On certain Anatomical relations between Abscess of the Brain and Aural disease.

(with illustrative drawings)

There is no part of the human body which in proportion to its size and its relations to other parts possesses so many important points for the consideration of the medical man as the organ of Hearing. Nor is there another department of Medical Science which promises larger returns for the labour of the Pathologist and Scientific Surgeon. And yet until a comparatively recent time there was scarcely another branch of Surgery in the profitable cultivation of which there was so little real progress. The late Professor Syme, I am told, when lecturing on diseases of the ear used to divide them into two classes, the "incurable" which he said were treated by the Aurists, and the "curable" which were treated by the Surgeon. And this was said at a time, forty years ago, when beyond the extraction from the external meatus of a polypus, or an accidentally im-

= bedded pea, or of some hardened wax, or the puncture of the membrana tympani, or the cath-
= eterization of the Eustachian tube there was little that the Surgeon could advance as a creditable set off against the pretentious placebos of drops, lotions, ear-trumpets and other paraphernalia of the Aural of that day.

But of late, and especially at the present time, so great is the diligence shown by brain-taking and able observers that the general practitioner regards with no feeling of jealousy or desire of depreciation the more equal platform from which his co-labourer, the specialist aural surgeon, now deals with a class of ailments that affect so largely the health, comforts, & material interests of the community.

It is in this spirit of sympathetic association that I now submit some observations relative to abscess of the Brain, associated with disease of the ear, the pathology of which has not, in my

opinion, been as yet sufficiently recognised.
It was long a popular belief that "a running from the ear" was rather a healthy affection than otherwise and even in the ranks of the profession there may still be found individuals who although not prepared to contend that Otorrhea is actually beneficial, nevertheless do not regard it as worthy of, or necessarily requiring, earnest treatment. But it is substantially a disease or rather the indication of disease. For the structure and functions of the middle and internal ear are always seriously affected when purulent discharges are of long duration. Such discharges are therefore no longer to be regarded as at the worst simply an unpleasant secretion, a mere troublesome affection having no other result. They are properly to be considered as symptomatic of one or it may be of several conditions, and the purulent matter itself is further to be looked upon as certainly provocative of a great extension of the original lesion if neglected. "As long as discharge from the ear is present" says Wilde "we can never know how,

"when, or where it may terminate or to what it may "lead."

The greater number of diseases of the ear and nearly all which are characterized by suppurative discharge, involve the walls of the tympanic cavity. Kramer states that 56% of all aural diseases are situated in the middle ear. And when it is borne in mind that there are only barriers of thin bone between the middle ear, the internal carotid artery, the jugular vein, the lateral sinus, the internal ear etc and these barriers are sometimes deficient or imperfect, it is matter of surprise that the extension of diseased action from the ear to the brain is not of still more frequent occurrence than has yet been shewn. But although the conservative processes that defend the delicate brain tissues from invasion are powerful there is accumulating evidence of diseased condition of brain originating more frequently than is commonly supposed from disease of the ear. And of these, abscess of the brain, the result of

neglected discharges from the ear is very frequent
So far therefore the practical importance of a "running"
from the ear is evident. But the rationale of the
pathological processes involved is, in certain condit-
-ions, somewhat obscure.

Dr. Barr, Lecturer on Aural Surgery in Anderson's
College, of whose special ability I have on several
occasions had personal knowledge, read a commun-
-ication to the Glasgow Medico-Chirurgical Society
in April 1880 in which he said "there may be
"readily developed out of the diseased condition of
"the ear, morbid changes in the walls of the vessels
"which by passing along to the dura mater may
"set up inflammation of that membrane, or to
"the sinuses may excite phlebitis with the attendant
"danger of the formation of thrombi and purulent
"deposition in either organs . . . . after the dura
"mater is involved the inflammatory condition probably
"passes to the brain by contiguity of tissue as there is no
"direct vascular or lymphatic connection between the

dura mater and the substance of the brain. How is the great factor of the pus on the brain to be accounted for? How do the Bacteria get admission to the purulent matter when there is no actual opening in the dura mater bone and no direct vascular connection? These are questions regarding which I would gladly hear the views of any member of the society and especially of Dr Coats or Dr Foulis, also how the extension from the middle ear of the suppurative process, takes place when a portion of healthy brain tissue intervenes between the dura mater and the Abscess?

From frequent observations in the Anatomical Rooms I had hitherto held the belief that in certain conditions there was a direct vascular connection between the venous blood from the ear and the substance of the brain but as Dr Bain's statement passed unchallenged by the well informed gentlemen who were present I shrank from expressing at the moment the contrary conviction I held. Subsequent reflection and further special investigation have

however satisfied me that there is a fair solution of the problem.

That my argument may be clearly followed I propose to show I. That aural diseases are more frequent in the early than in the later stages of life and that suppurative discharges from the ear follow the same law. II. That, contrary to what might be expected and to what is currently believed, abscess or suppuration in the brain, whether encysted or diffuse is much more frequent in advanced life than in early age. III. That there are anatomical peculiarities of structure in the organ of hearing which differ in the infant and in the adult, which explain the greater frequency of abscess of the brain in adult life as originating from disease of the ear. IV. That under certain conditions there is an abnormal state of the cerebral circulation which admits of a direct vascular connection between the ear and the brain.

Dr Kramer[x] in an elaborate analysis of 2000 cases of Aural disease states that 504 occurred in the first 10 years of life or about 25 per cent of the whole number. And Dr Wilde[*] gives a very comprehensive statistical table of 2385 cases of diseases of the Ear of every kind registered at St Marks Hospital, Dublin of which 411 or nearly 16 per cent were under 10 years of age. Substantially therefore the experience of both these eminent Aurists is in accord as to the large proportion of cases which occur in early life. And what is true of Aural disease in general is still more markedly evident in those that are characterized by suppurative discharges uncomplicated with caries, or growths or injuries. Of the 2385 cases registered by Dr Wilde of diseased of the ear of every kind there were 528 or 22 per cent described as Otorrhœa pure and simple and of these above 41 per cent occurred under 10 years of age. Between the ages of 11

[x] Resumé in Br. & F. M. Rev. 1847.

[*] Aural Surgery 1853, p. 102.

and 20 there occurred above 31 per cent, thus making fully 72 per cent of cases of Otorhoea under 20 years of age out of the entire number of cases of that disease at all ages.

Although cases of inflammation of the external auditory canal - not including eczema - are sufficiently frequent yet actual suppuration of that region is a rare disease. When chronic suppurative discharge issues from the ear it will as a rule be found to have its origin behind and not in front of the membrana tympani. Dr Roosa, (op. cit. p. 965) when showing the comparative infrequency of suppurative affections of the outer ear as contrasted with those of the middle ear, notes that of 2271 cases of inflammation with suppuration of the external & middle ear observed in certain specified Hospitals in New York there were 1769 cases wherein the suppuration proceeded exclusively from the middle ear. And in a more exact reference to cases occurring in private practice he states that of 1000

cases of the different varieties of aural disease observed by himself only 132 were cases of affections of the outer ear. There can therefore be no question of the greater prevalence of otorrhoea at all periods of life but particularly so in early life.

But my second proposition that abscess or suppuration in the brain is comparatively rare at the earlier ages is not in accord with current opinion. So far as I can gather from my contemporaries and from general medical literature this statement is much opposed to the common belief. And in consideration of the greater frequency of suppurative discharges from the ear in early life the fact is on first sight remarkable and unexpected. And yet the evidence is very clear. Lebert[1] has carefully analysed the histories of 80 cases of Abscess of the Brain from all causes one fourth of which were the outcome of cases of the petrous portion of the temporal bone. And

(1) Virchow's Archives Band X p. 391

though his investigations show that abscess of the brain may occur at all ages he has noted as a general result that the most frequent period is between the 16th and the 30th year. But this general fact although of great significance is not sufficiently definite to establish my proposition. I have accordingly constructed a table of 105 cases, consisting of a digest of 76 cases compiled by Drs Gull and Sutton and published in Reynolds's System of Medicine (vol. II p. 581), and of 29 cases additional given on the authority of 25 observers and collected by myself from scattered publications in general medical literature chiefly within the last 10 or 12 years. I have classified these cases under 4 divisions with as much carefulness as the published details admit. And I consider that the table is fairly representative not only of the relative frequency of abscess of the brain from all causes within the periods of life specified, but that it is also fairly illustra-

-tive of the special causes which originate suppurative deposits within the Brain.

Causes of Abscess of Brain	Total	Under 10 Yrs	11 Yrs to 20	Above 20	Not stated
	—	—	—	—	—
Disease of Ear with caries of bones	24	2	8	14	.
Suppuration from Ear; Caries if present not stated.	20	2	6	11	1
Injuries of Head.	20	1	6	11	2
Disease in other parts of body	41	.	4	31	6
	105	5	24	67	9

This table shows that there must be conservative conditions protecting the brain in early life. Less than 5 per cent of the cases occured in childhood and above 72 per cent occurred in adult life. This non-liability to abscess of brain from whatever cause is still more evident in the following table consisting of cases wherein the suppurative deposits either originated exclusively from or were directly

associated with disease of the Ear. This table is constructed of the 44 cases composed in the preceeding Table together with 30 cases collected from various sources by Dr Rivosa and of 6 cases recorded by Toynbee and are irrespective of those included in Dr Gulls synoptical list, ~~last~~ part of which is taken from Dr Toynbees classical Treatise.

Causes of Abscess of Brain.	Total	Ages			
		Under 10	11 to 20	above 20	Not stated
Caries or Necrosis of Temporalbone Suppuration of Ear,	46	6	13	26	1
Caries if observed not stated	34	3	7	23	1
	80	9	20	49	2

Here it is seen that only 9 cases or 11 per cent occurred in childhood and above 63 per cent in adult life. And if to this table those is added cases of Injuries of head the conclusion remains substantially unchanged, to the effect that whatever the originating cause may be

and even where the originating causes are restricted exclusively to Diseases of the Ear and injuries of Head it remains abundantly evident that Abscess of brain in childhood is rare when compared with its frequency at other periods of life.

I may note here that those cases in the preceding tables wherein the ages are "not stated", I would feel warranted from the context of their records in assuming that they were adults; but whether so included or entirely set aside the estimate I have drawn is not substantially impugned.

Whatever the age there is abundant evidence that diseases of the Ear originate a large proportion of cases of Abscess of the Brain. The proportion has been estimated at a high figure by that very careful and competent observer Von Tröltsch * who says "perhaps half of all cases of Abscess of the Brain take their origin from suppurative inflammation of the Ear". If I form a ratio from the Table at p. 12. the

* Surgical Diseases of Ear. p. 66 Trans of Syd. Soc 1874.

proportion of cases of abscess of the brain associated with disease of the ear is seen to be 42 per cent and if both tables p.p. 12 and 13 are thrown together the proportion is 56 per cent, and these tables are therefore so far an evidence that the estimate given by Von Tröltsch is not far from the truth.

The question naturally arises: since children are more subject to aural discharges, and since aural disease is the most frequent originating cause of Abscess of the Brain, why should Children be so largely exempt from liability to Abscess of the Brain? The explanation will be found, in a large measure as I believe, in considerations arising from a comparison of the structure of the Organ of Hearing in the child and in the adult, and of the changes the organ undergoes as it approaches full development.

In the child the mastoid process of the temporal bone is in a very rudimentary condition. It does not form a large projecting promontory as in the

adult. In section it is comparatively homogeneous and only minutely porous resembling in petto the surface of a fine sponge. It contains few mastoid cells properly so called, excepting one large cell the antrum mastoideum continuous with a rudimentary tympanic cavity. In nearly its entire thickness the mastoid process of the child forms a barrier of bone extending backwards between the tympanic cavity and the groove on the inner wall of the temporal bone for the lateral sinus.

In the adult on the contrary the mastoid process is large and projects considerably. It is hollowed out into numerous large cells which are in communication and are indeed an appendage of the tympanic cavity with which they are continuous. The aperture of communication between the purely mastoid cells and the tympanum is much narrower in the adult than it is in the child. This important fact which, as far as I can ascertain, has not

been hitherto noted, is very apparent on examin-ation of a series of sections of young bones at different ages. The cells occupy and completely transform that portion of the mastoid which intervenes between the tympanum and the osseous wall of the lateral sinus. The mastoid cells are not entirely formed by invasion backwards of cells which are in communication with the antrum. The whole mastoid process gradually becomes converted into cells which inter-communicate and ultimately lead into the antrum at its posterior wall.

There is therefore in the adult only a thin screen between the large cells of the mastoid and the lateral sinus. Not unfrequently there is no osseous barrier, for I have in several instances found the lining membrane of the mastoid cells in direct contact with the dura mater.

In the child the outer surface of the temporal bone where the squamous unites with the mastoid portion, the line of junction is only partially ossified and often so defective as to permit a readily formed opening through

which at times is spontaneously discharged the purul-
-ent contents of the tympanum and antrum.

But in the adult this suture is completely ossified and the outer layer of bone instead of being weakened by the developement of the mastoid cells is on the contrary strengthened by the attachment of the powerful muscles which by their strain induce a stimulated nutrition and consequent thickened cortex to the bone. Near the meatus where no muscles are attached, the bony cortex is thinner and the mastoid cells are nearer to the surface a fact not to be lost-sight of when that useful operation of trephining into the mastoid cells or into the tympanum is desirable or necessary.

In the adult there is not unfrequently only a thin lamina of bone forming the roof of the tympanic cavity (the tegmen tympani) and in some instances although rarely, as I believe, it is altogether deficient. According to Toynbee and certain other aural authorities this defective condition

or complete absence of the tegmen tympani has been seen so frequently as to constitute fully 5 per cent of cases. But I am well satisfied that this percentage can only be derived from an examination of temporal bones in which the disease has more or less existed. For, to satisfy myself on this point, I have made a very careful examination of above one hundred healthy crania and in no one instance did there exist such deficiency. I have therefore no doubt whatever that in the majority of cases where the tegmen tympani is found deficient it was more or less a consequence of a previously diseased condition that has induced atrophy and absorption.

The alleged greater frequency of caries of the tegmen tympani over that of other portions of the temporal bone, - if such does actually occur, - must be due to other causes than actual deficiency of the bony roof.

The tympanic cavity, together with the mastoid cells which may be considered analogous with the cells and sinuses of the organ of smell, is lined

with a delicate fibro-mucous membrane, which to other uses adds that of a periosteum in nourishing the structure of the bone. The large surface presented by this membrane explains the profuseness of discharge which characterises "a running ear". While the number of cavities and the complexity of their communications explains the difficulty and occasional impracticability of efficient topical treatment, especially in the adult, because of the more extensive and more complicated surface presented. And hence the advantage of early attention to cases of running ear, and hence also the increasing gravity of the prognosis as the disease becomes more and more chronic. Because, in the former case, there is an increasing probability of diseased action having extended from the tympanum into the mastoid cells or into the sinuses and this probability becomes all the greater in the adult because of the comparative feeble vitality of the thin laminæ of bone which screen the cerebral cavity from the inner surface of the temporal bone. But this

liability to the extension of diseased action in the direction of the brain cavity is not so great in the child where a comparatively limited surface only is presented by the partially undeveloped tympanic cavity and single mastoidean cell, and where the thick barrier of bone between the tympanum and the interior of the skull is at the most active stage of growth and of reparative power. The differenc which exist between the organ of hearing in the child and in the adult extend to every part of the structure and exercise an influence that modifies all the pathological conditions that can arise. Thus the dura mater which in the child is closely adherent to the temporal bone and also to the wall of the lateral sinus becomes in after life lax in its connection with the bone and contributes little nutriment though such connexion as exists. That nutriment in the adult is furnished substantially by the vessels of the fibro-mucous membrane that lines the mastoid cells of the interior. Therefore when suppuration occurring in the tympanum

of the adult extends into the antrum and other mastoid cells, this lining membrane in its depressed state of nutrition and subject to pressure by an accumulating diseased secretion becomes incapable of supporting the healthy vitality of the thin lamina of bone that forms the walls of the mastoid cells where they abut upon the lateral sinus or where they form the roof of the tympanic cavity and Caries or necrosis is a frequent result. But when suppuration occurs in the tympanum of the child the diseased action is hindered from extending backwards and inwards by a barrier of thick well nourished bone, and therefore it is rare in the child that such suppurative action penetrates the lateral sulcus or the lateral sinus. And in a degree greater than in the adult it is also hindered from penetrating through the tympanic roof.

The tendency of the suppurative flow is nearly altogether outwards in the child, because the purulent matter finds less hindrance and a readier vent to

the external surface through the thin and frequently imperfect suture that forms the junction of the squamous with the mastoid process of the temporal bone behind and close to the meatus. Hence the greater frequency of caries of the mastoid bone behind the ear which is observed in the child. In this connexion I note that notwithstanding the frequency of caries of the mastoid process and the important benefits that unquestionably have resulted and may further be expected from surgical operation upon this part, the most recent text books on Surgery either omit all reference to caries of the mastoid or make the barest allusion to it as if it was a disease of rare occurrence.

As to the mode in which the disease progresses from the ear to the brain, the general opinion seems to be that the temporal bone becomes carious and as a consequence the dura mater ulcerates and the arachnoid, pia mater, and ultimately the substance of the brain participates in the disease as the result of direct extension from

the ear or by contiguity of tissue as conjecturally explained by Dr Barr. And when purulent matter has actually exuded from the mastoid cells through the osseous wall of the lateral sinus or has penetrated upwards and laid bare the roof of the tympanic cavity it is easy to recognise how the ulcerative action by mere contiguity of tissues should extend and form purulent deposits in the brain. But this is not the whole case. Purulent deposits in the brain are not always the result of diseased action. For in some instances an abscess is developed in the brain without manifest ulceration of the mucous membrane of the tympanum or cells and without caries of the bone. No doubt abscess of the brain associated with diseased bones of the ear is more frequent than where no caries or necrosis of these bones has been observed. Nevertheless so far as my data goes to illustrate this point the difference in relative frequency is not excessive. For, of the cases of abscess of the brain associated with disease of the ear

N. L.

given in table p. 13. There were 34 in which no carious or necrosed state of the bone had been observ-ed or at least noted although from the descriptive context if any such diseased condition had existed it would almost certainly have been recorded.

I do not think it necessary to pause here and enquire whether it is more probable that the suppurative action may have extended in some of the cases from the brain to the ear rather than from the ear to the brain. The consensus of well in-formed opinion is that the diseased condition extends from the ear to the brain, and that only in very exceptional circumstances can there be a probability of its extending from the brain to the ear.

These considerations lead to the question of the possi-ble or probable conditions under which suppurative action attacks the brain in cases where the bones are not carious or necrosed. Some observers believe that a sufficient explanation is to be found in the continuous irritation produced by chronic inflammation of

the mucous membrane, with want of free outlet for the accumulating depraved secretion. For, it is argued, the vessels which nourish the tympanum have, so far as is known, no direct connexion with the substance of the brain and therefore there exists no direct route along which septic matter can travel. And this is the very important problem to which Dr Barr has directed attention.

I venture however to affirm that under certain conditions which often exist in cases of abscess of the brain associated with disease of the ear — an indirect route may be established, and that a consideration of certain peculiarities in the Anatomy of the brain and its relations to its osseous envelope furnish a sufficient or a very probable explanation.

Hitherto I have restricted my considerations to the influence exerted upon diseased action by peculiarities in the structure or anatomical development of the osseous portion of the organ of hearing; and so far as these modify diseased

action occuring in early as contrasted with adult life. I have now to speak of peculiarities in the blood circulation of the bones of the cranium and in the sinuses, and of conditions under which that circulation becomes altered and thereby furnishes a new and a direct route along which disease producing influences may be conveyed from the ear to the brain.

When the dura mater is being separated from the surface of the brain there are seen small fibrous bands which stretch across and connect the two surfaces near the base of the brain and chiefly opposite the sinuses. These are veins. At two points they are larger than elsewhere, and three or four vessels are often comprised in one band.

Two sets of these veins enter the lateral sinus, one from the under surface of the cerebellum and the other from the under surface of the middle and posterior cerebral lobes. I have further observ-ed with unvarying frequency one and sometim

two veins which leave the inferior surface of the middle cerebral lobe and enter the superior petrosal sinus.

The usual flow of blood along these veins is from the brain towards the ear and therefore under usual conditions they cannot carry any septic matter from the ear or against the stream. But the cerebral veins, and all the veins inside the cranium, have no valves and therefore when any impediment occurs in the normal current there takes place a reversed flow and the blood reaches its ultimate normal destination by collateral channels and circuitous routes. What are the conditions which may cause such an impediment and such a reversed flow and where is that obstruction most likely to occur? In the adult as has been already observed the lateral sinus is in close proximity and sometimes in immediate contact with the fibro-mucous membrane of the mastoid cells and there are numerous small veins

which pass from the cells into the sinus. These veins originating in a diseased membrane readily propagate their inflamed or diseased condition to the corresponding coats of the lateral sinus. An equally ready channel for the conveyance of septic matter contained in the tympanum or mastoid cells exists in the perivascular spaces of these mastoid veins, and along these spaces the irritating matter can travel with little hindrance until it emerges within the cranium between the fibrous coats of the lateral sinus and the osseous groove in which it rests. The pressure and irritation caused by the retained pus gives rise to more or less thickening of the walls of the sinus, to a diminution of its natural calibre, and to consequent obstruction. This irritative or inflammatory action may induce Thrombus. In detailed reports of cerebral abscess, it is very frequently noted, although without drawing the deduction to which I am leading, that the

lateral sinuses contained thrombi and I think it likely that if attention is given to this occasional association of thrombus in the sinuses with co-existing abscess of brain the presence of clots in the sinuses will be more frequently recorded. But this is a point that I will elucidate at greater length subsequently.

Irrespective therefore altogether of actual caries or of necrosis of the temporal bone the walls of the lateral sinus are exposed to irritating influences propagated from the tympanum and mastoid cells. Septic matter contained in those cells may enter the mastoid veins directly and be carried into the lateral sinus. The modus operandi by which blood cells pass through capillary walls from within outwards or from without inwards without actual breach of surface has been sufficiently shown by Cohnheim and others. Klebs* has shown how Bacteria pass into the circulation

* vide Koch on Traumatic infective diseases.
Lud Soc. Trans. p 3 v= 1880

from a surface bathed with septic matter and has traced their penetration into the interspaces of the cellular tissue either with or without the aid of wandering lymph corpuscles – has observed their penetration through the eroded walls of a vein into the circulation and has detected their presence in thrombi within the veins. And the experiments of Koch in which he produced artificial traumatic infective diseases have abundantly demonstrated that the soluble poison "sepsin" which exists in putrid blood, and also the various forms of microscopic parasitic germs known under the names of Bacteria, Micrococci, Zooglea &c can permeate the vascular tissues and become located in the heart, lungs, liver and other organs. He revels in description of the various modes in which the various forms of infective germs assail the organs and tissues. "It is quite possible" he says "that the Baccili grow into the vessels and enter the circulation through spaces in their walls which

permitted the exit of the much larger red blood corpuscles. He tells us that after subcutaneous injection of septic matter in the capillaries the "Bacilli congregate particularly at the points of division" and that "one meets everywhere with vessels containing free Bacilli, and with white blood corpuscles with Bacilli in their interior"[1]. He shows that these infective microscopic organisms differ in size, form and in most other points and describes six out of many varieties which he believes to exist and shows various modes in which they affect the living organism. Of one variety - Pyæmic - he says "the manner in which these micrococci exist when spun round the blood corpuscles and enclose them seems to me to be quite characteristic of this particular form" and is disposed to believe that the large metastatic deposits in the liver and in the lungs do not arise by gradual growths of a mass of micrococci but by the arrest of large groups of micrococci and of

the clots associated with them found in the manner described in the circulating blood; in other words by true embolism. Of another variety - Septicæmic [redacted] - he says "they "never enclose the blood corpuscles even when "they have accumulated in large numbers in the "interior of the blood-vessels. They rather push "them on one side. They do not cause coagulation "of the blood and thus emboli do not occur." And when referring to the remarkable distinction in physiological character of the different classes of these parasitic microscopic germs he says "I scarcely know a more striking example than "the case of the Bacillus and of the chain like "Micrococcus growing together in the cellular "tissue of the ear; the one passing into the "blood and penetrating into the white blood "corpuscles - the other spreading out slowly in "the tissue in its vecinity and destroying everything "round about."

[of the mouse after traumatic infection]

The observations of Koch although in their main portions restricted to generalisations are yet so remarkably suggestive as to be in some respects special. Thus to my mind they stimulate reflection and give aids in explaining why at one time an abscess in the brain associated with disease of the ear is characterised by unpleasant fetor and at another is bland and innocuous.

The lateral sinus may therefore become inflamed – may receive septic matter carried from the tympanum and mastoid cells – and may become more or less occluded through various causes. At one time the obstruction is explicable on simple mechanical principles, at another time it is based on the action of pathological stimuli. These conditions are well illustrated in a Report on Thrombosis and Embolism by Meisner* wherein he gives an analysis of 74 cases collected by Lancereaux. That observer distinguishes an inflam-

* Schmidt Jahr. Vol 117. p 209. 1863.

-matory and a nonanflammatory form of thrombosis of the cerebral sinuses. Of the 74 cases he alleges that 39 were of the former, and 35 of the latter. But neither Virchow nor Dusch who have treated ably of this condition admit the distinction. Inflammatory thrombosis of the sinuses according to Lancereux is invariably connected with ulcerations of the scalp or bones of the head. In 39 of the cases collected by him there were 30 in which caries existed and 24 in which "otitis interna" was present. The sinuses adjoining the seat of mischief were always diseased, while the superior longi-tudinal and the symmetrical blood channels were rarely affected. Purulent meningitis or abscesses often occur not only in the vicinity of the obstructed sinus, but also sometimes at a distance and unconnected with it. Effusions of blood are alleged to occur only in exceptional cases because by means of the previous inflam

-mation collateral channels have been formed which, he states is not the case in non-inflam-
-matory thrombosis. Dusch* concludes generally that coagulation of blood in the sinuses may be due to the propagation of a coagulum from the neighbouring veins in cases of caries, necrosis, and wounds of the cranium and of extravasation of blood into the substance of the brain. Or, it may be due, he says, to any cause either of a local or general nature, such as anaemia, feeble heart, or the compression of the sinuses by tumours, — and to the latter cause I may add as already adduced — to reduced calibre of the sinus from thickening of the coats.

But whatever the cause of obstruction, the flow of blood is arrested just as it should pass out of the cranium into the internal jugular vein. The venous blood thus intercepted or retarded must then reverse its normal course and go to

* Brit. Med. Journal April 1861

swell the stream flowing through the sinuses on its way to the heart by the internal jugular vein of the other side. But from their structure the sinuses are practically non-dilatable and therefore every collateral channel is overtaxed to carry off the accumulating blood. The superior petrosal sinus on the affected side, which is fed by veins from the inferior surface of the middle lobe and also by veins from the tympanum and middle ear, is the first to become overcharged. As the obstruction is distal to the entrance of the cerebral and cerebellar veins already referred to they also become turgid and also have their normal flow reversed more or less. They are then liable to convey some of the blood which was intercepted at the lateral sinus into other sinuses such as the cavernous or longitudinal. These vessels however are dilatable and have their walls which under distention are liable to become varicose. The

effect of this distended varicose condition is a continued and localised pressure upon the delicate surface of the brain, together with consequent œdema and impaired nutrition. The chain of diseased process is therefore considerable and very connected, and quite sufficient to induce softening or other form of diseased action as suppuration. And this altogether irrespective of the liability to the deposit of septic matter which if present in the lateral sinus has now by the circuitous channel I have described, direct access to the surface of the brain. It is to me therefore very clearly evident that blood flowing from the tympanum or internal ear can - under the conditions I have specified - pass directly into the lateral sinus or into the superior petrosal sinus and from thence by the cerebral veins direct to the surface of the brain. And thus - as I contended at the outset - although admittedly there may be no <u>normally</u> <u>direct</u> vascular

connection between the Ear and the substance of the brain there is nevertheless an abnormal or indirect connection which in certain conditions ~~does exist~~ becomes established.

It forms no part of my subject to deal with the practical aspect of the questions that naturally arise having reference to treatment. I have restricted myself to anatomical and pathological considerations, in the belief that I will have contributed a sufficiency of suggestive matter in my references to the importance of early and earnest attention to the diseased condition commonly called "a running ear", and as an important department of the necessary treatment in directing attention to the probable ~~nay~~ certain value which should be placed on the operation of trephining the mastoid in cases of retained pus.

James A. Adams M.B.

Fell. of the Fac. of Phys. & Surgeons

Explanation of Plates.

Plate I. Fig. 1. Drawing of adult right temporal bone shewing the squamo-mastoid suture (α-β) through which pus finds a ready vent in the young bone. Thinnest part of cortex is in front of this. Fig. 2. Young temporal bone (left). Single mastoid cell or Antrum (D.). Porous section of mastoid (E). in which no cells have as yet formed. Tympanic ring or bone (C).

Fig. 3. Squamous portion of temporal bone removed. Fully developed mastoid cells (H.), leading into tympanum (G) by the antrum mastoideum (F). Styloid process (i).

Plate II. Sinuses at base of skull. The arrows on left side indicate normal flow of blood. On right side owing to obstruction at O. the reversed current is indicated. A.=Lateral sinus. B. & E=veins from the surface of brain. C = position of internal jugular vein. D.=Sup. Petrosal sinus. F.= Inf. ditto. G.= Transverse sinus. H = circular and I = Cavernous.

Plate I

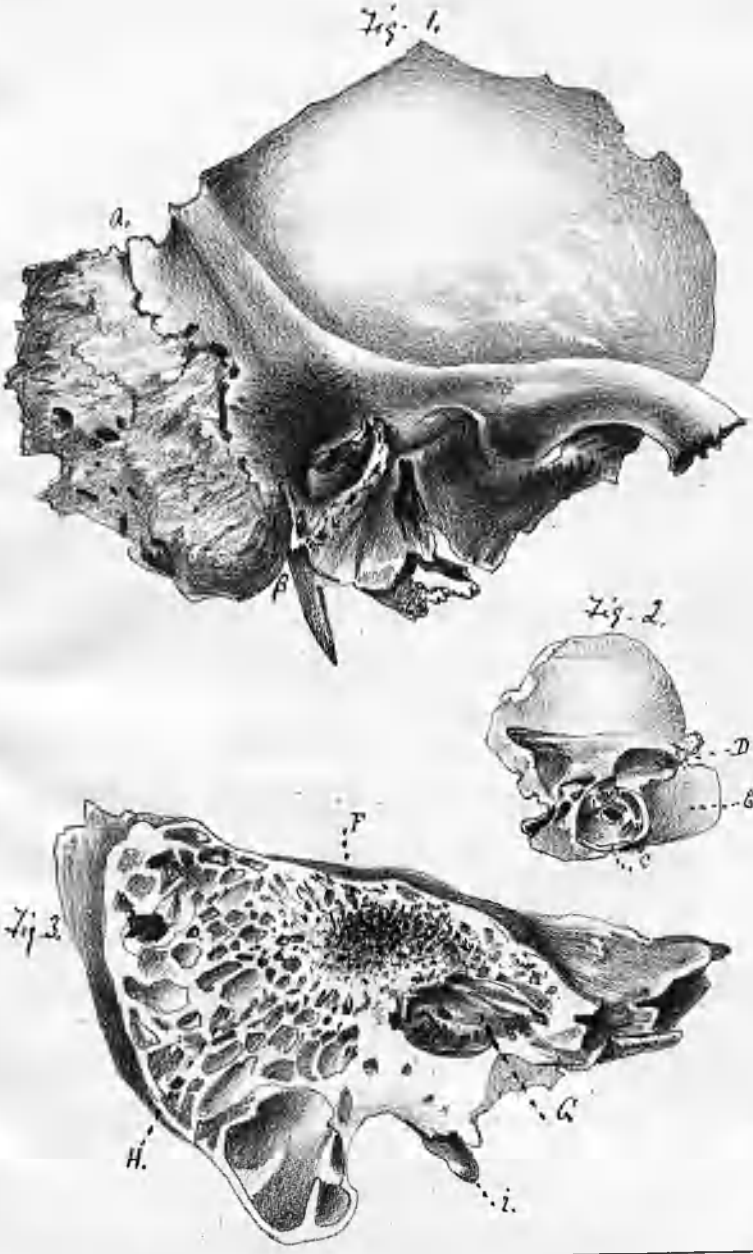

Plate II

J. A. A.