

therapy, which often proves a powerful auxiliary to outdoor air and exercise. Used with due caution, much good may be expected from cold douches, and especially cold sponging. No one has insisted more on the importance of hydrotherapy in early phthisis than Professor Peter, of Paris. He begins with frictions of dry flannel, then with cloths dipped in cologne or vinegar, followed by dry rubbing for five or six minutes, and finally advances to the use of the cold sponge. These exercises should be taken at rising and retiring. Sponging is better than the douche. The patient should gradually get accustomed to the cold water applications. In cases where a change of climate is impossible, the debilitated young man or woman may, by utilizing at home the advantages of cold water, obtain considerable amelioration.

(To be continued.)

OTITIS MEDIA PURULENTA.¹

BY E. D. SPEAR, M. D.

THE fact that study of the anatomy of the middle ear reveals the causes of some of the complications found in cases of purulent disease, is a sufficient apology for making reference to it.

The middle ear, so called, or that part of the auditory apparatus concerned in the transmission of sonorous vibrations, includes the tympanum, Eustachian tube, and mastoid cells, the membrana tympani, and membrane of the fenestra rotunda (membrana tympani secundaria), and the ossicula (malleus, incus, and stapes), with their muscular and ligamentous attachments.

The tympanum or drum cavity proper, lying deeply as it does within the temporal bone, is bounded above, below, in front, and on its inner side with bony walls. In most directions, and especially superiorly, these are composed of thin laminae. Its floor forms anteriorly a considerable portion of the carotid canal, and inferiorly a part of the jugular fossa. The inner wall, in which are to be found the openings of the oval and round windows, is quite thick, and composed of dense bone. On its outer side the tympanum is limited for the most part by the membrana tympani, a firm, transparent membrane set in a ring of bone (annulus tympanicus). This "membrana tympani" is of importance pathologically because through it pus and other fluid products of inflammation must usually find an exit from the tympanum.

We note also the following relations of the tympanum which show the necessity of knowing its position in cases of disease there. The upper wall or tegmen tympani, often of very thin bone, forms the only septum between it and the meninges of the brain. A plate of bone, also thin, and in young subjects sometimes wanting, separates it from the internal carotid artery. The sigmoid fossa, for the lateral sinus, often encroaches deeply upon the mastoid portion of the temporal bone, and lying in close proximity to the cells which, in the adult, fill this part, is also only separated from them by thin walls of bone. These cells are simply irregular spaces or cavities in the mastoid formed by the division of its interior by thin plates of bone. They communicate freely with each other and (through the mastoid antrum) with the tympanic cav-

ity, are lined by a delicate mucous membrane, and serve an important physiological function. The tympanum is in communication anteriorly with the throat through a partly osseous and partly cartilaginous canal, the Eustachian tube. This canal is about twenty-five millimetres (one inch) in length, is shaped like a flattened trumpet, and is constricted at the point of junction of its two portions. The osseous part is triangular (eleven millimetres long) and quite narrow, having an average diameter of two millimetres. Attached to the roughened edges of this bony canal and to the basilar process of the occipital bone is the hook-shaped cartilage which completes the passage way to the nasopharynx, where the mouth of the tube forms an oval aperture. On transverse section this cartilage is seen to occupy about two thirds of the lumen of the canal, forming its outer side and its upper boundary, the other third being filled in with fibrous tissue, muscle, and fat. The long axis of the Eustachian tube forms an angle of 40 degrees with the horizon, and one of 135 degrees with the axis of the external auditory meatus. Its physiological function is that of a ventilating shaft and drainage tube. These cavities and passages are lined with mucous membrane, furnished in the Eustachian tube with ciliated epithelium, and continuous with that of the naso-pharynx. It becomes very thin and delicate as it ascends into the tympanum and mastoid cells.

Besides blood-vessels and small nerves supplied to the structures within the middle ear may be mentioned, though not to be considered a part of it, the chorda tympani nerve, which, reflected from the facial, passes forwards close to the posterior periphery of the membrana tympani until it reaches the height of the musculus tensor tympani, when it winds forwards between the malleus and incus, being invested with a special fold of mucous membrane, and emerges at the Glaserian fissure.

The facial nerve on its way through the temporal bone passes very near the upper posterior boundary of the tympanum, though it is separated from it by a bony partition. This proximity of the facial renders it liable to injurious pressure from products of inflammation, especially after this septum has been eroded by carious processes.

There are two forms of acute inflammation found to take place within the middle ear quite distinct in their courses and perhaps the result of different causes.

One finds in some cases of cold-in-the-head, where there is always a local congestion of the Schneiderian membrane, a corresponding condition within the tympanic cavity, shown subjectively by a diminution in the hearing power, a disagreeable fullness and sense of pressure, and later by pain in the ear; objectively by the appearance of dilated blood-vessels in the membrana tympani, tenderness limited to pressure on the tragus, and in the later stages of the disease by marked swelling of, and the presence of an opening through, the membrane, with a serous or mucous discharge at the bottom of the external auditory meatus.

In another class of cases occurring more especially in patients convalescing from the exanthemata, measles and scarlet fever, the inflammatory process is very severe, more rapid in its progress, and attended with greater destruction of tissue, the subjective signs being similar to those in the acute catarrhal inflammation, though the pain is much greater.

¹ Read before the Boston Society for Medical Observation, February 19, 1883.

It is this latter disease, of purulent inflammation of the middle ear, in both its acute and chronic forms, and more particularly the complications which so frequently arise, to which your attention is invited.

As has been stated, the middle ear is lined with mucous membrane continuous with that of the pharynx. In cases of disease of the membrane (in the pharynx) the congestion and swelling is likely to extend to the Eustachian tube, and from there it readily reaches the tympanic cavity, its progress being assisted by a peculiarity of the blood supply. For the artery from which branches go to the Eustachian tube and tympanic membrane passes along the under side of the upper wall (of the tube), while the veins, returning the blood, lie along the lateral walls and are consequently compressed by their apposition when the lining membrane becomes swollen. This obstruction to the reflux of the blood soon produces a stasis in the veins of the tympanum and thus brings about the first stage of an inflammation. In the first stage of purulent disease of the middle ear a swelling of the mucous membrane occurs, extends rapidly to the tympanum, and if the membrana tympani is then examined it will be found uniformly reddened and infiltrated, its lustre diminished, its contour distorted; instead of being concave, its outer surface is convex and hulging from the swelling and accumulation of fluid beyond it. After this stage of congestion and swelling of the mucous membrane there comes a stage of transudation in which serum and pus appear and by pressure soon produce a sloughing of the tissues in the membrana tympani and an opening in it through which they find exit.

After the disease has reached its height in the rupture of the drum-membrane and the discharge of pus, resolution takes place in uncomplicated cases. The congestion diminishes, the discharge of pus is less abundant and finally dries up, the perforation in the drum-membrane cicatrizes and closes by a reproduction of the inner and outer coats of the membrane, and the ear is restored to its former condition, though of course with some impairment of its hearing power, — the extent of this loss being dependent upon the size and position of the perforation and the amount of thickening of the mucous and sub-mucous tissues in the tympanum caused by the inflammatory process.

The fact that chronic purulent inflammation is the most common disease among all the affections of the ear would lead one to infer either that resolution without complication is not, however, the rule or that there is negligence on the part of patient or physician in the early and careful treatment of its more critical acute stages. So that instead of the favorable course marking the progress of the purulent process in ordinary uncomplicated cases, which ends in complete resolution, various changes occur which delay convalescence and give rise to complications which modify the aspect of the case. The simple change from the acute to the chronic form of inflammation consists in a subsidence of the swelling and congestion and the cessation of pain while the secretion of pus is still kept up.

This purulent discharge may continue for an indefinite time, gradually diminishing in quantity until healing finally takes place.

Where the destruction of tissue goes on for a long time and a large perforation remains in the membrana tympani, the efforts of nature at repair result in the formation of granulation tissue which produces a cicatricial membrane and fills in the opening. This does

not occur, however, in those cases of total destruction of the membrane, and but rarely when the perforation is very extensive.

This reparative process is sometimes misdirected, or from some cause becomes excessive, and the granulations are found to be superabundant, especially in cases where there has been any destruction of the periosteal lining of the tympanum and consequent caries or necrosis of the bone. These granulation masses sometimes also become organized into growths which have received the name of polypi. These are classified under the general terms of mucous and fibrous from the nature of the tissues from whence they spring. The mucous variety includes all the soft vascular growths found to consist of a net-work of blood-vessels held together by loose cellular tissue.

The fibrous polypi are of denser structure, are frequently very tough, and contain fewer vessels. The former are of rapid growth, often reaching a considerable size within a few days, the latter requiring several weeks and even months for full development. These growths may start from any portion of the tympanum, — the fibrous variety also from the auditory canal, — are of any size from small nodular masses to those sufficiently large to fill the external meatus, and occur at any period in the course of the disease.

Among other important changes are those directly traceable to an extension of the inflammation to neighboring structures which may take place in various directions; outwards, along the posterior wall of the external meatus to the outer surface of the mastoid process — not perforating the bone; directly backwards, through the mastoid cells to the meninges of the brain or to the lateral sinus (causing thrombosis); upwards through the tegmen tympani (to the meninges) or inwards, perhaps, through small natural openings in the bone, to the inner ear, thence to the brain, through the aqueductus vestibuli, or along the internal auditory canal. That most frequent, perhaps, and most likely to excite apprehension, because of its liability to reach the cranial cavity, is the extension backwards to the mastoid cells. As has been seen, the antrum mastoid-eum, though lying somewhat above the floor of the tympanum, offers a ready means of access to the cells, especially when the exit of pus through the membrana tympani is interfered with in any way, as by extreme swelling, by granulations filling the perforation, or in some acute cases by a peculiar nipple-like projection of the mucous membrane in the perforation through the membrana tympani. The inflammation once within the cells and unchecked by treatment progresses rapidly, and the accumulation of pus and transuded serum, here as in the tympanum, brings about necrosis of the delicate mucous lining and bony walls. In adults, however, the resistance offered by the thicker outer wall of the mastoid process is so great that, before an opening is effected for the discharge of pus outwards, congestion of the meninges takes place, and goes on to real inflammation, meningitis, at once a dangerous and an almost unmanageable complication.

This result is favored by the thinness of the septum of bone corresponding to the inner table of the skull separating the cells from the meninges. In children below the age of puberty in whom the mastoid cells do not entirely fill the mastoid portion, and in whom a comparatively thick wall of bone separates this part from the brain, the liability of extension inwards is greatly diminished. We therefore find that the

course taken is outwards through the mastoid, or along the posterior wall of the meatus, pus sometimes working its way through a fissure in the tympanic ring, in these instances causing similar symptoms with the appearance of a fluctuating swelling behind the ear.

The symptoms of an inflammation affecting the mastoid cells are great dizziness, nausea, vomiting, and a severe pain which is not confined to the ear, but is complained of as if radiating from it in a direction principally towards the back of the head. It may also extend upwards and forwards, though pain in the frontal region is oftener symptomatic of disease extending to the upper portion of the tympanum. A peculiar and characteristic sign noticed by the surgeon is the tenderness or sensitiveness to touch observed when the mastoid is gently percussed, and this is sensibly increased over a small area corresponding to the position of the mastoid foramen. All these symptoms are accompanied by fever; indeed a sudden rise of temperature in a patient with purulent disease is usually indicative of an extension of the inflammatory process. Later in the disease redness, swelling, and fluctuation are observed in the mastoid region.

Extension to the upper portion of the tympanic cavity and through the roof of the tympanum, though seen more rarely than the disease in the mastoid cells, is by no means uncommon, and is often overlooked as a cause for meningitis because of the absence of those objective signs by which the latter is distinguished. There is no swelling in the tissues over the mastoid, little if any redness, no particular tenderness about the external ear.

Examination within the meatus may reveal the presence of granulations or polypi, and there is usually oedema of the upper wall, yet in many cases the presence of a purulent discharge, often coming freely through a large perforation of the membrana tympani, and which may be unnoticed by the patient or is so lightly thought of as to be easily forgotten, is the only external evidence of disease. Severe pain on one side of the head, referred also to the eye, is the principal symptom which causes the patient to apply for relief. Vertigo, staggering, and a tendency to stupor, accompanied with a full, tense pulse and fever, are to be watched for as showing the beginning of meningeal irritation.

There are many other conditions which are the immediate result of purulent inflammation or arise in consequence of it, among which are caries and necrosis of the small bones of the ear with their partial or complete exfoliation, and periostitis within the tympanum or external meatus or upon the mastoid, also followed by partial necrosis, and rarely by the formation of large sequestra.

Paralysis of the muscles of the face on the same side with the affected ear is occasionally seen, and is the result of pressure in the course of the seventh nerve, usually within the bone. Here the prognosis is favorable for recovery of muscular power if the pressure is not long continued. In severe cases, accompanied by extensive necrosis in the tympanum, a more serious lesion of the nerve may be suspected.

To recapitulate. We have here described a very common but peculiar disease of an important organ of sense, which when untreated is very likely to become permanent, is attended with great destruction of tissue, and therefore with impairment or complete loss of function in the organ, and is often the starting-

point for many serious and sometimes grave complications.

As regards treatment. Much can be done in the way of prophylaxis, and in common with other writers upon this subject I would ask all members of the profession to carefully watch their patients during the prevalence of scarlet fever and of measles, especially, and do all in their power to prevent the inroad of so tedious and intractable a disease as chronic purulent inflammation so often proves to be. During its very first stages, while the congestive process is extending to the ear, the artificial inflation of the tympanum by Politzer's or Gruber's method is often alone sufficient if practiced several times a day, and it has been shown how this acts by separating the walls of the Eustachian tube, thus relieving the blood stasis, and equalizing the atmospheric pressure. If, however, the congestion has extended too far upwards, and the membrana tympani is red, but not bulging, the application of two or more leeches near the auricle will, by the slow abstraction of blood, put an end to the inflammatory process, and relieve the suffering of the patient. Later paracentesis of the drum-membrane and gentle douching of the canal with warm water may be necessary. Opiates are indicated in all cases with pain unrelieved by the air-bag, paracentesis, or leeching, indeed, whenever the inflammation is so severe as to cause continuous discomfort and loss of sleep.

When the acute stages are over, and the ear is discharging pus, simple cleanliness, preferably obtained by syringing with warm water, and the instillation of mild astringents twice or three times a day *ought* to suffice, but directions for "simple cleanliness" left with the parents of the child are usually *not* sufficient, and it is always well to inspect the ear after it has been syringed, or, better still, instruct the mother in the use of the syringe. This certainly seems an easy matter, but the ease with which it is often done is the drawback to its employment. As one instinctively fears to use any degree of force upon a tender and sensitive ear the consequence is that the purulent collection is allowed to remain unremoved by the syringing, and is itself the source of an irritation, and interferes with the action of the astringent lotions upon the diseased surfaces beneath.

The treatment of redundant granulations in the ear is the same as for those elsewhere, the application of caustics, silver nitrate being preferable to others. It should be used in saturated solution, and upon a cotton-tipped probe applied thoroughly to the surface after all moisture has been wiped away. Light touching only stimulates. For the removal of the larger growths the aural polypus snare is recommended, but its use must always be followed by caustics. Pure hydrate of potassium, the purified potash of commerce, placed directly upon the growth, after protecting the skin of the external meatus by lining it with paper or with absorbent cotton saturated with dilute acetic acid, is a most certain remedy, but requires particular care in its use.

In cases of inflammation recurring in ears long diseased active interference with granulations and with polypi is to be deferred, and measures taken for the relief of the acute symptoms. Douching the ear with warm water, the application of dry heat, and, if necessary, of leeches, with laxatives and opiates, are indicated.

When there is evidence of the invasion of the mastoid cells, and the presence of pus is suspected, prompt

and energetic treatment should be at once carried out, and this even to trephining the mastoid if a simple incision to the bone is not enough.

The great importance of the early employment of Wilde's incision, even before any fluctuation has been observed, cannot be over-estimated. The relief to pain which immediately follows this simple operation in a large proportion of cases ought to be a sufficient reason for it, but when it has been delayed, or when a spontaneous opening has occurred, and we find, too late, that necrosis of the bone has also taken place, its necessity becomes at once apparent.

In the treatment of *chronic* purulent cases much depends upon the condition of the ears found in each particular patient, but the general rule may be laid down that thorough cleanliness, if not strict antisepsis, will be followed by the best results. We know that when we find a variety of methods of treatment and a long list of remedies recommended for any disease it is because that disease is an intractable one. This is certainly true of the affection under consideration, and I hope to be excused from giving a detailed account of the methods in vogue even at present, and shall simply offer the results of my experience in the opinion that the so-called dry treatment with powders of alum, of talc, and that more recently experimented with, of boracic acid, must give way in the majority of cases to the treatment by syringing combined with astringents.

RECENT PROGRESS IN PATHOLOGY AND PATHOLOGICAL ANATOMY.

BY WILLIAM F. WHITNEY, M. D.

CATARRHAL ULCERATIONS.

VIRCHOW¹ has recently made a communication with the above title in which he shows that the term *catarrh* is used too comprehensively, and that ulceration only follows it indirectly. The term *catarrh* should be restricted to the process which takes place in the mucous membrane, and is solely to be diagnosticated by the presence of the secretion. The only condition justifying the name of a dry *catarrh* is that occasionally found in the bronchi. Then the secreted mass is tough, not moist, and closely adherent. All other conditions which have received this name are merely those where the originally fluid secretion has been rapidly deprived of its water, and there remains behind a firm, compact mass.

Those who do not recognize this barrier have gone further and further and have extended the meaning wider until some organs, the stomach for example, suffer from nothing but *catarrh*. The term should only be used for those cases where there is an excessive secretion of mucus, the surface occasionally being covered with a layer a finger thick, and every state of irritation should not be designated by this name.

As to ulcerations, he does not consider them as in the regular sequence of *catarrh*. There are evidences enough to show that all sorts of dispositions are produced in any sickness which can give rise to further consequences. In a child with a tender organization circumstances arise when the epidermis is easily macerated and removed. With insufficient care erosions occur, a crust forms, beneath which pus is produced, and finally an ulcer is found in this place.

¹ Berlin. klin. Wochenschrift, Nos. 8 and 9, 1883.

Virchow thinks that ulcerations of this sort are produced only upon surfaces covered by pavement epithelium. Such surfaces extend quite far into the body. From the lips they can be followed to a little below the cardia, and also as small projections in the stomach itself.

In the respiratory tract there are only very few parts covered by a simple pavement epithelium. On the posterior wall of the larynx between the arytenoid cartilages and the true cords are such places. Here there arises a peculiar kind of ulceration which could be called erosive, since certain portions are deprived of their epithelium, leaving a moist, soft surface exposed. Naturally this does not dry as in the case of the external skin. From the loss of its covering it is exposed to continual irritation, becomes easily deepened, and an ulceration takes the place of the eroded spot.

The same erosion is found at the place where the mucous membrane of the cervical canal of the uterus passes over into that of the vagina. The pavement epithelium is gradually loosened by the catarrhal secretion which flows out from the uterus. Large flakes are cast off, and after a short time the exposed surface assumes a velvety appearance. This is due to the enlargement of the papillæ and the engorgement of the vessels, and from this eventually arise the dark-red granular erosions seen during life. These never present any loss of substance of the true mucous membrane, and almost never pass into real ulceration.

In the remainder of the mucous surfaces of the respiratory and digestive tract erosions do not occur like those above described. In those covered by cylindrical epithelium a loss of substance occurs from a profuse secretion, which is to be considered as analogous to the formation of vesicles in the epidermis. The pavement epithelium cells are connected together so closely that they can withstand for some time the accumulation of fluid beneath them. Finally they give way, and an erosion is the result. In the mucosa clothed with cylinder epithelium the union of the cells is so slight that vesicles cannot be formed, but the tissue itself is at once loosened. Hence it is that there is never a vesicular enteritis or gastritis. All diseases associated with profuse diarrhœa, especially cholera, typhus, and typhoid fever, cause such a desquamation of the mucous membrane. The history of these erosions is not fully made out as yet, and it must be done by a careful examination of the stools during life, as secondary changes are produced with great rapidity after death. To these processes are to be added many of the diseases caused by drugs, for example, those following the use of large doses of mercury.

The surfaces thus deprived of their covering are exposed to all sorts of insults. Bacteria at once find a suitable place on which to develop. Then a diphtheritic condition is produced, and the spot is covered in the same way as in primary diphtheria. In animals a genuine diphtheria may be induced by preparing the ground where the parasite is to grow by the exhibition of violent cathartics.

The so-called uræmic ulceration is simply one of the same kind. The process begins when the urea secreted by the kidneys is diminished, and a vicarious excretion of this from the stomach and intestines takes place, accompanied by marked diarrhœa. Then follows the same sequence, first erosion, then a diphtheritic condition, and finally ulceration. But there is no specific uræmic ulceration, simply a diphtheritic ulcer