

In the tertiary stage, gummy tumors and deep ulcers, sometimes involving the cartilage of the tube, are occasionally met with at or within the faucial orifice. According to Zauf,⁵² the plica salpingo-pharyngia is most frequently the seat of gummata. They present themselves as round tumors of a yellowish-red or red color, smooth surface, and a broad base, varying in size from a pea to a hazelnut. The deep ulcerations found in this stage of the disease are probably always the result of the breaking down of gummatus deposit. Such ulcers are, according to Schwartze, not infrequently found on the tubal prominence and at the entrance to the faucial orifice, together with similar ulcers on the septum narium, choanae, fornix, posterior surface of the velum palati, etc., in cases in which the usual inspection without the rhinoscopic mirror fails to arouse a suspicion as to their presence. They have, however, been seldom found beyond the mouth of the tube. These ulcers frequently spread with great rapidity and cause extensive destruction. If seated on or near the mouth of the tube, a complete growing together of its walls may occur during cicatrization of the ulcer. The aural symptoms caused by an ulcer on or near the mouth of the tube do not differ from those described under the head of diseases of the secondary stage. Pain referred to the ear is, however, more frequently complained of in connection with ulceration than with erythema and mucous patches on or near the mouth of the passage.

In the treatment of the tertiary symptoms our chief reliance must be placed on iodide of potassium alone or in combination with mercury. Locally, nitrate of silver, in substance or in solution, the acid nitrate of mercury, iodoform, or iodol, may be applied daily or less often. Thorough cleansing of the ulceration should precede the application of the remedies named.

Hyperostosis and exostosis of the osseous part of the Eustachian tube are, according to Gruber,⁵³ sometimes caused by syphilis. This is, however, denied by other writers.

MASTOID PROCESS.—*Osteo-sclerosis* and *hyperostosis* of the mastoid process are, according to Schwartze, sometimes caused by syphilis. We know of no signs by which a differential diagnosis can be made between the idiopathic and syphilitic forms of these diseases. A course of antisiphilitic treatment will, however, soon decide which form we have to deal with. Gummata of the mastoid cells are extremely rare. Superficial and extensive caries of the outer cortex of the mastoid process, without disease of the middle ear, occurs, according to Schwartze, only as the result of syphilitic or tuberculous periostitis. The syphiloma or gumma may develop under the picture of a periostitis of the mastoid process. It may break down in parts and simulate the feeling of fluctuation. Its development may be very rapid, and it may disappear as quickly under antisiphilitic treatment.⁵⁴

THE INNER EAR.—Of the affections of the organ of hearing caused by syphilis, diseases of the inner ear are probably least frequently met with. These diseases usually make their appearance toward the latter part of the secondary stage, or at a still later period. According to Politzer, they are sometimes developed simultaneously with secondary skin or throat affections, and in one case observed by him, a disease of the inner ear appeared as early as the seventh day after the primary infection. The same author has also recorded a case in which labyrinthine disease was developed simultaneously with a gumma of the skull, twenty-one years after infection; and the present writer has notes of a case in which sudden and absolute deafness of one ear, in connection with naso-cranial osteitis, occurred twenty-six years after the primary disease, and after an interval of more than twenty-five years of complete freedom from symptoms of constitutional syphilis. Hutchinson ("Syphilis," p. 32), on the other hand, has no knowledge of any form of deafness due to syphilis which occurs in the tertiary stage of the acquired form.

The diseases of the labyrinth may be developed alone

or in association with tympanic diseases. Frequently they supervene on pre-existing catarrhal or purulent inflammation of the middle ear.

The *symptoms* of syphilitic disease of the labyrinth do not differ essentially from those of the affection of this part due to other causes. In this form, as in diseases of the labyrinth in general, a marked diminution or total loss of the hearing power in one or both ears occurs, usually more or less suddenly. Subjective noises, of a variable nature, often of great intensity, sometimes precede the onset of the deafness, but more commonly are developed at the same time. They are rarely entirely absent. Vertigo and unsteadiness of gait sometimes usher in the attack, but more frequently these symptoms follow the deafness. Nausea, vomiting, headache, and weakness in the limbs are also early symptoms in many cases. Pain in the ear very rarely accompanies the attack. Inspection of the drum membrane will in many cases give a negative result, while in others it will reveal the changes usually found in connection with chronic catarrhal disease of the middle ear. Evidences of acute inflammation of the tympanic cavity are usually wanting. The air douche through the catheter commonly shows a pervious Eustachian tube, and the sounds heard on auscultation are generally broad and dry.

A closer examination of the hearing power in these cases shows that besides the impairment of hearing for the voice, the perception of sounds through the bones of the skull is either greatly diminished or entirely wanting. In cases in which both ears are deaf, vibrating tuning-forks placed on the vertex or between the teeth are usually not heard at all, and in cases in which only one ear is diseased, the tuning-forks are heard most distinctly in the healthy ear and never only in the affected ear. Placed on the mastoid process of the affected side, the tuning-fork (the writer usually employs for this purpose a small C² fork of 212 vibrations a second), if heard at all, is heard from this part less long than normally in persons of the same age. In cases of great impairment of hearing for the voice the employment of Rinné's test nearly always shows the predominance of aural over bone conduction; while in total deafness for the voice small tuning-forks are not perceived at all, but very large ones, when struck with much force, are heard when placed on the mastoid process. The examination with the piano or tuning-forks of different pitch, not infrequently shows that the perception of certain tones of the scale, usually the highest, is diminished or destroyed, or that whole groups of tones are not perceived. In a case observed by Knapp,⁵⁵ tuning-forks of high and low pitch were not heard, while those of medium pitch were perceived; neither the highest four (e¹—a²) nor the lowest four tones (A²—D³) were heard; the octave next to the highest was heard, and that above the lowest tones only feebly. The power of appreciating low tones is the last to suffer and the first to recover in most cases, so that these will be heard when the high ones are not heard at all, or false, or doubled.⁵⁶ In a case reported by Blake and Walton,⁵⁶ a tuning-fork (562 v. s.) was heard in the left ear one-fifth higher than in the right; and sixteen days later, tuning-forks (560 v. s. and 1,200 v. s.) which were heard through the air, and the tone reproduced by the patient's singing, normally in the right ear, were heard and reproduced below their pitch in the left ear; otherwise the hearing was equally good in both ears.

The course of this disease is not always the same in all cases. While the clinical picture usually presented is that of a very rapid decline of the hearing power, till complete deafness is reached, the progress in the impairment is in some cases comparatively slow. In cases observed by Politzer, nearly total deafness was present three days after the onset of the disease. Concussion of the head, sometimes of slight degree, will occasionally cause a rapid increase in the deafness in these cases (Politzer, Troeltsch, Urbantschitsch, Gruber). Fluctuation in the deafness is less often observed in this disease than in affections of the middle ears. The vertigo, unsteadiness

of gait, and headache generally continue for a few weeks or months, and then gradually disappear. The hardness of hearing unfortunately often remains, and in the few cases which end in recovery the improvement takes place very slowly.

Syphilitic disease of the labyrinth cannot be distinguished from disease of this part due to other causes, either by the aural symptoms or by the hearing tests employed. The sudden onset of the disease and the rapid progress of the deafness for the voice, together with the absence of bone conduction, are regarded by many authors as peculiar to the syphilitic form of this disease. The present writer has, however, seen quite a number of cases presenting such a history in which syphilis was entirely out of the question, and therefore cannot regard the above-mentioned symptoms as characteristic of syphilis of the inner ear. If, however, the train of symptoms described occurs in connection with undoubted evidence—in the skin, the eye, or other parts of the body—of constitutional syphilis, or in an individual with a clear history of syphilis, we may assume with much confidence that the labyrinth disease is due to the invasion of syphilis. In the absence of a history, or of other symptom of syphilis, our suspicion as to its presence should be aroused, nevertheless; and we should make a searching examination for its presence in all cases of sudden loss of hearing, unaccompanied by pain, occurring in vigorous young or middle-aged persons whose nervous system was in a healthy condition previous to the attack, and in whom traumatism or other plausible causes of the deafness can be excluded (Schwartze). In several of such cases in which syphilis was absolutely denied, Politzer was enabled by a rigorous search to prove conclusively that constitutional syphilis was the basis of the ear disease. In this connection it should also not be forgotten that an outbreak of tertiary symptoms may occur after a long period of apparently good health.

The differential diagnosis between this disease and affections of the middle ear involves no great difficulty in recent cases. The absence of objective symptoms of middle-ear disease, and the results of tests with tuning-forks and the piano will decide the diagnosis. The case is, however, entirely different if well-marked signs of middle-ear disease are present, and more particularly if both ears are diseased and the loss of hearing has developed gradually. Under these circumstances the results of even the most patient examination with tuning-forks and the piano will often leave it undecided whether one or the other or both parts are diseased. The supervention of syphilitic disease of the labyrinth upon middle-ear disease may be inferred from the history of the case, the suddenness of the increase in the hardness of hearing, and the result of the hearing tests previously mentioned.

So far as is known to the present writer, Roosa (*op. cit.*, p. 610) is the only author who thinks that we are justified in going a little farther in our classification than merely to state that this is a disease of the labyrinth. We may perhaps, he says, diagnosticate disease of the cochlea, or at least say that the affection of the cochlea is predominant in certain cases (great impairment of hearing, inability to hear certain tones, and the production of false ones), just as we may speak of disease of the semicircular canals, when vertigo and staggering gait are the predominant symptoms. To such cases he applies the name of syphilitic cochleitis.

With regard to the pathological anatomy of syphilitic disease of the labyrinth, it must be admitted that our knowledge is still in a very unsatisfactory state. Indeed Schwartze, than whom no one is better qualified to express an opinion on this subject, does not hesitate to say that we have no anatomical knowledge whatever of this disease, and that the pathological changes in the labyrinth found by Toynebe, Gruber, Moos, Politzer, and others, of which a brief account will be given farther on, cannot be regarded as specific, since the same alterations occur in non-syphilitic cases. The condition of the organ of hearing found post mortem in individuals in whom syphilis and ear disease were known to have existed, was

as follows: In a case of secondary syphilis, with catarrh of the middle ear, described by Voltolini,⁵⁷ there was found hyperæmia of the vestibule, of the commencement of the cochlea, and of the horizontal semicircular canal, and hyperostosis confined to the parts surrounding the fenestra ovalis. Gruber⁵⁸ found in a syphilitic subject who had become suddenly totally deaf, and who died from typhus fever, considerable hyperæmia of the lining membrane of the tympanic cavity and of the membranous labyrinth, which appeared much thickened. The fluid in the labyrinth was abundant in quantity and bloody in color. It is not stated that a microscopic examination was made. Whether the changes found in this case were the result of syphilis or of the typhus must remain undecided.

Moos⁵⁸ made an examination of the right petrous bone of a woman, forty-nine years of age, who had been very deaf on this side and blind in her right eye since her seventeenth year. The deafness and blindness were attributed by her to washing her head while in a state of perspiration. In the history of the case it is said that she had been treated for syphilis, but whether the infection occurred before or after the development of the deafness is not stated. She died from intracranial disease. At the autopsy, made by Professor Arnold, parts of the right parietal bone were found to be atrophied in consequence of gummy tumors. There were gelatinous œdema of the pia mater and hydrocephalus internus. In the right corpus striatum was found a fresh diffuse hemorrhage. Old syphilitic scars were seen in the liver. The examination of the petrous bone, made by Moos, showed, besides alterations in the drum membrane and in the tympanic cavity, rarefactive osteitis in the posterior semicircular canal. The stapes was firmly united with the oval window. The membranous structures of the vestibule and the membranous semicircular canals were in part intimately attached to the periosteum by connective-tissue bands, with the exception of the posterior membranous semicircular canal, which was much thickened but not adherent to the periosteum. In those parts of the semicircular canals which could still be isolated, the epithelium and the connective-tissue membrane were no longer distinguishable. They were covered partly by innumerable large and small cells lying close together. The bands of newly formed connective tissue between the periosteum and the connective-tissue membrane were also infiltrated with cells. The form and structure of the membranous portion of the vestibule were obliterated by a thick layer of hyperplastic connective tissue which covered the membrane almost everywhere; in some central places of the membrane, where the tissue was less opaque and more reticulate, the described infiltration of cells could, however, be observed. Where the newly formed connective tissue was most abundant there were seen numerous isolated, and in some places aggregated, globular concretions of phosphate of lime. The lamina spiralis was of a lemon color, it was much thickened and appeared under the microscope very opaque, very vascular, and infiltrated with numerous cells; of its several zones only the dentate region could be made out.

Commenting on the above Moos says: "The above-described anatomical lesions of the organ of hearing furnish a sufficient explanation of the total deafness during life. Leaving out of account the myringitis which supervened toward the end of life, the deafness was due to the ankylosis of the ossicles and the chronic inflammation of the labyrinth. Very probably this condition resulted from secondary syphilis, although the microscopic data would not of themselves point to it as a specific cause. As far as I know, we have not as yet reliable anatomical signs of syphilitic inflammation of the labyrinth. We know too little of the pathological anatomy of the labyrinth to be able to decide this question."

In another case of constitutional syphilis examined by Moos,⁵⁹ in which violent subjective noises, vertigo, and pain in the bones of the skull were followed later by a remarkably rapid destruction of the hearing power, he found the following condition: The osseous substance of

the petrous bone was sclerosed wherever it was examined. The middle ear was entirely normal in every part. The labyrinth alone showed pathological alterations. The periosteum of the vestibule was slightly thickened; the foot plate of the stapes was also thickened and immovable. The connective-tissue supports between the bony walls of the vestibule and the vestibular membranous structure were hyperplastic and infiltrated with small cells. The connective-tissue membrane itself of the membranous vestibular structures was likewise hyperplastic and infiltrated with small cells. The periosteum of the lamina spiralis ossea, as well as all the zones of the lamina spiralis membranacea, exhibited the same small-cell infiltration. The exudation consisted of small round cells, with a few oval ones containing a single nucleus, which were placed with regularity very close to each other. With regard to the degree of dissemination of the infiltration, it remains to be mentioned that the periosteum of the lamina spiralis ossea was much less infiltrated than that of the zona pectinata and Corti's arches; the two last-named regions were so densely infiltrated that but few of the teeth and of Corti's arches could be seen distinctly; on the other hand, the infiltration was more copious in the ampullæ and sacculi, and in the connective-tissue supports between them and the bony walls, than in the membranous semicircular canals. The trunk of the auditory nerve was intact.

According to Politzer,⁶⁰ recent investigations leave no doubt that, in cases of long duration, a chronic inflammation of the lining membrane of the labyrinth may result in a periosteal bone proliferation in the cavity of the labyrinth. The following case occurred in his own practice: The patient was a man, fifty years of age, who had been totally deaf for ten years in consequence of syphilis. In the right drum membrane two broad, ribbon-shaped stripes extended downward at an acute angle from the end of the handle of the hammer. Bone conduction was destroyed. Death was caused by phthisis pulmonalis. Autopsy: The ribbon-shaped stripes on the drum membrane proved to be ridges of horny, thickened epidermis. The lining membrane of the tympanic cavity and the ossicles were normal on both sides. In decalcified sections of the cochlea, pathological alterations were mainly found in the ganglion cells in Rosenthal's canal. Within these cells were seen small, round, granular cells without a distinct nucleus, and also oval and annular bodies, in only a few of which a nucleus could be recognized. (Atrophy and degeneration of the ganglionic cells in the ganglion spirale.) The modiolus showed in spots a reticular structure. In the spiral membrane, in the vestibule, and in the semicircular canals no changes were visible which could be interpreted as pathological.

Pathological alterations in the blood-vessels of the inner ear, similar to those described by Heubner as occurring in syphilis of the brain, have thus far been observed only in a case examined by Baratoux.

The prognosis must be guarded as regards the recovery of hearing. In acute cases of recent date recovery has occasionally followed the energetic employment of mercury and iodide of potassium; but in cases of gradual loss of hearing or in those of long standing, the prognosis is decidedly unfavorable. Politzer is of the opinion that the degree of deafness is not always decisive for the recovery of normal hearing, since recovery from total deafness has been observed; while, on the other hand, in milder cases, active antisyphilitic treatment not only fails to produce an improvement, but is, moreover, sometimes followed by an increase in the deafness. This author has also seen patients in whom the deafness came on while they were under the influence of mercury.

Treatment.—If the ear disease occurs during the earlier stages of constitutional syphilis, mercury should be used freely, preferably by inunctions, till the system is brought under its influence; after that the remedy must be continued in smaller doses for a long period. Mercurial baths, subcutaneous injections of corrosive sublimate, and the internal administration of calomel, blue pill, and other preparations of mercury, may be substituted for

the inunctions when they are objected to. The iodide of potassium, alone or in combination with mercury, is especially useful in cases occurring during the intermediate or tertiary stage. Roosa has obtained very encouraging results from this remedy in very large doses (gr. cxx. to gr. cccxix. daily), in cases in which smaller doses failed to produce any effect. He used, however, inunctions of the oleate of mercury at the same time. To avoid disturbance of digestion it will be found best to dilute the iodide largely with water, and to administer it in divided portions during meals. Tonics and a generous diet should be given with both the mercury and the iodide to patients in feeble health. Subcutaneous injections of the muriate of pilocarpine, in gradually increasing doses (gtt. iv. to xij. of a two-per-cent. solution), have also proved useful in this disease in Politzer's hands. He is of the opinion that it should be tried for from eight to fourteen days in all recent cases, and that mercury and iodide of potassium should be given only if at the end of the above-stated period no improvement is manifest. Lucae, Moos, Barr, Bacon, and others also speak highly of the effect of pilocarpine in these cases, and think it worthy of further trials. Lucae has also seen temporary improvement of hearing follow the application of the artificial leech.

In order to protect the diseased ears as much as possible against the injurious effect of noises, while undergoing treatment, the patient should be kept in a perfectly quiet room, away from the streets, and it may even be advisable to cover the ears and the side of the head with cotton batting. If disease of the middle ear is present, this must be treated in the manner already described. Care should, however, be exercised, that the force employed during inflation be not greater than is absolutely necessary.

AUDITORY NERVE.—Of the syphilitic diseases of the auditory nerve, beyond the labyrinth, little or nothing is known. An intracranial disease involving some part of this nerve may be assumed, however, if in addition to the symptoms enumerated under the head of diseases of the labyrinth, positive symptoms of intracranial disease are present in a syphilitic individual. Foci of softening in the brain, gummata, circumscribed basilar meningitis or pachymeningitis, chronic periostitis ossificans of the petrous bone, with hyperostotic narrowing of the porus acusticus and paralysis of the trunks of the nerves from compression, are mentioned by Schwartz as the morbid conditions probably present in such cases. Of the morbid changes in the trunk of the auditory nerve and in its nuclei, due to syphilis, we have no knowledge.

B. INHERITED SYPHILIS.—Affections of the ear due to inherited syphilis are met with at two periods of life, during the first year and between the fifth and twenty-fifth years of age.

IN INFANTS.—In infants suffering from syphilitic disease of the nose and pharynx, affections of the middle ear are of common occurrence. Both the catarrhal and the purulent inflammations of this part, occurring under these circumstances, present no features by which they can be distinguished from the non-syphilitic form of inflammation. Caries and necrosis of the ossicles and the walls of the tympanic cavity may perhaps be developed more frequently, or more speedily, in the syphilitic than in the ordinary form, but no statistics are available by which this is proved. As in many of these cases the general health is seriously impaired by the constitutional disease, often but little attention is given to the ear affection by the parents or the medical attendant of the infant, and treatment is delayed until great destruction has already taken place. In a case of purulent inflammation of both middle ears, of two months' standing, which was recently under the care of the writer, paralysis of the right facial nerve existed when the patient was first seen, and paralysis of the left facial and exfoliation of the hammer and anvil of both ears occurred a few days later. The child was greatly emaciated, and although mercury was given at once and the usual local treatment pursued, the child died two weeks later, apparently from marasmus. The prognosis is probably less favorable in syphilitic cases

than in otherwise healthy children, but under proper general and local treatment, begun shortly after the appearance of the disease, many cases make a good recovery. Concerning the pathological anatomy of diseases of the ear in syphilitic infants, we know but little. Baratoux (Transactions of International Medical Congress, held in Washington, D. C., September, 1887), who made autopsies of forty-three still-born or new-born infants with hereditary syphilis, found lesions of the middle ear twenty-three times, lesions of the labyrinth four times, and lesions of both parts twelve times. When the internal ear was affected simultaneously with the middle ear, without pus being formed in the labyrinth, the walls of the ampullæ and cochlea were reddened; the axis of the cochlea was injected and infiltrated with round cells, and the parts were bathed in a sero-sanguinolent fluid which had taken the place of the lymph. When the internal ear alone was affected, the blood-vessels were found dilated, the walls were thickened, and in some instances hemorrhagic spots were found.

The local treatment of these diseases does not require any other measures than those usually employed in the non-syphilitic form. Local treatment will, however, accomplish but little so long as the constitutional disease is active. For this mercury must be given; gr. x. of the mercurial ointment rubbed into the palms and soles twice daily, as recommended by Hutchinson, will usually make the symptoms disappear very rapidly. Iodide of potassium is rarely beneficial in these cases.

IN CHILDHOOD AND ADOLESCENCE.—*The Drum Membrane.*—Special affections of the external canal and drum membrane are doubtless of very rare occurrence in connection with syphilis hereditaria tarda. The only case of such a disease on record, so far as the writer knows, has been described by Pomeroy ("The Diagnosis and Treatment of Diseases of the Ear," 2d ed., p. 350) under the heading Papulo-tubercular Affection of the Drum Membrane in a Subject of Hereditary Syphilis. In this case, that of a boy, eighteen years of age, with parenchymatous keratitis and considerable impairment of hearing, both drum membranes, just behind and below the malleus handle, were the seat of a nodular, grayish mass of triangular form. Large blood-vessels traversed the region of the tumors. Efforts to remove the masses by wiping with cotton-wool were unsuccessful. After a few days the color of the tumors changed from gray to a dull red, and after the tumors had disappeared vessels of large size remained. Under constitutional treatment and inflation of the tympanic cavity the drum membrane regained its normal appearance in about six months. Pomeroy infers that the tumors were in the dermal layer of the drum membranes, as the malleus handles and short processes were distinctly behind the tumor. The drum membranes were not perforated. It is not denied that there was more extensive disease than this, there evidently being an inflammation of the drum cavity with exudation into the tympanic lining, including that covering the round and oval windows. The tuning-fork tests pointed to a suspicion of labyrinthine disease, but actual proof of that does not exist.

Middle and Inner Ear.—In the offspring of syphilitic parents, and almost exclusively in those of the female sex between five and twenty-five years of age, there occurs occasionally a disease of the ears producing in most cases great impairment of hearing or total deafness in a short space of time. The connection between the ear affection and inherited syphilis was first pointed out by Hutchinson,⁶¹ though von Troeltsch and others had previously mentioned the occurrence of hardness of hearing in the children of syphilitic parents. Wilde's (*op. cit.*, p. 265) familiarity with the disease under consideration is shown by his remark: "It sometimes coexists with, sometimes alternating with, the ocular disease." "What is termed strumous ophthalmia, and also corneitis, are the forms which the eye affection assumes. Occasionally it is that of iridochoroiditis." Since the appearance of Hutchinson's paper numerous cases of this affection have been put on record by various authors, and the clinical history of the

disease is now well known, but our knowledge of its pathology is still very meagre. This disease is by no means of as frequent occurrence as the eye affection of inherited syphilis, and is, as has already been observed, found chiefly in the female sex. The present writer has met with it (or rather has seen it associated with well-marked symptoms of inherited syphilis) but once in a male, while he has notes of over twenty cases occurring in females. Other physicians have had a similar experience. The disease seems to be, from all accounts, of less frequent occurrence in this country and in Germany than in England, where, according to Hinton, five per cent. of the aural patients treated at Guy's Hospital, London, suffered from it.

The subjects of this disease of the ears have, in many cases, manifested symptoms of hereditary syphilis during the first year of their lives, and usually have enjoyed good hearing during early childhood. The ear disease usually begins between the fifth and twenty-fifth years of age, and is commonly preceded by an attack of parenchymatous keratitis or of an inflammation of the uveal tract of one or both eyes. Not infrequently the ear disease commences while the eyes are still inflamed, and occasionally it precedes the eye disease. Painless swellings of the larger joints, more particularly of the knees, which pass away without much treatment, are often present at the same time, or are developed later on. In most of the cases, the patients or their guardians are unable to assign an immediate cause for the ear trouble; but occasionally, as in one of Gradenigo's cases,⁶² and in one of the writer's cases, both of which occurred in young women, the deafness was attributed by the patients to exposure, particularly of the head, to draughts of cold air while the hair was wet. The first symptom to attract the attention of the patient, or of those who are with her, to the ear affection is a sudden and marked impairment of hearing. Pain in the ear is almost never complained of. Vertigo, unsteady and staggering gait, subjective noises, and headache accompany the hardness of hearing in most cases. In a number of cases seen by the writer, vertigo and headache preceded the impairment of hearing; while in others these symptoms developed afterward. Occasionally nausea, vomiting, and headache usher in the attack. The hardness of hearing, which at first perhaps may not be of the same degree in both ears, increases steadily, and often very rapidly, to total deafness. Sometimes total deafness is found to exist as early as the second or third day after the beginning of the attack, but more commonly a period of from six to ten weeks elapses before this stage is reached. Occasionally the progress is still slower, and is then usually characterized by marked variations in the degree of deafness from day to day.

The vertigo and the staggering gait usually continue for months and then gradually pass away. The deafness, after it has once become total, nearly always remains so. In several of the cases seen by the writer a perforative purulent inflammation of the middle ear, of one or both sides, develops several years afterward.

In the beginning of the disease the patients can usually hear the tuning-fork (the writer uses tuning-forks which, when struck with moderate force, are heard for from thirty to forty seconds normally when vibrating in the air near the ear) longer and louder through the air than through the mastoid process. The tuning-fork C⁴ (2,048 vibrations a second) is often not heard at all. In some cases bone conduction for tuning-forks of small size, of high and low pitch, is entirely abolished, while massive forks (for instance Politzer's C fork, described and illustrated in his "Lehrbuch," 2d ed., p. 117) are still heard through the mastoid. In cases of complete deafness of both ears, seen by the writer, he found that the tuning-forks C (1,285 v. s.), C¹ (2,565 v. s.), C² (5,215 v. s.) were heard both through the air and through the mastoid only when they were struck with great force, and louder and longer through the mastoid than through the air. None of these forks was heard from the vertex or when placed between the teeth, but the large C fork of Politzer (which is two or three times larger than the