CHRONIC EXUDATIVE OTITIS EXTERNA

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SIR JOHN MAUD in a recent broadcast on "Personal Pleasures" gave this quotation from Abraham Tucker[1] :

> " After all, perhaps, we have no greater enjoyments among us than those of eating when we are hungry, drinking when we are thirsty, laying down when sleepy, or as the second Solomon has pronounced, than scratching where it itches."

And this last sentence, in my opinion, very aptly sums up the causation of otitis externa.

The problem of otitis externa is not new. An excellent description of the condition was given by Du Verney[2] in 1737, when he was Professor of Anatomy and Surgery in the Royal Physick-Garden at Paris, in his *Treatise of the Organ of Hearing*, and very possibly earlier books may contain an equally good description of this disease.

My investigation was confined to genuine cases of Chronic Exudative Otitis Externa and did not include the mycotic infections so commonly met in the East. This series of cases was uncomplicated by any other external or middle-ear condition, such as furunculosis or chronic middle-ear suppurations and therefore there can be no ambiguity as to the true nature of the infection and its response to treatment. While the presence of various scalp conditions has been noticed in the examination of the cases it is not proposed to discuss these affections in detail. Allergy of the external meatus as a predisposing cause of otitis externa has been ignored for obvious reasons.

My remarks are based on a series of 231 ear cases of otitis externa ; 103 of which were investigated during 1942 in an Army General Hospital in England while the other cases were mainly concentrated in Edinburgh Royal Infirmary. It was thought important in view of the general use of anti-biotics to survey the bacteriological side of the condition, and for this purpose, a series of normal as well as pathological ears, were so investigated.

Sociological Conditions

It is my considered opinion that otitis externa originates by infection being introduced to the outer ear by contaminated fingers, and finger nails, during the act of scratching. Scratching of the ear one might almost say is a " conditioned reflex " as any slight irritation in the ear,

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causes an immediate response on the part of the individual to scratch. During mental aberration or embarrassment the ears are often fingered quite unconsciously and once the ear becomes really irritated the patient is compelled to obtain some temporary relief by a good scratch and they will tell you that they may wake up in the night finding themselves scratching with the utmost vigour even in the unconscious state. The organisms shown to be present in the affected ears are found in dirt, sewage and in the intestines. By and large the Human Race is unclean in its person and its habits, and the practice of elementary hygiene is often lacking, either because of inherent laziness or thoughtlessness, or for want of the essential facilities for carrying it out. Talks with miners, for instance, demonstrate the primeval conditions pertaining underground for the performance of the natural functions. It is most important that the general public are educated in the basic principles of personal cleanliness, and the sufferers from otitis externa, in particular. Not infrequently it has been observed that patients suffering from a B. coli type of infection of the ear look a scruffy and unwashed lot. More soap and supplies of hot water should be made available, especially to those, engaged on " dirty " jobs, and also to Hotels and Restaurants for use in their wash-up places as it is indeed rare to find soap provided for the general public, and the communal roller towel should be abolished. Extra rations of soap are granted to certain industries and occupations but one gathers in conversation with patients in such employment that such supplies are quite inadequate.

Histo-pathology

Before discussing the tissue changes found in otitis externa it would be useful to refresh our memory on the histology of the gland formation in the external ear. Sebaceous, sweat and wax secreting glands are present in the external meatus and the " sweat proper " glands, are distributed lateral to the others. The main difference between the sebaceous and the sudoriferous glands is that the former are of the saccular and the latter of the tubular type. The cerumen glands are of course modified sweat glands but much larger in size and must not be confused with the sebaceous glands although they often exist in close proximity with each other. Histologically the wax glands are made up of a single layer of cuboidal or columnar cells and these cells are continued into the duct where they assume a double row formation with a fine cuticular lining. Muscular fibres are found only around the secretory part of the gland. The secretory saccules of the sebaceous glands on the other hand are almost solid with epithelial cells.

The histo-pathological changes in otitis externa are necessarily difficult to determine owing to the unavailability of material in any

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quantity. Two such sections of these tissues were studied and showed no great change in the epidermis. A marked non-specific inflammatory cellular infiltration of the dermis was present, polymorphonuclears predominated, and there was also some fairly recently-formed patchy fibrosis. Many of the ceruminous glands were grossly inflamed, dilated and full of pus and surrounded by dense polymorph infiltration. The sebaceous glands appeared normal.

No definite opinion can of course be formed from the study of microscopical sections of two cases of otitis externa and further research on this subject would be extremely valuable. It was interesting to note that the wax glands appeared to suffer so much and this microscopic appearance fitted in with the clinical findings on the disappearance of wax in otitis externa. This absence of the wax secretion, which is neutral in reaction, theoretically would make no difference to the action of the antibiotics but the secretion of sweat, which is acid in reaction, would, if unaffected or increased, rather tend to aid the action of penicillin and to inhibit the action of streptomycin. Conversely if the sweat secretion ceased it would cause a condition more favourable to streptomycin which acts in an alkaline medium. An inhibition of the secretion of sweat would also tend to lower the resistance of the tissues to infection.

Bacteriology

An investigation was made into the bacteriological findings present in 104 healthy ears in order to demonstrate how the bacteria found in these cases differed from those ascertained to be present in otitis externa. The results of this are summarized in Table 1. All the organisms isolated are sensitive to penicillin except of course the *B. coli* which were present only in 2 cases. It is interesting to note that 34 ears were found to be sterile and that the *Staph. albus* group numbered 55 and the *Staph. aureus* only 5, while a combination of these two were but present in 1 case.

A further bacteriological investigation was carried out in a series of 126 cases of otitis externa and the results are shown in Table II.

On analysis of these findings the presence of Proteus, *B. pyocyaneus* *B. coli* and enterococci either by themselves, together, or in combination with other organisms was noted in 94 out of the 126 examinations. The staphylococcal group was made up of 25 *aureus* and 17 *albus*, which is a very different proportion to that found in normal ears.

For infection of the skin tissues to take place a definite traumatization (e.g. scratching) of it must occur with the consequent entry of infecting organisms, and even those commensal organisms which merely lead a saprophytic existence on the surface of the skin may become pathogenic

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Chronic Exudative Otitis Externa

TABLE I.

BACTERIOLOGY OF HEALTHY EARS.

Total Number of Cases—104.

Results obtained on Culture.		
Sterile	34	
Staph. aureus	4	all penicillin+
,, ,, and diphtheroids	1	,,
,, ,, ,, albus	1	,,
Staph. albus	32	,,
,, ,, and micrococci	1	,,
,, ,, ,, diphtheroids	17	,,
,, ,, ,, C. xerosis	2	,,
,, ,, ,, ,, and B. coli	1	(staph. and xerosis penicillin+)
,, ,, diphtheroids and non-hæmolyt. streps.	1	,,
,, ,, Strep. mucosus	1	,,
Strep. mucosus	2	,,
Non-hæmolytic streptococci	2	,,
C. xerosis	1	,,
Diphtheroids	2	,,
Micrococcus tetragenes	1	,,
B. coli.	1	,,

on actual contact with the traumatized tissues. The *Bacillus proteus* is pathogenic to man and is found in the fæces, and the *B. pyocyaneus*, with a correspondingly lower pathogenicity to man, is also found there. *Bacillus coli* and enterococci when present outside the intestinal canal are pathogenic and of course indicate the origin of the infection. These

TABLE II.

BACTERIOLOGY OF OTITIS EXTERNA.

Total Number of Cases—126.

Results obtained on Culture.

Staph. albus	2	B. pyocyaneus	12
,, ,, diphtheroids	4	,, hæmolyt. streps.	1
,, ,, ,, Staph. aureus	3	,, diphtheroids	2
,, ,, proteus	6		
,, ,, staph. aureus	1	C. xerosis and B. mycoides	1
,, ,, B. pyocyaneus	1	B. coli and staph. albus	3
Staph. aureus	10	,, ,, ,, diphtheroids	6
,, ,, diphtheroids	7	,, ,, ,, C. xerosis	3
,, ,, ,, streps.	1	,, ,, ,, B. proteus	3
,, ,, ,, B. proteus	1	,, and staph. aureus	4
,, ,, C. xerosis	2	,, ,, ,, B. pyocyaneus	1
,, ,, B. pyocyaneus	1	,, ,, ,, B. proteus	4
,, ,, proteus	1	,, ,, ,, diphtheroids	3
,, ,, ,, hæmolyt. streps.	2	,, B. proteus	3
		,, Enterococci	2
Strep. non-hæmolyt.	1		
Proteus	15	Enterococci, Staph. albus and diphtheroids	1
,, B. pyocyaneus	6	,, Staph. aureus ,,	2
,, C. xerosis	1	,, B. proteus ,,	1
,, hæmolyt. streps.	4	,, B. pyocyaneus	3
,, subtilis	2		

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last two groups of organisms together with *Bacillus subtilis* produce an enzyme called penicillinase which inhibits the action of penicillin. The staphylococcus and non-hæmolytic streptococcus group may also be found in the intestinal tract. The *Bacillus subtilis* can produce quite a severe infection of the eyes—e.g. irido-cyclitis, but *Bacillus mycoides*, although belonging to the same group is considered non-pathogenic to man. *B. Xerosis* is also usually considered a commensal but can take part in an infection of the eyes. Thus the greater number of the organisms isolated in this investigation were associated directly or indirectly with the intestinal tract and this would appear to strengthen the conclusion as to the sociological origin of otitis externa. It is possible that in a mixed infection certain organisms may react favourably to the local application of the antibiotics or chemical substances, thus disturbing the balance of growth factor. This favourable response on the part of those bacteria may be held responsible for some of the acute reactionary exacerbations which have arisen from time to time in a number of cases in the present series.

When a number of packs saturated with streptomycin were removed from the external meatus they were seen to be tinged slightly blue, from which we might suppose that streptomycin actually stimulated the growth and activities of *B. pyocyaneus*. This blue staining was only observed in one case under treatment with penicillin.

Fairbrother[3] has drawn attention to the definite antagonism pertaining between *B. pyocyaneus* and the staphylococcal and streptococcal groups because of the production of a substance pyocyanase which is inimical to these cocci groups. This is well demonstrated by the fact that the *B. pyocyaneus* was found infrequently in combination with the staphylococci and streptococci.

Radiological Investigation of the Para-nasal Sinuses in Otitis Externa

It was decided to have a radiological examination of the para-nasal sinuses carried out in as many cases of otitis externa as possible in order to ascertain whether an associated sinus infection was present and if so to what extent this infection delayed healing of the ear condition and also whether it was responsible for the recurrence of otitis externa which is so troublesome a feature of this disease. There is no doubt that an adjoining source of infection to the ear can maintain a depressant action on the healing and resistance of the ear tissues and also present a constant source of reinfection (Table III). The para-nasal sinuses of 164 patients (81 Army and 83 Civilian) suffering from otitis externa were radiologically examined and in 121 cases the results showed healthy sinuses.

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Forty-three cases showed an infection of one or more of the nasal sinuses and this included infection of 30 antrums, 10 antrums and ethmoids, 2 antrums, ethmoids and frontals, and 1 ethmoid and frontal. Proof puncture was performed on 27 suspected antrums and 17 were found to be positive and 10 negative. The remaining 15 cases of " radiological "

TABLE III.

RADIOLOGICAL EXAMINATION OF PARA-NASAL SINUSES IN OTITIS EXTERNA.

Total Number of Cases—164 (81 Army and 83 Civilian).

Healthy Sinuses	121	cases.
Infection of Maxillary Antrum	30	,,
Infection of Maxillary Antrum and Ethmoids	10	,,
Infection of Maxillary Antrum, Ethmoids and Frontal Sinus ..	2	,,
Infection of Frontal Sinus and Ethmoids	1	,,

Confirmatory Diagnosis of Antrum Infection by Proof Puncture.

Infection of 17 Antrums confirmed on proof puncture.
,, ,, 10 ,, not confirmed on proof puncture.
,, ,, 15 ,, due to mild degree of infection insufficient to merit proof puncture.

antrum infection were not proof punctured as the appearances on the X-ray plates were such as to be interpreted as a very mild infection and not worth a proof puncture. Thus 17 positive antral findings out of 164 patients was a very small number and therefore para-nasal sinus disease constituted a relatively unimportant factor in otitis externa.

Treatment

Despite some disappointing results our treatment has advanced since the days when otitis externa was treated, by the application of leeches to the ear, and the instillation of drops which were made up with the urine of a hare either neat or mixed with spirits of wine.

In order to determine the optimum method of treatment a comprehensive study of the factors underlying and predisposing to this condition is most important and they must all be taken into consideration not only from the treatment point of view but also in order to prevent a recurrence.

Clinically there are two distinct stages in healing and therefore in treatment. The first stage is concerned with the drying up of the wet condition while the second carries on from this to the final or healed stage.

The exhibition of these substances which kill off the pathogenic bacteria, dry up the discharge and promote the exfoliation of the unhealthy epithelium were employed in the first stage while mild antiseptic and soothing ointments were applied during the second stage. It is dangerous to continue with the treatment prescribed for the first

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stage during the second stage as such treatment causes a secondary irritation of the meatal walls and a vicious circle is thereby created which reverses the act of healing. Treatment to be effective must be carried out regularly and in skilled hands. This will necessitate frequent journeys on the part of the patient to hospital and therefore it is most important to obtain his co-operation.

In view of the freeing of all restrictions on streptomycin it was thought that an investigation into the treatment of cases of otitis externa by the local application of this substance would be useful and at the same time it might be ascertained whether there was any connection between the action of streptomycin and any particular organisms present in the diseased ear. Similarly, a few cases were treated by penicillin to see whether any comparison could be made between the results of treatment by these two antibiotics. A combination of streptomycin and penicillin was tried in several cases and later abandoned as it served only to confuse the issue and in any case the results were very poor. The sulphonamides were also used and this investigation includes a series of 103 cases which were treated by these drugs in a British Army General Hospital in England. The value of local irradiation in the first stage of otitis externa by ultra-violet light was also investigated and the results of this form of treatment have been encouraging.

From amongst the better known drugs used in the treatment of otitis externa, ichthyol 20 per cent. in aqueous solution has given reliable results in the first stage.

First Stage

Table IV. As regards treatment with the antibiotics, streptomycin and penicillin, the following figures are of interest. Of 54 cases treated by the local application of streptomycin ointment (125 mg. per 1 gram) 18 cleared up satisfactorily and 36 failed to respond to this treatment.

TABLE IV.

RESULT OF TREATMENT IN OTITIS EXTERNA.

	Total Number	*Cured*	*Failure*
Antibiotics	82	22	60
Sulphonamides	134	98	36
U.V.R.	43	30	13

DETAILS OF TREATMENT.

	Total Number	*Cured*	*Failure*
Streptomycin	54	18	36
Penicillin	28	4	24
Sulphathiazole	49	38	11
M. and B.	56	39	17
Sulphathiazole and M. and B.	29	21	8
U.V.R.	43	30	13

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Several cases showed a marked local reaction which was extremely painful for the patient. Twenty-eight cases were treated by penicillin ointment locally (500 units per 1 gram). Four cleared up while 24 failed to do so. A severe local reaction was observed in a number of this last group of patients and this reaction was observed more often with penicillin than with streptomycin. There appears to be no relationship in otitis externa between any particular organisms and its response to treatment by the antibiotics and therefore treatment by these cannot be based on any bacteriological findings. Even in these cases where all the organisms reported on were said to be penicillin sensitive, failure to respond to treatment by penicillin was often noted and indeed some quite severe reactions were observed.

The result of treatment with the antibiotics in 82 cases have been most disappointing with only 22 cured. Much was expected more especially from the treatment by streptomycin when the invading type of bacteria was taken into account. Of course the optimum dosage of streptomycin may not have been given and that is one possible explanation of the poor results.

A more hopeful note is introduced in the treatment by means of the sulphonamides. This group was exhibited as sulphathiazole (720), M. and B. (693), and as a mixture of these two, all suspended in an emulsion (25 per cent.). Thirty-one cases from the present investigation have been added to the Army cases making a grand total of 134. The results obtained now and in 1942 are strikingly similar. Forty-nine cases were treated by the local application of sulphathiazole with 38 cured and 11 failures. M. and B. was utilized for local treatment in 56 cases with 39 cured and 17 failures. A mixture of the two drugs were used in 29 cases with 21 cured and 8 failures. To sum up the treatment by the sulphonamides 98 were cured and 36 failed to respond. It was seldom that any marked local reaction resulted but in one case there was a striking reaction. Ultra-violet radiation from a Kromayer Lamp with a special ear applicator was carried out on 43 cases with 30 cured and 13 failures. The initial dosage given was a minimum of 30 seconds and thereafter increased as the condition improved. The patients spontaneously said how much easier the ear felt even after the first application of these rays, and no untoward reaction was observed.

Second Stage

The second stage of treatment consisted in the application of ribbon gauze soaked with a soothing, mildly antiseptic ointment such as ichthyol and zinc oxide in a lanoline base. The time taken for the second stage to clear up was relatively short and when healing was

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complete a prophylactic paint with gentian violet 2 per cent. in spirit was given to the meatal walls. The patient was instructed to report in 14 days' time for a final check-up. A small point, but an important one, is that the patient should be warned that he will not hear any traffic when the ears are tightly packed and that he must therefore exercise caution, and rely more on his eyes than his ears, when crossing thoroughfares.

Summary of Treatment

To sum up, the treatment by streptomycin may be indicated in a few cases that fail to clear up with other forms of treatment. The results of penicillin applied locally have been so poor and the reactions so numerous that its use should be entirely abandoned. Sulphathiazole or M. and B. on the other hand have given good results and their use is to be thoroughly recommended while ultra-violet irradiation is also an extremely successful form of treatment but ordinarily it cannot be carried out in the consulting room and therefore is more of use with hospital patients.

In conclusion, it gives me great pleasure to express my thanks to Professor Drennan and Dr. Bain of the Pathology Department of Edinburgh University for their advice and help in this investigation, also Drs. John Bowie and Gould of the Bacteriology Department of the Royal Infirmary for their arduous task so conscientiously carried out. I am grateful, too, for the interest, enthusiasm and help given me by my colleagues, Drs. Donaldson and Young, of the Ear, Nose and Throat Department, and also to Miss Mann and her assistants of the Physiotherapy Department of the Royal Infirmary, Edinburgh.

REFERENCES

[1] TUCKER, ABRAHAM, 1805, *The Light of Nature Pursued*, vii, 29, 309, 2nd edition, R. Faulder, New Bond Street, and T. Payne, Newgate, Charing Cross.

[2] DU VERNEY, 1737, *A Treatise of the Organ of Hearing*, Samuel Baker, Ruffel Street, London.

[3] FAIRBROTHER, R. W., 1949, *Text Book of Bacteriology*, 366, 6th edition, Heinemann, London.

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