

these the best and most generally used is that known as Hartmann's tympanic-cavity cannula (see Fig. 1781).

Syringing of the tympanic cavity through the Eustachian tube is not much resorted to in this country. It presupposes, as a matter of course, a free exit for the liquid used through a perforation in the membrana tympani, and requires a catheter, fitted at one end by the syringe, and fitting at the other end rather snugly into the mouth of the Eustachian tube. It seems to me a rare occasion indeed when all that this method will accomplish cannot be more easily and better done in some other way. This criticism applies with even greater force to the method of Saemann and Gruber, by whom it is recommended that, in some cases of perforation of both membranes, the ear be syringed out by means of Politzer's method of inflation, with the single difference that the air bag, instead of being filled with air, be filled with water of a suitable temperature.

4. *Drying the Ear.*—This seems to me a therapeutic measure of sufficient importance, and one that is so often wrongly carried out, or not carried out at all, as to warrant us in speaking of it under a separate heading. In all cases in which an ear is syringed, or in which secretion is present, whether in the external canal or in the tympanic cavity, and especially if any medication is to be applied, thorough drying is an essential factor in successful treatment. The reason for this is evident: the amount of medication that can come into contact with any particular portion of the skin of the canal or mucosa of the tympanum is at best small; if this be diluted at the point of contact by ever so little water or secretion, the strength of our application becomes at once an unknown quantity.

This drying may be best accomplished by means of absorbent cotton and a cotton carrier; the small pledgets of cotton being applied under a good illumination of the parts. The pledgets used at the termination of this drying process should be so small as to pass through the perforation of the membrane, and absorb and remove the moisture from within the tympanic cavity. For the same reason I believe that patients should have impressed upon them the importance of drying the ear as a part of the home treatment, and I find that, as a rule, they can be taught to accomplish this with a fair degree of success by means of small pledgets of cotton rolled together between the thumb and finger of one hand to such a consistence as to hold their shape and reach nearly or quite to the bottom of the external auditory canal—beyond this of course a patient cannot safely go. The dry treatment of suppurative conditions, including dry cleansing, will undoubtedly be treated in detail elsewhere.

5. *Compression and Rarefaction of Air.*—(a) *Air Compression:* The technique of using compressed air—by Politzer's method, catheterization, etc.—is described elsewhere. To my lot falls a short discussion of its therapeutic use.

The influence of the air douche is first of all mechanical. In the next place, by opening the Eustachian tube it ventilates the tympanic cavity, and makes pressure on its walls, especially on the membrana tympani, pushing it outward, and with it the ossicular chain, thus tending to rectify a position of the membrane which is pathological, and to lessen the fixation of these parts. The same pressure is exerted upon the movable parts of the labyrinth walls—the two fenestrae, thus more or less affecting the intralabyrinthine pressure. As a further effect of the procedure, there may be, and probably is, some slight

tendency, on the part of the air current, to catch up small portions of mucus, germs included, and force them from the naso-pharynx and Eustachian tube into the tympanic cavity.

Upon the tympanum the effect is dependent upon the presence or absence of a perforation in the tympanic membrane. If a perforation exists, secretion is pushed through it into the external canal. If there is no perforation, it is still possible that a portion of the secretion, if not too thick and if the head be held in a proper position, may be forced out through the Eustachian tube and thus escape into the naso-pharynx. More usually, however, the air and secretion become mixed up and spread out in a thin layer over much of the surface of the tympanum. The further influence produced by the changes in the air pressure upon the circulation and the lymph stream seems to require a word, since, according to Kessel, the lymph vessels in the tympanic mucosa show round or sac-like enlargements, and stand in open communication with the tympanic cavity. If this be true, then pressure upon the mucous membrane should cause a movement of the contents of the lymph vessels in the natural direction. With the lessening of the pressure the lymph spaces are refilled from the tympanic cavity, and in this way a sort of suction is produced which must effectively aid the absorption of the mechanically broken-up and spread-out secretion. However this may be, experience proves that absorption of secretion can be accomplished by the use of the air douche.

The therapeutic effect to be obtained from Politzer's method of inflation seems much more limited than that from the Eustachian catheter, and to be attended with rather more risk of harm. The former would seem to find its legitimate use especially in cases with perforation of both tympanic membranes, when it is desired to empty the cavities of secretion; and possibly in children with tubal catarrh, as a temporary expedient until the condition is removed by proper attention to the cause. Catheterization, on the other hand, would seem to be the better method when the desire is for the ventilation of one ear only, and in the chronic cases.

(b) *Rarefaction of the Air:* This procedure has been used in the external auditory canal to affect the membrana tympani and ossicles, as well as to influence the intralabyrinthine pressure; it has also been much recommended for the removal of secretion from the middle ear. When the membrane is intact it may be used through the Eustachian tube, but in the case of a perforation it should be employed through the external canal. To get the desired effect in the canal the simplest means consists of a piece of rubber tubing armed at one end with a tip which tightly fits the meatus, and at the other with a mouth-piece through which suction is applied. The same principle is involved whether the suction be made by an empty rubber bag, as with Siegle's otoscope, or with the Delstanche *rarefacteur*. A word of caution as to all these methods is necessary, since if rarefaction is too vigorously applied, the result may be a rupture of the vessels with ecchymosis, or even rupture of the membrana tympani itself. The therapeutic effect most frequently obtained is a lessening or cessation, for a longer or shorter time, of tinnitus, a lighter feeling in the ear and head, and less often a gain in hearing.

The most frequent manner of using this principle for the removal of secretion from the tympanic cavity through the Eustachian tube, corresponds in a general way with the process for inflating the ear, with the difference that the air bag, supplying the suction power, is applied to the catheter empty instead of full, the effect being more or less enhanced by placing the head at the same time in such a position as to favor the escape of fluid through the tube. This method of necessity presupposes that the secretion is thin, and in suitable cases the procedure is oftentimes attended by appreciable results.

6. *The Use of the Eustachian Bougie.*—Opinion has varied greatly in regard to the use of the Eustachian bougie. Many have claimed excellent results from its use, while some have put their very positive stamp of

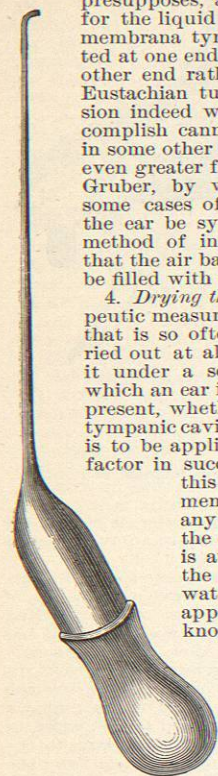


FIG. 1782.—Glass Middle-Ear Pipette.

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disapproval upon it, as an instrument capable of doing much harm. While it must be admitted that, if carelessly or unskillfully used, serious injury may result, can this not be said with equal truth of all good measures whether medical or surgical? For myself, I am sure that much good can be accomplished with the Eustachian bougie, especially in cases in which tinnitus and deafness are in a measure due to stenosis of the tube. The ordinary celluloid bougie answers well the purpose.

A closely allied therapeutic measure is that which is based upon the use of the metallic (gold) bougie, or electrode. This consists really of the bougie plus electrolysis, and some authorities claim that much more good is to be obtained from this procedure than from the use of the bougie alone, especially in those cases in which the strictures are dense and tight. The use of the bougie for massage of the isthmus tubæ will be spoken of under massage.

7. *Massage.*—The application of massage to the organ of hearing may be accomplished in various ways, and various parts of the ear may be thus treated. In the first place, going from without inward, may be mentioned that form of massage which was first described by Gerst, then elaborated by Zaufal, and finally warmly recommended by Schwartze. In this form the massage is applied to the region around the auricle, and is said to have its greatest value in promoting the absorption of secretion from the tympanic cavity in acute middle-ear catarrh. Zaufal's description of the method follows: "The patient sits with bare breast, and head inclined to the opposite side, on a low stool. The masseur stands behind the patient; both hands, well anointed with vaseline, are laid flat, one on the mastoid process, the other on the parotid region, so that the index finger of one presses upon the root of the sterno-mastoid muscle, the other on the anterior edge of the tragus; then rub downward, at first lightly, then with increasing pressure, to the level of the shoulder, so that the pressure of the index fingers is exerted especially in the groove between the ramus of the jaw and the head of the muscle, as well as upon the vessel furrow below." He recommends daily three sittings of three minutes each, or two of five minutes; and that in acute processes it should be deferred until the fever has disappeared.

Secondly, massage of the membrana tympani and ossicles, applied by some one of the various methods, may be used directly or indirectly. In case of its indirect application the cylinder of air in the external auditory canal is used as a medium for alternate rarefaction and compression. "Tragus pressure," as recommended by Hammell, may be mentioned first on account of its great simplicity. By rapid to-and-fro pressure on, and releasing of, the tragus, the air in the canal is thereby alternately compressed and rarefied, thus causing more or less motion of the membrana tympani and ossicles. The procedure is to be carried out by the patient from four to six times daily, each time for a minute or a minute and a half, and at the rate of from one hundred and twenty to one hundred and fifty times per minute. Although this method is frequently recommended by a number of aurists, I cannot say that I have ever seen much benefit from its use.

The same principle, it seems to me, can be much more effectively carried out by means of Siegle's otoscope, Delstanche's *masseur*, or some similar apparatus. In a certain proportion of cases the tinnitus is certainly somewhat relieved, at least temporarily, and less often the hearing manifests some improvement. In a somewhat similar manner the massaging force has been applied by means of more or less powerful sound vibrations, as produced by the vibrophone, vibrometer, etc. I mention these procedures, however, only to condemn them.

Direct application of massage to the membrane and ossicles may be accomplished by means of the flexible pressure probe of Luce, applied to the short process of the malleus, or by the mechanical vibrators of Lester, Freudenthal, and others. My experience with the so-called mechanical massage is, I must confess, limited, but it has been sufficient to force upon me the conclusion

that its use is not likely to be very extensive on account of the marked tympanic congestion which results, as well as on account of the pain experienced by the patient.

Intratympanic massage seems to me to be well worthy of mention here. For its accomplishment it is necessary that a more or less rapidly interrupted stream of compressed air, cold, warm, or medicated, should be conducted through the Eustachian catheter and tube against the inner surface of the membrana tympani. Its use is naturally limited to a great extent to the treatment of chronic middle-ear catarrhal conditions.

Finally, *massage of the isthmus tubæ* has been recommended by Urbantschitsch and more or less used by many of us. It is carried out as follows: a probe-pointed bougie (celluloid) is pushed through the Eustachian tube to the isthmus, and then rapidly (from one hundred and fifty to two hundred and fifty times per minute) moved in and out, first in the bony, then in the membranous portion. Begin with a session lasting a half-minute, and gradually increase the length of time of the sitting to three or even five minutes, with short pauses. The special indication for the employment of this method is to be found in the tubal swelling which accompanies chronic middle-ear catarrh, in which cases it should do more good than simple dilatation, the benefit manifesting itself by better hearing and less tinnitus.

8. *Local Medication.*—This may be applied: (1) to the region around the ear; (2) by way of the external auditory canal; (3) by way of the Eustachian tube.

(1) *The application of drugs to the region around the ear* is limited almost entirely to (a) sedatives, in the form of salves or liniments, and (b) to counter-irritants, mostly applied to the mastoid region. The power of either for good must of necessity be slight, while the use of the latter in certain acute mastoid affections may be positively harmful through the masking of symptoms which at best are not always easy to determine.

(2) *Medication by way of the external auditory canal* is of much value, because a direct therapeutic effect can be obtained upon the disease processes of the canal and membrana tympani, and, if the latter is perforated or a sinus exists, upon the more or less distant parts of the tympanic cavity. Liquids, powders, or solids may be used. Of great importance for the successful employment of this mode of treatment is the previous thorough removal of all secretions, etc., which, by covering the parts, by diluting the medication, or through chemical combination, may limit the effect of the drug. All fluid applications should be warmed, and should be introduced by means of a pipette or spoon, the head being inclined to the opposite side and the external canal straightened; after which, by appropriate pressure on the tragus, the fluid can be forced further into the canal, into the tympanic cavity, or even all the way through the Eustachian tube into the naso-pharynx. A prolonged effect may be obtained by saturating a pledget of cotton and placing it in contact with the affected part.

Medication of the external and middle ears by means of powders has been, and is, a much-abused method. If the material is finely pulverized, or triturated, and used in small quantities, excellent results are often obtained in cases having a fairly large perforation in the tympanic membrane. For the introduction of powders into the ear various powder blowers have been devised, of which the one shown in the cut (Fig. 1783) gives excellent satisfaction. For use by the patient a glass tube, with an attachment of rubber tubing and a mouthpiece, answers a good purpose.

Caustics—such as chromic acid and nitrate of silver

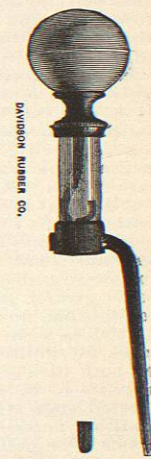


FIG. 1783.—Davidson's "Powder Blower," with End-Pieces of Two Different Sizes.

(fused on the end of a slender probe)—are applied through the external canal. In using them it is of great importance to the patient's comfort that *only* the desired spot be touched, and that too only after thorough cleansing and drying. Under this heading may be mentioned a special form of local treatment, that of aural suppositories or bougies, of medicated gelatin, as suggested by Gruber; these are introduced into the ear by means of forceps, and then afterward the canal is closed with cotton.

(3) In case of an intact membrana tympani fluids and vapors may be introduced into the tympanic cavity through the Eustachian tube. Only small quantities (from eight to ten drops) should be used at a time, and only after being warmed. After the catheter is in position, introduce into it with a syringe or pipette the requisite amount of the fluid to be used, and then with the air bag blow it with some force into the tympanic cavity, always using the diagnostic tube for information as to the successful carrying out of the manœuvre. The entry of the fluid into the tympanum may be facilitated by having the patient swallow at the moment of emptying the air bag, by having the head well inclined toward the side to be medicated, and by using a catheter which enters well into the mouth of the tube. Steam, plain or medicated, formerly much used in the treatment of middle-ear catarrhs, has now largely given place to volatile medicaments (chloroform, chloride of ethyl, menthol, etc.), or to some of the vaporized or nebulized oils containing various substances in solution. By using some one of the well-equipped nebulizing apparatuses the fine vapors can be thrown, warm, into the tympanic cavity through the catheter, with rapid interruptions, so as to obtain a three-fold effect, viz., that of the medicated oils, that of the heat, and that of the pneumatic massage acting upon the inner surface of the membrane and the ossicles. While the injection of fluids into the tympanum is certainly less in vogue than formerly, still with caution, especially as to the fluids used, it sometimes accomplishes beneficial results, mostly for tinnitus, when other means fail.

9. *Electricity.*—The general aural therapeutics of electricity furnishes a good illustration of how great an absence of unanimity there may be in the profession relative to a given subject. While as regards the value of electricity in diagnosis and prognosis there seem to be a few who think alike, when it comes to the question of therapeutics there exists the most astonishing divergence of opinion. It is true that there are competent observers who claim good results from the treatment of the ear by galvanism, faradism, static electricity, and cataphoresis. It is also true that equally good observers have utterly failed by the same methods to obtain similar results. In a general way, as the result of a moderate amount of experimenting, I am compelled to cast in my lot with the latter class. At the same time the effort to bring order out of what is at present a state of semi-chaos, is a fascinating one. I believe that much good thought and considerable time are being given to the subject, and that the time is not far distant when those who are prosecuting these studies will be able to give to the medical world some greater uniformity of thought in regard to this matter than now exists.

It does seem in some measure settled that there are cases of tinnitus which are benefited, and even cured, by both the constant and the interrupted current. This appears to be especially true of those cases in which a morbid state (either torpidity or hyperæsthesia) of the auditory nerve exists. It is also easy to believe, what seems to be pretty well proven, that electrolysis is useful in the treatment of strictures of the Eustachian tube, as well as in connective-tissue strictures of the external auditory canal. The use of the galvano-cautery in the external and middle ears, although it has been highly recommended, seems to me to present no advantages over other methods, and to be fraught with greater possibilities for harm.

In the present uncertainty as to the value of electricity in aural therapeutics, it seems to me better to refer any one wishing to investigate the subject, to treatises and

articles in which the general and special methods of application can be more exhaustively handled than would be possible in the present article.

III. GENERAL REMEDIES.—It is self-evident that general conditions are often of the utmost significance in local disease; that ear diseases may both cause, and arise from, constitutional disturbances, and that the cure of the former may be greatly hindered unless our therapeutic efforts take into account not only the local disease, but the general bodily health as well. Suppose, for example, a disease of the ear has for its underlying cause tuberculosis, anæmia, disturbances of nutrition, etc.; the best results can be obtained only by using all the therapeutic procedures, medicinal, hygienic, dietetic, etc., which medical science offers for the cure of these conditions. The following should receive careful attention: the climatic conditions; the condition of the dwelling-place; the choice of bedrooms; the proper ventilation of the house; and the suitability of the clothing. A general tendency to take colds must be combated; the condition of the general circulation is an important factor; outdoor exercise may have to be urged; the school life of children often needs regulation; tobacco and alcohol will need to be limited or stopped; and, finally, the evil effects of late suppers, venereal excesses, masturbation, etc., must all be done away with. Changes of climate from cold to warm, and vice versa, or from the seashore to the mountains, often accomplish, especially among children, what local treatment utterly fails to effect. Patients who show a tendency to frequently recurring stubborn middle-ear catarrhs, as well as those who are subject to the milder transient catarrhal attacks, need a stimulation of the superficial circulation. Such patients may often be benefited by baths, saline, hot and cold, Russian, Turkish, etc.

Treatment of ear diseases by internal medication, formerly almost the exclusive treatment, still has its uses. For example, purgation in acute ear processes, especially in those of full habit, after blood-letting, is of practical use, as it is also in chronic passive hyperemic conditions of the ear. Pilocarpine, which is so effective in inducing sweating, may also afford material aid to local treatment, in cases of acute and chronic middle-ear catarrh, by favoring the absorption of exudates or as yet unorganized inflammatory products in the internal ear. A kind of specific action has been ascribed to the use of quinine, in the manner recommended by Charcot, in Ménière's group of symptoms. Although in general I do not approve of the use of narcotics, antineuralgics, and antipyretics, in affections of the ear, there are times when it seems necessary to prescribe them.

Suggestion and hypnosis have been recommended for the cure of hysterical deafness, and Urbantschitsch claims to have achieved success with it in the relief of tinnitus as well as deafness. Other writers also have published good results from its use. Nevertheless, great caution must be urged upon those who contemplate dealing with remedies such as these.

J. E. Sheppard.

EAR DISEASES: INTRACRANIAL COMPLICATIONS OF ACUTE AND CHRONIC INFLAMMATIONS OF THE MIDDLE EAR.—The intracranial complications of suppurative otitis are due to infection of the brain and its membranes by the same microbes which are infecting the ear, the infection reaching the brain either through caries of the bone in direct relation with the brain, through some of the natural passages which lead from the aural cavities to the brain, or through some of the connective-tissue fibrils and minute blood-vessels which pass through the bone. The intracranial disease originates, in most cases, at the point where the infection has penetrated the cranium; consequently, when the extension is through the roof of the tympanum or mastoid it is in the cerebrum, and where the extension is through the medial wall of the mastoid or through the labyrinth it is in the cerebellum. The intracranial infections of otitic origin manifest themselves as pachymeningitis, leptomenigitis, brain abscess, and sinus-phlebitis.

PACHYMEMINGITIS is an infective suppuration of the external surface of the dura mater. It may be limited in extent about the spot where the infective material entered the skull, and by adhesion of the dura to the bone the pus may be confined to a small area—the so-called extradural abscess; or it may be diffusely spread out over a large surface of the dura. When the dural inflammation forms about the lateral sinus it is called perisinous pachymeningitis; when over the tympanic roof, epitympanic pachymeningitis. When an extradural abscess has formed, it may be large enough to produce brain pressure; but when the pachymeningitis is diffuse, the pus is usually in such a thin layer that marked brain pressure is wanting.

Pachymeningitis is the most frequent of the intracranial complications. Jansen asserts that it is four times as common as sinus-phlebitis, and twenty times as common as brain abscess. Perisinous pachymeningitis is its most common form. Pachymeningitis is very often associated with one or more of the other intracranial diseases; the most common being phlebitis of the lateral sinus in connection with perisinous abscess.

Symptoms.—In the majority of the cases the development of the disease is insidious, and marked by no symptoms whatever that can be distinguished from those of the ear affection, the pachymeningitis being discovered on removal of the carious inner wall of the mastoid or of the carious tympanic or mastoid roof. In exceptional cases, and particularly in children, there may be in the beginning a chill with fever. Other symptoms, when present, are due to pressure on the brain: headache, general or localized on the affected side; slowed pulse rarely; and somnolence. Fever is the exception rather than the rule, except in the last few hours of life.

LEPTOMENINGITIS (an infective suppuration of the arachnoid and pia) is often the closing scene in cases of brain abscess, sinus-phlebitis, and pachymeningitis, but in more than half the cases it exists alone and is due either to a general sepsis or to infection of the arachnoid and pia through the minute blood-vessels. There are two distinct varieties of the disease: the rapid, almost apoplectic variety, usually fatal in from a few hours to two or three days; and the protracted variety, of from two to three weeks' duration.

Symptoms.—Fever and headache are the two prominent symptoms. In the rapid variety the fever is high (104° to 106° F.), with a very variable curve and continuous; in the protracted variety it is alternately high and normal or subnormal. In both varieties headache is usually present in the earlier stages, in most cases of a very intense character and referred to any part or the whole head. It is, however, often remittent; exceptionally the headache is only slight. As the disease progresses symptoms of irritation of the brain appear: restlessness, excitement, sensitiveness to noises and light, nausea, delirium. From irritation and pressure on the gray substance of the convexity of the cerebrum we may have convulsions of the extremities, with monoplegic or hemiplegic paralyzes; from exudation in the fossa Sylvii, occasionally motor aphasia. From involvement of the base of the brain there may be symptoms of irritation and pressure on the cranial nerves of the base, showing themselves, in the ocular muscles, as strabismus and ptosis, or as dilatation or contraction of the pupil without reaction to light; in the facial as facial paralysis; in the vagus as disturbances of respiration. Constipation is almost always present.

Diagnosis is easy in the rapid variety, for the high fever, the excruciating headache, and the brain irritation followed by paralytic symptoms, monoplegic or hemiplegic,—in the extremities when the disease is in the convexity of the cerebrum, or in the cranial nerves (third, fourth, fifth, sixth) when the disease is at the base of the cerebrum, or in the seventh, eighth, and tenth when it is at the base of the cerebellum,—leave no doubt when the disease of the ear and of the bone has been already recognized. In the protracted variety the diagnosis is very difficult in the earlier stages, for the moderate headache and remittent

fever are found also with sinus-phlebitis, and, only when the serious disturbances of the sensorium set in, can the diagnosis be absolute.

Lumbar puncture (Quinke) and examination of the cerebro-spinal fluid which is withdrawn are in some cases of undoubted value in proving the diagnosis, but in what



FIG. 1784.—Caries of the Sigmoid Groove. Leptomenigitis of cerebellum.

proportion of the cases cannot yet be said to be determined. The presence of the pyogenic organisms, the Streptococcus and Diplococcus pneumoniae, is confirmatory of the existence of leptomenigitis, as is also probably that of the Staphylococcus aureus and albus, but the absence of the organisms cannot be said to exclude the disease. For a detailed description of the method of procedure see Vol. II., p. 248.

Treatment.—Ice to the head, best by a Leiter's coil, and leeches behind the ear and to the temporal region, with morphine subcutaneously, often afford a certain measure of relief. By exposure and incision of the brain membranes, in cases in which the disease was circumscribed, Macewen has effected a cure in several instances.

Prognosis.—Only within the last few years has the prognosis of otitic leptomenigitis been considered other than absolutely unfavorable; coma sets in, sometimes with convulsions, and death ensues. The opinion now seems to be gaining ground that patients occasionally recover, although anatomical proof of this is very difficult. The otitic intracranial diseases present usually such a confused mass of symptoms that when a recovery from apparent leptomenigitis takes place one is apt to consider that an error in diagnosis has been made, but I myself—judging from my own clinical experience and from that of others—believe that recovery does sometimes occur. The only anatomical proof I can offer is that of a case of otitic brain disease which presented all of the characteristics of leptomenigitis, and yet recovery was perfect; but, death having occurred six months later, from another disease, the autopsy showed old adhesions with slight thickenings of the dura, arachnoid, and pia over the convexity of the cerebrum on the side of the ear affection. These were considered by the pathological experts to be the result of leptomenigitis, but, unfortunately, the value of the specimen was not appreciated, and no thorough examination and report of it were made.

BRAIN ABSCESS is much more common from chronic than from acute tympanic suppurations, the proportion being variously given at from 83 (Jansen) to 91 (Grunert) per cent. for chronic, against 17 to 9 per cent. for acute. In 92 (Körner) per cent. of the cases the bone is diseased directly on to the dura, and the abscess is usually connected directly with the suppurating ear, either lying directly against the diseased bone, or situated within the brain at a distance of from a quarter to half an inch from the diseased bone, but connected with the latter by a fistulous tract. In 9.5 per cent. of the cases there are multiple abscesses, usually connected by fistulae. In 6.6 per cent. (Körner) the abscess lies within the brain, and is separated from the bone by normal brain tissue, it being