Chronic otorrhoea: Spectrum of microorganisms and antibiotic sensitivity in a South African cohort

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Background. Chronic otorrhoea is difficult to treat, with treatment in South Africa (SA) being protocol driven and generally initiated at the primary healthcare level. There is a lack of local studies that focus on the bacteriology and antimicrobial sensitivities of chronic otorrhoea, which underpins the management advice offered.
Aims. To determine the microbiological profile and antimicrobial susceptibility of patients with chronic otorrhoea and the validity of the Department of Health's (DoH) current guideline.
Methods. We conducted a prospective study at Groote Schuur Hospital from 2005 to 2009. We included patients with chronic otorrhoea classified as either otitis media or otitis externa, according to our definitions. Pus swabs were taken, from which microorganisms were cultured and tested for antimicrobial susceptibility.
Results. Of 79 patients with otorrhoea, 50 had otitis media, 21 had otitis externa and the condition was not determined in 8 patients. The most common organism isolated with otitis media was *Proteus mirabilis* (18/50; 36%) and with otitis externa, *Pseudomonas aeruginosa* (7/21; 33%). Otorrhoea had a different microbial spectrum compared with international reports, with methicillin-resistant *Staphylococcus aureus* infection in a single patient. The organisms isolated were susceptible mainly to fluoroquinolones (96%) and aminoglycosides (81%).
Conclusion. Amoxicillin is a poor choice of antibiotic due to its low sensitivity, which calls into question the current DoH guideline for otorrhoea. Antimicrobial treatment protocols should be based on local data and be revisited from time to time. This study suggests that, should first-line treatment fail, an antibiotic with Gram-negative cover, e.g. a topical fluoroquinolone, should be considered.

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Otorrhoea due to either external or middle-ear pathology is often difficult to treat. Different geographical areas may have unique patterns of infecting organisms and antimicrobial susceptibility. Worldwide, there has been a change in the profile of organisms causing otorrhoea and increases have been observed both in the incidence of methicillin-resistant *Staphylococcus aureus* (MRSA) and in resistance to antimicrobials.[1] In South Africa (SA), patients with otorrhoea are often initially treated at the primary healthcare level. Otorrhoea is seldom investigated by microscopy, culturing or sensitivity testing; treatment is usually empirical and has limited options. Although treatment is protocol driven, a PubMed search failed to reveal SA studies focusing purely on the bacteriology and antimicrobial sensitivities of chronic otorrhoea underpinning the management advice offered.

Aims

To investigate the microbiology profiles of patients presenting to a tertiary hospital in Cape Town with chronic otorrhoea and to ascertain the validity of the current treatment protocol for chronic otorrhoea outlined by the SA Department of Health (DoH).

Methods

We conducted a prospective study at the tertiary-level Groote Schuur Hospital (GSH) in Cape Town over 4 years from 2005 to 2009. Patients with chronically discharging ears, who were referred to the Ear, Nose and Throat (ENT) Outpatients Unit by primary and secondary level services, were enrolled at their first visit to the hospital.

To best reflect the clinical situation at primary or secondary care level, we defined chronic otorrhoea as an ear discharge present for ≥2 weeks, either due to otitis media or otitis externa. We based the diagnosis of otitis media on the presence of a tympanic membrane (TM) perforation with the otorrhoea originating from the middle ear. We defined otitis externa as an intact TM and an inflamed, discharging lining of the external auditory canal. Our exclusion criteria included: patients with cholesteatoma, patients who had previous surgery, anatomical factors predisposing patients to recurrent ear infection, patients with foreign bodies, cerebrospinal fluid otorrhoea and patients who had received systemic or topical antibiotics in the 2 weeks prior to presenting to the hospital.

To obtain a representative sample of the ear discharge, ear toilet was first performed with a diagnostic microscope before a pus swab was carefully taken with a single mini-tip culture swab under direct microscopic vision. The swab was generally too big to pass through a TM perforation, and thus the discharge was sampled just lateral to the TM.

Pus swabs were analysed by GSH's microbiology laboratory, a SA National Accreditation System accredited laboratory, within the National Health Laboratory Service (NHLS). Swabs were inoculated onto blood agar, boiled blood agar and MacConkey agar and incubated for up to 48 hours. Isolates were identified using standard laboratory techniques and antimicrobial susceptibility testing was performed using either the Vitek 2 system (bioMérieux, France) or standard Kirby Bauer disc diffusion test. Results were interpreted using Clinical and Laboratory Standards Institute (CLSI) guidelines.[2]

Results

Seventy-nine patients met the inclusion criteria for the study with a mean age of 39 years (range 13 - 83 years). The female-to-male ratio

was 1.3:1 and the ratio of left to right ears was 1.2:1. Eight patients volunteered that they were HIV positive, 42 that they were negative and 35 did not know their HIV status. The duration of otorrhoea ranged from 4 to >100 weeks (mean 47 weeks). Otorrhoea had been present for >52 weeks in 34 (43%) patients.

Of the 79 patients enrolled in the study, 50 had otitis media, 21 had otitis externa and in 8 patients this distinction was not documented. In 31 patients the treatment that they had received prior to referral had been documented and included oral antibiotics, i.e. amoxicillin (*n*=24), ciprofloxacin (*n*=2), flucloxacillin (*n*=1) and amoxicillin-clavulanate (*n*=1). Five patients had received topical acetic acid drops, 2 of whom had also received amoxicillin.

Proteus mirabilis (36%; 18/50) was the most common isolate in otitis media while *Pseudomonas aeruginosa* (33%; 7/21) occurred most commonly in otitis externa (Table 1).

The patterns of susceptibility are listed in Table 2. MRSA, which was sensitive to erythromycin, was detected in only 1 patient (with otitis media) – a 35-year-old HIV-positive patient with a 2-year history of otorrhoea.

Discussion

Our results describe the microbiology associated with chronic otorrhoea (both otitis externa and otitis media) in patients referred from primary and secondary healthcare facilities in the Western Cape. The most common organisms were *P. mirabilis* (29%), *P. aeruginosa* (20%) and *S. aureus* (15%). The microbiology associated with otitis media differed from otitis externa, with *P. mirabilis* (36%) and *P. aeruginosa* (33%) being the most common isolates, respectively (Table 1). Our results roughly parallel the microbiology pattern reported by Loock[3] at another tertiary hospital in Cape Town in chronic otitis media patients, namely *Proteus* spp. (29%), *P. aeruginosa* (24%) and *S. aureus* (14%) as the most common.

A problem when comparing our results with those of some other studies is that they refer to 'chronic suppurative otitis media', defined as 'inflammation of the middle ear and mastoid process, accompanied by a perforated tympanic membrane and discharge'.[1] In such studies, sampling would include otorrhoea due to cholesteatoma (treatment of which is surgical) and non-cholesteatomatous ears. Although most studies indicate that only non-cholesteatoma cases were included, this is not true for all reports. Although some African studies reported *P. mirabilis* to be the most common organism, other international studies report *S. aureus* and *P. aeruginosa* to be the most common organisms encountered with chronic suppurative otitis media.[1,4-7] A recent Nigerian study reported that Gram-negative bacteria (*Klebsiella* spp., *Escherichia coli* and *P. aeruginosa*) comprised 80% of isolates.[7] The microbiology with cholesteatoma is fairly similar, with a predominance of *P. aeruginosa* (31%) and *S. aureus* (19%), but there is also a significant anaerobic component.[8]

The incidence of MRSA in Cape Town is low compared with other studies. In our study, MRSA was isolated in only 1 patient (1.7%) with otitis media for 2 years; it is not known what treatment the patient had received at primary care facilities. This is similar to the 1.9% incidence of MRSA reported by Loock[3] in patients with chronic active otitis media. These results differ from reports of changing bacteriological spectra and increases in the incidences of *S. aureus* and MRSA.[1] Hwang *et al.*[1] reported from Taiwan that, when compared with Juan (1986),[1] there had been an 8.5% increase in the incidence of MRSA in acute otitis externa; they also reported an increase in MRSA with granular myringitis, and that the biggest change in microbiology profile – a 15% increase in MRSA – had occurred with chronic otitis media.[1] Similar trends were observed in a large study from Korea, with the prevalence of MRSA increasing from 21.4% to 27.4%.[1] Hwang *et al.*[1] postulated that the change from *P. aeruginosa* to *S. aureus*, especially MRSA, could be attributed to improvements in public healthcare, reduced severity of ear disease and a more liberal use of antimicrobial drug therapy.

At primary care level, chronic otorrhoea is treated medically with ear toilet according

Table 1. Culture results

	Otitis media (*N*=50) *n* (%)	Otitis externa (*N*=21) *n* (%)	All cases (*N*=79) *n* (%)
Proteus mirabilis	18 (36)	1 (5)	23 (29)
Staphylococcus aureus	7 (14)	5 (24)	12 (15)
Pseudomonas aeruginosa	7 (14)	7 (33)	16 (20)
Other bacteria*	4 (8)	-	6 (8)
Fungal	-	1 (5)	1 (1)
Mixed growth/only skin flora†	14 (28)	7 (33)	21 (26)

* *E. coli, Enterobacter cloacae, Alcaligenes faecalis.*
† No distinct organism cultured.

Table 2. Antibiotic sensitivities of isolates from patients with otorrhoea for both otitis media and otitis externa

	P. mirabilis (*N*=23) *n* (%)	*P. aeruginosa* (*N*=16) *n* (%)	*S. aureus* (*N*=12) *n* (%)	Other organisms (*N*=6) *n*	All organisms (%)
Ciprofloxacin	23 (100)	16 (100)	10 (83)	6	96
Gentamycin	23 (100)	13 (81)	4 (33)	6	81
Amikacin	23 (100)	16 (100)	-	5	77
Ampicillin	20 (87)	-	1 (8)	2	40
Amoxicillin/ clavulanate	23	-	-	-	41
Cefotaxime	23	-	-	-	41
Cefuroxime	22	-	-	-	39
Ceftazidime	-	16	-	6	39
Co-trimoxazole	14	-	-	4	32
Tobramycin	-	10	-	6	28
Oxacillin	-	-	11	-	19
Erythromycin	-	-	11	-	19

Table 3. Current SA DoH guideline for chronic otitis media[9]

Non-drug treatment	Avoid getting the inside of the ear wet
	Dry mopping
	Topical 1% acetic acid or diluted vinegar solution
Drug treatment	Amoxicillin
	Penicillin allergy: Co-trimoxazole

SA = South African; DoH = Department of Health.

to set protocols. Only when otorrhoea does not resolve are patients referred to a more specialised service. As otorrhoea generally is not cultured and an accurate distinction between otitis externa and media is usually not made at primary care level, commonly encountered pathogenic organisms should inform empiric treatment protocols. The current DoH guideline for treatment of chronic otitis media recommends amoxicillin or co-trimoxazole for patients allergic to penicillin (Table 3).[9] Many of the patients in our study had received amoxicillin in accordance with this guideline. Although the majority of the *P. mirabilis* isolates were susceptible to amoxicillin, only 40% of organisms overall were susceptible.

The organisms isolated in our study were susceptible mainly to fluoroquinolones (96%) and aminoglycosides (81%) (Table 2). Topical fluoroquinolone eardrops, commonly ofloxacin or ciprofloxacin, are known to be as effective as aminoglycoside drops, and have the advantage of not being ototoxic.[10] Ofloxacin has been shown to be very effective in all studies except for a study done in Malawi[6] that reported that after an initial 73% response rate at 10 days, the response rate dropped to 42% at 21 weeks. However, most ears (in 91 candidates) in this study harboured faecal bacteria, and it was postulated that this finding was due not to bacterial resistance, but due to poor hygiene.[6] In keeping with previous studies, Loock[3] reported that topical quinolone eardrops were effective in the management of active chronic otitis media. Weber *et al.*[11] showed that no significant antibiotic resistance emerged from the use of topical antibiotics.

Our results suggest that should additional antibiotic therapy be considered in patients who have failed to respond to first-line therapy in a primary care setting, agents with better activity against Gram-negative bacilli should then be considered.

Another concern highlighted by our study was that 43% of patients had a discharging ear for >52 weeks. The reasons for this delayed referral to specialist centres require further research. We were unable to analyse the effect of HIV status on otorrhoea; further microbiological investigation at primary care level is required to determine whether it differs from HIV-negative patients.

Conclusions

Otorrhoea is generally treated at primary care level in SA and, hence, has to be protocol driven. Antimicrobials (topically or systemically) recommended for otorrhoea in the DoH guideline need to cover the majority of organisms encountered; be it due to otitis media, granular myringitis or otitis externa, as the primary healthcare worker is unlikely to distinguish between these causes of otorrhoea. The results of this study suggest that the microbial spectrum in the Western Cape, and possibly the rest of SA, differs from elsewhere in the world and that MRSA infection is uncommon. Amoxicillin appears to be a suboptimal choice for chronic non-responders due to its low sensitivity when compared with topical fluoroquinolone eardrops with ear mopping, which covers 95% of organisms cultured and is not ototoxic. Should the first-line treatment fail then an antibiotic group with Gram-negative cover should be considered.

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