

membrana tympani will be found to be destroyed throughout from one-half to two thirds of its entire area. The opening, in such cases, usually extends as high as the short process of the malleus above and as low as within a few lines of the inferior portion of the tympanic ring below; it also extends laterally almost to the circumference of the ring, thus showing prominently a goodly portion of the handle of the malleus, almost directly in the centre of the opening. In many of these cases the opening is filled in with exuberant granulation tissue, springing from the inner wall of the tympanum. There may be only a single mass of this tissue or it may be present in two or more distinct masses; and when this occurs, we find one overhanging the other.



Fig. 1772.—Large Perforation with Irregular Edges, Occupying the Greater Part of the Posterior Half of the Membrane.

In the fifth group we find destruction of the entire membrane, except that portion known as the membrana flaccida, or Shrapnell's membrane. At the margin of this opening we usually find a thick reddish membrane, which extends over the entire background and which is covered with secretion. At first sight this looks like a mass of flattened granulation tissue. In reality it is the thickened mucous membrane covering the inner tympanic wall.

In the sixth group we find complete absence of the drum membrane, except a portion of Shrapnell's membrane, which has been left by the disease, and which through thickening and distortion has entirely lost its natural appearance. The handle of the hammer has been completely destroyed, and if anything is left of the ossicular chain, it is hidden from view behind the thickened Shrapnell's membrane. It is only by using the probe that we are able to ascertain whether these little bones are present or not. In a case of this description we may find that the background—the inner wall of the tympanum—consists either of bone divested of its natural covering, or of thickened mucous membrane. In both of these conditions the amount of secretion present may be very slight. In other cases, however, and especially in those in which proper cleansing measures have not been carried out, there may be a considerable accumulation of a foul-smelling secretion.

Finally, in a seventh group of cases, we find, though only in exceptional instances, a white cyst-like body occupying the region of the posterior superior quadrant of the membrana tympani. In some cases the surface of the cyst is dry, but if it has opened spontaneously, or if a puncture has been made in it, a small amount of a purulent secretion, or a thin serous discharge, will be seen escaping from the small opening. The presence of such a condition is due, no doubt, to the fact that prolonged pressure exerted from within upon the drum membrane at this point causes a loss, to a certain extent, of the inherent elasticity of the drum tissue (atrophy of the substantia propria), and later a gradual stretching and giving way of this structure takes place, so that a cul-de-sac or pouch is formed which becomes filled with the retained secretions. During the past year the writer has had occasion to observe one of these cysts in private practice. In size it was as large as a



Fig. 1774.—Complete Destruction of the Drum Membrane, except Shrapnell's membrane, with preservation of the entire malleus.

small pea, occupied the middle portion of the posterior half of the membrane, was white and glistening, showed no evidence of any discharge, and was not associated with pain or discomfort. When it was opened, it gave escape to a light-colored serum, which seemed to be contained between the outer and inner layers of the drum membrane, for close inspection failed to establish any posterior opening leading to the tympanic cavity.

Special Methods of Exploring the Middle Ear in Cases of Chronic Purulent Inflammation.—It is always a very important point, in these cases of chronic purulent otitis, to discover the exact location from which the discharge emanates, as quite frequently we see an area of exposed bone, or a granulating surface covered with secretion or with pus, and are misled into believing that at this point we have found the source of the trouble, whereas in reality we have only exposed to view some subordinate area of inflammatory action—as, for example, a swollen and granulating mucous membrane covering the inner wall of the tympanum, the inflamed condition of which is actually due to the fact that



Fig. 1775.—Complete Destruction of the Drum Membrane Proper, including the Manubrium Mallei.

irritating pus from a distant point, situated at a higher level, constantly flows over its surface. In order to make sure of our diagnosis, we should bring to our aid, in the examination, the use of the silver probe, the tip of which should be bent in accordance with the anatomical relations of the particular part which is to be explored. By carefully palpating the various regions of the tympanum, we shall often be able to demonstrate the existence, in some part of the attic, of a sinus, or of a polypoid growth, or of an area of diseased bone. In all cases we should make a most careful inspection of the entire surface of what remains of the membrana tympani, not forgetting the margins at their insertions into the tympanic ring.

The method of examining for dead bone in the attic recommended by Dench ("Diseases of the Ear," p. 397) has been found very efficient by the writer in a large number of cases. It is as follows: Wind a small piece of cotton around the point of a delicate probe, bend the latter to the proper angle, and insinuate it gently into the various portions of the tympanum, particularly above the margin of the superior portion of the tympanic ring. In this way, when dead bone is encountered, the cotton at the tip of the probe will often catch upon the roughened bone surface, thus transmitting the sensation to the fingers; or upon its withdrawal we shall find fibres of the cotton which have been pulled upon and drawn from the main mass attached to the end of the probe. Other authorities prefer to use the probe without any such wrapping of cotton. In not a few instances a mass of firm granulation tissue, springing up from the tympanic cavity, has been mistaken, under mere ocular examination, for a bulging drum membrane; but in such doubtful cases the use of the probe will at once render any such error impossible.

In cases in which there has been a purulent condition of long standing, followed afterward by a cessation of the secretion and by a partial regeneration of the drum membrane, the perforation may be so small that we cannot locate it upon simple inspection or by passing the end of the probe over the surface of the membrane. Under these circumstances we have at our command two simple and fairly accurate methods of finding out if a solution of continuity exists. In the first, we ask the patient to perform inflation for himself by the Valsalva method, and then we watch what takes place in the drum



Fig. 1776.—White Cyst-like Mass Protruding from the Posterior Superior Quadrant. (Author's case.)

membrane during this act of inflation. In a certain percentage of these cases we shall be able to note the facts that a slight motion takes place at a particular point, and that immediately afterward there is produced a hissing or squeaking noise due to the passage of the air through a minute perforation. In the second method the inflation is made by means of the Eustachian catheter, and the operator connects his own ear with that of the patient by means of the soft-rubber diagnostic tube. In this manner the hissing or squeaking noise mentioned above will be heard more distinctly than when the other plan is adopted. There are a few other conditions in which it is possible to arrive at a fairly accurate diagnosis. Such are, for example, the following:

When a discharge is finding its way through the membrana flaccida, or Shrapnell's membrane, we may count, with considerable certainty, on finding caries of that portion of the malleus which lies above the tympanic ring, within the vault. If a mass of granulation tissue hangs over the superior portion of the drum membrane, and especially over the membrana flaccida, then we may feel confident that the principal area of disease is located in the vault, that it has been of long standing, and that in all probability both the malleus and the incus are involved. A mass of granulations springing from the region of the superior posterior quadrant would indicate, more particularly, a diseased condition of that part of the tympanum which corresponds to the aditus leading to the mastoid antrum. Furthermore, in all of these cases much can be determined from the character and extent of the discharge; for when the discharge is slight, the area of bone destruction is of a correspondingly small extent. On the other hand, if the existing discharge is profuse, and if it possesses a pronounced odor, then we usually find a much larger area of bone involved. In a very large number of the cases suffering from this disease and accompanied by a discharge, even though scanty, we are enabled by inspection to locate readily the opening in the drum membrane; for when the patient performs Valsalva's method of inflation, we see bubbles of air escaping with the secretion through the opening, at some particular point in the membrane; or we may see only a drop or two of serum or pus forced through the opening. If the pus is very thick and the opening a small one, the former will be forced against the opening in such a manner as to be seen distinctly; and then, when the pressure from behind ceases, the pus will disappear within the tympanic cavity again. In cases in which we are in doubt as to the existence of a perforation, we may derive aid from the use of the pneumatic speculum, but by far the larger number of diagnoses are made by simple inspection rather than by any other method. When only a fissure-like perforation exists, inflation will show that the edges of such a perforation move toward the person inspecting it, and this condition is often seen during the later stages of convalescence, particularly when the perforation exists in the posterior quadrant. It is only rarely that we meet with cases in which the Eustachian tube will not admit sufficient air to aid us in making a diagnosis. At times, when an opening, though small, exists in a drum membrane the tissues of which are greatly swollen, we see upon inspection, at the point where such an opening exists, a distinct, rhythmical pulsation, synchronous with the heart beats. This is due to the tension of the blood in the small vessels at this point.

When the mucous membrane covering the inner wall of the tympanum is exposed, it may very often be mistaken for a bulging and markedly inflamed drum membrane, although scarcely a vestige of the latter may be present. But if we examine carefully with a probe between the margins of the canal and this reddened surface, it will easily be seen that a solution of continuity exists, for the mucous membrane at this point lies on a much lower plane than that of the canal.

In each and every case, in order to arrive at a correct diagnosis, and thus be able to give an intelligent prognosis, an examination of the hearing function should be

made. As a rule, the following conditions, with slight variations, will be found to be present in patients suffering from this disease: The acoumeter of Politzer will not be heard so well as whispered words. Words spoken in an ordinary tone of voice are often not heard so well or so distinctly as those spoken in a forced whisper. In many cases it is found that the upper tone limit is normal, while the lower tone limit is elevated. If the disease has lasted over a long period of time—for several years, for example—the upper tone limit is almost invariably lowered, owing to the involvement of the labyrinth. The majority of cases show an increase in bone conduction. When the fork is placed on the vertex of the skull, the patient nearly always hears it more distinctly in the affected ear, and the difference which is ordinarily observed between the bone conduction and that through the air is usually reversed. No mention will be made here of the various signs of mastoid involvement, as this part of the subject is fully treated in another portion of this work.

Prognosis.—In this disease, more than in almost any other form of aural disease, does the prognosis depend upon the treatment and care of the case, for in a large majority of instances the general tendency is not toward a spontaneous resolution. We can usually sum up the prognosis under the following heads: as to hearing, as to curing the otorrhoea, and as to life.

As to Hearing.—We should never (except under certain conditions to be named later) encourage the patient to believe that the hearing will be improved when an arrest of the discharge is effected. In fact, it is well known, clinically, that many of the cases do not hear so well after the existing discharge has ceased as they did before, and to such patients the discovery of this fact always brings marked disappointment. The cause of such a diminution in the hearing power is probably to be found in the increased dryness, or diminished succulence, of the soft tissues, and this is particularly true of those which are in the vicinity of the stapedial foot-plate; for here the drying of the soft tissues and perhaps more or less calcification can scarcely fail to influence injuriously the mobility of this plate of bone. For this reason, if for none other, each case should be tested functionally when first seen, and this test should be referred to as a standard during the continuance of the discharge and after it has ceased. When any large area of the membrana tympani is destroyed, and particularly when this area corresponds to the upper and posterior quadrant; and when, furthermore, there is no obstruction in the region of the oval window, and we find upon the use of the probe that the stapes is movable, then we are quite safe in telling the patient that, when the discharge ceases, the hearing will be as good as it is at that time, although but little or no improvement beyond this point can with reason be looked for. On the other hand, if adhesions exist, binding down the stapes, we may, by dividing them, effect a distinct improvement in the function of hearing.

When labyrinthine involvement is shown by the tests to be present, then a guarded prognosis should always be given. It was formerly supposed by many that the amount of local destruction would give us a fairly accurate idea as to the extent of functional impairment, but clinically this has been found not to be true; for there are many cases in which, from a mere physical examination, we should be led to give a very bad prognosis as regards the hearing, and yet, when we compare the results of our functional examination in these cases with the physical conditions observed, we are surprised to find that the hearing power is out of all proportion better than we anticipated.

If, upon simply cleansing the external auditory canal and gently inflating the middle ear, the hearing improves to an appreciable degree, we may safely predict that treatment will restore a useful degree of hearing power to the affected ear. If, however, these simple measures produce no effect upon the deafness, and especially if with it there be associated distressing tinnitus and de-

fective bone conduction, we may confidently assume that the case is one in which no remedial measures of any kind are likely to improve the hearing to any material extent. When a large amount of granulation tissue is present over and around the stapes, its removal almost always is followed by an improvement in the hearing, and this improvement continues undiminished so long as the granulations are not reproduced.

If ankylosis of the stapes has already taken place, there will be marked and incurable impairment of the hearing.

As to the Otorrhœa.—In many cases the discharge seems to cease spontaneously without any treatment whatever; but if we follow the history of these cases we shall find that the disease recurs from time to time, usually from the effects of a cold, thus showing that the pathological condition still exists and needs only such an irritant to become active.

If no carious condition of the bone is present and if free drainage exists, then under proper treatment the discharge will cease in a short time; but when it persists, we are sure to find, upon careful examination, that the bone is diseased in one or more of the regions already mentioned. If the ossicles alone are involved in the process, we can then give a favorable opinion as to the cessation of the discharge under proper treatment (mention of which will be made later). If, however, the deeper structures show involvement, and the history is one of long-continued suppuration, then the discharge will not cease until after a radical operation upon these parts has been performed, and this will be spoken of in full in another part of this work. Where no dead bone exists, we can usually promise immunity from mastoid and other involvement. Before expressing an opinion as to the length of time a discharge will probably last, we should always make sure that we have discovered its source; and if we find that it is seated in the attic, we should give a guarded prognosis—at least so long as the patient declines to submit to a radical operation.

The character of the existing secretion will often enable us to give a fairly trustworthy prognosis. Thus, for example, if it is thick and if the drainage is inadequate, we may say that the case will probably be one of long duration. When a discharge has lasted for a long time, and in spite of frequent aseptic irrigations we continue to get a foul odor, both from the discharge and from the recently cleansed canal, we may be certain, under such circumstances, that we are dealing with a case in which diseased bone is present. Again, when we find a profuse, stringy discharge, draining through a large opening in the drum membrane, we may expect that the disease will pursue an obstinate course, on account of the extent of mucous membrane involved. It is not an uncommon experience, in such cases, to find that there is a certain amount of hypertrophied adenoid tissue in the vault of the pharynx; and the removal of it by operative procedure often exerts a most favorable influence upon the otorrhœa.

As to Life.—If at the time of the examination we find no evidence of any mastoid or intracranial involvement, we can safely say that, under proper care and treatment, no danger to life exists; neither is there immediate danger to life even though a simple uncomplicated mastoiditis exists. But if, on the other hand, we find that some intracranial complication is actually present, the prognosis is certainly grave, though not to such an extent as we were wont to look upon it several years ago before the aurist accomplished such brilliant and successful results in the treatment of intracranial conditions. The subjective noises, which are present in some of these chronic purulent cases, have proved to be so disturbing to the mental condition of certain patients that their lives have been in danger from attempts at self-destruction.

In every case in which intratympanic caries exists, there is always present the danger that at some subsequent time the patient's life may thereby be placed in peril. Such diseased tissue should therefore be removed, and the best time for accomplishing this is shortly after

the discovery of the fact that bone caries exists in some part of the middle ear. That this is a wise rule to adopt is shown by the fact that in the past very many people have lost their lives from the sequelæ of chronic purulent otitis media, and in quite a large proportion of these it was not even suspected that a diseased condition of the ear was the real cause of death.

Before taking up the treatment of this disease, we must consider its bearing upon the question of life insurance, for the companies are continually rejecting applicants for insurance because they have formerly suffered from this disease; and yet many of the cases so rejected are not rendered, by the mere fact of their having once had a purulent otitis media, less desirable risks than those who have never suffered from such disease. The important question in every such case is, Did the pathological process really undergo healing? If we find in such an applicant complete closure and cicatrization of a former perforation, then such an applicant should be accepted as a risk. If, however, a perforation still exists, even though perfectly dry and perhaps very small in size, then by no means is the applicant an entirely safe risk.

TREATMENT.—In treating a case of chronic purulent inflammation of the middle ear we should have three objects in view: first, the cure of the otorrhœa; second, the improvement of the hearing; third, the relief of the distressing subjective sounds, if present.

In the treatment of the discharge the first cardinal principle is to secure cleanliness, and this can be accomplished in two ways. In the first place, if the discharge is rather scanty, and if the patient can be seen frequently by the surgeon, it will be an easy task to remove the existing discharge by mopping the parts with sterilized cotton wound on a cotton carrier. After the field has been gone over in this way, it should be thoroughly cleansed with some rather strong non-irritating germicide or disinfectant, and one which the writer has found beneficial is the following:

R Acid. boric..... gr. xx.
Sol. hydrarg. bichlor. (1 to 1,000)..... ʒ ij.
Spir. vini rect. ad ʒ i.

M.

The parts are to be thoroughly cleansed with this solution, and then any granular surface which may be present is to be touched with a small cotton-tipped probe, dipped in silver nitrate, of a strength ranging from 20 grains to 240 grains to the ounce of distilled water. Such applications will, in a large number of the cases, so stimulate these granulations that we may expect, by using such treatment two or three times a week, to effect a speedy cure.

In the second place, if we are dealing with a case in which the discharge is profuse, then the patient, or whoever is to care for him, must be taught the proper method of syringing the ear, and the treatment must be carried on by irrigation. In adults a hard-rubber ear syringe, provided with a blunt point or nozzle, and holding an ounce of fluid, is usually employed for this purpose. In the case of young children, however, it is desirable that the syringe should be of soft rubber in order that it may not irritate the meatus or the canal. In a general way its shape should be like that shown in the accompanying figure (Fig. 1777).

A point to be remembered in syringing the ear, and one also to be impressed upon the patient or nurse, is that, in all adult cases, the auricle should be grasped

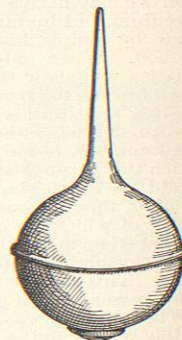


FIG. 1777.—Simple Model of Soft-Rubber Syringe.

gently between the thumb and fingers of the left hand and drawn upward, backward, and a little outward, thus straightening the meatus and cartilaginous canal and bringing it on a line with the osseous canal. Otherwise, when we use the syringe, we shall be directing the stream of fluid against the side of the canal wall instead of straight into the lumen of the passage. In syringing the ears of a child under three years of age, the auricle should be drawn outward and downward, as this position best aids us to overcome the natural curve of the canal at that age. The frequency of irrigation will depend largely upon the character and quantity of the discharge, and at no time must the latter be allowed to accumulate to any extent in the auditory canal. In an ordinary adult case, the ear should be cleansed every three or four hours at first, and then, as the discharge begins to lessen, the frequency of irrigation may be diminished to three times a day, or once or twice a day, and later even to every second or third day. In a child it will be necessary to irrigate more frequently on account of the smallness of the canal and the tendency of the walls at the orifice to lie in contact, thus preventing the escape of the secretion. In these cases we should irrigate as frequently as every two hours until we notice a gradual lessening of the discharge; and, from this time onward, the frequency may be reduced to every three, four, or six hours, according to the quantity of the discharge that presents itself each day. It is always well to bear in mind that an ear should be irrigated only frequently enough to keep the discharge from accumulating in the canal, inasmuch as too frequent irrigation serves to soften, make flabby, and lessen the integrity of the parts, thus prolonging the disease. Only a small amount of force should be used in irrigating an ear, whether the case be that of a child or that of an adult, and we should never use a cold solution, but one tepid, or slightly warmer, depending upon the amount of comfort given to the patient. The quantity to be used at each irrigation varies anywhere from a quarter of a pint to a pint. Rarely is it necessary at one sitting to use more than the maximum quantity given above.

If irrigation produces, as it sometimes does, disagreeable symptoms, as pain, vertigo, or nausea, and these persist, then, no matter how profuse the existing discharge, we must cease the irrigation and remove the discharge by frequent mopping and cleansing with cotton. In all cases, after irrigation, it is desirable to dry the deeper parts as well as the meatus with cotton.

The various solutions that have been used for syringing the ear are legion, but only those will be mentioned which the writer has found of value from a clinical standpoint.

A solution of bichloride of mercury in boiled water, of a strength ranging from 1 to 5,000 to 1 to 2,000, is the solution most used, and the one from which we obtain the best results at the present time.

A solution of value, and one largely used to-day by the general practitioner, is that of boric acid of the strength of twenty grains to an ounce of boiled water. As a cleansing solution it answers the purpose very well, but, if considered from a disinfecting or germicidal standpoint, it leaves much to be desired.

A solution of carbolic acid in sterilized water, of the strength of one or two per cent., was formerly used, but in recent times it has been practically abandoned. In recent cases, a weak solution of formalin, 1 to 500, is often of service, owing to its active germicidal properties, but even in this strength it has to be frequently discontinued, owing to its irritating qualities. If it be thought advisable to continue its use, a much weaker solution must be employed.

A solution of potassium permanganate, of the strength of half a drachm of the liq. potass. permanganat. in from four to six ounces of sterilized water, is often used to abate the discharge on account of its strong disinfecting properties. It possesses the further advantage that it acts as an excellent deodorizer when we have a foul-smelling discharge to treat.

When a certain amount of exfoliated epithelium is

found in the discharge, accompanied by a roughened condition of the canal walls and a roughened and excoriated condition of the meatus, we have found of the utmost value a solution containing from one to two drachms of an eight-per-cent. alcoholic solution of salicylic acid and four ounces of sterilized water; the acid here seeming to exert a marked healing effect on the excoriated tissue.

For simple cleansing purposes, a tepid solution of plain sterilized water will be all that is needed.

In a few of the cases that come under the aural surgeon's observation, the so-called irrigation treatment seems to increase rather than diminish the amount of the discharge. When this occurs, the patient, or whoever is caring for the case, must systematically use the dry treatment spoken of above, in order to obtain the beneficial results desired.

In order to save the patient's clothing while using the irrigation method, we should always have him hold, beneath the ear, a kidney-shaped hard-rubber or agateware basin into which the water coming from the canal may escape. These are easily obtained and are furnished for sale in all sizes.

As soon as the discharge begins to lessen perceptibly, the congestion and swelling gradually subside, and the structures slowly regain their normal appearance.

In all cases, before we undertake the local treatment of the ear, we should make a thorough investigation of the upper respiratory tract, and when we find that these structures are involved in a catarrhal process, we should, while giving the ear proper attention, direct our treatment to the cure of these pathological conditions; for, if they be neglected, we shall doubtless observe that exacerbations of the ear disease—although the latter may be benefited for a time by the measures which we have adopted—occur from time to time, owing to the influence exerted by the pathological conditions in the nose and naso-pharynx. We should search especially for any lymphoid hypertrophies, and if found they should be promptly removed. If we discover any other obstructive condition, which interferes with a normal naso-pharyngeal function, this also should be removed.

When the drum membrane has to a large extent been destroyed, and we find the inner tympanic wall exposed and presenting a mucous surface that is swollen, congested, and covered with mucus, or even if it is only slightly moist, then we must stimulate this surface by applying to it some suitable remedial solution. That which gives the best results is one of silver nitrate. At first a weak solution should be employed, one of ten grains to the ounce of distilled water, and then afterward, according to the indications, the strength may be gradually increased to as much as 240 grains to the ounce, or even to 360 grains to the ounce, when a rapid effect is desired. A point of value in applying the silver solution may be mentioned here, and that is, care should be taken not to touch other parts of the tympanum or any portion of the skin lining the canal. The application should be restricted to the particular area that we wish to stimulate, and this can be accomplished easily by exercising a little care in preparing the cotton-tipped probe. It should not be large or bulky, but quite small, and only the tip should be dipped into the solution; all the excess of fluid should be pressed out from the small mop before we introduce it into the canal, as otherwise there is a strong probability that some of it will come in contact with normal tissues, and thus cause excessive irritation. Other solutions which may be used with beneficial results are varying strengths of the zinc and copper salts; of the latter, a two-per-cent. solution is the one most frequently used.

As the discharge becomes less abundant and the patient is seen less frequently, a solution to be used at home should be prescribed—as, for example, one like the following:

R Boric acid..... gr. xx.
Bichlor. of mercury solution (1 to 1,000) ʒ ij.
Absolute alcohol..... enough to make ʒ i.
M.