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ON THE OCCURRENCE AND THE SIGNIFI-
CANCE OF COCCOBACTERIA IN PURU-
LENT OTORRHŒA, WITH REMARKS ON
THE TREATMENT OF CASES IN WHICH
THEY ARE PRESENT

BY

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ON THE OCCURRENCE AND THE SIGNIFICANCE OF
COCCOBACTERIA IN PURULENT OTORRHOEA, WITH
REMARKS ON THE TREATMENT OF CASES IN
WHICH THEY ARE PRESENT.*

BY DR. B. LOEWENBERG, PARIS.

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PART II.

PATHOLOGY.

THE external auditory meatus, amongst all the cavities of the human body, is the most suitable camping-ground for those micro-organisms which are incessantly blown to and fro by the constant currents of air about us. To these minute corpuscles its orifice must seem an immensely wide opening. When they once touch the sticky walls of the meatus they cling very firmly, gradually collect in its blind and pouch-like cavity, and usually remain for a long time entirely undisturbed, simply because the deeper portions of the meatus are exceedingly sensitive to all attempts at cleansing.

If now a fluid secreted in the tympanum during an attack of acute otitis media is effused into the meatus through a rupture in the Mt, it becomes at once exposed to all those influences which favor putrid decomposition. Microphytes of the most various types, or their germs, are present, the fluid stagnates, the meatus is warm; what better soil then could we have for the development of schizomycetes? Moreover,

* *Conclusion.*—Compare previous number of these ARCHIVES, page 220.

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the serous or purulent discharge contains albuminous bodies, salts, and an abundant amount of moisture. Hence, in connection with the ~~acid ingredients held in suspension~~ ^{oxygen} in the air, which always has free access to the meatus, we find a perfect combination of all the materials necessary for the luxurious nourishment of these micro-parasites, as we have already demonstrated in the preceding chapter. It would be indeed astonishing if these putrefactive organisms were not developed under such favorable circumstances as these.

We must, however, insist upon the fact that these organisms are not confined exclusively to the meatus, but are pushed onward into the tympanum by syringing or by the instillation of lotions. Sometimes they fall deeper into the meatus by simple gravitation, whenever the patient lies upon the healthy side. Even the luxuriant multiplication of schizomycetes is sufficient to push the gelatinous envelope further on toward the tympanic cavity. I have seen many cases which proved beyond a doubt that cocci really pass beyond the *Mt*, for, after the most scrupulous purification of the meatus, I have once more driven air through the perforation with Politzer's bag, forced out pus, and found within it a bit of the gelatinous envelope. Moreover, I am firmly convinced that the gelatine is frequently found in the regions adjoining the tympanum. The structure of the petrous bone, with its numerous fissures and cavities, offers a superabundance of recesses in which the secretion, protected from every thing but the most careful cleansing, can stagnate undisturbed and degenerate into a perfect condition of putrefactive decomposition.

This condition of things in the middle ear is not to be regarded as an accidental and insignificant contamination by schizomycetes, but a definite *settlement* and rank development of these micro-organisms in this region. This is proved by the constant occurrence of the more highly developed and pathologically important forms of the coccus-gelatine (*Zoöglea*).¹

¹ This paper will refer to micrococci alone, no attention being paid to the rod-bacteria, which are by no means rarely observed.

We may take it for granted that acute inflammation of the middle ear is almost invariably followed by a much more frequent and persistent suppuration than in any other part of the body. Indeed, the fact is so common that we take it as self-evident without troubling ourselves to think of the strangeness of such an occurrence, the key to which, in my opinion, lies in the fact that here, more than in any other region of the body, all the conditions for the development of schizomycetes appear realized in a so to speak, ideal perfection. The germs of schizomycetes capable of propagating themselves are always found in the micro-organisms stored away in the meatus. Whenever they multiply under these favorable circumstances, they manifest the same influence which they always exert upon wounded surfaces, preventing recovery by first intention, causing and maintaining suppuration.

The pathological importance of these micro-parasites is, however, by no means exhausted with this account of their influence in disturbing the normal processes of repair. On the contrary, they may induce a much more critical state of affairs. When we give our chief attention to one of the most frequent complications of otitis media, *inflammation with collection of pus in the mastoid process*, it seems very plausible to assume that this condition may occur in the cavities of this bone by simple propagation of the morbid process by continuity and contiguity. In the same way we can assume as another cause, some obstacle to the escape of the secretion, such as a closure of the communication between the antrum and the tympanum by polypi, etc. Still, when we consider how often pus is found in this region in a condition of *stagnation* and putrefaction, we cannot but think that putrid decomposition of the secretion can occur in this locality and subsequently induce violent local or even general constitutional disturbances.

The same may be said of *caries and necrosis*. It is plain that the inflammation and formation of pus can extend directly from the periosteum to the bone itself, while we have an additional cause for the affection of the osseous substance proper in the development of decomposition fungi.

For we know since the publication of Klebs' ¹ investigations into mycosis septica² that the cocci which flourish upon the granulating surfaces of old abscesses, fistulous canals, surfaces of joints, etc., can loosen the tissues and cause defects of substance. It is quite probable that the ulcerations upon the mucous membrane of the tympanum in chronic otorrhœa originate in this manner, and that the bone itself may subsequently become affected. Several causes might operate in bringing about this last condition of things which is still obscure in its finer details. If we grant that the schizomycetes cannot directly dissolve the osseous tissue, yet we may agree with Klebs that these organisms may affect this tissue by mere mechanical action, despite the fact that they cannot enter the osseous canals. I am also further inclined to think that the soluble acid substances which are formed during the development of schizophytes and the simultaneous putrefactive decomposition of albuminous bodies when plenty of air is present, are capable of dissolving at least the carbonate of lime in the bones. And,

¹ Edwin Klebs: Beiträge zur Pathol. Anat. der Schusswunden. Leipzig, 1872, p. 104, *et seq.*

² Great confusion seems to exist in the daily increasing literature on micro-parasites, owing to the fact that the word "mycosis" is used for the most heterogeneous things. Thus, for example, we comprehend under this title the diseases caused as well by the hyphomycetes as by the schizomycetes, and yet we know that there is a very wide difference between these two classes, as well in reference to their influence upon the organism, as to the conditions necessary for their existence, their chemical reaction, etc. Parenthetically, it may be mentioned, that by "mycosis" we also designate a body discovered by Mitscherlich in the ergot, as well as an affection of the skin, which, so far as I know, is not of a parasitic nature at all.

It seems urgently necessary in the interest of scientific exactitude that we should thoroughly sift this terminology, at least so far as concerns the diseases caused by schizophytes on the one hand, and by mucedineæ on the other, that we should divide them into two sharply defined classes and provide them with special and characteristic titles. I propose, therefore, to continue for the affections caused by mucedineæ or hyphomycetes (aspergillus, penicillium, etc.), the name mycosis, and to use for those originated by the schizophytes, the new name SCHIZOSIS (from *schizo*-mycetes).

I am convinced that in this way we shall be able to avoid all misunderstanding, which was previously a matter of great difficulty.

I would even go further and express the desire that especial titles could be created for the various groups of diseases caused by schizomycetes, *e. g.*, coccosis, bacteriosis. We might entitle those aural affections chiefly due to schizomycetes, "otoschizosis;" those due to cocci, "otococcosis," etc.

I cherish the hope that this nomenclature may be as unanimously accepted as was the title which I proposed in 1866, of "Corti's pillars." (See B. Loewenberg: "La lame spirale du limaçon et l'organe de Corti. *Journal d'Anatomie*, etc.)

moreover, we know that where osseous tissue which has resisted putrefaction for thousands of years is at last deprived of its calcareous portions, it at once yields to decomposition like all other tissues.

It is a fact that the coccus-gelatine can destroy the *periosteum*, so that the bone is laid bare and its blood supply from the outer surface cut off; in other words, necrosis can ensue. Since many chronic periosteal affections are but slightly painful, we may even see them lead to the formation of sequestra without any complaints on the part of the patient of disagreeable subjective sensations. So far as concerns the *ossicles of hearing*, I would say that they may be exfoliated in a condition which is far removed from a necrosis, for their articulating surfaces (schizomycetes can dissolve cartilage) and connective-tissue ligaments can become corroded, and disappear, so that all support is taken away and the bones drop from the meatus.

The inflammation and suppuration may advance and finally occasion *disturbances of the most serious nature in those organs which adjoin the petrous bone, as well as in those at a distance*. Thus we may observe meningitis (with or without perforation of the intervening petrous bone), phlebitis with corrosion or formation of thrombus in the adjacent sinus or internal jugular vein, or ulceration of the internal carotid, etc., all of which accidents are really to be regarded as a simple extension of the morbid process.

In contradistinction to these cases we observe others in which we find thrombi in the sinuses which are separated from the diseased bone by healthy tissues, or in which abscesses exist in portions of the brain provided with a normal cortex, or, finally, cases in which meningitis occurs only on the convexity of this nerve-centre. In such cases as these, we attempt to lift ourselves over the gap by embracing the opinion that the inflammation must have extended along the connective-tissue fibres and vessels, despite the fact that this view is evidently insupportable when we consider the normal condition of the parts which lie between the petrous bone and these organs (brain, etc.).

In opposition to this hypothesis, the proof of the occur-

rence of micrococci in purulent otorrhœa seems to offer a key to the correct significance of these complications, which are as dangerous as they fortunately are rare. We have already seen that innumerable and luxuriant cocci are present in all cases of otitis media purulenta, and *it is even more than probable that the morbid process is spread to a distance by the migration of these micro-organisms.* Inasmuch as they are absolutely incapable of self-motion (the pretended movements of cocci are simply molecular movements) they may be transferred from place to place by the agency of the *migratory cells*, into which they easily penetrate, and even into the fissures in the looser connective tissue, or into the sheaths of the blood-vessels. If this be true, we now see why they do not cause any symptoms whatever while on their pilgrimage, and only begin to act deleteriously when they meet with some impediment in the substance of the brain, where mechanical or functional causes lead to their colonization. This is the manner in which I explain the occurrence of those cerebral abscesses which show no visible connection with an existing affection of the middle ear, as well as meningitis without any connection with the inflammation of the tympanum, and so on for the other unexplained complications which have previously been mentioned. An observation by Klebs (*l. c.*, p. 110) is valuable in so far as concerns meningitis, for according to this the microspores from clumps of pus can penetrate through the tissues into the neighboring serous cavities, and even after the disappearance of all local irritative phenomena give rise to new inflammation and suppuration.

It is well known *that death occurs, during many cases of otorrhœa, under pyæmic or septicæmic symptoms*, without visible caries of the petrous bone or palpable alterations in the adjoining organs. In these cases, likewise, the mechanism by which local suppuration leads to constitutional infection is easy to understand, when we reflect upon the putrefactive processes going on in the tympanum and adjacent cavities. We prove that schizophytes penetrate the walls of the lymphatics, and even of the blood-vessels, in company with migratory cells, and we are safe in assuming that metastasis

into the lungs is caused by cocci swept into the circulation alone or in company with thrombi. Nevertheless, I am unable to say what part is taken in this process by *that toxic material which is formed during the decomposition of albuminoid corpuscles*. I would therefore recommend an examination of the blood from the living patient, in order to demonstrate the propagation of micro-organisms, and careful study of the course of the general constitutional symptoms, since poisoning by albuminous matter undoubtedly causes death more rapidly than an invasion of all the blood in the system by the parasites.

v. Troeltsch¹ gives an excellent description of the septic complications in purulent inflammation of the middle ear, and expresses the opinion "that the *septic gases* exude through the thin walls, which are usually composed of but a single membranous layer, and irritate the neighboring structures into a condition of putrefaction." I would like to modify this theory by suggesting that the gases do not infect the tissues, but render them more receptive to micro-organisms.²

The chief circumstance which fortifies me in the opinion that all these complications depend upon putrid decomposition is that they always occur in *old, chronic* otorrhœas, in which the development of putrefactive organisms is so wonderfully favored by the stagnation of pus in the cavities communicating with the tympanum. The fact itself is one which I discovered after carefully examining many cases recorded in literature, in which, so far as concerns the older ones, I made extensive use of the rich collection of Gintrac.³ It is further remarkable how often aurists speak of the fœtid odor as well as of a putrid secretion in such cases. If we do not find this mentioned in the cases communicated by

¹ Lehrbuch der Ohrenheilkunde, 1881, 7te Aufl.

² Compare Wernich, "Grundriss der Desinfectionslehre." I take this opportunity of yielding to this author of so many interesting papers on schizomycetes the priority in the discovery of the heating of cotton plugs for bacterioscopic cultivation, for I find by the above work, which reached me after the publication of the first part of this article, that Dr. Wernich had already resorted to this precaution for a long time. Compare also his article in *Virchow's Archiv*, Band lxxviii.

³ Gintrac: Cours théorique et clinique de pathologie interne, etc. Tome viii, Paris, 1869.

non-specialists, it is a question whether they did not consider it superfluous to direct attention to this symptom of purulent otorrhœa, simply because it had come to be regarded as a matter of course.

I would say, finally, that I have as often noticed the odor characteristic of caries, although caries was not really present, as inversely. The bad odor indicates putrid decomposition, which oftentimes follows caries.

PART III.

THERAPEUTICS.

With the proof that schizomycetes colonize in the meatus in purulent perforative otorrhœa, we have now a rational basis for the various plans of antiseptic treatment lately suggested in this affection. We can, moreover, advance one step further, and distinguish :

1. Fresh cases of otitis media which are as yet uncomplicated with the immigration of schizomycetes.
2. Chronic cases, already infected with these organisms, and
adopt a regular treatment for each class.

The treatment which has hitherto prevailed, in so far as concerns the influence of schizomycetes upon the middle ear, has been almost entirely *antiseptic* ; it has simply aimed to destroy the putrefactive condition already present. But for myself I lay great stress in fresh cases on the *aseptic* treatment, *i. e.*, to prevent the immigration of schizomycetes, and to stop the putrid decomposition of the secretion as well as the suppuration.

In the second class it is necessary, in addition to antiseptics (which is even nowadays left too much out of account), to follow out the therapeutical indications necessitated by the structure of the affected parts, their physiological peculiarities, and, above all, by their pathological alterations.

I.—*Treatment of Fresh Cases.*

Asepsis.

The aim of Lister's method is to prevent schizomycetes

from invading the surfaces of wounds after injuries, ulcerations, etc. If we succeed in this we obtain asepsis, so that the chances for recovery by first intention, without suppuration, become extraordinarily favorable, as has been proved by innumerable difficult and extensive operations.

If, however, we do not seek for asepsis or attempt it too late, and if schizomycetes which are capable of propagation have already encamped upon the diseased surface, we have to undertake the much more difficult task of making them innocuous and inactive; in a word, we have to strive for antisepsis. But recent experiments have shown that we need much more powerful agents to oppose the activity of schizomycetes, if already present in the putrid secretions, than to prevent their immigration. *Antisepsis, therefore, is much more difficult to obtain than asepsis.*

*If we apply these general considerations to the special relations of inflammation of the middle ear, we find that in the vast majority of cases we do not see the patients until chronic otorrhœa is present, or, at least, until the tympanum is already connected with the meatus by a perforation in the *Mt*, and suppuration is well under way.¹*

Instead, therefore, of being able to strive for asepsis, we are in the less favorable position of being obliged to resort to antisepsis. This task, however, with the complicated structure of the tympanum and its adjacent parts, as well as its slight accessibility in case of a small perforation (see below), is oftentimes extremely difficult, while it is infinitely easier, if we can begin at the right time, to prevent the schizomycetes from entering the meatus at all, and thus cause a rapid recovery.

In every fresh case, therefore, I would suggest the following procedure, to which I have resorted for some time with the most brilliant results: When perforation of the *Mt* appears unavoidable, we should at once perform paracentesis. While it is quite true that almost all aurists agree to this proposition, they only perform paracentesis in order to shorten the duration and intensity of the pain. I follow of

¹ I leave entirely aside the question of the possible entrance of microphytes or their spores through the Eustachian tubes, and their effect.

course the same idea, yet I aim at the additional point of making a regular linear opening, with much more favorable chances for recovery than in the case of an irregular opening made by a spontaneous perforation. Yet, further, and this is my principal motive, *I operate for the very purpose of disinfecting the tympanum.* Therefore, directly after the paracentesis, which I perform with a carbolized needle, I fill the meatus with finely pulverized boracic acid, which is not only well borne, but fulfils our purpose of warding off the immigration of schizomycetes and causing a rapid recovery.

This method is easily learned and is of so great benefit that I most heartily recommend it to the profession for use in all acute cases, in order to avoid infection of the tympanic cavity by schizomycetes.

II.—*Treatment of Chronic Cases.*

Antisepsis and Additional Therapeutics.

By "chronic" I mean all those cases in which, although the acute symptoms have ceased or have even been entirely absent, suppuration still continues, and the perforation in the *Mt* is still open. If we follow out the indications suggested by the condition of affairs in these cases, we shall have to act antiseptically; to kill the schizomycetes which are present, or to make them innocuous, or to prevent the immigration of a fresh colony, and in this way to terminate the process of decomposition which keeps alive the suppuration.

These aims are reached in many cases by Bezold's method, which owes its action to the gradual absorption of the mass of boracic acid in the meatus by the constantly secreted fluids, so that every portion of the tympanum is constantly bathed in a weak solution of this acid. If it remained in the ear undissolved it would of course exert no curative action. Furthermore, when we syringe the ear with an aqueous solution of the acid, we can drive the antiseptic to a greater depth than would be possible with a powder, unless we used immense *vis a tergo*. Even with a large perforation, I can hardly comprehend how a powder

can be blown into all the recesses of the complicated system of cavities, to say nothing of the fact that they are usually lined with a swollen mucous membrane, and more or less extensively filled with pus.

The slight solubility of boracic acid (which implies the application of weak solutions only), in connection with other reasons to be later mentioned, induced me to make additions to the method of Bezold, to whom we can hardly be thankful enough for the introduction of such satisfactory treatment into practical otology. But as I was hardly satisfied with its results in all of my chronic cases, I thought over the whole subject and at last invented a *combined method* which has given me much more favorable results in the latter class of cases than the simple method of Bezold.

The train of thought which I followed was this: Our aim in all these cases is to get thorough disinfection; we must kill these schizomycetes, we must put a limit to this process of decomposition. But beyond this, and it is this point which is just now almost *entirely overlooked*, we have a *second task to fulfil*; we have to cure the diseased surfaces.

Now this problem is by no means solved by obtaining simple antiseptis, since the pathological alterations of the parts concerned, although caused by the process of decomposition, do not cease spontaneously with the cessation of the decomposition, but demand especial treatment of their own. Therefore, the treatment which I have adopted in these chronic cases has for its double aim the disinfection by antiseptics of the secretions which cover the diseased surfaces, and, secondly, the cure of these surfaces by suitable astringents.

Let us now consider the rules for disinfection, preceding them with a few remarks on the antiseptic cleansing which ought to be performed before any application is made to the diseased cavity.

Cleansing of the Meatus and Tympanum.

If our treatment of suppuration of the middle ear were to consist simply in the removal of the secretion from the *meatus*, it would be quite sufficient to swab out this cavity

with tampons of cotton, which are highly recommended by many specialists. But it is plain that we cannot cleanse the tympanum or its adjacent cavities in such a manner. I cannot, therefore, give my assent to the view that this method of cleansing a suppurating middle ear is quite satisfactory.

The first step necessary toward repair is the constant removal of the stagnating and decomposing secretion. Without this we can neither disinfect the locality nor act satisfactorily upon the diseased mucous membrane. The only way in which we can obtain this effect is, in my opinion, by *frequent syringing with a large amount of fluid and a forcible stream*. It is quite evident that a cavity with so many fissures and crevices can only be cleansed from all the secretion which it contains, and as much as possible from the microbes within, by a powerful stream and long-continued syringing. Beyond this, I thus endeavor to enfeeble, as far as possible, the vitality of the micrococci which remain. We know that rest and consequent stagnation are the chief causes of putrefaction, while frequent agitation, *e. g.*, with a stream of water, interferes with this process, as is witnessed in the flushing of drains, etc. Moreover, we know how easily stagnant water decomposes, and how rarely this process occurs in running streams.

Again, a superabundance of moisture exerts a noxious influence upon the growth of schizophytes. The addition of a *slight* amount, on the contrary, increases their growth. It is therefore probable that we can in this way interpret the occasionally harmful results of slight and infrequent syringing of the ear.

Nevertheless, if we use a great amount of fluid we run the risk of making the tissues swell too much by *excessive osmotic saturation*. I am sure that the antipathy of many aurists to extensive syringing is based upon a dread of this unfortunate occurrence, which may be avoided by using anti-osmotic fluids, such as a *concentrated* solution of chloride of sodium.

Common water always contains numerous micro-organisms, so that in the very act of using it to cleanse a wound, we

might infect it. But inasmuch as boiling for a length of time always destroys the propagative capacity of these structures, especially in a medium so poor in organic substances as water, I always boil for an hour before using, every fluid which I employ for syringing.

Desiccation hinders the development of schizomycetes in the same way as excessive moisture. Would not this fact explain those rare cases in which desiccated masses of pus, etc., have remained for a long time in the tympanum and its adjacent cavities without any injurious effect, while the instillation of even a slight amount of water, as is the case with careful syringing, produces the most violent inflammatory symptoms? This phenomenon is usually ascribed to the rapid swelling of the collected masses, but it seems to me that this is due to a renewed excitation of the decomposition which has hitherto been in a state of suspense. So long as the schizomycetes and their spores are dry, their further development is hindered. But the addition of water causes a stormy increase in the microphytes as well as a rapid decomposition of the albuminoid corpuscles, in which train of symptoms we are not to forget that it is the initial products of decomposition which act so noxiously. My opinion on this point is supported by the fact that the masses removed from the meatus under such circumstances possess a noticeable putrescent odor. If we wish to avoid all possible danger in those cases in which experience teaches us that the above symptoms may appear, it is best to syringe abundantly and repeatedly with water which has been rendered antiseptic by boracic acid, alcohol, etc., by which means the putrid decomposition will be held in check.

In so far as concerns the cleansing of a suppurating ear, it is important not only to show the person entrusted with the syringe how to use it, but also to let him go through with the whole procedure in our presence. It is also important to have a proper syringe. For eighteen years, I have used syringes provided with a groove along the conical nozzle, so that the fluid runs off more easily and too strong pressure is avoided.

The size of the perforation is another important point in

the treatment of otorrhœa. It is self-evident that we should not be satisfied with simply treating our cases with antiseptics, or astringents and caustics in connection with cleanliness, but be sure that the remedies really reach the seat of the disease (tympanum and adjoining cavities). This is of course impossible in the case of minute perforations in Shrapnell's membrane (where they are, moreover, often concealed by granulations or polypi) or in the *Mt* itself. I think that these minute openings almost always exist in the anterior portion of the periphery, the thin cicatricial tissue which covers a larger loss of substance in this region being often perforated so minutely that we cannot see the hole, and can only recognize its existence by hearing a faint squeak when we use the air-bag or the patient blows his nose. It is well known that such cases are very hard to cure, and simply, as I think, owing to the opening being so small that we cannot treat the surfaces of the tympanum at all efficiently. It is therefore indispensably necessary for us to enlarge such perforations by a sufficiently extensive incision, in order that the syringing-water as well as the lotions may fairly reach the diseased cavity. If it is impossible to fix the situation of the perforation, *e. g.*, on account of a peculiar conformation of the walls of the meatus, we must make a free incision at some suitable place, and try to keep it open as long as possible. By following out these rules we shall hasten recovery, just as we do by enlarging fistulous openings, by making counter-punctures, etc., in other portions of the body.

At the same time we must force *air* freely through the tubes and tympanum, not only in order to blow out the secretion, but to fulfil still another important indication. Stagnation in the air leads to putrid decomposition just the same as stagnation in water.¹ Frequent renewal and agitation of the air hinder decomposition. The insufflation of chloroform vapor, which is likewise an antiseptic agent, might increase this action in a high degree.

¹ Compare the conclusions of the Moscow Surgical Society, "Méthode d' aération : traitement rationnel des plaies," 1877.

Treatment of the Diseased Surface.

If we could only treat every case of acute otitis media before perforation of the *Mt*, or at least directly after it occurred, we should undoubtedly obtain a perfect recovery in a very brief time by the above-mentioned antiseptic treatment. The only exceptional cases would be those dependent upon some severe constitutional affection such as tuberculosis, typhus, diphtheritis, etc. On the other hand, the percentage of disturbances of hearing after the acute exanthemata would be reduced to a minimum. Nevertheless, it cannot be too earnestly insisted upon that, as things now stand, the specialist rarely sees cases of this nature until the favorable moment has long since passed, either because the aural affection was overlooked in the presence of the severe constitutional disease, or because it was left to get well of itself.

In a vast majority of cases, therefore, the diseased surface is already infected with putrid organisms, so that we must at once begin with the antiseptic treatment. But even then we have not done all.

In addition to the decomposition of the pus we generally find extensive alterations in the lining of the tympanic walls as well as of the ossicles and the neighboring cavities. The deeper tissues also are often affected. The mucous membrane is swollen, infiltrated, or hyperplastic; its epithelial layer has been lost; while ulcerations or granulations are frequently noticed upon its surface.

While we may style the antiseptic treatment a defensive and, as it were, a preventive method, the anatomical conditions just described, as well as the functional disturbance, require, if we may so style it, an offensive treatment, a positive and energetic attack.

In order to fulfil this double purpose, I add to the simple boracic acid, which is soluble with difficulty, and to its directly curative action, a substance—alcohol—which increases the antiseptic effect of the acid, and exerts a beneficial astringent action upon the diseased surfaces of the affected regions.

Although I have for years been well assured of the ex-

cellent effects of alcohol in suppurative otitis media, and regarded its energetic action upon the diseased mucous membrane as a modification of the condition of the tissues by desiccation and molecular coagulation of the albuminoid fluids, I now lay great stress upon the beneficial antiseptic action of this remedy.¹ In point of fact, this action has long since been resorted to in the preservation of anatomical preparations, and even of entire bodies, for the purpose of opposing decomposition in fresh tissues and cutting it short in old.

Although a liquid remedy can penetrate into all cavities and fissures, it cannot remain everywhere in permanent contact with the diseased surfaces, which is another point in treatment upon which I lay great stress. This condition, however, can be fulfilled by keeping a reserve of active material in the meatus in the shape of a pulverized remedy whose gradual solution produces a continuous action. *For this reason I resort to a combination of alcohol and boracic acid.*

Whilst boracic acid is soluble in absolute alcohol in only one part in twenty-five, I order an addition of 10 to 20 per cent. more than this vehicle can dissolve. Before using, I shake the mixture well in order to distribute the superfluous powder evenly, and then I warm a part of it (at first diluted with considerable water, then stronger and stronger) in a test-tube and pour it into the ear. In this way the boracic acid is carried along with the fluid, reaches all the surfaces, and by inclining the head toward the healthy side, it sinks by its own weight into the deepest cavities.

I will here call attention to the important point of *completely filling the meatus*, since the action on the schizophytes and the coagulatory effect upon albuminous substances manifests itself all the more forcibly, the greater the amount of active substance which comes into contact with them. Moreover, as a prolonged contact is just as important as the above point, I let the lotion remain in the ear as long as possible.

¹ Thausing: *Allg. Zeitsch. für Bierbrauerei*, etc., Band vi. Anti-fermentative action of alcohol.

I find this method more suitable and more applicable than my former one of using the above remedies alternately: insufflating the pulverized boracic acid at evening and instilling the alcohol in the morning.

By using both of these methods, especially *the supersaturated alcoholic solution of boracic acid*, I have cured many a case in which boracic acid alone was of no benefit. The significance of the results thus obtained is easy to explain when we consider the inefficiency of merely antiseptic agents against the pathologico-anatomical substratum of this disease and the powerful action of alcohol in this respect.

Even granulations and polypi often disappear under this treatment without any direct operative interference. Alcohol alone also gives us the same result, as both Politzer and myself have noticed for many years.

Satisfied with the results which I have obtained by this method of treatment, I have not as yet experimented with other substances dissolved in alcohol, more especially since boracic acid is the least irritating of all antiseptics, as is proved by the fact that it can even be used on mucous membranes in a condition of acute inflammation.

After successfully using this method, or the simple boracic-acid treatment, I noticed in some cases that, despite the disappearance of every symptom of putrefaction (disagreeable odor, etc.), and an advance toward recovery, *the microscope still revealed occasional clumps of cocci*. I will mention, by the way, that Klebs (*l. c.*, page 107) "rarely failed to find his microsporon septicum in laudable pus." Moreover, schizomycetes which are still capable of propagation are often found under Lister's antiseptic bandage even when thoroughly and successfully applied. I willingly confess that I cannot explain these facts, which seem to oppose the modern theory of the recuperation of wounds, and I can only say that we cannot as yet correctly explain these phenomena. When other authors try to support their views by declaring that such micro-organisms are "incapable of invasion," I cannot but regard it as a most unsatisfactory method of begging the question. Billroth's opinion¹ that

¹ Billroth, *Allg. Chirurg. Pathol.*, 9 Aufl., page 183, Berlin, 1880.

those micrococci only are inflammatory "which originate in certain inflammatory products, in decomposing pus, urine, etc., and there receive the fermentative principle" is much more precise.

Besides using alcohol and boracic acid in combination, I have employed other antiseptics and astringents, *e. g.*, the *insufflation of a mixture of pulverized boracic acid and alum*. Still, I have not as yet had sufficient experience with this method to be able to define its precise value. Nevertheless, I will here emphasize the following point, which is to be borne in mind in using alum in any combination: it is well known that hyphomycetes (*aspergillus penicilium*, etc.) are frequently observed in solutions of alum and other substances, as I long ago noticed and recognized as a cause of otomycosis.¹ The facility with which these parasites make their appearance in solutions of alum especially, lies, in my opinion, not so much in the chemical nature of the substance in solution, as in the contamination of the finely pulverized and carelessly guarded or manipulated alum with dust, to say nothing of all sorts of spores or germs. I have, however, tried to deaden their effect by applying great heat to the powder before dissolving it, and afterward by boiling the solution.

These contaminations are often of a coarse and macroscopic nature. Thus, I noticed most extraordinary inflammatory symptoms in the *Mt* of one patient after the first insufflation of the mixed powder of alum and boracic acid. On syringing the ear, large clumps were removed, which even by weak powers showed a variety of mineral and vegetable contaminating substances. Among them there was found even a particle, visible to the naked eye, which under the microscope was recognized (by the dots) as pine-wood. It is therefore necessary to examine the ordinary alum powder (and perhaps, also, other powders) for contaminations, for we must be sure of the purity of a remedy if we desire correctly to know its effect.

I am inclined to believe that the furuncles observed by other aurists after instillation of alum solutions did not re-

¹ On fungous ear-disease. Cork Congress, 1879. *Les champignons parasites de l'oreille humaine*. Congrès de l'Assoc. Française, Reims, 1880, and *Gazette Hebdomadaire*, 1880.

sult from the chemical effect of the liquid, but from the micrococci introduced with the powder.

In conclusion I would recommend that the powdered boric acid be preserved in well-closed bottles, in order to prevent contamination from dust.

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