Eighteen days.	An abscess in the lower part of middle cerebral lobe communicating with the tympanum.	M. Sabatier, 'Médecine Opératoire,' tome iii, p. 10.
Adult.	At intervals for some time from left ear.	Apoplexy, paralysis, convulsions. Ten days.	An abscess in cerebrum, above the left petrous bone; the latter carious.	Laubins, Lallemand, loc. cit., p. 118.

26	From right ear since measles in childhood.	For twelve or sixteen months headache and giddiness; pain in the ear; heaviness, insensibility, twenty-three days. Headache, vomiting, chilliness, five days; was then convalescent; a day after, intense pain in the ear came on. Ended in death in five days. Convulsions, coma. Five days.	An abscess in upper part of right cerebral hemisphere; dura mater detached from upper wall of tympanum, ulcerated and very thick.	Dr. W. Merriman and Author, MS. notes and preparation.
10	Five years from left ear; earache at times.	Headache, vomiting, chilliness, five days; was then convalescent; a day after, intense pain in the ear came on. Ended in death in five days. Convulsions, coma. Five days.	An abscess as large as a small hen's egg in the left middle cerebral lobe; dura mater over tympanic cavity very thick, partly detached, an orifice in one part; carious orifice in upper wall of tympanum; tympanic cavity full of scrofulous matter.	Mr. Farish and Author, MS. notes and preparation.
Boy.	From left ear since childhood.	Convulsions, coma. Five days.	An abscess in the greater part of left middle lobe of cerebrum; dura mater ulcerated; upper wall of tympanum carious.	Mr. Pollock, 'Proceedings of the Pathological Society of London,' 1846-7, p. 13.
Adult.	From right ear for twenty years.	Pain in the head fourteen days; fever, coma, four days.	An abscess in the right middle cerebral lobe; dura mater ulcerated; upper wall of tympanum carious.	Mr. Jarvis Highmore, MS. notes and preparation to Author.
24	From left ear for three years.	Cerebral irritation, abscess, under the temporal muscle, delirium, coma. Some days?	An abscess in the left middle cerebral lobe; the dura mater partially detached from the petrous bone, thick, and of a dark brown colour; the bone dark, but not carious.	Mr. Pilcher, MS. notes and preparation lent to Author.
55	Not stated	Pain in the head, coma. Several days.	An abscess in the left middle and anterior lobes of the cerebrum, the inner surface of squamous bone presented a necrosed portion of bone surrounded by new bone; dura mater detached; new bone deposited on the outer surface of squamous bone; osseous meatus rough; there is an orifice in the squamous bone above the mastoid process, by means of which purulent matter escaped from the inner surface of the skull beneath the dura mater.	Mr. Pilcher, MS. notes and preparation lent to Author.
12	Not known	Cerebral irritation, fever, coma. Twenty-two days.	An abscess in cerebrum; pus between the dura mater and squamous bone; dura mater thick.	Mr. French, MS. notes and preparation to Author.*

* Case of disease advancing from the meatus to the cerebrum.

Age.	Duration of discharge.	Acute symptoms and their duration.	Post-mortem appearances.	By whom reported.
14	A long time, with headache.	Violent pain in the head, convulsions, coma, insensibility. Three days.	A large abscess over petrous bone containing green, fetid pus; dura mater ulcerated; bone carious.	Dr. O'Brien, 'Medico-Chirurgical Journal,' Oct. 1819, p. 235.
14	Twelve years . .	Severe cerebral symptoms, coma, death.	A large abscess above the petrous bone, communicating with the external meatus, through petrous bone and dura mater.	Sir B. Brodie, 'Trans. of a Society for the Improvement of Med. and Surgical Knowledge,' vol. iii.
14	Not stated; right ear affected.	Violent pain in the head, convulsions, insensibility.	A small abscess in the right middle cerebral lobe, communicating with the external meatus by an opening through the dura mater and bone.	Mr. Parkinson, 'London Medical Repository,' No. 39, 1817.
60	Two years, followed by intense pain.	Violent cerebral irritation. Thirteen days.	Dura mater covering petrous bone detached from it and full of orifices; an abscess in cerebrum; petrous bone carious; tympanic cavity and vestibule full of pus.	M. Itard, 'Traité des Maladies d'Oreille,' tom. i, 1821, p. 255, Obs. 24.
19	For a considerable period from the right ear.	Suddenly seized with symptoms of putrid fever.	An abscess in the cerebrum; caries of the squamous and petrous bones; pus in the mastoid cells.	M. Itard, loc. cit., p. 266.
A young woman.	For four years deaf.	Right membrana tympani punctured, profuse discharge in twenty hours; continued for four months with pain in the forehead; acute head symptoms and rigors followed. Three days.	An abscess in the lower part of the right middle cerebral lobe; mucous membrane of tympanum thick and villous.	Dr. Butcher, 'Dublin Med. Press,' April 1, 1846.
18	From right ear for more than a year.	Great pain in the ear, cerebral excitement, delirium, aberration of intellect, paralysis of left arm. Three weeks.	An abscess in the right cerebral hemisphere; dura mater detached from temporal bone.	Mr. Denmark, 'Medico-Chirurgical Trans.,' vol. v.

TABLE II.—Cases of Disease in the Lateral Sinus and Cerebellum, originating in affections of the External Meatus.

Age.	Duration of discharge.	Acute symptoms and their duration.	Post-mortem appearances.	By whom reported.
15	Six or seven years.	Pain in right ear, shivering, headache, abscess behind the ear; great prostration. Ten days.	Coats of lateral sinus thickened; coagulum in sinus.	Dr. Abercrombie, 'The Diseases of the Brain,' 3d edition, p. 35.
4	Pain and remitting discharge for some weeks from left ear.	Pain in the ear and head, rigors, symptoms and low irritative fever, convulsions.	Caries of the petrous bone; lateral and petrosal sinuses contained coagula.	Mr. Dendy, MS. notes sent to Author.
17	Pain and discharge at intervals from the left ear.	Cerebral irritation, cough, excitement of the heart and of the respiration; bowels deranged. Three weeks.	The lateral sinus was distended by fibrine; the posterior wall of the external meatus,† and the bone of the mastoid cells, carious; their posterior wall, which forms the anterior boundary to the sulcus lateralis, presented a carious orifice two lines in diameter.	Mr. Pilcher, MS. notes and preparation lent to Author.
37	Not stated.	Pain in left ear and side of head; discharge; delirium; incoherency of mind.	Lateral, petrosal, cavernous sinuses, and jugular vein, as low as the subclavian, contained pus; cerebellum indented.	Dr. Bright, 'Medical Reports,' vol. i, p. 129.
45	For twenty years from left ear.	Pain in left side of head, during the night only; cerebral irritation; delirium. Eight weeks.	The cavernous sinuses full of gray-coloured matter; mastoid portion of temporal bone carious.	Dr. Duncan, 'Edinb. Medical and Surgical Journal,' vol. xvii, p. 333.

* It is highly probable that these cases belong to the third series, where pus was found in the lateral sinus, and where secondary abscesses were formed.

† This layer of bone forms the anterior wall of the mastoid cell.

1.—Coagulum in Lateral Sinus.*

2.—Pus in the Lateral Sinus.

Age.	Duration of discharge.	Acute symptoms and their duration.	Post-mortem appearances.	By whom reported.
Boy.	Subject to discharge from the left ear.	Severe pain behind one of his eyes; delirium.	Lateral sinus contained pus, mixed with blood; its cavity continuous with the ear; petrous bone carious.	Dr. Stokes, 'Lond. Medical and Surgical Journal,' vol. v, p. 679.
27	From right ear since early life.	Pain in head, rigors, fever; an abscess over the mastoid process; stupor; coma. Three weeks.	Lateral sinus full of pus; sulcus lateralis carious.	Dr. Bruce, 'Medical Gazette,' vol. xxvii, 1841, p. 636.
	Particulars of case not given.		Lateral sinus and jugular vein thick, and contained pus.	Dr. Stark, 'Craigie's Practice of Physic,' vol. ii, p. 360.
20	Subject to pain and discharge from right ear for six or seven years.	Shivering, headache, and pain in right ear, followed by abscess behind it. Ten days.	Abscess in left lobe of cerebellum; sulcus lateralis carious; pus in lateral sinus; secondary abscesses in the neck and in the right lung.	Dr. Heale & Author, 'Reports of the Pathological Society of London,' 1849-50, p. 271.
Adult.	A long period.	Headache, stupor, and rigors.	Lateral sinus full of pus and lymph; sulcus lateralis carious; abscess in the neck.	Dr. Bruce, 'Medical Gazette,' vol. xxvii, p. 638.
3½	Two years from left ear.	Pain in the ear and head; convulsions; great physical prostration. Three weeks.	Caries of meatus externus and sulcus lateralis; pus in sinus and jugular vein; abscess in neck; cerebellum soft; membranous meatus not ulcerated.	Author, 'Reports of Pathological Society,' 1850-51.

2.—Pus in the Lateral Sinus (*continued*).

8.—Pus in the Lateral Sinus, with secondary deposits.

35	Several weeks certainly; most probably for some years, from left ear.	Pain in left side of head; rigors; difficulty of breathing; prostration; muttering; delirium. Some weeks.	Cerebrum firm but vascular; ecchymosis on the surface of the dura mater in the left middle cerebral fossa; state of cerebellum and lateral sinus not recorded; the tympanum and mastoid cells full of pus; the layer of bone between mastoid cells and lateral sinus presented numerous small orifices; secondary deposits in each forearm. Lateral sinus full of pus; sulcus lateralis carious, and its cavity continuous with that of the ear; purulent deposits in the lower lobes of the lungs.	'Post-mortem Book,' St. George's Hospital, 1847.*
9	At intervals, for five years, from left ear.	Pain in the ear and headache; abscess behind the ear; delirium; convulsions. Five weeks.		Dr. Bruce, 'Medical Gazette,' vol. xxvii, 1841, p. 610.
45	Subject to discharge from left ear.	Pain in the ear and head; drowsiness; coma. Five days.	Pus deposited on the outer surface of the cerebellum, especially on left side; pus in the tympanic cavity.	Dr. Abercrombie, loc. cit., p. 59.
Child.	Not stated.	Abscess behind the right ear; convulsions; cerebral irritation.	Pus at the base of the skull, covering the cerebellum; posterior surface of petrous bone carious; dura mater ulcerated.	Morgagni, Epist., xiv, No. 3.
20	Not stated.	Pain in the right ear and head, followed by stupor and shiverings. Ten days.	Abscess between lobes of cerebellum; petrous bone carious; dura mater very thick; pus between dura mater and bone.	Dr. Abercrombie, 'The Diseases of the Brain,' 3d ed., duodecimo, 1834, p. 32. Idem.
9	Stated to be subject to a discharge from left ear.	Pain in forehead; delirium; stupor, convulsions, and coma. Five days.	Abscess in left lobe of cerebellum; petrous bone carious on inner surface; only dura mater spongy.	
19	At intervals, during two years, from right ear.	Intense headache; tenderness of abdomen; great physical prostration.	Abscess occupying nearly the whole of the right hemisphere of cerebellum; petrous bone carious and soft; tympanic cavity full of pus; cerebrum healthy.	Dr. Duncan, 'Edinb. Medical and Surgical Journal,' vol. xvii, p. 331.

* There appears but little reason to doubt that the lateral sinus contained pus.

3.—Pus in the Lateral Sinus, with secondary deposits (*continued*).

4.—Pus on the surface of the Cerebellum.

5.—Abscess in the substance of the Cerebellum.

Age.	Duration of discharge.	Acute symptoms and their duration.	Post-mortem appearances.	By whom reported.
32	About two years, from right ear.	Pain in the ear and side of head; drowsiness, stupor, and coma. Six weeks.	Abscess in right hemisphere of cerebellum; petrous bone carious; an orifice communicated with the ear; dura mater ulcerated; cerebrium healthy.	Dr. Macleod, 'Medical Gazette,' vol. xvii, p. 157.
20	Right ear deaf for two years.	Three weeks before death the membrana tympana was punctured; the operation was followed by attacks of headache and cerebral irritation.	Abscess in the right hemisphere of cerebellum; dura mater much thickened.	Dr. Butcher, 'Dublin Med. Press,' April 1, 1846.
18	Not stated.	Pain in left ear, headache; tendency to coma; great physical depression. Eighteen days.	Abscess occupying the whole of the left lobe of the cerebellum; dura mater thick and spongy; bone sound.	Dr. Abercrombie, loc. cit., p. 104.
20	Subject to pain in the right ear for a long time.	Cerebral irritation. Twenty-four days.	Abscess in the right lobe of cerebellum; pus on its inferior surface; dura mater ulcerated.	Lallemand, 'Recherches Anatomico Pathologiques sur l'Encephale,' 1823, tome ii, p. 87.
Adult.	For sixteen years; headaches for two years.	Headache, stupor, coma. A few days.	Abscess in the substance of the cerebellum; petrous bone and mastoid cells carious.	Dr. Macintyre, 'Proceedings of the Pathological Society of London,' 1846, p. 12.
13	Several years from right ear.	Headache; fits like epilepsy; great depression three weeks; convalescence; sudden death.	Abscess in right hemisphere of cerebellum; external meatus and petrous bone carious.	Dr. Pilcher, MS. notes lent to Author.

5.—Abscess in the substance of the Cerebellum (*continued*).