

the curette and follow the fistulous tract which exists and which always leads into the antrum. After he has reached this cavity he may proceed with curettes and forceps as in the first type of cases. In following such

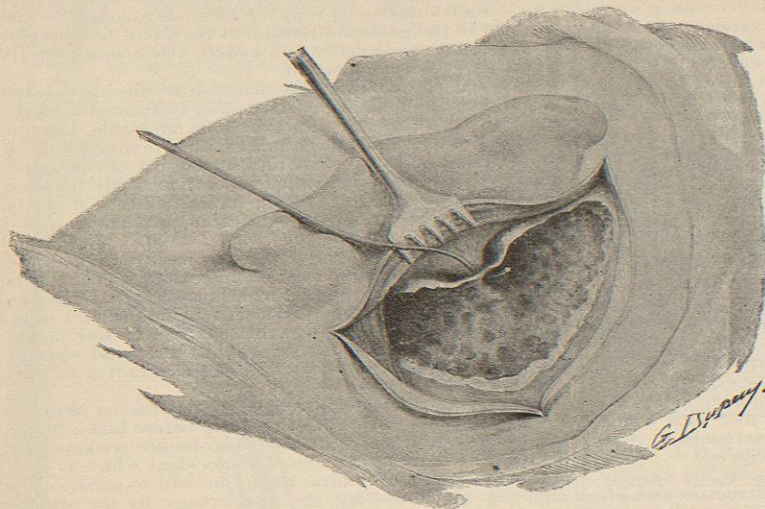


FIG. 3328.—The Completed Operation for Simple Mastoiditis. The digastric muscle is shown, at the inferior portion of the field of operation, occupying the place previously occupied by the removed mastoid tip. The upper portion of the operative field shows the ablation of the cells at the root of the zygomatic process. These cells at times extend farther forward than is shown in the illustration. The illustration is also utilized to show the placing of the bent silver probe in position, which acts as a guide in the removal of the posterior wall as is done in the radical operation (see below). The probe is introduced between the bony and membranous walls of the external auditory canal into the middle ear through the aditus and antrum and its bulbous-tipped end shows in the excavated antrum. Of course this probe is not used in cases of simple mastoiditis. In an illustration of this character it is impossible distinctly to show the actual depth of the antrum and the excavated portion of the mastoid process.

a fistulous tract, however, considerable caution is needed if one wishes to avoid plunging into an uncovered lateral sinus.

When the surgeon is positive that every pneumatic cell of the mastoid process has been excavated, and after he has carefully smoothed down all the rough places both on the inner table of the mastoid process and along the edges of the excavation in the bone, he may either cleanse the cavity with a decinormal salt solution or simply mop the surface with dry sterile gauze. (In children particular care should be taken not to use such solutions as one of bichloride of mercury, on account of the ease with which solutions pass through the Eustachian tube into the throat.) After this has been accomplished, the next step is to tie off any bleeding vessels, then to close with silk-worm-gut sutures the posterior cutaneous incision, if one has been made, and, finally, to close in the same manner the upper angle of the auricular incision as far as the level of the external auditory canal. The remainder of the incision is left open. The cavity of the wound is packed with iodoform gauze, and a small wick of iodoform gauze is also inserted into the external meatus. The wound and the auricle are then covered with sterile gauze and a bandage is applied over all.

This dressing is left in place until the sixth or seventh day (unless pain, or a rise of temperature, indicates the necessity for its earlier removal). In many cases a post-operative fever will occur on the day after the operation, and in infants and young children the temperature is very likely to rise as high as 102° F. If the fever continues on the second and third days it may be due to wound infection or to some complication; under these circumstances the dressings should be removed and the parts examined. The cavity at each dressing is dry-cleaned, a sterile gauze dressing is very loosely placed in it, and

the external dressings are applied as before. The sutures are removed on the seventh or eighth day. If the case has been one of simple mastoiditis, it is seldom requisite to keep the patient in

bed more than from seven to ten days. Care must be taken in all subsequent dressings that the granulations shall spring up evenly around the bottom of the wound, and that the superficial healing of the wound shall not occur before the cavity is filled with healthy granulation tissue.

In cases with a past history that is favorable, healing takes place in from four to six weeks; while in cases with a previous history of ill-health the healing may be delayed for as many months. The after-care of the case is one that requires much judgment. Irrigation, especially with a solution of bichloride of mercury, is injurious to the delicate granulations which are endeavoring to fill the cavity. For cleansing the latter, careful use should be made of pledgets of dry gauze or of pledgets of absorbent cotton moistened in sterile water. After the first few dressings the wound should be packed with simple sterile rather than with iodoform gauze, as the latter tends to promote exuberant granulations. The packing should be introduced somewhat loosely, the quantity of gauze used being simply sufficient to absorb the discharge and to prevent the superficial union of the tissues. The scissors or the curette or the stick of pure nitrate of silver or chromic acid may be used for the removal of exuberant granulations, which at times form along the edges of the wound. To stimulate the formation of granulations on the bone, in cases which are slow to heal, an application of pure carbolic acid, followed immediately by one of absolute alcohol, will be found advantageous. A solution of nitrate of silver, of a strength of from forty to sixty grains to the ounce of distilled water, or balsam of Peru, may also be used. Insufflations of boric acid, of subgallate of bismuth, or of xeriform, are of assistance in cases in which there is much discharge, as also toward the end of the healing process. After the first few dressings the gauze bandage (Johnson and Johnson manufacture a black gauze bandage which is less conspicuous than the white one) may give way to a black silk pad which is tied over the wound by means of tapes passed around the head. When the wound becomes small enough, the dressing may be fastened to the skin by means of flexible collodion.

THE RADICAL OPERATION, OR THE SCHWARTZE-STACKE OPERATION.

This operation is undertaken for the purpose of curing cases of chronic purulent inflammation of the middle ear in which the actual disease is not confined to the lower portion of the tympanic cavity and the cells around the tympanic end of the Eustachian tube, but consists of a caries of one or more of the ossicles and of some portion of the epitympanic space, associated with caries of the adjacent cells. The disease may or may not be accompanied by a cholesteatomatous condition of these cavities.

By means of the operation the surgeon seeks to establish a single large cavity consisting of the excavated mastoid cells, the tympanic cavity, and the external audi-

tory canal; this cavity eventually to be lined with a non-secreting epidermal membrane.

Indications for the Operation.—In all cases in which there is a chronic purulent discharge (odorless or non-odorless), which will not, after a thorough trial, yield to skilled treatment, this operation ought to be performed, and no other objective symptom is to be waited for. And why? Chronic purulent inflammation of the middle ear is the direct cause of from thirty (Pitt) to fifty (Barr) per cent. of the brain abscesses that occur. It is estimated that in this country about four thousand cases of brain abscesses of otitic origin end in death annually. According to Körner the Prussian statistics for 1885 give a death rate for otitic brain abscess three times as great as this for each ten thousand of population, or 1.5 for each ten thousand of population. A fairly large percentage* of the cases of leptomenigitis, of pachymeningitis, of pyæmic sinus-thrombosis, and, to a less degree, of septic pneumonia, pleuritis, etc., are of otitic origin. To prevent the development of these most serious complications the aural surgeon must urge the necessity of dealing with every case of chronic purulent discharge from the middle ear as something not to be lightly regarded, but as a disease which must be eradicated, no matter how innocent a case it apparently may be. The disease is capable of advancing most insidiously, and generally without any symptoms, until a very extensive destruction not alone of the tympanic cavity and its adnexa but of the brain tissues as well, has taken place. Brain abscesses have often been found at the autopsy to have been the cause of death

when no such lesion was suspected in life. How many more cases of this and other pyæmic complications of otitic disease are fatal annually, in which death is attributed to the complicating pyæmic metastasis, or to apoplexy, or to heart disease, may only be suspected.

Macewen says "that one who has a chronic purulent otitis media is liable to have, with very little warning, a most serious or even a fatal illness." Acute or chronic disease of the middle ear is a disease that is fraught with much danger to life and should always be regarded most seriously.

THE STEPS OF THE OPERATION.—The first portion of this operation is performed, with some slight changes, in the same manner as is the operation for simple mastoiditis. The incision is carried a little farther forward to a point a few millimetres in front of the anterior insertion of the auricle. If a fistulous tract exists in the skin surface it is excised or the incision is made so as to include it. In the retraction of the anterior flap it is pushed farther forward and at the same time the posterior wall of the membranous external auditory canal is separated from its bony support and made to lie flat on the anterior wall of the canal, thus exposing the entire upper and posterior wall of the bony canal as far as the tympanic ring. The operation upon the bone is performed in the same manner as in the first operation described, up to the stage at which the latter is considered complete; then from this point onward certain additional steps are required. The first of these consists in bending the tip of a pure silver probe at nearly

* About five per cent. of all cases of meningitis and two-thirds of all cases of sinus-phlebitis are of otitic origin (Pitt). In 17,028 autopsies in London death was due in 102, or 1 in 167, to an otitic lesion. In 10,707 cases with tympanic suppuration 69 deaths occurred as the result of the aural lesion, or 1 in 155 (Körner). In 38,017 aural patients death occurred, as the result of the disease, in 113, or 1 in 339 (Bürkner's and Randall's individual statistics combined).

a right angle (the bent portion measuring about 6 or 7 mm. in length) and then passing it along the posterior wall of the external auditory canal into the tympanic cavity until its tip projects into the antrum (see Fig. 3328). This probe serves as a guide to show the position of the facial nerve, while the upper and posterior canal wall is being removed. Jansen's forceps (Fig. 3324) is the best instrument with which to accomplish this object, although the mallet and chisel may be used in the removal of the external portion of this canal. When, however, the surgeon reaches the internal portion of this posterior wall he will have to remove a bridge of bone which has no support, and if, for the accomplishment of this, he employs the chisel, it may easily happen that he will remove a piece which is much larger than he intended to remove, and which may include the facial canal. On the other hand, with Jansen's forceps, especially curved for this purpose, the amount of bone removed may be accurately gauged. The portion of bone which must be removed at this point extends, like a partition, from the tympanic roof to the floor of the aditus ad antrum. The next step is to remove the remnants of the ossicles and such granulation tissue as may be present in the tympanic cavity, especially in the vicinity of the pharyngeal end of the Eustachian tube and on the floor of the cavity. This is best accomplished with the curette, which must be cautiously used, as it is with this instrument that damage to the facial nerve is most often done. It is therefore safer, before curetting, to use the probe, in order to determine whether or not the facial

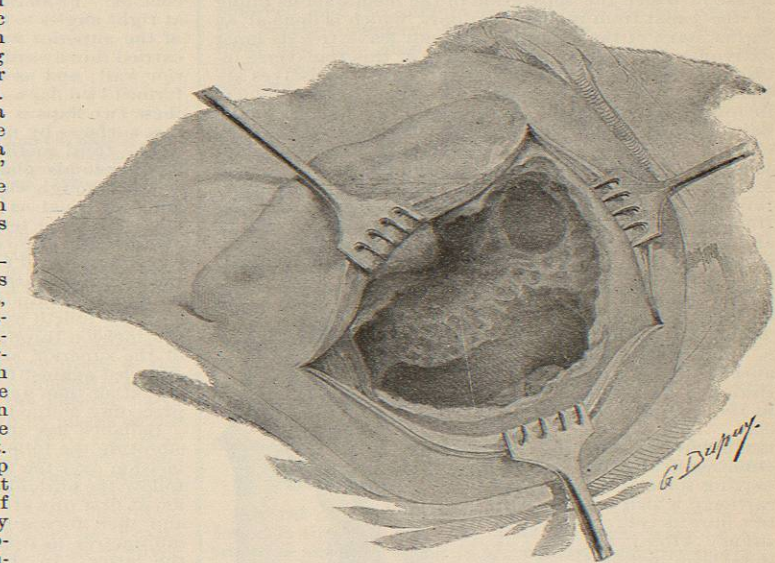


FIG. 3329.—The Illustration Shows the Completed Radical Operation; the Posterior Wall has been Removed, and the Excavated Mastoid Cells and Middle Ear have been United with the External Auditory Canal to Form One Large Cavity. It also shows the exposure of the dura mater in the middle fossa and the exposure of the sigmoid sinus from its knee to within a short distance of the jugular bulb. When it appears desirable to expose the posterior fossa the bone must be removed in a backward direction over a still larger area.

nerve is exposed. When it is exposed, the pressure of the probe will cause the muscles of the face to twitch. It is by the use of the probe, furthermore, that information is to be obtained in regard to the possible existence of a sinus leading into the posterior or the middle cranial fossa. If such a sinus is discovered the bony structure through which it passes must all be removed and the underlying dura mater and sigmoid sinus inspected, so

that, if any complicating lesion of the meninges, the sinus, or the brain itself, exist, it shall not escape discovery.

In cases of chronic suppuration with cholesteatoma the bone should be thoroughly searched for the presence of any fistulous tract, and if one is found it should be thoroughly curetted. At no point should any but healthy bone denuded of membrane be left behind. Unless this is done a recurrence of the cholesteatoma is most likely to ensue.

When the surgeon has smoothed and rounded off all sharp edges of bone and is positive that he has removed all necrotic tissue, he may proceed to form, from the posterior portion of the membranous external auditory canal, the flaps which are to serve in large part as a lining membrane for the excavation in the bone. It is usual, at this point, to speak of dividing transversely the membranous external auditory canal near its inner extremity. I may state, however, that I have never seen

a case in which the separation of the membranous lining of the canal from its bony support, which is done at an earlier stage of the operation, did not leave free its inner extremity and so render the making of this transverse incision unnecessary. So far as the flaps themselves are concerned, it is possible to solve this part of the problem in four different ways. According to the first method a pair of artery or dressing forceps is introduced into the external auditory canal and held open so as to render tense its posterior cutaneous wall; then, with a small scalpel, an incision is made in the membranous canal through the middle of its superior surface and extending from its freed extremity to the cavum conchæ. A similar and parallel incision is next made through the inferior surface of the canal. In this way (Körner's method) there is formed, out of the posterior canal wall, a quadrilateral flap which is united to the auricle by a vertical line of union in the cavum conchæ. This flap is made thinner, at its outer end, by removing some of the cartilage which enters into its composition. After it has thus been reduced in thickness the flap is turned backward into the mastoid wound and united—by means of two catgut ligatures passed through its free extremity—to the posterior flap of the mastoid incision. The next step is to unite the edges of the mastoid incision—not throughout its entire length, but from the upper end down to within 10 or 12 mm. of its lowest point. The cavity made by these operative procedures and partially lined by the flap

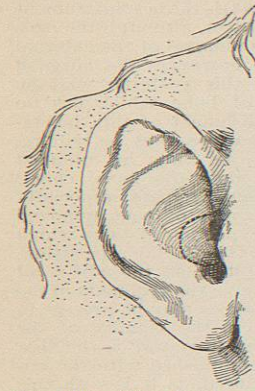


Fig. 3330.—The Incision to Form the Concho-meatal Flap in Ballance's Modification of the Radical Operation.

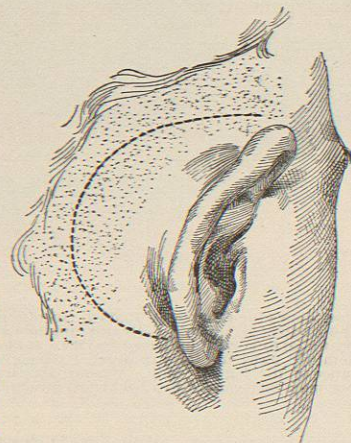


Fig. 3331.—The Incision as Suggested by Ballance in his Modification of the Mastoid Operation.

described above, is packed through the external meatus with a strip of iodoform gauze, and a small piece is introduced into the lower angle of the mastoid wound. The usual outside dressings are applied.

If the method of operating here advocated is adopted, the raw surface of the flap will be brought in contact with the raw surface of the flaps of the mastoid incision, and subsequently they will unite. From the free edges of this inner flap a new growth of epithelium will gradually extend over the granulating surface of the rest of the cavity, and thus, in the course of time, a non-secreting dermal lining will be supplied for the entire cavity which has been created by the breaking down of the partitions separating the mastoid cells, middle ear, and external auditory canal. After the healing is complete, a survey of the cavity will reveal the fact that a small ridge is located in its lower portion. This ridge, which is composed of the remainder of the posterior bony wall of the auditory canal, contains the facial nerve and divides the cavity into a posterior and an anterior half. In a few instances I have observed the development of facial paralysis at the end of a few hours, or even a day or two, after the operation. I have attributed the phenomenon, which was only transient in character, to the pressure exerted upon an exposed facial nerve by the saturated dressings which filled the cavity.

The second method of providing a lining for the excavation in the bone is that suggested by Panse. The first step in this procedure consists in carrying the incision through the middle of the posterior membranous wall of the external auditory canal as far outward as the cavum conchæ. From this point one incision is carried upward, at right angles to the first incision, as far as to the summit of the superior wall of the canal, while a second one is carried downward as far as the lowest point of the inferior wall; and as a result of these incisions there will be formed two flaps—an upper and a lower one. Each of these two flaps is held in position against the underlying raw surfaces by means of a gauze tampon.

The third method is that suggested by Stacke. According to his plan, the flap is made by carrying an incision through the middle of the superior wall of the auditory canal as far outward as to the cavum conchæ, while from the termination of this first incision a second one is carried downward as far as to the lowest point of the inferior wall of the canal. The flap thus formed is pushed downward into the bony cavity and held in place by a gauze tampon.

In the fourth method the flap is constructed by making the incision through the inferior cutaneous wall instead of the superior, and then by means of the packing it is crowded against the upper and posterior wall of the cavity rather than against the lower and posterior, as in the preceding method.

Ballance has still further modified the operation by adopting the following course: He begins the cutaneous incision over the tip of the mastoid process, but does not follow the auricular groove; instead, he carries the incision at first upward and backward, in a curving direction, and then forward, above the auricle, to a point a few millimetres in front of the anterior superior insertion of the latter. In this way he makes an unusually large semicircular anterior flap (Fig. 3331). From this preliminary incision onward the operation proceeds as in the one described above until the stage is reached at which it becomes necessary to make the flap in the auditory canal. In constructing this, Ballance carries his incision along the floor of the canal as far as to the concha, then downward, then slightly backward and upward, and finally slightly forward and upward until the helix is reached (Fig. 3330). This flap is united by sutures to the anterior mastoid flap. After the ends of the suture have been brought through the canal flap the needle is threaded double and passed through the mastoid flap (Fig. 3332), and then the two ends of the suture are tied over a small piece of rubber tubing. The outside wound is entirely closed. The inner cavity is packed with gauze. From ten to fourteen days later

the patient is given an anæsthetic, the cavity is washed out with a warm sterile saline solution, and the mastoid wound reopened. After all oozing has been stopped a Thiersch's skin graft, which has been obtained in the mean time from another portion of the body, and which is large enough to cover completely the granulating surface of the cavity, is carefully applied to this area and then covered with gold leaf. The cavity finally is plugged with sterile gauze which is left in place for two or three days. At the end of this period the gauze should be removed and the gold leaf gently washed out. Ballance claims for this mode of operating a much shorter period of after-treatment.

THE STACKE OPERATION.

The patient is prepared as for the former operations. The first incision is made as in the radical operation described above. The anterior flap is reflected forward so as fully to expose the bony external auditory canal; the membranous canal is then completely shelled out of its bony support and the entire mass is held forward with a blunt retractor. This gives an unobstructed view of the tympanic cavity and of the bony structures to be operated upon. If any remnants of the tympanic membrane or of the ossicles, or any granulation tissue, be present, they should all be removed and the tympanic cavity cleaned. As the next step, the upper and posterior walls of the canal should be removed with the chisel to such an extent as will fully expose to view the epitympanic space and the antrum. Of course great care must be used to avoid wounding the facial nerve. As an extra precaution against this accident Stacke makes use of a hook-like instrument which he calls a "protector" and which is introduced from the tympanic cavity into the antrum, so that if by any chance the chisel should slip it will strike this protector.

The posterior canal wall is removed as in the radical operation and all cells adjacent to the antrum are removed; in fact, the operation on the bony parts should, so far as circumstances will permit, be as radical as the so-called radical operation. The chief point of difference between the two is to be found in the fact that in the radical operation the mastoid cortex is first removed and the antrum entered from behind, while in the Stacke operation the antrum is entered from in front and the mastoid cells are excavated by work done wholly from the side of the external auditory canal—the mastoid cortex being left undisturbed. This operation must necessarily be less complete than the Schwartz-Stacke operation, for it is not possible, by way of the external auditory canal, to remove the mastoid cells at the tip, or even those situated at a higher level. Exposure of the middle or the posterior cerebral fossa often takes place in the Stacke as in the other operations, but under strict asepsis this occurrence need cause no anxiety. Stacke's, as well as the other methods of furnishing an epidermal lining for the excavation by means of a flap, has already been described above. The flap or flaps thus provided are to be pushed into place and iodoform gauze packed down upon them to hold them in apposition with the bony wall after the external mastoid wound has been entirely closed. In the subsequent management of the case the same directions are to be followed as those which are mentioned in the description of the Schwartz-Stacke operation.

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In the class of cases which we are now

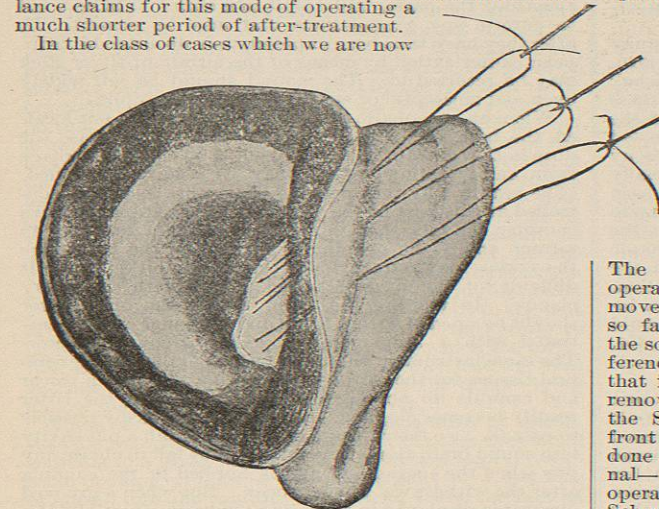


Fig. 3332.—The Concho-meatal Flap is seen Behind the Mastoid Flap. The sutures are passed through it and the two ends of each suture are then threaded on one needle and passed through the mastoid flap and then tied over a piece of rubber tubing. (From Jacobson and Steward: "The Operations of Surgery.")

considering, the after-treatment requires much judgment. Irrigation should not be resorted to if it can be avoided; as a substitute, very gentle dry cleansing is to be preferred. The first dressing need not be disturbed for six or seven days unless the temperature denotes a septic disturbance; subsequently, however, the parts will have to be dressed every other day. The sutures are generally removed at the time of the first dressing. The gauze drain in the lower end of the mastoid wound is to be gradually shortened until the wound has healed from the bottom. Exuberant granulations are to be cut down by means of the curette, which must be used very gently, or by means of a small bead of nitrate of silver fused on the end of a silver probe. At each dressing the cavity should be dusted with finely powdered boracic acid or with subgallate of bismuth, and a loose packing of sterile gauze should be inserted. If there is much suppuration from the Eustachian tube an application of a solution of nitrate of silver (fifteen or twenty grains to the ounce of distilled water), or of one of sulphate of zinc (five or six grains to the ounce of distilled water), should be made to the mouth of the tube on a cotton-tipped applicator. The cavity must not be allowed to become obliterated by excessive granulations and strict asepsis must be employed so as to prevent the possibility of perichondritis. If the case is one in which an acute exacerbation has taken place, with the formation of a subperiosteal abscess and perforation through the skin, it may be impossible to obtain, from the immediate vicinity, enough healthy skin to cover the exposed portions of the mastoid. When this is found to be the case, the difficulty may be overcome by a resort, at some later date, to a plastic operation, or the healing may be hastened by the transplantation of small skin grafts.

OPERATIONS FOR MENINGITIS, EXTRADURAL ABSCESS, ENCEPHALIC ABSCESS, AND FOR SINUS-THROMBOSIS OF OTITIC ORIGIN.

Several of these intracranial lesions are often to be found in the same case, the most frequent being an extradural abscess, which is a localized pachymeningitis, walled off by adhesions from the rest of the dura mater. In cases of sinus thrombosis a complicating encephalic abscess is more apt to be cerebellar than cerebral. As a rule, the intracranial lesion is most often found in the vicinity of the most necrotic portion of the causal focus of ear disease.

I. *Extradural and Encephalic Abscesses.*—Extradural abscesses in the middle fossa generally lie just outside of (*i.e.*, below) that portion of the dura which covers the lower and posterior portion of the temporo-sphenoidal lobe, while those occurring in the posterior fossa are in contact with that portion of the dura which encases the anterior portion of the occipital lobe. Of encephalic abscesses the majority are to be found in the cerebrum, and of these the larger proportion are to be found in the temporo-sphenoidal lobe where they generally occupy