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ORIGINAL COMMUNICATIONS.

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PRACTICAL PROBLEMS IN OTOTOLOGY AND RHINOLOGY.*

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I should be proud to place before you a piece of original investigation containing some epochal addition to the sum of human knowledge, or at least of that section of it with which we are particularly occupied. Such, however, I am unable to do, as, from circumstances, and perhaps from temperament, I have been led to enroll myself as a simple healer of the sick. My inquiries have always been conducted in the light of practical pursuits, and if there is one thing on which I think I may congratulate myself more than another it is the possession of a frame of mind which enables me to extract the greatest amount of benefit (duly acknowledged) from the work of others, instead of racking my brains to find means of criticising and depreciating it. How often have I seen the critical frame of mind deprive its possessor of much of the good he might otherwise have derived.

My initiation into otology dates from thirty years ago, when my valued friend and relative, Mr. Laidlaw Purves, indoctrinated me in the practice and principles of the specialty and inspired in me an interest in this branch of the medical art which I venture to think I still retain and hope never to lose. As the successor to Hinton in the great school of Guy's Hospital, he maintained the best traditions of British Otology as established by Toynbee, enhanced by a familiarity with the advances in the art as developed and practised in Continental schools, notably in Vienna, where Grüber and Politzer were the chief exponents. Grüber is now no more, but Politzer, in spite of the length of his active career, is still as recep-

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tive and appreciative of new ideas as ever and bids fair to continue long an example of industry and enthusiasm which we may well emulate and strive to imitate.

At that time the ear was mainly studied in relation to its main function, that of hearing, and the surgical developments of otology, with which we are now so familiar, were scarcely dreamt of. I cannot help thinking that the progress in this direction has dazzled the otological eye by its brilliancy and diverted from the less sensational problems of what I may call acoustic otology, the attention they have deserved. It cannot be said that in this department the progress has been at all in proportion to that in the surgical.

Far be it from me, however, to say that we have remained at the stage where cases which failed to respond to the syringe or to the air-douche were considered hopeless, but the advance beyond it has not been so considerable as could be wished.

THE VALUE OF TUNING-FORK TESTS.

At the commencement of the period I have mentioned the functional examination of the ear was by no means neglected. Tuning-fork tests were studied by Lucæ, Schwabach and other otologists, and Hartmann devised his well-known conventional graphic representations, but I think it will be generally agreed that the fullest development was only attained by the laborious investigations of Professor Bezold of Munich, for the results of which he is entitled to our warmest gratitude. Ostmann and Gradenigo have been among the other most diligent developers of this method of testing, at a great expense of time and labor. Possibly there has been a tendency to overestimate the value of these tests, especially when we consider their subjective nature and the "personal equation" of such untrained observers as the patients on whose statements we have to depend. On the other hand, it is surprising to read the statement by the surgeon in charge of the aural department of a metropolitan medical school that he has quite given up tuning-fork tests. Jacobson, late of Berlin, now, unfortunately, deceased, has certainly exposed them to the most destructive criticism, but has in the description of his practice shown himself unable to dispense with them. As usual, the truth lies in the middle, and we must realize the limitations of the tuning-fork tests, not reject them. Care must be taken both in observation and interpretation.

In the first instance we must only accept results which are well marked. Bing suggests that no difference of less than two seconds from normal duration should receive consideration. This applies

especially to the measurement of hearing by bone-conduction. Again, it is well to repeat the tests several times, exercising considerable skepticism if they vary to any great extent.

Forks of very high or very low pitch are ill adapted for tests connected with bone-conduction. Very high-pitched forks are apt to be heard by the opposite ear by air-conduction, in spite of our closing it up, thus rendering the testing of the ear under investigation very unreliable. For Weber's vertex test they are, therefore, ineligible. Low pitched forks are of such weight and magnitude that the patient may feel the mechanical vibrations after he ceases to hear the sonorous ones and thereby be led into error in reporting. The ideal fork for bone-conduction in general and especially for such tests as Rinne's and Weber's is Gardiner Browne's, tuned to c, with 256 vibrations per second. It should be heard by a young adult for about 15 seconds through the bone and for about a further 15 opposite the meatus. This "acro-osseal difference" is an important item which should not be omitted in the description of a tuning-fork. The duration should be long enough to allow of a good margin for observation and it should not be so long as to induce phenomena of exhaustion in a normal person.

Having been born in the year in which Rinne's test saw the light (the one in which Garcia invented his laryngoscope), I take the test somewhat to heart. I consider its evidence, especially when "positive," as indispensable, but would remind you of an obvious fallacy into which I and many others have been led by it and which in many text-books receives no notice. This is that in unilateral nerve-deafness we get a "negative Rinne" because we are comparing the air-conduction of the diseased side with the bone-conduction of the sound one, the vibrations of the tuning-fork on the mastoid being conveyed through the cranial bones to the opposite ear. Here we have to check our results by means of the vertex test and the Galton whistle in a way I need not here recount.

I think I have said enough to show that the results of our tuning-fork tests must not be blindly accepted, but must be interpreted in the light of their limitations. Moreover, we must take them in combination with other signs. We must not rely on them alone any more than we would rely on any other single method of examination of any organ of the body.

For the production of pure tones we have no more convenient instrument than the tuning fork, and in some form or other the graphic method of recording the field of audition, for which we are

primarily indebted to Hartmann, will never be dismissed from employment even though submitted to modification in some directions. Probably it will advisably be confined to air-conduction, and the number of octaves may, by the use of nine instead of five tuning-forks, be increased to eight with advantage. The amount of time required may be considered sufficient to render it impracticable for general use, but this pales into insignificance beside Professor Bezold's monumental "continuierliche Tonreihe." I may remind you that to facilitate calculation and to save time I have devised and described a method by which the percentage duration of hearing for nine forks can be taken for both ears in less than twenty minutes, not merely by an aurist, but by any assistant possessed of normal hearing and conscientiousness.¹

To convert this percentage of duration of hearing into percentage of actual hearing power is a problem which is certainly of great interest and probably of great practical value. Undoubtedly as a step in the direction of scientific righteousness it merits our careful attention. In the mere testing with the watch or the voice we ought, if we are to be accurate in our measurement of the patient's acuity of hearing, to allow for the fact that sound diminishes as the square of the distance. To grasp and apply this comparatively simple rule would disconcert many of us; how much greater is the difficulty in calculating the percentages of hearing by the tuning-fork when we remember that the tone dies away by logarithmic decrements with a factor peculiar to each individual tuning-fork. Bezold, by adopting a rule of Edelmann's assuming that the decrement of all tuning-forks was the same, calculated out a very near approximation to the desired result. Schmiegelow adopted the method of measuring the distance at which the fork under investigation was heard at the end of the different periods of duration. Ostmann's method is in a way an extension of Gradenigo's, being founded on the principle that the visible and calculable amplitude of vibration is an index of the intensity of the sound. Gradenigo makes them exactly proportional, but in reality the intensity varies as the square of the amplitude. My friend, Dr. Womack, investigated for me the set of forks I use, employing the microscopical method for finding the constant factor peculiar to each of the lower forks and the distance method for the higher ones. He has prepared for me charts which show for the nine forks the relation borne by the percentage duration to the percentage auditory acuity. It will be seen that the divergence is greatest at the middle of the duration, 50 per cent. of duration in case of a tuning-fork of medium pitch being equivalent to only about 15 per cent. of normal auditory power.

How far this correction of the charts with which we have so long been familiar will lead us to greater accuracy in diagnosis is quite uncertain, and for the present Hartmann's claim to our gratitude is certainly indisputable.

DIAGNOSTIC VALUE OF TESTS FOR HIGHEST PITCHED TONES.

It is pretty generally accepted that loss of hearing for the highest pitched tones is characteristic of and, indeed, almost pathognomonic of disease of the labyrinth, we may almost say of the lowest turn of the cochlea. The tympanic apparatus is mainly required for the conduction of the comparatively slow vibrations of the lower pitched tones, and in spite of it being diseased or at least fixed, the highest pitched tones are heard. If, with evidence of disease of the conducting apparatus, the hearing for the highest pitched tones is defective or lost, we assume that there is simultaneous labyrinthine disease.

If our tests exclude disease of the conducting apparatus any deafness present must be attributed to disease of the auditory nerve in its labyrinthine expansion, its trunk, its cortical center or the fibers of communication between the nerve and this center. If the deafness is, under these circumstances, most marked for the highest tones, the affection is most probably situated in the cochlea. Should, however, the defect of hearing be equal or more pronounced for deep tones, the portion of the auditory nervous apparatus concerned is more probably some part other than the labyrinth, possibly the cortical centre.

What is the foundation for this view?

Gradenigo,² in Schwartz's handbook, asserts it as well established by his experiments and observations, and Politzer³ quotes Gradenigo directly. The typical defect for high tones is shown in most of our charts of hereditary syphilitic disease known usually to affect the labyrinth. On the other hand, in Siebenmann's⁴ case of central disturbance of hearing depending upon a lesion of the crural tegumentum, the perception of the lower tones was the first affected, later the perception of all tones being equally diminished. In Gradenigo's⁵ cases of lesion of the auditory nerve-trunk, the tones in the middle of the range were the worst heard.

I have ventured to lean on these results and to assume as a practical rule that in cases of nerve-deafness in which the defect is not most pronounced for the highest pitched tones, but for all tones in pretty equal proportion and perhaps even more for the lower tones, the affection is probably one of the auditory center rather than the

labyrinth or nerve-trunk. If, further, there is no evidence of an organic lesion of the other cranial nerves or central nervous system, there is a reasonable probability that the affection is a functional one and the prognosis is *ceteris paribus* more favorable. I have applied this principle in numerous instances, as in neo-marital and tobacco forms of nerve-deafness. Two most striking cases, one of hysterical deafness, and one of neurasthenic dulness of hearing, I published in the *Journal of Laryngology*. In the former⁶ the hearing, which suddenly returned, had been so genuinely extinguished that the patient spontaneously acquired the art of lip-reading. In the latter⁷ a little more generosity in diet, stimulants and rest and greater economy of labor and of conscientiousness resulted in recovery.

In regard to lengthened bone-conduction may I state a conviction that this is produced by increased tension in the conducting apparatus, not by simple obstruction, as I have found it practically absent in cases of uncomplicated ceruminous occlusion?

We will all admit, no doubt, that in combinations of affections of the nervous and conducting apparatus the shortening of bone-conduction due to the former may neutralize the lengthening due to the latter. The degree of loss of air-conduction and the alteration of the aero-osseal difference (negative Rinnè) may here enable us to check results. As a rough rule I think that in pure "obstructive" deafness the amount of loss of A. C. should be about equal to that of the increase in B. C.

THE ACTION OF QUININE ON THE AUDITORY NERVE.

The more the nature of the changes produced by quinine in the internal ear is investigated, whether from experimental or clinical research, the more complicated the question becomes. Kirchner's somewhat crude experiments seemed to have proved that there was a congestion with effusion of blood in various portions of the labyrinth. It was later elicited that in each case the animal's death was accompanied by convulsions, and it was shown by Grunert that in animals killed in such a way as to produce convulsions, but without any administration of quinine, similar disturbances were produced in the labyrinth, though possibly in a less degree.

Wittmaack's experiments showed that changes were brought about in the auditory cells and in the auditory nerve of such a nature that Nissl's bodies disappeared, a phenomenon seen in degeneration of other parts of the nervous system. This very objective observation left unanswered the question as to whether congestion or anæmia was produced.

In favor of the anæmia theory was the analogy with the quinine amblyopia cited by Brunner. This is accompanied by an unmistakable anæmia of the retina and the citer argued by analogy that the same condition must be present in the labyrinth. It cannot be said that his contention has been altogether disproved, and some highly competent observers (I may mention among them Dr. Milligan of Manchester) are of the same way of thinking. The majority are, however, apparently inclined to believe in the existence of a congestive condition. Rossa reports the actual occurrence of visible congestion of the tympanic membrane as the result of the administration of quinine. Blake warns against its administration in cases of inflammatory congestion of the ear (though it must be admitted that the ultra-conservative or anti-paracentesis school headed by Zaufal and Piffel give salicylate of soda with a view of cutting short an acute otitis media.) Numerous writers accept without question the view that these drugs cause congestion of the labyrinth, and I myself am of this opinion, as the result of inference from general clinical observation and also from finding the tinnitus produced by quinine quieted by compression of the vertebral arteries. This has the effect of diminishing the blood-pressure in the basilar artery, its branches, the internal auditories, and, thereby, in the vessels of the labyrinth.⁸ I may remind you that this compression may be made in the suboccipital region, the thumb and finger of one hand being placed in the hollows behind the mastoid processes while counter-pressure is exercised by means of the other hand placed on the forehead. As the arteries lie under the complexus muscle the pressure has to be rather firm. If such pressure checks pulsating noises or vertiginous feeling, the inference is that these are due to congestion in regions supplied by the branches of the basilar artery, probably the internal ear.

QUININE IN AURAL VERTIGO.

Allied to the question of the effect of quinine on the hearing-power is its mode of action in cases of aural vertigo. In regard to this it is hardly too much to describe it as specific. One might almost borrow a term from the homeopathist and call it dynamic. I need not recall to you the history of the matter. It was first supposed that enough had to be given to destroy the functions of the entire internal ear, the vertigo ceasing as soon as the auditory power was extinguished. Needless to say, one hesitated to adopt such a drastic measure, and quinine did not take in the routine treatment of aural vertigo the place which it deserved. With some it is more habitual

to treat "Mènière's disease" with bromide and iodid of potassium. I made an attempt to distinguish "congestive" from "anæmic" forms, giving bromides in the former and quinine in the latter, but found that so far as the vertigo was concerned, quinine was efficacious in both. As regards the dosage, I found large quantities quite unnecessary, and one grain or even the half or the quarter of a grain (with or without ten to fifteen minims of dilute hydrobromic acid) was ample. In fact, I ventured the opinion that quinine acted in regard to vertigo neither by causing congestion nor anæmia, but by exercising a direct sedative effect on the vestibular nerve. The recent experiments^o of Dreyfuss have confirmed this view and established it on a scientific basis. These experiments were carried out on guinea-pigs by means of the rotating table, and he found out the peculiar attitude adopted by the animal when the rotation reached a certain minimum degree of rapidity. When he rotated animals which had been dosed with quinine he found that a very much higher degree of rapidity was required in order to induce the adoption of this attitude, the sense of disturbance being obviously dulled by the drug. It seems to me that these results should give us the greatest confidence in the employment of this remedy in aural vertigo, remembering, however, that many other contributory factors in treatment are of undoubted importance. Among others we may note the value of a few days' rest in bed, the treatment of the alimentary system, the kidneys, etc.

In cases in which the diagnosis between aural and epileptic vertigo present difficulties, which Dr. Risien Russell so well described in a discussion by the Otological Society of the United Kingdom, I believe we have in quinine a test well worthy of consideration.

A rough rule in regard to the action of drugs in some important types of vertigo is that aural vertigo is benefited by quinine, epileptic by bromides, renal by iodides and traumatic by small doses of perchloride of mercury. I am assuming for the moment that there is no obvious aural lesion (polypus, cholesteatoma, etc.) which the practical otologist would not overlook, nor the ocular, cerebral, spinal or migrainous disorders which he ought to keep in mind.

SOME USES OF INSPIRATORY EFFORTS IN NASAL AND LARYNGEAL THERAPEUTICS.

In a paper by Klebs, read before the German Otological Society, attention was drawn to an observation of Hunter regarding a point in the physiology of the respiratory and vascular system, which seems to me of great importance to the rhinologist. It is to the

effect that during vigorous inspiration the expansion of the chest must mechanically induce a certain amount of dilatation of the cavities of the heart and great vessels. In-suction of blood is thus produced and this must *ceteris paribus* lead to a diminution of the blood pressure in the peripheral vessels and among others those of the upper respiratory passages. The direction of suction favors the formation of coagulation plugs in vessels which may have been opened, as by operations in the nose.

Patients are, therefore, recommended to avoid snorting out, but, on the contrary, to snuff vigorously up through the nose and spit out by the mouth any blood which has been drawn into the back of the throat. I have thus found the hemorrhage after operations for adenoids, for instance, diminished to an extraordinary degree if these instructions are carefully followed. I may incidentally offer as an argument in favor of the short anesthesia for these operations that the patient is all the sooner able to perform these voluntary movements.

Another application of inspiratory effort is its use in the emptying of accessory nasal sinuses. Mott of Arnheim recommended in cases of acute catarrh of the frontal sinuses that the patient should pinch his nostrils and then draw a full breath, thus exercising suction more or less on all the sinuses, but as a rule chiefly on the frontal, as having the most dependent opening. By changes in posture the various cavities may be put into favorable position as, for instance, the sphenoidal by bending the head downwards and forwards, as I have several times observed.

For the purpose of suction of the nasal sinuses the mechanical arrangement devised by Sondermann is very recommendable. It consists of a nose-piece like an anesthetist's face-piece in miniature provided with pneumatic India rubber cushions round its margins so as to fit air-tight. To the front of it is attached a tube and air-ball with valves so arranged as only to allow of exhaustion. The ball is compressed and only allowed to expand when the patient raises the soft palate by the utterance of the sound "ee" or "kee." With a little practice the knack is easily acquired and very marked suction effected. I have observed this in both the frontal and sphenoidal sinuses. The relief afforded in a chronic frontal catarrh in the person of the wife of a Canadian medical friend was most striking.

Again for the irrigation of the nose I think I have utilized the process of inspiration to great advantage. A small glass vase has a cork with two tubes, one going down to the bottom of the vessel,

the other only through the cork. The former has a bulbous orifice at its outer extremity to fit the patient's nose; the other is cut quite short. If the patient snuffs vigorously through the tube the liquid from the bottom is drawn up through the nose and back into the throat where it can be spat out. It will be remembered that when the air is snuffed up the nose it runs up towards the roof before going backwards, and the same direction seems to be followed in some degree by the fluid, as I have often seen the middle meatus thoroughly cleansed by this method. It has another advantage, namely that the *vis a fronte* draws it past the Eustachian tubes, so that the risk of infection of the middle ear is reduced to a minimum. The instrument reduced to its simplest form consists of a short tube with a bulbous orifice.

Inspiration may be practiced for the benefit of the larynx, and those who have not introduced Leduc's tube for the inhalation of powders into the larynx into their practice, would do well to give it favorable consideration. It consists of a glass tube of about 10 inches in length, one end of which is pushed to the back of the patient's throat while the other is placed in a small saucer containing the powder to be inhaled. The end in the throat is curved downwards for about half an inch through an angle of 100°. The opposite end is bent down for 3 inches so as to dip conveniently in the powder. The lips are compressed firmly round the tube and if a sharp sucking inspiration is made, a quantity of powder is drawn into the larynx. This can be done by the patient, who thus has placed in his hands the means of anesthetising a tuberculous larynx and of rendering the swallowing of nourishment possible in cases in which it would otherwise not have been so.

Among the most useful powders are: Di-iodoform as an antiseptic. Orthoform as a local anesthetic in ulceration. Anesthesin similarly a local anesthetic and antiseptic. It is useful also when there is no ulceration and tends to reduce edema. Its anesthetic action is in my experience shorter than that of orthoform. A combination of two parts of orthoform with one of resorcin acts as an excellent anesthetic and antiseptic.

There is no doubt that in persons with weak and dilatable hearts the inspiratory efforts I have described should only be practiced with the greatest discretion and in some cases should be avoided altogether. Incidentally I cannot help thinking that the violent inspirations through the nose, which are such a feature of some courses of physical instruction, may lead to cardiac dilatation, more especially in the presence of nasal or naso-pharyngeal obstruction.

THE VALUE OF INTRANASAL TREATMENT IN SPASMODIC ASTHMA.

Considerable divergences of opinion have been expressed with regard to the influence of intranasal disease in the production of spasmodic asthma. My views were stated in my address as president of the Hunterian Society of London in 1900.¹⁰ I then expressed myself to the effect that asthma is a disease in the treatment of which general medicine owes much to the specialist, and every practitioner in diseases of the nose must have before his mind cases in which the treatment of the nasal cavity has resulted in long and even permanent relief from the suffering depending upon this disease. I went on to say that, at the present time, physicians make a rational search for nasal symptoms and when such are present or suspected, then only are the patients brought before the notice of the rhinologist, and under such circumstances the percentage of beneficial results is by no means a contemptible one.

It would indeed be strange if the important experimental proofs of the interaction between the nerves of the nasal mucous membrane and those of the bronchial muscle, brought forward by Brodie and Dixon, were not confirmed by clinical experience. No doubt the exaggerated hopes raised by Hack and his followers, and the natural disappointments that ensued, were calculated to bring the nasal theory and the practice founded on it into discredit. The harm done thereby was small, however, compared with the result of leaving the nasal condition alone. I remember well the case of a medical man who, on account of asthma, had been obliged to give up his practice near London and retire, at great loss, to a town on the South Coast. He had acted on the advice of a physician who, he states, had actually not even examined his nose. At a later period, too late for the mischief done to be repaired, I found his nose packed with polypi which must have been already present, though no doubt in a lesser degree, when the asthma had established itself. Mr. Mayo Collier narrates another case in which the same spirit of skepticism had prevailed. On the other hand, all must have seen, as I have done, occasional cure and frequent relief following the removal of nasal sources of irritation. As illustrating the effect of nasal treatment I may say that I have observed at least two cases in which the attacks were checked by a nasal spray of mucin as devised by Mr. Stuart-Low. The immense vogue obtained by the advertised nasal spray "cures," which appear to contain chiefly cocaine, adrenalin and atropin, shows how beneficial nasal treatment can be. The results obtained by Francis by cauteriza-

tion of the septum, however explainable, offer strong confirmation of the value of the intranasal treatment.

In order to check my impression by the results of cases, I wrote some years ago to eleven patients and found that three of them were cured, three much improved, four relieved for a time and one not relieved at the time but cured subsequently. These were a few consecutive and unselected cases, and did not include others before and after, among which I could easily quote some of my most satisfactory results. This is very much what one would have expected and I think it sufficient to justify comparatively moderate views. In reality it probably makes the case for nasal treatment less favorable than it ought to be, because among the failures there were certainly some who did not give the treatment a fair trial. One, for instance, was an alien lady who, for reasons of economy, chose to be treated in the hospital, but being quite unsuitable for charitable treatment, withdrew herself from the institution and from my care, to the detriment of the result. In another instance the irritation caused by the operation induced a temporary aggravation of the asthma (a clear proof of the causal nexus), and the recovery which followed took place in other hands and was attributed, I am informed, to the administration of small doses of arsenic. Again, from one cause or another, intranasal operations are sometimes, as such, unsuccessful in my hands, though possibly other and more skillful or less experienced nasal surgeons can boast of having no disappointments. I can not.

SCLEROSIS OF THE MIDDLE EAR.

One of the most distressing problems is the nature, cause and, if possible, the cure of those insidious progressive and incurable forms of deafness without visible change in the tympanic membrane and without narrowing of the Eustachian tube. I need hardly say that I refer to what is now known as sclerosis of the middle ear, otosclerosis, ankylosis of the stapes, chronic labyrinthine capsulitis.

It has taken long for this condition to have its proper place in our otological nosology, many of the cases formerly described as nerve-deafness being doubtless examples of this disease, and many cases described as sclerosis being really chronic tympano-Eustachian catarrhs. The introduction of methodical tuning-fork tests corrected the former error to a considerable extent, the latter one being apparently still current, if we may judge by the descriptions of stenosis of the Eustachian tube and thickenings of the tympanic membrane in the accounts of cases put forward as instances of

sclerosis. There may no doubt have been in these cases an ankylosis of the stapes, but in any event they were certainly not cases of pure sclerosis as we now understand. In Professor 'Politzer's second last edition of his great text-book, cases of sclerosis were included in the account of chronic catarrhal adhesive processes, although among the drawings of his pathological sections were beautiful specimens of the disease in question. In his latest edition (1901) it need scarcely be said that the condition receives ample individualization and is most clearly named and described. Panse, Stern, Katz, Siebenmann and others have added important contributions to our knowledge and Denker's monograph¹¹ gives a complete study of all the original work on the subject. Recently it was discussed by the Otological Society of the United Kingdom, Dr. Albert Gray¹² adducing reasons for thinking that the osteitis and osteoporosis, now recognized as the main morbid anatomical condition, was attributable to a slowing or feebleness of the circulation. This view was corroborated by my own and others' observation of its occurrence in young anæmic women and also by the familiar fact of its frequent inception after child-birth. What its exact pathogenesis may be seems still obscure and of course the post mortem examinations are few in number and do not afford much guide as to the early stages. It is interesting to note the observations of Ducrest¹³ and Moreau¹⁴ to which Professor Kolisko first drew my attention. They found small osteophytic plates on the inner surface of the skulls of women who had died in child-bed, though it must be admitted this suggests nothing more definite than a tendency to osteoid changes in association with parturition. The part played by parturition in exciting osteo-malacia is perhaps also suggestive, though it cannot be said that the osteo-porosis of otosclerosis presents much in common with the limelessness of the bones in the other disease. Possibly more numerous sections may throw greater light on this obscure matter. I think it probable that it will be found to arise from various causes. Among others I am disposed to give a prominent place to that strange disease, chronic osteo-arthritis deformans. In many of my cases of sclerosis I have found evidence of actual arthritis or of its early symptoms, with frequently a history of its existence in the family, especially in the mother. Again, in the examination of some cases of osteo-arthritis, I have found, with even quite slight disturbance of hearing, a negative Rinné, but without indrawing of the membrane, narrowing of the Eustachian tube or improvement on inflation. In such cases the remedy most likely to be beneficial is the carbonate of guaiacol.

Siebenmann has initiated a plan of treatment by means of phosphorus and anything advanced with the weight of his opinion deserves our very highest consideration. I confess, however, a difficulty in following the arguments in favor of this recommendation. It is founded on the observations originally made by Wegner and confirmed by Miwa¹⁵ and Stoetsner, that in young animals the administration of phosphorus modifies the bones in such a way that where spongy tissue should be formed in the growing bone, dense solid tissue takes its place, which, examined by the naked eye and microscope, is found to consist of well-formed bone.

With these results before us, I fail to see *à priori* the advisability of administering a drug whose action seems to be to cause solidification of spongy bone, thereby rendering it all the more dense. Possibly there is some flaw in my reasoning and I am most open to conviction if I am in error. However, Professor Siebenmann¹⁶ says that in about 50 per cent. of the cases treated with phosphorus the result as regards "cessation of falling off of hearing-power" was very satisfactory. These statements may be accepted as unquestionable, but we are free to consider whether the cessation was a result or simply a coincidence.

This brings us to the very important question of prognosis, in regard to which all who have had much experience know the necessity of caution. We were formerly led to believe that these cases went of necessity from bad to worse till the patients became "stone-deaf," and we accordingly told them so and said we could do nothing for them. I cannot say there is very much more we can do for them, but we have seen so many cases who years later were no worse and, if anything, a little better, that we are justified in most instances in reassuring them that there is, at all events, no certainty of their getting entirely deaf or even worse than they are beyond the natural changes incident to advancing age. In short, although we cannot offer any hopes of recovery, we need not give a prognosis of despair.

As to the influence of child-birth in originating or increasing otosclerosis, there can be no doubt, but whether we are justified in prohibiting marriage or in inducing the extrusion of the fertilized ovum in the subjects of this disease, is a very anxious question. Marriage is not always followed by child-birth, and child-birth is not always followed by increase of oto-sclerotic deafness, so that on the whole, in view of the uncertainties of result on the one hand and the sociological advantages of wedlock on the other, we are only justified in giving warning as to possibilities, not in uttering a

prohibitive prognosis. One of my earliest patients with sclerosis of considerable severity eventually married, and instead of getting worse as the result of two child-births, got, on the contrary, rather better. If marriage in any given case is likely to bring increase of happiness and comfort and to lead to the realization of legitimate aspirations, the result is calculated to be beneficial.

Some years ago I tried the effect of vibration applied to the spine by means of a small electric motor on the spindle of which was attached eccentrically a disc of metal so as to impart a jarring movement during its rotation. This was intended to supply such mechanical vibration as is experienced in a railway train or omnibus which, as is well known, produces for the time improvement in the hearing, which is attributed to the noise rather than the vibration. The best situation is the lower cervical region and the vibration seems to be communicated to the ossicles with less risk of exhausting the auditory nerve than when noisy acoustic vibrators are applied to the ear. The treatment was applied for about five minutes at a time once or twice daily or at longer intervals until the patient, if improved at all, attained the maximum amount of improvement. I reported ten consecutive cases, in two of which very considerable improvement had taken place, in others a variable degree and in some cases none at all. The cases were of the typical sclerotic type and unrelieved by treatment carried out through the Eustachian tube. From time to time I meet a case in which this treatment affords some relief.

DOES NASAL OBSTRUCTION CAUSE OR KEEP UP CATARRHAL CONDITIONS OF THE MIDDLE EAR?

A question in regard to which a good deal of controversy has taken place is whether nasal obstruction, as such, can cause or keep up catarrhal conditions of the middle ear. The practical question was as to the utility or even the justifiability of operations for the removal of nasal obstructions on account of the persistence of aural catarrh in general obstructive deafness.

That the influence of such obstruction has been immensely over-rated, I am perfectly convinced, but that in a certain proportion of cases it has a direct influence, I am equally certain. Naturally it is difficult to appraise its value in a large number of cases because the patients complain of the deafness and we adopt other methods of treatment over and above the removal of nasal obstruction. It is, therefore, only in rare cases, such as one in which I removed a septal obstruction on account of mouth-breathing and pharyngitis

in a singer who made no complaint of dulness of hearing but who afterwards stated that the ear on the same side as the obstruction, which had been his "deaf ear," ceased to be deaf when the obstruction was removed.

I think it will be admitted that if the changes in the middle ear are such as may be produced by non-ventilation of the tympanum, nasal obstruction may be included as a *particeps criminis*, and its removal may be considered as indispensable or at all events justifiable.

The best available evidence that non-ventilation is a causal factor in the aural disturbance is the occurrence of improvement in the hearing after inflation. 'This view was indicated by Dr. MacBride in a letter on the subject to the *British Medical Journal*' and it is one with which I venture to think most of us will agree, as also with the converse that in cases in which no improvement follows, and especially if there is at the same time free entrance of air on inflation, the ear is not at all likely to be benefited by the removal of a nasal obstruction.

Perhaps it might be stated that in cases of pure nerve-deafness, nasal operation is all the more contra-indicated (the shock and hemorrhage in nervous or anemic patients may be highly injurious). Here is a rule which seems absolute, but I can quote a case in which the removal of adenoids led to the complete recovery of hearing in the daughter of a medical friend, whose nerve-tone and general health appeared to be impaired by the presence of the adenoids but who suffered from nerve-deafness and not obstructive. This, however, is the exception and the rule remains.

In judging as to the importance of nasal spurs, we may be very much misled if we are guided merely by inspection. We must remember that the majority of so-called "spurs" run obliquely upwards and backwards and, therefore, in the direction of the current of inspired air. What, therefore, may to our eye look like a very formidable obstruction, may be in reality nothing of the kind and, therefore, in no need of removal.

The debates in our British societies seem to have interested one of our German confrères, Dr. Röpke of Solingen, who, in connection with his studies on the injuries of the nose and its accessory cavities, investigated the question of the influence of nasal obstruction on the ear.¹⁸ He found that in the large majority of cases the hearing-power was lower on the side on which the nose was obstructed. If there was lowered hearing power on both sides, it was almost invariably the ear of the side on which the nose was

obstructed, which was the worse. A further outcome of the investigations was that the hearing (still in the majority of cases) was improved or even became normal within a few weeks after operative correction of the nasal obstruction, without catheterization or any other therapeutical measures being adopted for the middle ear. He attributed the aural trouble rather to the stagnation of the secretions behind the obstruction and to their being driven up the Eustachian tubes, than to the comparative negative pressure on which others have laid considerable weight and which I also think is not without some influence."

We have, therefore, to decide whether the apparent obstruction is acting in reality as such and also whether the hearing is improved by ventilation of the tympanum.

NASAL OBSTRUCTION AND EUSTACHIAN CATHETERIZATION.

I formerly found many cases in which the passage of a septal spur or deflection interfered with the passage of the Eustachian catheter as usually practiced, and I have seen some in which practitioners of experience had pronounced the passage of the instrument as impracticable. One enthusiastic nasal operator glibly suggested that in such circumstances the obstruction should be removed.

By considering, however, the fact I have just recalled, that spurs generally run upwards and backwards, I hit upon the idea of introducing the catheter with the concavity upwards, the point lying on the floor of the nose under the anterior part of the spur. It will be readily seen that the farther the point advances inwards the more vertical room there will be for it under the spur, and thus placed it will get freer instead of more jammed, as it would be if the ordinary position were adopted. I published this in detail in the *British Medical* for September 28, 1901,²⁰ having found it then as now of the greatest value in what seemed impossible cases. In the first stage the tip of the nose has to be tilted well up, the shank of the catheter to stick up in the air, and the beak has to lie on the floor of the nose like the head of a golf-club on the turf. I have, therefore, ventured to christen it the "golf-club" method. My friend, Dr. Zarniko of Hamburg, has independently arrived at the same idea (a very natural one to a rhinologist) and published it in the second edition (1905) of his work on the diseases of the nose.²¹ As he states that he has seen it nowhere precisely described I am sure my publication of it has not come under his notice.

IMPORTANCE OF SOME OF THE SMALLER TECHNICAL DETAILS.

I wish in the first place to state my conviction that many patients whom I have failed to benefit, have received benefit from colleagues into whose hands they have subsequently passed; owing to my having failed to carry out some small technical detail as thoroughly as I might have done. The converse also is true, and among the details which have been apparently imperfectly carried out, have been the tightening of the relaxed membrane, the full and complete use of the Eustachian catheter and bougie, and the application of the cotton-wool drum.

In some cases the patient has assured me that instruments (catheters) had been passed up the nose, but that the ear had never before been so freely opened. What I have said with regard to the difficulty occasioned by a septal spur, explains some of these incidents. I would also attach importance to use of the intra-tympanic gum-elastic catheter of Weber-Liel. The fact of it being in situ in the Eustachian tube can be settled so decidedly by auscultation during inflation, that it can be used with a degree of confidence that the solid bougie does not give. In most cases, however, the fine transparent celluloid bougie serves our purpose, and I am indebted to Thost for an addition to its effect, namely, practicing vibration while it is in situ, as devised by Ernst Urbantschitsch. The vibration is effected by any of the ordinary mechanical external vibrators applied on the ear, on the mastoid or, as I find best, over the Eustachian tube on a pad of folded linen between the lower jaw and sterno-mastoid muscle. The outer extremity of the bougie should vibrate visibly. Thost's paper appears in the *Festschrift* dedicated to Professor Lucae.²²

The presence of general or circumscribed relaxation of the membrane is of course to be discovered by means of Siegel's suction-speculum, which should be in more constant use. The application of contractile collodion is, in my opinion, the best local treatment and I feel convinced that even after the layer has peeled off, the membrane remains somewhat tenser than before.

The artificial drum of cotton-wool, secured by a thread and moistened with paroleine, seems not to receive the routine use which it deserves, if I may judge by the cases calling for it which have come under my notice, in which others have not tried it.

LIGATION OF JUGULAR VEIN.

Some observations on the question of ligation of the jugular vein, which I communicated to the Otological Society of the United

Kingdom in June of last year," met with the opposition which any views suggestive of abstinence from operative interference are apt to arouse. From remarks since made to me they appear also to have aroused some thought as to whether this operation ought to be performed as frequently as is done, and whether its effect is as innocuous and beneficial as is generally supposed. I will not trouble you with all the various arguments, but will remind you that the experience of Macewen, confirmed by Heine," Cheatle and myself among others, shows that a large number of recoveries from sinus-phlebitis can be brought about by operation on the sinus itself without ligation of the jugular. That Macewen's remarkable series of successes" without ligature would be infinitely continued I am not, however, prepared to think likely.

In cases of thrombosis in the jugular bulb with pyemic symptoms, ligation and opening of the jugular is in my opinion most formally indicated, as it is also when the trunk of the jugular is obviously the seat of an infected thrombus. There is in most subjects ample means for the establishment of collateral venous circulation, but this affords at the same time free access for the infective materials into the general venous circulation and the lungs. When gradual occlusion by a growing clot takes place, the collateral circulation is steadily established, but when a ligature is applied on a non-occluded vein, the sudden disturbance of circulation and reversal of current is not so easily disposed of. I, as well as others, have seen proptosis from thrombosis in the cavernous sinus follow the operation and I have after death seen the pus extending down the deep vein of the neck after I had ligatured the jugular and drained it with utmost thoroughness.

You need not be reminded that half the cases of cerebellar abscess are associated with lateral sinus phlebitis and Pritchard has pointed out that in otitic abscesses in the cerebrum and cerebellum, the disease can generally be traced along the veins emerging from the part. The lateral veins of the cerebellum, according to Poirer, are directed outwards towards the circumference of the organ and terminate for the most part in the corresponding lateral sinus, the most anterior ones in the superior petrosal. Dr. F. W. Mott in a private communication states as follows: "The fact that the lateral veins receive the vein of the nucleus dentatus is, in my opinion, of considerable importance in connection with the formation of an internal abscess of the lateral lobe of the cerebellum by a direct extension of an infection of the lymphatics from the lateral veins

to the internal structures of the organ. From this it appears that ligation of the internal jugular vein would certainly lead to venous stasis of the whole lateral lobe of the cerebellum of the corresponding side."

In the case of occlusive clot, such as is common in chronic cases, a ligation can do little or no harm beyond, of course, the damming of the inferior petrosal sinus, but when, as in acute cases no such occlusion is present, I feel great diffidence in applying one. The opinions of authorities on this subject vary, and I beg to refer to my paper in the sixth volume of the Transactions of the Otological Society and to ask for an unbiased and "unheroic" consideration of this problem.

THE PRESERVATION OF MATRIX IN CHOLESTEATOMA OF THE MIDDLE EAR.

It must have happened to all who have had much experience in otology to have met with one or two cases in which the attic of the tympanum is lying freely open, the outer wall having completely disappeared while the cavity is entirely lined by a smooth pearly white membrane. Occasionally the loss of bone extends to the postero-superior wall of the osseous meatus, leaving an opening through which a cavity much larger than the antrum, though including this, is visible, the walls being covered by the same kind of shiny pearly white membrane. The patient may be free from all discomfort except the occasional accumulation of desquamative epithelial products which are easily removed. In such cases there has generally been a history of chronic suppurative inflammation of the middle ear of several years' duration, characterized by the occasional occurrence of severe headache and the extrusion of white macerated skin-like formations.

The course of events in such cases has been the development of the so-called cholesteatoma consisting essentially of a membrane lining the natural or pathological cavity in the petrous bone, desquamating so that the cavity is filled with epidermoid scales, the central ones of which have broken down into cheesy masses containing cholesterin crystals. Under the influence of moisture or inflammation the desquamation is increased and the cavity thereby filled and distended; the pressure causes the walls of this to give way at their weakest part, and if, as in the fortunate cases we are describing, this is the part presenting towards the tympanum and external meatus, the bone in those places is gradually eroded until

the cavity is laid so freely open that there is sufficient room for the exit of the contents.

The course of formation of such a cholesteatoma appears to be as follows: As the result of a suppurative inflammation extending into the antrum and adjacent cavities, the lining membrane becomes covered with granulations similar to those on an ulcer on the surface of the body; in some cases, especially the tubercular ones, progressive caries of bone results and very little or no attempt at healing takes place. In the absence, however, of such a dyscrasia, the smaller bony trabeculae give way and a comparatively large cavity remains, lined with granulation tissue. As the suppuration subsides the edges of the perforation in the tympanic membrane may become cicatrised, and it is possible for the granulations to subside, and a return to a fairly normal mucous membrane be effected. Should, however, the perforation in the membrane be peripheral, and there is a ready continuity between the epithelium of its outer surface and the granulations on the wall of the tympanic cavity, the same changes take place as on the surface of a healing ulcer on the leg. The cuticular epithelium proliferates over the granulations from the periphery onwards until the whole ulcer, if not too large, is covered with a cicatrix which may be a fair substitute for skin. In the middle ear this process has been traced, as shown by microscopical examination, to a considerable extent into the tympanic cavity; there is no reason why it should not continue through the aditus into the antrum, at first reaching only those portions of the walls of the cavity which are nearest this orifice, then gradually extending over the parietes until the whole cavity is lined with an epithelial cicatrix. Sometimes in performing the radical mastoid operation one finds the cavity in this condition. At other times the part nearest the mastoid surface is filled with granulation tissue and the shiny cholesteatoma membrane is found on the inner wall of the antrum and the portions adjacent to the aditus. Probably in this case the epidermisation was gradually extending towards the remoter spaces and in time would probably have eventuated in the formation of a typical cholesteatoma. Of course it would be impossible to predict whether this would be favorable or unfavorable to the patient's life, as the centrifugal pressure exerted by it might result in erosion of the bone in the direction of the lateral sinus or the other cranial contents; if the circumstances were favorable and the *locus minoris resistentiae* was in the direction of the tympanum and external auditory meatus, the bone might

give way, as in the instance I first quoted, and the contents of the cavity find their way into the outer passage of the ear. The lining of the cavities thus displayed is sometimes as perfect as could be desired and when freely exposed to the drying influence of the air and kept dry by the avoidance of the introduction of water and by the use of alcoholic instillations, the patient's condition may be one of complete comfort and safety. The main postulate is that the opening should be sufficiently wide for the entrance of air and for the immediate escape of desquamative products. It need hardly be said that it is only in exceptional cases that this takes place spontaneously in the favorable direction, and as soon as the condition of cholesteatoma is recognized the surgeon should be ready to carry out the operation necessary for its free opening. In the absence of such evidences of pressure as pain, vertigo, and bulging of the postero-superior wall of the meatus, he is justified in giving a trial to such dehydrating measures as the instillation or injection of alcohol in the form of rectified spirit, which may at first be diluted to the extent of 50 per cent. This preliminary treatment is all the more called for inasmuch as it is difficult, and perhaps impossible, to say beforehand how far the desquamating membrane extends into the mastoid cavities, and if this extension is very limited the necessity for operation may not arise. On the other hand, in the presence of pressure symptoms, no delay is permissible, and a free opening after the manner so well formulated by Stacke, is called for. If, when the opening has been made, it is found that the cholesteatomatous condition does not extend deeply into the cavities but that they are filled with granulation tissue and broken down bone, the hole should be thoroughly scraped out and suitable plastic arrangements for lining the cavity adopted. If the cavity is very small, any of the various well-known flaps may be formed, and cicatrization over the granulating surface encouraged, the rapidity of healing being in proportion to the smallness of the area which has to heal. Should the cavity be fairly large, I have no hesitation in saying that it should be lined by means of Thiersch's skin graft according to the technic so perfectly devised by Ballance. Even in the hands of one who is only moderately expert in the technicalities of this process, the results far surpass those obtainable without it in cavities of the same size.

In those cases, however, in which the cicatricial process has extended over the whole of the walls of the cavity, I venture to believe that we have already to hand as good a lining as we can desire, and

that it is not merely a justifiable, but a very desirable economy of the patient's time and tissue to preserve and make the most of the lining in question. I have in several cases put this principle into practice and found a complete healing of the parts and drying-up of the discharge produced with a rapidity and ease unequaled in other cases. Under such circumstances I content myself with gently scraping out the contents of the cholesteatomatous cavity and leaving the white shiny membrane *in situ*, swabbing it carefully but thoroughly with rectified spirit. I then insufflate a quantity of sterilized aristol, a substance recommended by Mr. Ballance for use when plugging the cavity he has lined with Thiersch's grafts, applying over this a light tampon of iodoform gauze, and, after about a week, starting the instillation of alcoholic drops.

In cases then, and there are such, in which a shiny uniform membrane is found lining the cholesteatoma cavity, I see every reason to think that this should be preserved instead of being scraped out, as is recommended by most operators up to the present. Should the membrane be pulpy, imperfect and not homogeneous, I am equally convinced that it is our duty to practice complete erasion and to line the cavity by transplantation of a skin graft.

In conclusion, although I can not boast of having made any original addition of value to our science and can merely pose as, at the most, a lucid expositor of elementary otology, I venture to believe that there have been few items of practical value published in French and German which I have failed to study for the benefit of my students and myself. I am bound to acknowledge above all our indebtedness to our German collaborators, whose industrious and enterprising use of their opportunities has so greatly advanced the usefulness and reputation of our art, as also to our French fellow-specialists who have clarified and systematized so much that was obscure and involved. It is to an Anglo-Saxon, however, that all are indebted for the establishment of otology on a sound basis of pathological anatomy, and Toynbee's collection is still an illustration of the remarkable powers of initiative which individuals of our race occasionally display, in spite of the absence of any present aid or immediate hope of reward. May we hope that in the friendly rivalry among the nations, others like Toynbee may help us to attain for Anglo-Saxon otology the position we would desire for it.

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