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Otomycosis—A continuing problem

by

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Abstract

The microbiology of 12,174 symptomatic ears presenting over an eight-year period to one hospital was examined in detail. 1,061 cases of fungal infection were found. The incidence and pattern of these fungi and the accompanying bacteria, in cases of mixed infection, do not appear to have been affected by the widespread use of powerful topically-applied antibiotic/steroid preparations over more than two decades. Otomycosis remains an uncommon, often overlooked but important cause of morbidity in a temperate climate.

Introduction

Chronic infective disorders of the ear remain a common source of misery for patients and frustration for doctors. At the Royal National Throat, Nose & Ear Hospital the majority of ear infections seen are therapeutic failures referred by general practitioners, underlying repeatedly the frequency, chronicity, morbidity and therefore the importance of these complaints. The question of why this should be so has often been asked, but never satisfactorily answered. Infections of a short, easily accessible blind sac should be readily amenable to treatment.

Clearly, part of the answer here, as elsewhere in the body, lies in the mismatch of aetiology and treatment. This contribution is concerned mainly with the aetiological side of the equation—in particular with fungi and their significance and role in chronic ear disease in a temperate climate.

Several authors have drawn attention to various aspects of otomycosis since Mayer in 1844. Here we examine the incidence and pattern of fungi in the symptomatic ear, together with that of associated bacteria, presenting at this hospital over an eight-year period.

Method

The microbiology of 12,174 infected ears presenting at this hospital between 1972–1979 inclusive was examined in detail. Only those patients from whom fungi were isolated in significant growth (as reported by the laboratory) on their first visit were retained for study. Any cases where fungal contamination was suspected by the laboratory were rejected.

A brief synopsis of the laboratory procedure for identifying fungi is as follows. In those cases where a specific request for fungal studies is made, a direct 'wet' microscopical examination is prepared before inoculation onto a Sabouraud Maltose Agarslope (plus chloramphenicol 0.05 mgm./ml.) and incubated aerobically at 37°C. for four weeks. Six routine culture plates are also inoculated and kept at room temperature. These cultures are examined weekly.

If fungal studies are not requested a routine 'wet' slide preparation is not examined before the inoculation.

In positive culture where yeasts are grown, microscopy, germ tube tests and morphology on corn-meal agar plates aid accurate identi-

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fication of the species.

In positive cultures where fungi are grown, macroscopic and microscopic appearance, rates of growth at different temperatures and slide cultures (with special attention to hyphae and spore characteristics) allow species identification.

Where identification of a fungus or yeast proves difficult the specimens are sent to a central Reference Laboratory.

From each case in this study the following data were extracted:

Age
Sex
Laterality
Initial diagnosis
Fungal species
Dominant associated bacteria—in cases of mixed infection.

Results

The total number of fungi isolated from the 12,174 cases reviewed was 1061 (8.7 per cent).

Age

Fig. 1 shows a bimodal distribution with the greatest incidence being in the third and fifth decades. The age range was from 18 months to 98 years.

The mean age of the males in the study was 42.7 years. That of the females was 39.6 years.

Sex and Laterality

Table I shows that there is little difference in either sex or laterality. In only 11 per cent of cases was there bilateral infection. The discrepancy between the total of 975 in the table and the overall total of 1061 patients with fungi is explained by the exemption of the 68 fungally infected mastoid cavities in the study and the 18 cases where laterality was not indicated. (Analysis of the mastoid infections, not shown here, revealed 35 male and 33 female infections).

Diagnosis

Fig. 2 shows that otitis externa was much

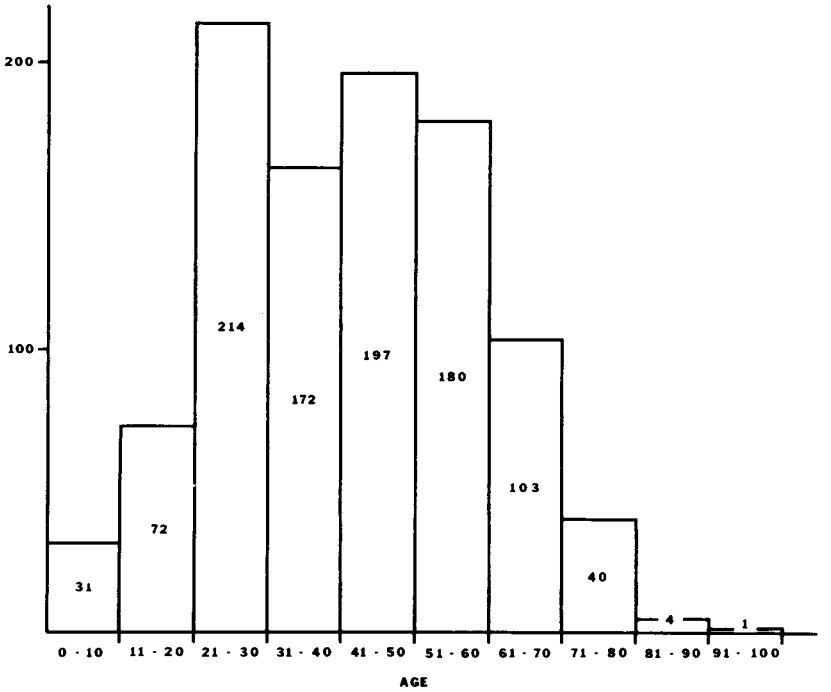


FIG. 1

Age. Vertical Axis—Number of cases. Horizontal Axis—Age by decades.

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TABLE I
SEX AND LATERALITY

	R	L	Both	Total
Male	213	228	46	487
Female	228	199	61	488
Total	441	427	107	975

the commonest diagnosis made (61.5 per cent) on first presentation of patients subsequently found to have fungal infection. Only in 11.6 per cent of cases was a correct initial diagnosis of fungal infection made. Reasons for this are considered in the discussion.

Fungi

Tables II–IV list the fungi isolated in this study in both pure and mixed culture.

In the latter case the dominant accompanying bacteria are listed in descending order of frequency, the exact occurrence rate following in brackets. Also included under this heading are any fungi where more than one species was present.

Table II shows Candida parapsilosis as the commonest non-albicans species where further analysis of the Candida Sp. group was carried out. This is significant because this particular yeast is usually considered either a non-pathogen or one of only minor importance, yet numerically it is the commonest fungal pathogen in this study of symptomatic ears.

Table IV serves as a reminder that in addition to Candida and Aspergilli other fungi may have to be considered.

Bacteria

Fig. 3 demonstrates the commonest accompanying bacteria in descending order of frequency in mixed infections.

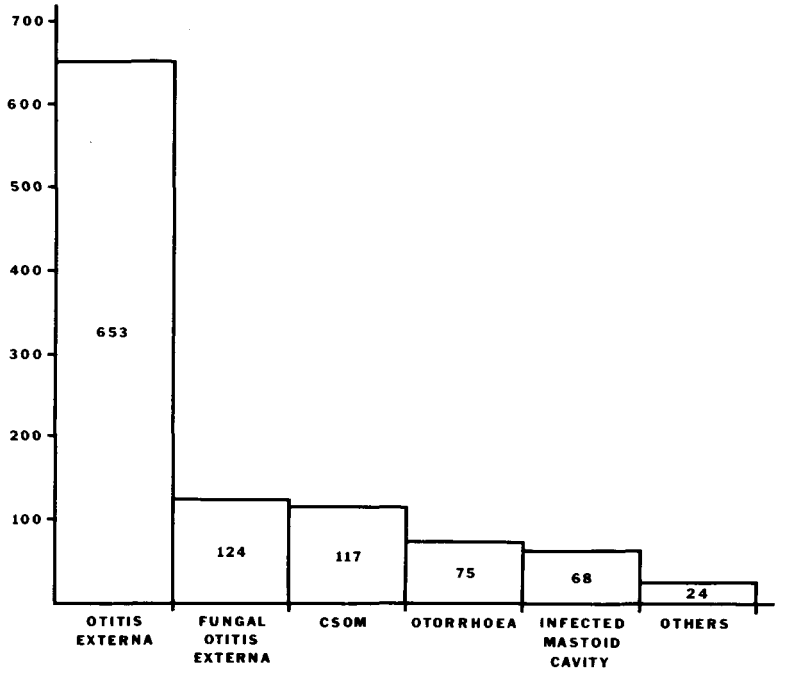


FIG. 2
Initial Diagnosis. Vertical Axis—Number of cases. Horizontal Axis—Initial Diagnosis.

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TABLE II
CANDIDA (C.)

Species	Total	Pure	Mixed	Main Bacteria
C. species	323	117	206	Pseudomonas (67) Staph. pyo. (61) Proteus (27) Strep. faecalis (16) Strep. pyo. (13) E. coli (8) A. flavus (1) A. niger (1)
C. albicans	210	95	115	Staph. pyo. (36) Proteus (22) Pseudomonas (20) β-haemolytic strep. (12) E. coli (8) A. niger (7) C. species (5) Strep. faecalis (4) Klebsiella (2) A. flavus (2) A. terreus (1) Others (5)
C. parapsilosis	90	34	56	Staph. pyo. (22) Pseudomonas (20) Proteus (5) Klebsiella (4) Strep. faecalis (4) β-haemolytic strep. (2) E. coli (2) A. flavus (1) A. niger (1) C. albicans (1)
C. guillermondi	8	5	3	Staph. pyo. (1) A. niger (1) Citrobacter (1)
C. tropicalis	4	2	2	Pseudomonas (1) Staph. pyo. (1) Proteus (1)
C. clauserii	1	0	1	Pseudomonas (1)

Discussion

The findings confirm Aspergilli and Candida as the dominant fungal pathogens of the external ear and Staph. aureus, Pseudomonas and Proteus as the dominant bacterial pathogens. None of the normal inhabitants of the ear canal featured in this study, thus demonstrating an altered aural flora and fauna in otomycosis. These findings also confirm that otomycosis, although a significant condition, is an uncommon one in temperate climates; that it is a 'one ear only' disease and that it is

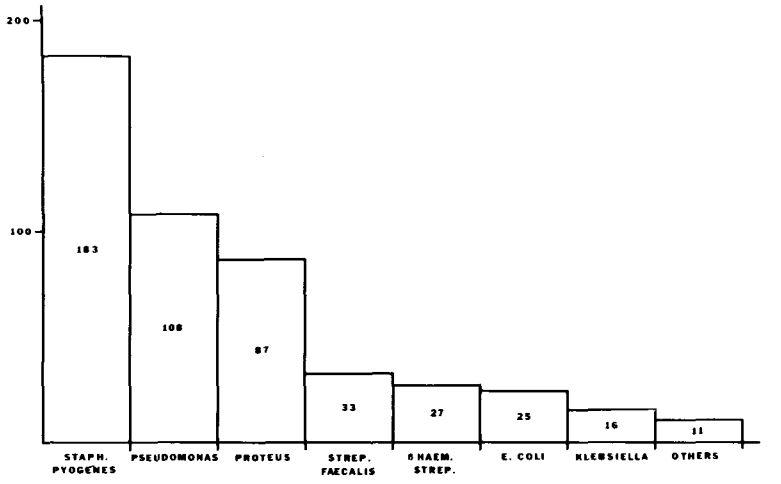


FIG. 3
Dominant bacteria in mixed infections. Vertical Axis—Number of cases. Horizontal Axis—Dominant Bacteria.

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TABLE III
ASPERGILLI (A.)

Species	Total	Pure	Mixed	Main Bacteria
A. niger	229	150	79	Staph. pyo. (24) C. species (17) Proteus (11) Strep. faecalis (8) C. albicans (8) Pseudomonas (5) E. coli (3) Klebsiella (3) Torulopsis glabrata (2) C. parapsilosis (1) C. guillermondi (1) A. flavus (1) A. terreus (1) Enterobacter (1)
A. flavus	82	45	37	Staph. pyo. (14) Proteus (8) Pseudomonas (5) Klebsiella (3) E. coli (3) C. albicans (2) C. species (2) β-haemolytic strep. (2) A. fumigatus (1) A. niger (1) Strep. faecalis (1) C. parapsilosis (1) Torulopsis glabrata (1)
A. fumigatus	56	41	15	Proteus (5) Staph. pyo. (5) Pseudomonas (3) β-haemolytic strep. (2) A. flavus (1) Acinetobacter (1)
A. terreus	33	18	15	Staph. pyo. (9) Pseudomonas (3) Proteus (2) A. niger (1) Klebsiella (1) C. albicans (1)
A. Glaucus	8	5	3	Staph. pyo. (2) β-haemolytic strep. (1) C. species (1)
A. species	10	4	6	Pseudomonas (2) Staph. pyo. (1) Proteus (1) Klebsiellas (1) Torulopsis glabrata (1)

no respecter of age or sex. Why is it uncommon? Aspergilli are common airborne saprophytes, though their incidence in the normal ear canal is disputed. They can be readily isolated from house dust and it seems not surprising that their incidence is seasonally increased in late Autumn. Wright (1970), for example, found an increased incidence of fungal *otitis externa* in October and November, whereas bacterial *otitis externa* peaked in August.

Conley (1948) pointed out that the external ear canal fulfils many of the requirements for fungal growth—few as they are—being essentially moisture, warmth and some protein or carbohydrate. Furthermore, the pH of the normal ear canal is on the acidic side of neutrality, and Yassin *et al.* (1964) have demonstrated that the commonly pathogenic Aspergilli have their optimum growth rate in the pH range 5–7. These authors also demonstrated that Aspergilli growth rates were maximum at a temperature of 37°C., a fact clinically supported by the predilection of fungi to grow in the inner one-third of the ear canal and thus nearer to core temperature.

Is it, then, that fungi are being overlooked as aural pathogens? Certainly, failure to consider fungi in the aetiology may often result in failure to find them. In only 11.6 per cent of cases were fungi positively considered in the diagnosis on presentation. The symptoms of fungal infection, namely itching, pain, discharge and a sense of fullness in the ear, are by no means specific, though in our experience pain is usually a feature, and discharge only if bacteria are also involved.

While it is easy enough to make a diagnosis of fungal infection when inspection of the ear canal reveals a 'forest' of waving conidiophores, as in the case of sporing Aspergilli, Powell and English (1962) have

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TABLE IV
MIXED CULTURES

Species	Total	Pure	Mixed	Main Bacteria
Torulopsis glabrata	6	1	5	A. niger (2) Staph. pyo. (2) A. flavus (1)
Pityrosporum Pachydermis	6	5	1	Proteus (1)
Penicillium species	5	4	1	C. species (1) Staph. pyo (1)
Scopulariopsis	3	1	2	Staph. pyo. (2)
Trichosporon beiglei	3	1	2	A. flavus (1) Proteus (1)
Streptomyces	2	0	2	E. coli (1) Pseudomonas (1)
Trichophyton rubrum	1	0	1	Proteus (1)
Trichophyton mentra	1	0	1	Proteus (1)
Geotridium species	1	0	1	Staph. pyo. (1)
Zygodesmos	1	0	1	Staph. pyo. (1)

pointed out that yeasts, even in the mycelial state, do not form the closely woven masses of hyphae that moulds do and are therefore more likely to be diagnosed as bacterial infection. They also make the clinically important point that, when a fungus is present as a mycelium only, the hyphae are embedded in debris and are not picked up by swabbing alone.

Why are Aspergilli and Candida, of the multitude of airborne fungi present in the environment, so dominant in aural pathogens? It has been suggested (Senturia, 1957) that saturated and unsaturated fatty acids have an inhibiting effect on most fungi and yet ear wax may support luxurious growths of Aspergilli despite containing numerous saturated and unsaturated fatty acids, as identified by Akobjanoff *et al.* (1954).

Do these fungi elaborate any substances which might aid their establishment? McLaurin *et al.* (1965) pointed out that in all cases of *otitis externa* there is an interruption of the external auditory canal lining: it is interesting to note, therefore, that Aspergillus fumigatus, for example, elaborates a haemolytic exotoxin capable of altering skin resistance. This fungus also elaborates an antibiotic active against Staph. aureus, and Table III shows that this is the only one of the Aspergilli found which was not accompanied most often by Staph. aureus in mixed infections. Once the integrity of the ear canal has been compromised, by whatever means, the resultant exudate provides a humid atmosphere encouraging both fungal and bacterial proliferation. Resultant debris provides nutritious fungal fodder.

By overlooking fungi as aetiological agents, does therapy perhaps contribute to chronicity? Does local elimination of bacteria encourage fungal proliferation, and do topical steroids predispose to Candida infections in the way that systemic treatments do? The combination of broad-spectrum antibiotics and potent steroids in topical preparations has been available for well over two decades and very widely used. But our study shows that not only are the same fungi and bacteria involved as before the introduction of these drugs, but that their incidence remains low. What, however, is not clear is whether these powerful compound drugs are disguising any allergic reactions to fungal toxins, the symptoms of which may be suppressed by the steroid component during treatment only to recur shortly after drug withdrawal.

A theoretically more serious hazard of pro-

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longed treatment of chronic ear disease mistakenly thought to be bacterial rather than fungal is the potential ototoxic effects of the topical antibiotics employed. Kohonen and Tarkkanen (1969) suggest that, because of the very few known complications given the widespread use of these drugs, the risk must be small. However, Brummett *et al.* (1976), in a stimulating paper, suggested that this situation might well be illusory since the damage done by aminoglycosides and polypeptides such as Polymixin B—both widely used and proven ototoxic agents when topically applied to guinea pigs—affect the basal portion of the cochlea first and thus affect frequencies higher than 8,000 Hz., the usual upper limit of conventional testing, and further that any sensorineural loss might be ascribed to the middle-ear disease rather than the therapeutic agent. In addition these workers showed that the degree of cochlear damage worsens as the duration of dosage administration is extended.

From the above discussion certain therapeutic considerations follow. Obsessional removal of debris and thorough cleaning of the external ear canal, together with reduction of humidity by using insufflations rather than instillations, will usually resolve known fungal infections. It follows that if all ear infections are treated rigorously in this way then the frequently overlooked fungi may present a lesser problem. However, even when fungi are found, their accurate indentification is of more than academic interest. Aspergillus terreus, for example, is resistant to nystatin, whereas the other common Aspergilli are not (English and Dalton, 1962).

Conclusion

Otomycosis remains uncommon in temperate climates, but the diagnosis is often missed.

The dominant fungal and bacterial pathogens in chronic ear disease remain the same despite more than two decades of the widespread use of potent antibiotic/steroid combination.

While otomycosis appears to have a bimodal age distribution, it is no respecter of age or sex and is a predominantly unilateral disorder, only 11 per cent having bilateral infection.

Otomycosis remains a diagnostic problem and may contribute significantly to chronic ear disease as a whole. It is not enough to say that it is uncommon and therefore unimportant.

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