Pathological researches into the local causes of deafness, based on one hundred and twenty dissections of the human ear / [Joseph Toynbee].

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BASED ON

ONE HUNDRED AND TWENTY DISSECTIONS

OF

THE HUMAN EAR.

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ST. GEORGE'S AND ST. JAMES'S GENERAL DISPENSARY.

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DISPENSARY.

Although the organ of hearing consists of several distinct parts, and exhibits much structural variety, but few successful attempts have hitherto been made to trace the local causes of deafness.

In a former paper, published in the Transactions of this Society,[2] I gave descriptions of several dissections of the human ear, as evidence of the fact, that the lining membrane of the tympanic cavity is frequently in a diseased condition. Subsequent dissections, and a careful investigation of numerous cases of deafness in living subjects, have led me to the conclusion that *the most prevalent cause of deafness is chronic inflammation of the mucus membrane which lines*

[1] An abstract of a paper from the twenty-sixth volume of the Medico-Chirurgical Transactions, published by the Royal Medical and Chirurgical Society of London.

[2] Vol. xxiv. 1841.

the tympanic cavity; and that by far the greater majority of cases commonly called nervous deafness ought more properly to be attributed to this cause. This opinion derives support from an observation made to me by Mr. Swan, that in the whole course of his multiplied aural dissections he has not encountered one single instance of disease in the internal ear; an observation which embodies the result of repeated examinations to which I have myself subjected that part of the organ.

At the same time that I advance this opinion, as an inference fairly deducible from more than a hundred dissections, I am far from denying the necessity of more extended researches previous to its validity being admitted.

In the present communication, it will be my endeavour to elucidate the different stages of this disease of the mucus membrane, and to point out the various morbid conditions to which it gives rise. In so doing, reference will be made to the cases published in my former paper, as well as to those which are appended to the present. And, bearing in mind the comparative novelty of the subject, it has appeared to me more desirable to state, briefly but accurately, the particulars rather than the general results of the dissections, that the very interesting facts which they will be found to contain may serve as a basis on which to ground future researches.

It is worthy of observation, that though some of the persons from whom the specimens were taken were known to have been afflicted with deafness during life, and others died of diseases which produced affections of the ear, yet the greater number, while living, were not supposed to be deaf.

This frequent occurrence of disease in the organs of persons not ordinarily esteemed to be deaf during life loses some portion of its singularity when more closely investigated. Slight defects of hearing are so common as scarcely to excite even a passing observation; and more serious cases,

from the very frequency of the disease—perhaps the most common to which man is subject—make but a slight impression. It may therefore be presumed that the ear is often in a pathological condition, though disease may not have proceeded so far as to produce such an extent of functional derangement as would cause serious inconvenience to the person affected, or reveal his infirmity to others.

As this paper is designed to treat principally of the pathological condition of the ear, it is not my intention to enter, at present, upon the causes of the great prevalence of deafness, nor to speak of the means which I have adopted for its Prevention and Cure. These important points I reserve for subsequent communications, with the simple expression of my conviction that, as we arrive at a more accurate appreciation of the *causes* of deafness, the means of alleviating or eradicating the disease will more readily suggest themselves, and aural surgery, freed from the uncertainties which have hitherto beset it, ere long will yield to no branch of professional investigation either in interest or importance.

ON INFLAMMATION OF THE MUCUS MEMBRANE LINING THE CAVITY OF THE TYMPANUM.

The tympanic cavity is lined throughout by a fine membrane, forming externally the interior layer of the membrana tympani, from which it can sometimes be detached without much difficulty.[1] In this situation it also serves as a partial investment to the chorda tympani nerve, and as a tubular sheath to the tendon of the tensor tympani muscle. Internally, it covers the surface of the promontory and the membrana propria of the fenestra rotunda; passes on to the margin of the fenestra ovalis, where it is reflected on the surface of the stapes; and, lastly, surrounds the tendon of the stapedius muscle, and envelops the ossicula auditus with their connecting ligaments.

[1] In Dissection No. 47, this mucus membrane was found entire after the complete destruction of the membrana tympani.

In the healthy state, this membrane is so remarkably thin and transparent, that its presence is not easily detected.[1] It is composed of extremely fine and delicate fibres, and in structure exhibits strong analogy to the serous membranes. Over its surface extends a layer of very minute epithelial cells; these again are covered by others, which are flat, broad, and elongated, terminating in a row of well-developed and firm cilia. The supply of blood-vessels is abundant; but they are so minute, and so rarely distended with blood, that, in the healthy state of the membrane, they are imperceptible; in disease, however, these vessels are very much dilated and surcharged with blood. In young persons, the membrane is highly vascular, and, when successfully injected, appears pervaded by plexiform ramifications.

Beneath the mucus membrane lie the ramifications of the tympanic nerve from the glosso-pharyngeal. In addition to the branches of this nerve, which have been described by Mr. Swan and Professor Arnold, I have been enabled, by the aid of the microscope, to detect numerous filaments, distributed to every part of the membranous lining of the internal wall of the tympanum; and their presence seems to offer a natural solution of the cause of the very acute pain which is experienced when there is inflammation of this structure, as in ear-ache.

In a healthy state, a small quantity only of mucus covers the surface of the tympanic membrane: the constant motion of the cilia already mentioned tends, no doubt, to prevent its accumulation.

Inflammation of the mucus membrane of the tympanic cavity gives rise to various pathological conditions, which it seems to me may be divided into Three Stages.

In the first stage, the membrane retains its natural delicacy of structure, though its blood-vessels are considerably

[1] For a detailed account of this membrane, see Dissections Nos. 1 & 2, Medico-Chirurgical Transactions, vol. xxiv.

enlarged and contorted, and blood is effused into its substance, or more frequently at its attached surface. Blood has also been found between the membrane and the membrana propria of the fenestra rotunda, and, in very acute cases, lymph is effused over its free surface. Instances of the presence of these conditions will be found detailed in the appended account of dissections.

The second stage is characterized by a variety of very important pathological phenomena, the principal of which are the following:—

1st. A very considerable thickening of the substance of the membrane, which is often pulpy and flocculent. In this state the tympanic plexus of nerves becomes concealed; the base and crura of the stapes are frequently entirely imbedded in it; while the fenestra rotunda appears only like a superficial depression in the swollen membrane. Occasionally there is also a collection of mucus.

2nd. Concretions of various kinds are visible on the surface of the thickened membrane. In some cases these have the consistence of cheese, and are analogous to tuberculous matter; in others they are fibro-calcareous, and exceedingly hard.

3rd. But by far the most frequent and peculiar characteristic of this second stage of the disease is the formation of membranous bands between various parts of the tympanic cavity. These bands are at times so numerous as to occupy nearly the entire cavity. They are found connecting the inner surface of the membrana tympani to the internal wall of the tympanum, to the stapes, and to the incus. They have also been detected between the malleus and the promontory, as well as between the incus, the walls of the tympanum, and the sheath of the tensor tympani muscle; and they so connect various parts of the circumference of the fenestra rotunda, as to form a network over the membrana propria. But the place where these adhesions are most frequently visible, is between the crura of the stapes,

and the adjoining walls of the tympanic cavity: this, for example, was the case in twenty-four instances out of a hundred and twenty dissections—being a fifth of the number. In one dissection, the bands of adhesion were five in number; and in other instances they were so strong, that, in removing the stapes, the mucus membrane was torn from the surface of the promontory. Sometimes, so broad and expanded have been these adhesive bands, as to have assumed the appearance of a membranous veil; they have also been known to contain blood and scrofulous matter. In some examples, the surface of the promontory is rough, and, in two instances, the membrane attached to the base of the stapes was ossified, and the anchylosis of the latter to the fenestra ovalis was complete.

It must appear obviously impossible that many of the remarkable phenomena which have just been pointed out can be present without the co-existence of functional derangement, more or less serious, in the organ of hearing. The thickening of the mucus membrane and deposition of mucus must necessarily interfere with the course of sonorous vibrations towards the membrane of the fenestra rotunda, and hinder the free action of the stapes.

The bands of adhesion, connecting the stapes with the walls of the tympanum, cannot do otherwise than impede the natural movements of the former, which has very frequently been found so firmly attached to the fenestra ovalis as to require considerable pressure with the scalpel to disengage it. Morgagni states that he found the cavity of the tympanum intersected by numerous membranes, which impeded the movements of the ossicula;[1] and it appears highly probable that these bands of adhesion produce irregular movements in the ossicula. I am inclined to ascribe deafness, and many of the distressing symptoms that often accompany it, as noises like the rushing of

[1] Epist. Anatom. vi. § 4.

waters, &c. &c., to the continued pressure exerted on the contents of the labyrinth by the stapes being drawn inwards, as a consequence of the formation and subsequent contraction of the adhesions. In this opinion I have been strengthened by the examination of living persons, having frequently observed that, where the membrana tympani has been removed by disease, or where the contents of the vestibule have not received any impression through the stapes (as in the instance of the latter bone being anchylosed), the patients have heard better than those where satisfactory evidence existed that the disease consisted in the thickened and adherent state of the membrane under consideration.

Another effect resulting from the pathological conditions apparent in this stage of the disease seems to be deserving of very attentive consideration. From the interesting researches of Dr. Wollaston,[1] and the more recent admirable and satisfactory experiments of Professor Müller on the Physiology of Hearing,[2] it would appear that too high a state of tension of the membrana tympani is an obstacle to the transmission of the sonorous vibrations to the internal ear.[3] In several of the dissections, it will be observed that the membrana tympani was bound to various parts of the tympanic cavity by firm bands of adhesion; that in others the tendon of the muscle was surrounded by thick membrane, while occasionally both it and the substance of the tensor tympani muscle were atrophied. All these changes must most certainly exert an injurious influence upon the membrana tympani; and from them doubtless arise many of the phenomena observable in deafness.

[1] Philosophical Transactions, 1820.

[2] Physiology, ii., 1259.

[3] If the membrana tympani be rendered tense, either by forcing air into the tympanic cavity, or by exhausting it, a considerable degree of deafness will be produced.

In the third stage of inflammation of the tympanic mucus membrane it becomes ulcerated, the membrana tympani is destroyed, and the tensor tympani muscle atrophied. The ossicula auditus are diseased, and ultimately discharged from the ear, and the disease not unfrequently communicates itself to the tympanic walls, affecting also the brain and other important organs. Of this class of diseases I am about to treat at length in a separate communication.

The Author then gave in detail the descriptions of the 120 dissections, of the results of which the following is a tabular view.

A. IN THE FIRST STAGE OF INFLAMMATION OF THE LINING MEMBRANE OF THE CAVITY OF THE TYMPANUM.

1	With simple inflammation of the mucus membrane; its vessels being enlarged, tortuous, and distended with blood	10
2	Ditto, with an accumulation of mucus . . .	1
3	Membrane inflamed, with effusion of blood into its substance	3
4	Membrane inflamed, with effusion of serum tinged with blood into the tympanic cavity . . .	1
5	Membrane inflamed, with lymph effused into the tympanic cavity	2
6	Membrane inflamed, with blood and lymph effused into the tympanic cavity	2
7	Membrane inflamed, with effusion of pus into the tympanic cavity	1

B. IN THE SECOND STAGE OF INFLAMMATION.

1	With simple thickening of the lining membrane of the tympanic cavity	5
2	The membrane thick and pulpy	2

3	The membrane thick and flocculent	1
4	Ditto, and the cavity full of bands of adhesion	1
5	Membranous bands connecting the membrana tympani to the inner wall of the tympanum	5
6	Membranous bands connecting the membrana tympani to the promontory, and the chorda tympani to the stapes	1
7	Membranous bands connecting the membrana tympani to the incus	1
8	Ditto connecting the membrani tympani to the stapes	2
9	Ditto connecting the membrana and chorda tympani nerve to the stapes	1
10	Ditto connecting the membrana tympani and malleus to the promontory	1
11	Ditto connecting the membrana and chorda tympani to the incus	2
12	Ditto connecting the membrana tympani and ossicles to the inner wall of the tympanum	1
13	Ditto connecting the malleus to the inner wall of the tympanum	2
14	Ditto connecting the incus to the inner wall of the tympanum	1
15	Ditto connecting the stapes with the promontory	24
16	Anchylosis of the stapes to the fenestra ovalis	2
17	Membranous bands, forming a network over the fenestra rotunda	2
18	A broad membrane passing from the promontory to the mastoid cells	2
19	The cavity of the tympanum full of bands of adhesion	1
20	Membranous bands containing scrofulous matter	3
21	The cavity of the tympanum full of calcareous concretion	4
22	Ditto full of caseous concretion	2
23	With ridges of the bone projecting from the surface of the promontory	2

C. IN THE THIRD STAGE OF INFLAMMATION.

1 With ulceration and thickening of the mucus membrane attended by the formation of pus . 3
2 With ulceration of the membrane, and loss of one or more of the ossicula . . . 3

It thus appears that of the 120 dissections there were:—

20 Ears in the first stage of inflammation of the tympanic cavity.
65 Ditto in the second stage.
6 Ditto in the third stage.
29 Ditto in a healthy state.

The Author concludes by expressing his thanks to the numerous friends who have so materially assisted him in obtaining the specimens necessary to the pursuit of this difficult subject, which had hitherto been entirely neglected; and he again takes the opportunity of stating that he shall feel much indebted for every opportunity that may be afforded him of dissecting the organ of hearing, especially when it is diseased.

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Note.—Since the publication of the Paper, of which the above is an abstract, the Author has made nearly 500 additional dissections of the Human Ear, the results of which are quite corroborative of the views respecting the nature of Deafness that the Author has already advanced.

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