653, gives a good description of the parasite, but mentions no cases.

Dr. Austin Flint, in fourth edition on "Practice," merely mentions the name of the worm as "*strongylus gigas*, inhabiting the kidneys."

Niemeyer, 1874, Vol. 2, p. 47, gives a very good description, but cites no cases. He states that the worm is from six inches to three feet in length.

In Quain's "Dictionary of Medicine," 1885, p. 1554, it is stated that the "*eustrongylus gigas* has only been once found in the human body," and that "the specimen is still preserved in the museum of the Royal College of Surgeons."

In Pepper's "System of Medicine," 1886, Vol. 4, p. 66, it is mentioned as occurring in seven different cases, but that "only part of these are admitted as genuine by certain authors."

The case cited by the writer will be kept under observation and reported upon as to future developments.

REMOVAL OF THE OSSICLES, WITH REPORT OF SIX CASES.

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Case 1.—Chronic sclerosing inflammation of the middle ear. J. B., a negro, age 25, employed as a waiter. His general condition is good, but there is a rheumatic diathesis. His previous history is of but little value. Has had little or no treatment. Has steadily increasing deafness which became apparent in the left ear first, about three years previously. This has become so great that it seriously interferes with the proper performance of his vocation. There is arterial tinnitus but he complained of it only when questioned. There has been no pain; no discharge. The deafness has become decidedly worse during the preceding four months.

Auricles and external canals normal, except for the absence of cerumen in the latter. Tympanic membranes pale; mobility slightly decreased; not depressed. Light reflexes quite normal. Handles of mallei were defined through their entire lengths. The Eustachian tube only slightly occluded; that on the right side more so than on the left.

Weber test positive for the right ear. Rinne with Koenig's A, negative for both; C, negative in right.

Speech for right ear two feet; for left between three and four. Whisper occasionally understood in left at one inch. Right not heard. Watch barely heard on firm pressure in left. Deafness in right ear by aerial conduction for tuning forks up to C₁, and duration markedly diminished. Left ear C₁ could be heard on some days. Nose and naso-pharynx negative.

Nov. 10, 1893, I operated on the right ear, with cocaine for local anesthesia. The drumhead and malleus and incus were removed. The stapes was found to be partially fixed in the pelvis of the fenestra. It was mobilized by severing the tissue about the footplate and left in situ.

Immediately after the operation, watch could be heard on light pressure. Speech four feet, but the patient complained of hearing in a confused manner. There was no reaction. The corda tympani had been severed and a metallic taste, on the corresponding side of the tongue, was complained of, but this disappeared in less than a week. The tinnitus was markedly benefited. After three months, speech was heard in the ear operated on, two feet; watch barely on firm pressure, and the tinnitus had recurred but not continuously.

Case 2.—Chronic sclerosing inflammation of middle ear. C. E., female; German; age 68; married. Complained principally of tinnitus. One had to shout into the ears to have her understand. Lucae's hammer-fork of 2048 vibrations could be heard in the right ear, by aerial conduction, when held very close. But it was in the right ear that the tinnitus was greatest. She applied for relief for this distressing symptom, and not to regain hearing. She described the noise as a great roaring sound. I chose the right ear for an operation because the noise in that ear was greatest. I removed the tympanic membrane, malleus and incus. The stapes was immovably

fixed in the fenestra. In attempting to remove it, the crura broke off near the footplate. Subsequent examination proved that the crura were atrophied—a condition, noted by Schwartz and Blake of Boston, which is liable to occur in stapes which have been ankylosed. There were apparently no adhesion bands, nor ankylosis other than that of the stapes in the pelvis. Immediately after the operation the tinnitus was slightly relieved, but in a week it was as bad as ever.

Case 3.—Chronic suppuration of the middle ear. A. F. T., American; male; age 25; clerk. Is of full habit. The disease dates from his thirteenth year, when he had scarlet fever. The discharge in the right ear ceased years ago, but that in the left continued. This was not great but very foul, and subject to exacerbations, accompanied with pain. Hearing for the watch three inches; for speech four feet; for whisper less than a foot. Drumhead thickened markedly; a central perforation through which projects granulation tissue, imbedded in which may be felt the necrosed remains of the upper portion of the handle of the malleus.

Nov. 9, 1894, I removed the drumhead, malleus and incus. The hemorrhage from the granulation tissue was abundant. The tympanic cavity, including the attic, was scraped clean and the whole packed with iodoform gauze. On the following day the packing was removed and the tympanum irrigated with permanganate of potassium solution, 1-1200, and again packed. Whenever exuberant granulations appeared, they were removed with the sharp spoon, and the bases cauterized with chromic acid in substance. With this treatment the discharge ceased in less than two months. Hearing unimproved. The arterial tinnitus was, however, greatly decreased.

Case 4.—Chronic suppuration of middle ear. R. S., American; age 24; male; machinist. Suppuration existed since his fifth year, as a sequela of scarlet fever. Condition about the same as the foregoing case, excepting that the membrane was more thickened, the discharge more offensive, and the perforation smaller and situated higher up in the posterior-superior quadrant.

Dec. 23, 1894, the membrane and body of the malleus was removed. Hemorrhage was profuse, delaying the operation greatly. I could not find the incus. The attic was freed from granulation tissue as far as possible, but on account of hemorrhage, the spoon was not used as freely as it otherwise would have been. The cavity was irrigated with Hartman's canula and packed. There was no reaction. The patient left his bed on the following day. In ten weeks, although there was still some oozing, not altogether odorless, he considered himself well enough to accept a position in a distant city, and went from under my observation. In this case the hearing was improved; five inches for watch, and three feet for speech.

Case 5.—Chronic catarrh of the middle ear. S. S. E., American; male; age 33; farmer. Deafness lasting seven years. Slowly progressive. Has had no previous treatment. General history negative, with the exception that he dates his tinnitus from an attack of malaria. There has been no discharge; little or no pain. Tinnitus continuous.

Both tympanic membranes depressed; darkened; handles shortened. Short processes prominent. Tympanic membrane and malleus of left ear movable. Weber to left. Positive Rinne for right; negative for left ear, with Koenig's A fork. Eustachian tubes slightly pervious. Speech for right ear three feet; whisper six inches; tuning fork C₁ heard; watch two inches. Left ear, speech one foot; whisper one inch; watch on firm pressure.

Operation, Feb. 10, 1894. Left ear. Membrane more thickened than I supposed before cutting it. The tensor tympani snapped when cut. The malleus and incus removed. The stapes was quite movable and was allowed to remain. Improvement after operation marked; for speech three feet; for whisper nearly a foot; watch three inches.

Although the tympanic membrane had partially reformed the improvement remained the same eight months afterward.

Case 6.—Chronic sclerosing inflammation of the middle ear. A. E.; female; age 41. She is now in the menopause. She has had ear trouble five years. The tinnitus is continuous and produces intolerable nervousness. She is becoming worse rapidly. There is no history of heredity.

Examination: Auricles, normal; external auditory canals normal and contain a very dark-colored wax. Tympanic membranes lack luster, and the left is somewhat retracted. Eustachian tubes are both open. Voice tests gave for right ear: speech at two feet; whisper on contact; watch not on firm pressure. For the left ear: speech at two feet; whisper at two inches; watch on forced pressure; fork C₁₁₁ heard in left ear; C₁₁ in the right; Weber to the left. Galton heard in the left ear in the upper half of its register only. I removed the drumhead, malleus and incus of the left ear under cocaine.

The stapes was found to be firmly fixed in the window and could not be removed without endangering fracture of the crura. The results were nil.

REMARKS.

Here we have six cases where the tympanic membrane and one or more of the ossicles were removed. Two of them were for chronic suppuration, three for sclerosis, and one for chronic catarrh. In the suppurative cases the results were highly satisfactory. In one case after a duration of twelve years the suppuration ceased in two months. In the other, after a duration of nineteen years, the ear was practically dry in ten weeks. We are not justified, however, in expecting that all cases will have so happy a termination. I have lately had a case under my care which was operated on by an eminent otologist over a year and a half previously, and the suppuration, foul and abundant, continued up to a few weeks ago. In this case the membrane had not reformed in the least. The pus seemed to arise from a point at the superior posterior portion of the cavity. Here I detected superficial caries. After carefully scraping the diseased area and packing with iodoform gauze for a short period, the suppuration ceased entirely. But there is a slight relapse whenever the patient takes cold. These relapses do not last but a day or two, and readily yield to cleansing douches. I believe that such relapses will occur until the cavity has been epidermized. The loss of the tympanic membrane may account for the condition, the mucous membrane being exposed to every infection from the air via the external auditory canal.

All this, however, does not militate against the performance of the operation in chronic suppurative otitis. I do not coincide with the opinion that this operation should be performed at an early date. There is a danger in being too precipitate, and yet there are a certain number of cases which very early in their course indicate this procedure. For instance, where there is a large perforation with no necrosis or granulation that may be demonstrated, but where a copious, constant or intermittent foul smelling discharge is present. All are aware of the futility of treating by the ordinary methods those cases in which fistulous perforations occur primarily in the membrana flaccida, for in such cases there is usually caries of the malleus or incus, or both.

Schwartz regards as nearly pathognomonic of caries of the head of the malleus a perforation over the short process of the malleus, with or without the presence of granulations. Further experience has fully verified this conclusion since its first publication (1884).

Grunert (A. F. O. xxxiii, p. 207), gives the following otoscopic picture as aiding in the diagnosis of incus caries:

1. Defect in the extreme upper portion of the tympanic membrane through which can be seen the retracted malleus. Beneath the upper and posterior edge of the perforated membrane may be seen a small granulation, or after careful irrigation a small drop of pus remaining, coming from above and behind. (Caries of the long process of the incus.)
2. Perforation behind the malleus, extending above to the edge of the membrana Shrapnelli, and forward quite or nearly to the long process of the malleus. (Caries of the long process of the incus.)
3. Fistula in the membrana Shrapnelli behind the processus brevis of the malleus. (Isolated caries of the incus.)

When there are two fistulous openings above and behind the processus brevis, or when the entire membrana flaccida is replaced by broad granulations the co-existence of caries of both the incus and the head of the malleus is in the highest degree probable.

Ludewig states the frequency of occurrence of isolated malleus caries compared with isolated incus caries as six to ten. The predilection point for caries of the ossicles is the long process of the incus (72 per cent). This is explained by its position, lying as it does, free in the tympanum. Its nourishment can be much more easily interfered with than that of the long process of the malleus, the circulation of which is intimately connected with the vessels of the tympanic membrane. Years ago, Schwartz called attention to this point in connection with that peculiar destructive process of the long process of the incus, accompanied by the accumulation of pus which undergoes fatty degeneration within the cavum, the tympanic membrane not being perforated.

The next in frequency to become carious is the body of the incus, 46 per cent. The head of the malleus was the seat of caries in 23 per cent., the handle in 25, and the neck 14, and the joint surface of the head 7 per cent.

Schwartz gives the following conclusion, based on the condition of the ossicles in a series of cases, the tympanic cavities of which were laid bare by external operation:

1. The amboss becomes earlier and more frequently carious than the hammer.
2. Isolated caries of the amboss occurs more frequently than isolated caries of the hammer.
3. In isolated caries of the incus, the incudo-malleus joint is unaffected.
4. The long process of the incus is by far the most often carious.
5. The incus is frequently destroyed in toto, even when the malleus in whole or in part is still present. I have formulated the following

INDICATIONS FOR OPERATION:

1. When the perforations, situated anywhere in the pars tensa, is small and the membrane thickened and the discharge copious, pustular, long continued and offensive and has resisted continuous treatment by means of gauze drain for one month.
2. Where the perforation is small, the membrane thickened, the discharge scanty, but odorous.
3. Where more or less of the pars tensa has been lost; but the discharge continues, evidently coming from the attic.
4. When any of the indications as formulated by Schwartz or Grunert are present (see supra).

When we determine upon the removal of the ossicles for the cure of suppurative otitis, the effect which that procedure may have upon the hearing scarcely enters into consideration, for the removal of a suppurating focus in the locality is much more important than the preservation of audition. But we may hope, not only that the same degree of hearing may exist after the operation as before, but that it may be increased. Ludewig in analysing the cases operated upon in Schwartz's clinic, to the end of 1891, found that in half the cases the hearing was markedly increased; unchanged in about one-third, and decreased in about one-twelfth. In Jack's eleven cases, all were improved in hearing power.

There still remains the consideration of this opera-

tion in its relation to catarrhal and sclerosing diseases of the middle ear. That it is indicated in certain cases belonging to the former class is at this time assured, but the good name of the operation and the operator forbid its use in the latter class.

Those cases of deafness which are caused by ankylosis of the stapes in the pelvis of the fenestra ovalis will not be relieved or improved by the removal of the incus, hammer or tympanic membrane. When, however, the fixity of the stapes is secondary to adhesions between other portions of the cavum and its contents, the removal of those adhesions will more or less improve audition. Likewise when the sound waves are reflected from the scala by adhesions or ankylosis which render the malleus and incus more or less immobile, the removal of the bones will be beneficial. But it is in sclerosis otitis that stapes ankylosis occurs earliest and most surely; this is the chief characteristic of the process, the real nature of which is almost entirely unknown to us. It is probable that the portion of the pelvis immediately surrounding the footplate is where the sclerosing process begins, and from this point spreads to the structures of the internal as well as to those of the middle ear. Operative interference for the relief of deafness or subjective sensations in these cases can be attended only with disappointment.

In the purely catarrhal cases the operation is rational and promises relief to subjective sensation and improvement of audition.

OSSICULOTOMY IN CHRONIC SUPPURATION OF MIDDLE EAR.

Presented in the Section on Laryngology and Otology, at the Forty-eighth Annual Meeting of the American Medical Association, held at Philadelphia, Pa., June 1-4, 1897.

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In chronic suppuration of the middle ear where there is necrosis of the soft tissues, tympanic walls and attic, and caries of one or both ossicles, the most rational treatment consists in removing the carious ossicles and all necrosed granular and fibrous tissue in the tympanic cavity.

Ossiculotomy for caries has passed the experimental stage and is now recognized not only as justifiable, but a rational method of treatment. There being no such thing as special surgery, we are no more justified in leaving carious bone in the middle ear than is the general surgeon in leaving it in any other portion of the body accessible to removal. The same general and well-known principles of surgery which apply to caries and necrosis of other parts of the body, are equally applicable to the ear, and when we find carious ossicles and necrosed tympanic walls they should be removed and all necrosed parts thoroughly curetted. There still exists some prejudice against this operation which is hard to understand. I can see no reason for tolerating the presence of dead bone in the tympanic cavity, neither do I believe it possible to cure a suppuration as long as the carious and infectious matter remains. From the results obtained in the thirty-six cases in which I removed one or both ossicles (malleus and incus) and curetted the attic, I am convinced that ossiculotomy (where caries exists) is not only the most conservative, but the most rational treatment for the majority of cases of chronic suppuration of the middle ear. The cases included in this report have been operated upon within the

last two years, the latest included in the report was operated upon four months ago.

The object to be attained is the complete removal of carious bone and the thorough curettement of the necrosed and granular tissue, and the establishment of perfect drainage of the attic and lower tympanic cavity. This I believe can be successfully done through the auditory canal. I follow the plan outlined by Dr. E. B. Dench of New York in his textbook on "Diseases of the Ear," except that I substitute a modification of Sexton's curette for cleansing the attic and removing part of the tympanic ring and superior wall of the auditory canal. So much has been written by eminent men, both in America and Europe, on this subject that a description of the operation is not necessary.

Observation leads me to agree with the published statement of Dr. C. H. Burnett that "necrotic tympanic structures must be removed before chronic purulency can be checked." I also believe that the Stacke or rational operation could be obviated in many cases if the entire tympanic cavity was thoroughly cleansed, and free and uninterrupted drainage through the auditory canal established. I need scarcely mention in this connection that the nasal and pharyngo-nasal cavities should receive scrupulous attention, in order that there be no obstruction to nasal respiration or danger of re-infection of the tympanic cavity through the Eustachian tube. From published reports I infer that secondary operations for relief of middle ear suppuration are as frequent from the Stacke operation as from those through the canal. The after-treatment is much shorter, there is no external wound, hence no scar, and less danger of injury to the facial nerve. I think the operation of ossiculotomy in the class of cases under consideration should be done under general anesthesia. I have found it impossible to do it with cocaine, the scraping of the wall of the tympanum causing intense pain. The after-treatment consists of cleansing and facilitating drainage by use of narrow strips of gauze introduced well into the cavity.

In one of the thirty-six cases included in this report there was facial paralysis (motor) which came on the day before and lasted for five weeks after the operation. There was an extensive caries of the ossicles and I suppose the paralysis was brought on by an exacerbation of the trouble due to an acute otitis, producing a thickening of its sheath.

A summary of the results in cases operated upon are as follows: In thirty cases suppuration ceased and hearing was improved from 10 to 20 per cent.; all uneasiness in ear and head relieved. In four cases the suppuration stopped entirely for several months, then returned; this was due to formation of granulations, which were easily destroyed and patient relieved; no improvement in hearing. In two cases the results were negative, so far as relief of suppuration or improvement of hearing; the fulness and dizziness were relieved and suppuration lessened. These cases were afterward found to be tubercular. In eleven cases the incus could not be found and only a part of the malleus. In the remaining twenty-five cases the entire remaining portions of the malleus and incus were removed. In no case did I find only one ossicle involved, the greatest amount of necrosis being observed in the incus.

The chief points to be observed in this method of treatment are: *a*, remove all carious bone; *b*, cleanse