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T H E S I S .

Experimental Acute Suppurative Otitis
Media and its influence on non-suppurative
lesions of the middle ear.

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In this paper I propose to record the results of an experiment made for the purpose of setting up an Acute Suppurative Otitis Media in an ear in which there existed a chronic catarrhal lesion, and to note its effects on the hearing acuity. I shall also give short notes on two such cases of the chronic catarrhal variety in which a purulent process supervened while under treatment. Further, I propose to refer to points in the Pathology, Prognosis and treatment of cases of the chronic non-suppurative middle ear variety (exclusive of otosclerosis).

Anyone who has any extensive experience of outpatient work ^{would} have been struck by the fact, that our present day treatment of these cases of Middle ear thickening is extremely unsatisfactory - In fact I am convinced that this, more than anything else, helps to bring the science of Otology into disrepute. Another outstanding fact is, that except in the very advanced cases, who have only come under observation years after the process has started, cases of suppurative Otitis media, are very much better off as far as hearing acuity is concerned; although these patients may run a more serious risk as to life, their condition is more amenable to treatment. This was one of the first things which struck me before I had many months experience of ear work. Why this should be one may at least wonder, the one being an active process, and the other a comparatively innocent one, coming on quite insidiously but none the less surely destroying the

hearing power. It is this very slow onset and progress which makes the majority of patients suffering from this malady so d^esp~~o~~ndent. I firmly believe the advanced "Post Catarrhal" cases would feel more satisfied if they saw an active process going on, and so, in their opinion, giving the surgeon a chance of combating it by active interference. After all is said and done, our modern treatment of chronic middle ear catarrh in the later stages is only palliative. Our hopes are centred mainly on maintaining and helping the patient to retain what measure of hearing he has by the time he comes under observation, and even this in the majority of cases is not effected. Whatever may be said about it the experiment I am recording remains extremely interesting especially when its influence on the hearing power is borne in mind. I shall now proceed to record the two cases, and give a short history of each as they were treated in the outpatient department. It was the observation of these two cases which led me at first to entertain the hope that if advanced cases of the kind could only be converted into suppurative cases, the result on the hearing would be interesting to watch.

CASE I.

Maggie Hunter, aged 21, Edinburgh. The history of this case has unfortunately been mislaid and up to now it has not yet been found. I shall therefore have to give the main outlines of the case from a very brief note I have of it. -

The girl was about 21 years of age, and was a telephone employee. - She was treated in the outpatient department (Ear and Throat) of the Royal Infirmary, Edinburgh, for about two years before she came under my notice in January 1908. She was treated for chronic middle ear catarrh without any benefit for some time. She had courses of treatment by inflation accompanied by suitable intranasal treatment. Both these did not relieve the deafness which had become so serious that she was in fear of losing her employment. By the end of 1907 a purulent process was set up in her right ear, and when she came under my notice in the beginning of last year there was an active purulent discharge from the right ear. This had no effect upon her hearing at first, but as soon as the discharge began to cease there was very marked improvement in her hearing. At first she could hear watch on contact, and by the end of March 1908 she could hear it at 18 inches, and a whisper at three feet. She was extremely pleased about it, and retained her employment. This was indeed a remarkable result, following on the purulent process. Her second ear, which was also a very bad one, remained in statu quo. It is rather unfortunate that I cannot obtain her address so that I can get her examined at the present day.

CASE II.

Alexander Boyd Taylor, 53 years.

Diagnosis: Chronic non suppurative media (acute suppurative otitis media subsequent-

History: Pain and noises in left ear for about six years, gradually getting worse. He puts the blame on a knock on the ear which he got six years ago. Never any discharge, but some deafness which is getting worse - No giddiness - General health fairly good.

LOCAL APPEARANCES; R. T. M. Retracted: No perforation: No discharge. L. T. M. bulging in Shrapnell's area: No perforation: No discharge: Tenderness in introducing speculum: On probing the swelling great pain is elicited. On removal of wax present the noises were greatly diminished.

Pharynx appears normal.

Nose: Septum irregular: Spine on left side turbinated, not very large.

Hearing. Watch R $\frac{18}{50}$.) Schwabach shortened.
L $\frac{4}{50}$) Weber not lateralized.

A.C. greater than B. C. on both sides.

Catheterisation causes slight improvement.

24. 1. 08. Hearing improving slightly after catheter. Noises less. Some meatal pain complained of. Swelling in Shrapnell's are^a gone.

30. 1. 08. Catheter. Complains of very severe pain in right ear and over vertex. Noticed some discharge from right ear about a week ago. No mastoid tenderness. - H₂ O₂ drops and syringing.

7. 1. 08. Very little discharge now, no mastoid tenderness, hearing rather worse.

12. 2. 08. He says he hears better now with the left ear which was the bad ear when he

when he first came. Still a little pain in the right ear, but no mastoid tenderness. He also had slight pain in the left ear last night.

14. 2. 08. Hearing watch R $\frac{1}{36}$.

L $\frac{4}{36}$.

Some granulations on inner wall of right meatus. Inflation to-day.

18.2. 09. Some pain in front of right ear to-day.

No mastoid tenderness - Inflation - He improves very much in hearing.

L $\frac{3}{36}$ to-day for watch.

25. 2. 08. Hearing watch L $\frac{6}{36}$ R $\frac{3}{36}$. Pain over vertex but no mastoid tenderness.

28. 2. 08. No pain or mastoid tenderness. Hearing gradually improving under inflation.

3. 3. 08. Had cold, right ear inflates but air enters with difficulty.

16. 4. 09. Nearly a year has elapsed and on examination we find -

L. T. M. There is little redness along handle of malleus, and perhaps a slightly atrophic part behind and below.

R. T. M. More indrawn but no evidence of any atrophic part. Right ear is much better than left and test with watch confirms it.

Unfortunately I did not have the benefit of watching these two cases until they were ultimately discharged.

In the second case the discharge was more of a serious nature and probably not strong enough to set up a

real purulent inflammation. I shall now proceed to record at greater length the case of the boy whose middle ear I infected.

CASE III.

James Henry Squires, aged 11 years,
51, Cobden Street,
Loughborough.

History.

This patient complained of deafness of several years standing. He was always a listless absent-minded boy at school. His hearing has gradually got worse until at the present day, August 1908, he can only hear the watch at $\frac{2}{30}$ left side. He has had no other serious illness in life excepting measles when a youngster. He is the only child of the family. No history of family deafness. No giddiness. Sometimes troubled noises in the head. Has always been troubled with severe colds in nose off and on. Tonsils and adenoids were removed about a year ago. This was followed by only a transient improvement in hearing.

On examination: Both membranes presented a greyish white appearance, and were markedly indrawn. Short process of malleus very prominent on each side - Cone of light split up on each side. Membrane appeared thickened. - Nose presented signs of chronic hypertrophic nasal catarrh. Post ends of inferior turbinals slightly enlarged. - Nasopharynx quite normal. No enlargement of tonsils. - No adenoid growths made out by post Rhinoscopy or by palpation.

Hearing R $\frac{2}{30}$ for watch L. $\frac{3}{30}$ for watch.

Right raised voice 3 feet. Left raised voice 3 feet.

Tuning fork. Weber not lateralized.

Rinnie positive by much shortened

Schwabach not lengthened. Hears high notes better than low notes.

Came under notice August 1908. On auscultation both tubes were found to be pervious but lumen much obliterated by catarrhal swelling. Left tube admitted air more freely than right. He never had inflation after tonsils and adenoids were removed.

Treatment. Systematic catheterisation was carried out for about six weeks at a time on two occasions, with very slight, if any, improvement. This was accompanied by appropriate nasal treatment in the form of alkaline nasal douches and menthol sprays, but no improvement resulted. - Ear was then infected. The method is as follows:-

I obtained some fresh active pus directly from the meatus of a young girl who was suffering from a suppurative otitis media. This I subjected to bacteriological examination and found the usual organisms common to ear discharge, viz. pneumo cocci, staphylococci, and a variety of others. I packed the ear of this young girl for some hours with strip gauze.

The discharge from her ear was very active, and the gauze was soon soaked with pus. I then proceeded to wash out the boy's right ear with ordinary tap water under a local anaesthetic. I then proceeded to incise the (right) tympanic membrane at the postero-inferior quadrant with a Woakes guarded paracentesis knife.

All the antiseptic properties of the local anaesthetic was washed away as far as possible with ordinary tap

water. After the lapse of a few hours when the bleeding has more or less subsided, I proceeded to pack the boy's right ear with the strip of gauze soaked in pus from the girl's ear. I tried to introduce the strip slightly into the paracentesis opening, so as to ensure an infection being set up. I then packed the external auditory meatus and kept the ear thus closed for two days. The temperature rose to 101° F. and remained at that for two days. My expectations were more than realised for on the third day pus was noticeable from the slit-like paracentesis. There was, of course, some local pain. Strange to say beyond the initial attempt to get a strip of the gauze through the opening no attempt was subsequently made to keep the paracentesis cut patent, but it remained so as long as the discharge lasted. No antiseptic treatment was carried out for a fortnight by which time the discharge was fairly active. Vigorous antiseptic treatment was then adapted twice daily, H_2O_2 drops and syringing, and the inflation performed through the catheter once a day. The result was that the discharge gradually grew less, and ceased practically at the end of about three weeks after the antiseptic treatment was begun. On examination now the paracentesis cut is completely healed. There is no perforation. - There is a tremendous improvement in hearing of (right) ear whilst the left ear remains more or less in statu quo. He now hears watch (right) at normal distance, viz. $\frac{36}{36}$ and a whisper at 15 yards. The mother is quite enthusiastic about it. Up to the time of writing the improvement is still maintained in the ear experimented upon.

Pathology.

Now let us for a moment glance at the pathology as recorded in these cases of chronic - non - exudative or Interstitial inflammation of the middle ear. We find that after simple hyperaemic swelling the mucous membrane becomes thickened owing to new *formation* of connective tissue in its interstices and in many cases becomes the seat of chalky and fatty deposits. After the swelling, the thickened and condensed mucous membrane usually undergoes a shrinking process. The secretion may also become inspissated and organised, thus hindering through agglutination the free movement of the ossicular chain. The ossicular ligaments connecting the ossicles to the walls of the tympanum become contracted and rigid due to the changes in the mucous membrane ^{covering} them. Adhesions, pseudo membranes and connecting bands form so that parts which are usually separate come to be in contact and after a time unite. As a result the tympanic membrane may become adherent to the inner wall of the tympanum, or with the incus and stapes. The tendons of the stapedius and tensor tympani may also be contracted from the same ~~cause~~ cause, and the muscles may become weakened or degenerated from myositis. The cartilages and capsules of the joints between the ossicles become in many cases stiffened, rigid and adherent. This stiffening of the ossicles cannot always be ascertained with correctness. When the manubrium does not move during the use of Sigli's speculum or during inflation, it is presumptive evidence either of rigidity of the whole chain of

ossicles or malleo-incudal joint (experiments to elucidate the amount of or position of the rigidity have been recorded viz. when words spoken into a hearing tube connected to the outer end of a catheter introduced into the Eustachian tube are heard the presumption is that the stapes is movable while the malleus and incus are rigid. Further, when the labyrinth is proved to be intact and yet no improvement follows repeated inflation, there is possibly a stiff immovable condition of the whole or some part of the ossicular chain). In spite of all this one of the greatest difficulties in the way of investigation has been the lack of pathological material wherewith to differentiate the various conditions met with, especially in their early stages. People suffering from chronic deafness due to non-suppurative otitis media very seldom come under the care of the Otologist and should he die from some other intercurrent disease his condition may never have been diagnosed. Yearsley has made a good attempt at classification for teaching purposes. According to the Pathology he divides the catarrhal process into four stages of which the first is subacute and the remaining three chronic. They are:-

- (1) The stage of congestion with exudation.
- (2) The stage of proliferation.
- (3) The stage of fibrous contraction.
- (4) The stage of cicatrisation or "post catarrhal stage"

All these stages pass gradually one into the other - The combined effect of contraction of cicatricial tissue and the lack of proper ventilation of the tympanic cavity due to stenosis of the Eustachian tube results

in retraction of the membrane. When obstruction in the Eustachian tube has been present for length of time the air in the tympan^{um} becomes absorbed so that the membrane is pressed inwards due to a greater pressure of the air in the meatus.

What are the effects of these processes upon the tympanum? We find that the free space in the tympanum is much diminished or even obliterated, and it may become divided into different compartments separated from each other by adhesions, and connecting bands. According to Toynbee & von Tröltzsch the bands are sometimes transformed by calcareous deposits into bone-like processes. The stapes becomes adherent and bound down to the walls of its recess, or united immovably to the edge of the fenestra ovalis. The membrane closing the fenestra rotundum and the annular band of the fenestra ovalis are thickened and stiffened, and the whole tympanic membrane is thickened. As is only to be expected the result of these pathological changes is that the conduction of sound through the tympanum to the labyrinth is more or less seriously impeded. (The vibratory function of the chain of ossicles being impaired) This will depend on which part of the tympanum is more affected than the other, i.e. we find that when the annular ligament of the fenestra ovalis or the membrane of the fenestra rotundum is the seat of the pathological changes the hearing will be more seriously impaired than when other parts of the tympanum are only impaired. One of the first effects noticed in retraction of the membrane is the splitting up of the cone of light. This is due to its situation over the weakest

part of the membrane which is the first to give way. The next point most noticeable in cases of marked retraction is the prominence of the small process of the malleus caused by the retractive action of the tensor tympanum *on* long process of malleus. The position of the handle of the bone is also very much altered. It may become displaced either inwards, upwards, or backwards. The anterior and posterior malleolar folds become prominent. The handle of the malleus may become fixed by the tendon contraction before mentioned coupled with the contraction of the ligaments of the malleo-incudal joint. The malleus also may become fixed to the promontory. The membrane loses its transparent glistening appearance, and becomes dull white and opaque looking, and atrophic patches become marked all over. (Sigli's pneumatic speculum is very useful in demonstrating adhesions of the membrane to the inner wall.)

The patency of the Eustachian tube is impaired by thickenings of its mucous membrane, or by adhesions or connecting bands which prevent the separation of the walls of the tube during the act of swallowing. The defective opening of the tube may also be caused by defective action of the two tube muscles, and abductor tube and the levator-palati. This thickening of the lining membrane of the tube extends to the tympanic cavity where the mucous membrane is thickened or chronically congested in the early stages, and afterwards becomes pale, dry and thinned. Disease of the labyrinth may become associated with anyone of these pathological conditions, originating as it may do in

the labyrinthine fenestra, the labyrinth may be partially involved from the beginning. The mastoid cells are also said to be encroached upon by thickening of their lining membrane or of their ossious walls.

Prognosis.

Briefly, the curability of chronic moist non-suppurative otitis media depends upon its chronicity and the pathological changes in the essential structures of the tympanic cavity. If the ~~the~~ disease is of recent occurrence and the morbid changes are slight, the prognosis is quite good. On the other hand if the process has gone on for some time, and the surgeon only sees it when advanced morbid changes have taken place, then the prognosis is most unfavourable. When adhesive processes have already occurred the prognosis will depend on whether the signs are favourable or not. More particularly in catarrhal inflammations of the Eustachian tubes only or of the whole tympanic ~~cavity~~ tract the prognosis is good provided the case be taken in time, but if it is allowed to progress without treatment, further changes will take place until after a time complete structural and functional restoration is impossible. This lapse of time has unfortunately already taken place before the patient thinks of getting his ears attended to. The slow insidious painless course of the disease and the almost imperceptible and extremely gradual loss of hearing explains why these patients defer treatment until the pathological process has gone on for one, five, or even ten years. Such extensive changes may

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have taken place that an ultimate improvement is out of the question and one must confine ~~oneself~~ to palliative measures, and to directing your efforts towards retaining what amount of hearing acuity the patient possesses at the time when he comes under observation. In determining this one must be guided a good deal by the objective symptoms which are present. Inflation is of considerable value in helping us to make a prognosis, i.e. if there are active signs present of catarrhal inflammation, i.e. an indrawn membrane, post nasal growth, enlarged tonsils and adenoid vegetations in the nasopharynx, if nasal stenosis and post nasal catarrh be present, and if there is an appreciable amount of improvement in hearing after a single successful inflation, then one would expect to find such a case at least amenable to treatment, and one might reasonably expect to check or hinder the further development of stiffening or adhesive processes. If on the other hand there are violent subjective sounds which progress rapidly, and we find no abnormal change in the tympanic membrane, if the naso-pharynx and nasal passages exhibit neither catarrhal nor hypertrophic changes, if the Eustachian tube be freely permeable, and when one obtains no improvement in hearing after a single successful inflation, the likelihood is that very little good will be ^{ed} ~~effectively~~ by treatment, as the fenestral structures and ossicular joints are probably permanently stiffened. These are the cases in which one might think of operative interference. The absence of improvement, or the temporary aggravation in the deafness after a single inflation

must be looked upon as an unfavourable sign, but in no case must a case be abandoned as hopeless no matter what the pathological changes are, until the patients have undergone a course of treatment - When the air enters the tympanum with difficulty - yielding a sharp thin blowing sound, with a slight improvement in hearing we may feel hopeful of effecting some good result. As I have said, every case should have the benefit of a course of treatment, but if the deafness is increased, and the subjective sounds augmented, we must stop treatment entirely. When an exudative element supervenes on an existing interstitial form the result will be more favourable. Immediate improvement generally follows inflation in such cases. Incurable stiffening of ossicles may be accompanied by relative excess of bone conduction, and such cases are not amenable to treatment.

Paracusis Willisii, or hearing better in a ~~noise~~ noise.

This is looking upon it as rather an unfavourable condition, and many otologists do not treat these cases. It makes its appearance in the later stages, i.e. post catarrhal stage. It is now generally admitted that its presence indicates a degree of rigidity of the conducting apparatus. It should not be regarded as a symptom excluding all possibility of improvement by treatment. I have seen quite good results following treatment in these cases.-

"Weak bone conduction", as tested both by Weber and Rinnie, test is a symptom generally of unfavourable significance. In these cases we may have the middle

ear lesion associated with labyrinthine disturbance and it implies that whatever improvement we obtain even in the exudative form will only be of a partial nature. On the other hand excess of bone ~~conduction~~ conduction although regarded as a favourable point in the prognosis is by no means a reliable indication that treatment will prove useful. It may be quite the opposite. In some cases of weak bone conduction it is quite possible that the nerve or labyrinthine affection may be of a temporary nature and improvement may follow a course of treatment. When this condition, however, occurs in children it is of very unfavourable significance, especially where repeated inflation produces no improvement in hearing.

Lastly I may state that where the general health is below par, it will exercise an unfavourable influence upon the middle ear lesion. Syphilis has a very unfavourable influence upon the disease owing to the greater tendency to labyrinthine complications with defective bone conduction. This usually occurs very soon after the reception into the system of the virus. Measles and scarlet often present a tendency to develop permanent changes in the tympanum. Generally we may say that in weak constitutions there is a tendency to develop permanent changes, especially in anaemic and tuberculous conditions, and where there is a hereditary tendency to middle ear disease and nasal catarrh. Occupation and mode of life when it exposes patient liability to contract to nasal catarrh is also unfavourable.

We now come to the most important part of all, viz. Treatment of these chronic cases (non-surgical). I may at the outset say that our modern treatment is most unsatisfactory. It is well to divide the treatment into three headings viz. (1) Treatment of Ear, (2) Treatment of nasal and pharyngeal spaces, (3) The constitutional treatment. In the very early cases our attention will almost always be directed to the Eustachian obstruction. Here we should direct our efforts toward relieving catarrhal conditions of the upper air passages. The effect may be removed in early cases by inflation. This is best done by the Eustachian catheter which in skilful hands is a very safe instrument to use. The tympanic cavity is inflated for three purposes, viz. (1) To force the secretion from the tympanic cavity and Eustachian tube, (2) to restore the equilibrium of the air pressure on the two surfaces of the tympanic membrane, (3) To improve the arterial and lymphatic circulation of the lining mucous membrane. When the Eustachian tube is markedly obstructed and the tympanic membrane very much indrawn, the use of the catheter at intervals of three days may be indicated for a month. Great control must be exercised over the force of the inflation which may do harm where the tube is fairly ~~permeable~~ permeable, and there is at the same time a coexistent atrophic membrane, but generally one would required five or six compressions of the airbag at each sitting. I may here mention the danger of instructing ~~patients~~ patients to use Valsalva's method as a means of inflation at home. They are almost sure to overdo it, when

they find it relieves their symptoms, and the result is a lax, useless membrane. If they are to carry out any home treatment they should be instructed in the use of Politzer's method. As a rule patients are quite able to carry this out at home after proper instruction. In the later stages when extensive adhesions have taken place, the value of inflation is practically nil. The catheter in my opinion, is a very much over-rated instrument as a therapeutic agent, in these later stages, for in the post catarrhal stage inflation is only of use as a means of diagnosis, its therapeutic value is then practically nil, although in some cases it may ~~be~~ ^{act} as a palliative measure for the tinnitis. The best effects are obtained when the mucous membrane has still a degree of softness and flexibility, and when the tympanic membrane is not fixed immovably in an abnormal position or the ossicles have not become completely rigid. Improvement after the first few sittings may only be ~~for~~ ^{of} a transient nature. The parts stretched out by the mechanical effect of the inflation soon fall back into their old position. Unfortunately it is only rarely that the otologist gets his cases early enough so as to enable him to effect a permanent cure by the use of the catheter, and how one can expect to break down firm adhesions when once found is a matter beyond my comprehension. In spite of this one sees in an outpatient department cases being treated by inflation month after month and year after year when the chances of improving their condition are practically hopeless. Unless more stringent measures are taken

~~these inoperable cases of the left tubal eustachian tube will improve~~

these poor people are best left alone. When improvement in hearing lasting one or two days follows each of the first few inflations the ultimate result of treatment will be much more favourable than when no improvement results after the first few times. The mechanical removal of secretions from the middle ear may be accomplished by paracentesis and by suction applied to the external meatus. When the eustachian catarrh is obstinate it is well to make use of injections through the catheter. The method is to place a few drops of the intended solution in the mouth of the catheter and then to blowing it into the middle ear by means of the air bag. The only cases in which this treatment is useful is where there is simple swelling of the mucous membrane due to rounded infiltration and not in cases where there is interstitial formation of connective tissue. By using oily solutions, i.e. Menthol grs. V. in parolein 1 oz. ^{the} lumen of the Eustachian tube becomes coated with it so that the opposing surfaces do not adhere. Other therapeutic agents are vapours, i.e. nascent chloride of ammonium, used in Godfrey's inhaler or some such apparatus, chloroform, tincture of iodine a few drops placed in the inflation bag, of 1% solutions of bicarbonate of sodium or iodide of potassium. A few drops of a 2% solution of pilocarpin used three times a week has given good results in the hands of Politzer. Cocaine and adrenaline has been employed by Barr in cases where there is catarrhal swelling of the pharyngeal end of the Eustachian tube. This undoubtedly causes a diminution in the swelling of the mucous

membrane as in the case of the nose, but its effects are purely of a transient nature, and the ultimate swelling and congestion is even worse than before the application of the solution. Other substances which I have tried repeatedly without any good result are acetic ether, eucalyptus.- A combination in which I have some faith is made up as follows: Menthol V grs. Camphor III gr. $\overline{\text{III}}$. Eucalyptus V m. Ol. Amygdal. Dulc. 1 oz. I have used it by means of a spray connected directly with the end of a eustachian catheter. In one case in particular it has given very gratifying results. This was followed intermittently by the use of the catheter and care should be taken not to spray in too much of the oily substance. (Politzer has obtained favourable results from the use of the following solution:

Sod. Bicarb. X gr.
Glycerine VIII M.
Aq. destill. 1 oz.

Sig. 5 - 8 drops to be injected into the middle ear 2 - 3 times per week. Delstanche and Goldstein have recommended liquid vaseline. It lubricates and is supposed to soften the fibrous tissue. When there is organised obstruction in the Eustachian tube and no air can be forced into the tympanic cavity, the only alternative is to employ the Eustachian bougie, but all mechanical means adopted for overcoming these strictures have ended more or less in failure. The bougies generally used are made of gum elastic, others are made of celluloid, whalebone or catgut, after having first been dipped in sterilized vaseline. The bougie is

allowed to remain in position in the Eustachian tube for a couple of minutes. It is then withdrawn, and inflation performed. Great care is required in its introduction, and this operation is only to be undertaken by the experienced surgeon, because if the mucous membrane is at all injured emphysema is easily set up. Electrolysis has been advised for overcoming organised strictures, but I have never seen it done, and it is still in too experimental a stage to hope for any definite opinion as to its value. Having done all we could locally for the ear, our attention should then be directed towards treating any co-existent condition of the nose and naso pharynx. When there is catarrh of the naso pharynx repeated painting with Mandl's solution may relieve ~~it~~ it. It is made up as follows:

Iodi.	gr.	VI
Pot. Iodid.	"	XX
Mentholi	"	V
Glycerini	oz.	I

In addition to this one should employ the alkaline nasal douche. The one I always employ is made up as follows;

Sod. Bicarb.	
Sod. Biborat.	aa 1 oz.
Sod. chlorid.	2 drachms.

Sig. 2 drachms in a pint of water.

The nose is washed out by this solution by means of a Higginson's syringe, and blown very gently after, first one nostril and then the other. The treatment of the nose and nasopharynx should never be omitted as it is of extreme importance in these cases that all abnormalities in the upper air passages should be corrected. All adenoids, when discovered, and enlarged tonsils should be removed. When there is erectile

swelling of the turbinateds during the night, and thus causes mouth-breathing, the galvano cautery may with advantage be applied to the inferior turbinateds. Ethmoiditis and sphenoiditis are particularly responsible for otitis media and should receive appropriate treatment when discovered. The examination of the epipharynx and post chonal may show a muco-purulent secretion flowing over the post end of the middle turbinal. The removal of the middle turbinal will often exert a very favourable influence upon the course of the disease. Where there are very pronounced septal ridges or deflections causing considerable stenosis, operative interference is indicated. In the more advanced cases, viz. "Post catarrhal" in which there is extensive contraction, strychnine in large doses internally is of great benefit. The drug is pushed until the limit of toleration is reached, i.e. until $\frac{1}{10}$ g. is taken thrice daily. It exercises a marked influence on the hearing acuity. It may either be given alone in water or combined with dilute hydrobromic acid in doses of \mathfrak{zss} to \mathfrak{zj} . Iron and arsenic are useful in anaemic cases. This condition is discovered in the majority of cases on full-blooded individuals, and here frequent depletion of the system by ^ℓCarlsbad salts and mercurial purges or other hepatic measures are of the utmost value. It seems to have a very beneficial effect on the tinnitis

One drug which I have found of use is Iodide of potassium. It is especially useful in small doses of 1 gr. t.i.d. combined with about XX m. of spirit ammoniac aromaticus. One case in which I used thyroid extract

there was marked improvement . It seems to act mainly by reducing the general flabbiness of the body in full blooded individuals. Thiosinamine has also been used with benefit by Dr. Geo. F. Suker. It acts as a glandular stimulant at first and so aids in the absorption of secretions and exudates. When a case has been under treatment for one month and no benefit results local treatment must be abandoned as useless. On the other hand treatment should be continued so long as there is an appreciable degree of improvement. This however, should not be carried out for too long, at one time. Treatment should be continued for about 2 months and then stopped for about 2 months, and then resumed again, so that the patient may be subjected to about three courses of treatment during the year. Superheated air 400^o F. has been employed by Hopkins with benefit. When the hearing of the patient can be maintained in statu quo. as he came under consideration, the surgeon can be in many cases quite content. It is my opinion that by far the greater majority of advanced cases in spite of all treatment gradually get worse. It is mainly for the relief of these cases that the various and numerous intratympanic operations were undertaken. Before describing these I wish to mention another form of treatment which has lately become very fashionable, viz. pneumo massage of the tympanum. This form of treatment is useful for cases in which there is rigidity and retraction of the ossicles and membrane. It should be employed with inflation. Various forms of oto-massagers are on the market at present marked either by hand, water power or by an electro-motor. I consider this form of

treatment in the more advanced cases as far superior to inflation. The length of the piston excursion should be carefully regulated. From 2 - 3 minutes ~~and~~ may be regarded as a safe length of piston stroke. The massage may be repeated twice or three times a week, and continued for about 1 minute at a sitting. It should not be used more than six weeks at a time, and three times during the year at regular intervals. Dundas Grant has also employed vibratory massage of the spinal column with benefit in some cases, although it is difficult to understand what the action is.

Operative treatment:-

Of all the operative measures devised, incision of the posterior fold of tympanic membrane is the one most generally adopted, in fact, it is the only operative measure adopted by some otologists. This is probably due to the fact that nearly all of them have so far been failures, and that this one is the easiest and at the same time less radical than any of the other measures devised. It is useful in cases when there is extreme retraction of the membrane with great prominence of the post fold and also of the short process of the malleus. while the hearing is at the same time very defective, and the tinnitus distressing. Unfortunately it is very difficult to maintain a permanent artificial opening. With this object in view attempts have been made to excise a portion of the membrane and to burning a hole in it with the galvano cautery but the opening

made in either of these cases generally heals, in course of time so that its good effects are only of a temporary nature, i.e. as long as the opening remains patent. Where the membrane tympani is very flaccid a number of these incisions may be made with the hopes that with the subsequent scar tissue formation the membrane may be made more rigid.

MOBILISATION OF THE MALLEUS. This is effected by means of Lucae's probe which is applied to the short process of the malleus, and then pressing it repeatedly inwards. The process is a painful one, and here again the old story of failure in the majority of cases must be recorded. The application is only made under gas or ethyl chloride. Improvement in hearing is usually immediate, but does not last long.

Exploratory tympanotomy: has been performed to examine the condition of the stapes, and the region round about. A flap is made in the post fold and turned down but the operation is only of an experimental nature.

Yearsly has succeeded in discovering a band of adhesion in this way, and so freeing it.

Tenotomy of the Tensor Tympani:- Hartmann's curved tenotome is very useful in performing this operation. The membrane is incised parallel with and close to the handle of the malleus. The tenotome is introduced through the incision between the ~~manubrium~~ manubrium and the long process of the incus, and the tendon is cut from below upwards. If attempted at all it should be done where the deafness is already of an extreme

character, and where the tinnitis is so unbearable as to demand every effort to relieve it.

Extraction of the incus. This has been performed through an incision made behind the short process, and following the periphery of the membrane backwards and downwards. The flap is retracted and incus disarticulated by means of an incus hook, and flap replaced. Result is failure in the majority of cases to effect any improvement. Kessel has lately devised an operation for mobilisation and extraction of the stapes, but it is still in its experimental stage. Politzer has also lately devised an operation for separating adhesions between the crura of the stapes and the walls of its niche. Section of the anterior ligament of the malleus has also been devised by the same author, when there is marked drawing in of the tympanic membrane. In order to establish a permanent opening into the middle ear Malherbe has recommended removal of the post wall of the meatus external to the annulus tympanicus. He then establishes communication between the middle ear and the meatus via antrum and aditus ad antrum. He maintains the opening by inserting a celluloid or gold tube.

CONCLUSIONS.

Of all these operations mobilization of the malleus has given the most encouraging results, and all the others have been more or less failures or have given very temporary ^{favourable} results.

It must be confessed, however, that in spite of all our treatment there are cases which advance until a condition of very serious deafness is reached. It is with

hopes of relieving these cases that we have to concentrate all our efforts towards improving our treatment. It must be noted that I have carefully refrained from referring to the condition known as "otosclerosis" which does not come within the scope of this paper, and the pathology (bony exostosis of the wall of the labyrinth) which is by no means indisputably established. Now our conclusions are that early cases of chronic catarrh are fairly amenable to treatment by our modern methods, but when once the case has advanced to the stage of rigidity of ~~ossicles~~ ^{to the} formation of adhesions our efforts to effect a permanent improvement are practically useless. Something more radical must be thought of. The point is we have practically a small blind ^{for} cavity, but ^{the} outlet of the Eustachian tube, the contents of this cavity are matted together by adhesions. If we can only get rid of these adhesions our purpose will be effected. Now a suppurative process anywhere will in a very short space of time destroy these or render them so soft and devitalized that the slightest mechanical effort is enough to tear them asunder. But this suppuration will not stop there, it will go on to the main structures unless the process is stopped in time. The point is therefore to accurately gauge the time when to step in and stop the process by our antiseptic means, but when once the softening or destruction of the superficial fibrous bands have been accomplished, it is easy to mobilise the ossicles and keep them movable by concomitant ⁱⁿ inflation of the tympanum. After all even a chronic infection is very successfully treated nowadays, and an acute process

ever so much more so. Now the difficulties of infecting the middle ear would be apparent in a healthy vigorous individual, and to employ a weak organism would be almost useless. Therefore in the case that I did I used mixed infection. This would be the only possible way of infecting a healthy tympanum. Of course, the strength of the infection can be very accurately gauged by passing the organism through a series of culture media. The organisms in each, after culture is obtained, being inoculated in the next, and so on until one would ultimately get almost a sterile culture. In this way the strength of the infection can be gauged to a nicety. On the other hand the vitality and virulence of the organism can be increased by inoculating a series of rabbits etc. or other animals, infecting each one in turn from the last one. What we do require is just a mild reaction which would either destroy or soften the adhesions and so enable one to successfully mobilize the ossicles by vigorous inflation. We see that the various operations that have been performed have been found to be more or less failures, and even in these very operations there is the risk of sepsis. Therefore I say, why not infect directly, keep your patient under observation and be ready to step in when danger threatens. The only real supposed danger is the risk of setting up a general septicaemia. For myself I am convinced that there is no more danger in this direction, than there is for a man suffering from a urethritis to obtain a general septicaemia. What I am recording is simply an experiment which has proved interesting as

far as it goes, but the result has certainly justified the adventure. Barr mentions in his book "Diseases of the ear" p. 386, that cases have been recorded in which there is an actual improvement in the hearing after the purulent process, and I have at least two to add to that list. What I now propose doing is to extend the experiment. I shall take twelve cases of different ages in which there can be no doubt as to the diagnosis of chronic catarrhal otitis media. - I shall also inoculate a series of culture tube one from the other and so destroy the virulence of the organism. I shall then begin with the weakest one and infect all the middle ears, and then one can gauge the strength and virulence of the organism required to set up the desired purulent process. My own opinion is that one would require almost a direct culture to produce the desired result in a healthy middle ear. Now we are aware that the prognosis in an acute purulent otitis media, unless it follows scarlet fever or one of the exanthemata is extremely favourable, and even when the discharge becomes chronic our methods of combating it are still very successful. The point is that the acute suppurative otitis media cases that we get for treatment are those in which the process came on while the patients health was below par for the time being, while the cases that are infected are vigorous individuals, and the chances of stopping the process are even more favourable. Although I have not done so in this case which I record, the future cases which I would select are those in which there are

extensive rigidity and adhesions covering the ossicles, and in whom the hearing has been very considerably destroyed. Our sole aim has been hitherto to combat adhesions when once found. So far we have not discovered an agent or means by which to effect our purpose in advanced cases. My own opinion is to let such adhesions slough away. We must have these patients under ~~o~~^operation, and we are ready with hammer and chisel to open the mastoid when danger threatens. This, in my opinion, will never be necessary. Then again, in our modern developement of the partial radical mastoid operation, ^{associated with the name of Sketh.} of which I am an enthusiastic admirer, we have a means of successfully combating the process of suppuration, even when it becomes chronic. Taken all in all I don't think one can more effectually destroy the hearing even by ripping out all the ossicles than the advanced adhesive processes do in these non-suppurative cases. The measure that I propose is nothing more severe than any of the intratympanic operative ~~at~~ attempts, all with more or less failure, that have been made, and provided one takes the patient into one's confidence and explains exactly the nature of the operation, and its possible attendant risks, and after results, there is no reason why these experiments should not be carried out, as in the case of all the others that have been done. Personally I think there is something in it, and the results obtained in the one case would certainly justify some further similar experiments being tried. Who knows whether it might not be of use in those cases in which the tinnitis is

so troublesome and severe that they would let you do anything in order to relieve it. In conclusion I wish to thank Dr. Logan Turner for permission to use the two cases referred to, and to Dr. Fraser for sending me the copies. My thanks are also due to Dr. Wray the present House Surgeon at Loughborough for looking after my cases for me when I left, and carrying out the further treatment.
