Chronic suppurative otitis media: bacteriology, susceptibility and clinical presentation among ENT patients at Mulago Hospital, Uganda

Rubena Justin[a], Gregory Tumweheire[b], Henry Kajumbula[c], Chris Ndoleriire[d]

a Resident, Makerere University, Department of Otolaryngology Mulago Hospital
b Consultant Lecturer, Makerere University, Department of Otolaryngology, Mulago Hospital
c Consultant Lecturer, Makerere University, Department of Microbiology
d Lecturer, Makerere University, Department of Otolaryngology

Correspondence: Rubena Justin lugela4@yahoo.com

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Background: Chronic Suppurative Otitis Media (CSOM) is a major health concern in developing countries due to its association with hearing impairment, particularly among children as it may affect their communication skills. Serious complications like meningitis and brain abscess have been reported as a cause of death.

Objective: The study aimed to determine the bacteriology, susceptibility and clinical presentation of chronic suppurative otitis media among ENT patients at Mulago, Uganda.

Methodology: We performed a cross sectional study and enrolled 89 patients. Pus was collected from the middle ear for microbial laboratory examination. Our primary outcome was microbial isolates, sensitivity patterns and common clinical features.

Results: The commonest isolates identified were *Pseudomonas aeruginosa* (17.32%), *Klebsiella pneumoniae* (17.32%), *Proteus mirabilis* (13.39%), *Escherichia coli* (9.5%) and *Staphylococcus aureus* (9.5%). *Pseudomonas aeruginosa* was found to be 64.7% sensitive to ciprofloxacin, 57.1% to chloramphenicol, and 41.2% to gentamicin. More than 60% of patients had a hearing impairment; 78% had a central perforation.

Conclusion: Susceptibility patterns to antimicrobial agent greatly varied but most demonstrated sensitivity to ciprofloxacin followed by choramphenicol and gentamicin.

Key words: chronic suppurative otitis media, bacterial isolates, susceptibility profiles

INTRODUCTION

Chronic Suppurative Otitis Media (CSOM) is an inflammation of the middle ear that causes a perforated tympanic membrane (TM) with persistent discharge lasting more than three months [1]. The World Health Organization (WHO) in 2008 estimated 65-330 million individuals affected worldwide, with 60% experiencing significant hearing impairment [2]. In the developed world and emerging economies disease prevalence was estimated at as low as 1% for UK and Denmark, and 1-2% for Brazil. However, prevalence is high in developing countries such as Tanzania (6%) [1]. In Uganda, unpublished prevalence data of under-five year old patients with CSOM gave a figure of 13.2%, which is double the known global prevalence [3]. CSOM is commonly found among children of poor socio-economic status and patients with inadequate health care access [4].

Global patterns of CSOM show the commonly encountered microbial isolates are *Staphylococcus aureus, Pseudomonas aeruginosa, Proteus mirabilis, Escherichia coli* and *Klebsiella pneumoniae* [5]. According to WHO microbial predominance and their antibiotic sensitivity patterns change over time which warrants periodic reviews [1]. It has been noted that different geographical regions yield different types of organisms [6].

Unpublished 2008 Ugandan data of HIV-positive children with CSOM, showed *Proteus mirabilis* and *Pseudomonas aeruginosa* to be the commonest isolates sensitive to ciprofloxacin at 78% [7]. It is not known whether the same is reflected among the general population across all age groups.

This study aimed to determine the bacteriology, susceptibility and clinical presentation of chronic suppurative otitis media among ENT patients at Mulago, Uganda.

Table 1. Number and percent of common organisms isolated from the ear swabs by age groups

Bacterial isolate	Age groups (years) <5 n (%)	6-12 n (%)	13-18 n (%)	>18 n (%)	Total n (%)
Klebsiella pneumonia	6(27.3)	5(22.7)	2(9.1)	9(40.9)	22(17.3)
Pseudomonas aeruginosa	3(13.6)	2(9.1)	4(18.2)	13(59.1)	22(17.3)
Proteus mirabilis	3(17.6)	5(29.4)	4(23.5)	5(29.4)	17(13.4)
Actinobacter spp	3(21.4)	4(28.6)	1(7.1)	6(42.8)	14(11)
Escherichia Coli	3(25)	2(16.7)	1(8.3)	6(50)	12(9.4)
Staphylococcus aureus	3(25)	0(00)	3(25)	6(50)	12(9.4)
Citrobacter spp	3(30)	2(20)	0(00)	5(50)	10(7.8)
Morganella Spp	1(25)	2(50)	0(00)	1(25)	4(3.2)
Viridian Streptococcus spp	1(25)	1(25)	0(00)	2(50)	4(3.2)
Enterobacter spp	0(00)	0(00)	0(00)	3(100)	3(2.4)
Enterococcus spp	1(50)	1(50)	0(00)	0(00)	2(1.6)
Serratia spp	2(100)	0(00)	0(00)	0(00)	2(1.6)
Haemophilus influenza	1(100)	0(00)	0(00)	0(00)	1(0.8)
Providencia Spp	0(00)	0(00)	0(00)	1(100)	1(0.8)
Moraxella catarrhalis	0(00)	0(00)	1(100)	0(00)	1(0.8)
Total	30(23.6)	24(18.9)	16(12.6)	57(44.9)	127(100)

Table 2. Gram stain and bacterial culture

	Positive n (%)	Negative n (%)
Gram stain	89(94.6%)	5(5.4%)
Culture	88(93.6%)	6(6.4%)

METHODOLOGY

A descriptive cross sectional study of 89 patients diagnosed with CSOM attending the outpatient clinic were consecutively enrolled. These patients had persistent/ recurrent ear discharge of more than three months and a perforated tympanic membrane. Patients who declined consent and/or had a narrowed ear canal were excluded. Aural toilet using sterile cotton or suction was done and the tympanic membrane visualized using an otoscope and/ or otomicroscope (12.5X). Samples from the discharging middle ear were collected with a sterile ear swab guarded by appropriate speculum size, put in armies media and transported for laboratory examination.

Data were entered into EPI-info version 3.2.2, coded and exported to SPSS version 16 for statistical analysis using a univariate, bivariate and multivariate methods.

Chi square was used to assess the effect of previous exposure to an antibiotic for CSOM and the type of organisms isolated.

RESULTS

There were 47 patients aged under 18 years and 42 aged over18 years; 52 were males and 37 were females. Five patients had bilateral CSOM; swabs were taken from each ear. The number and percent of common organisms isolated from the ear swabs by age groups are shown in Table 1. The number of bacterial isolates per swab were one (33%), two (47%) and three (20%).

Table 2 shows the distribution of bacteria by culture and gram stain. The findings of sensitivity tests of bacterial isolates to the common antimicrobials was done and shown in Table 3. Among the 89 patients with CSOM, 86 (91.5%) presented with offensive discharge and 59 (62.8%) with reduced/affected hearing. Other clinical presentations are shown in Table 4. The site of tympanic perforation in the patients with CSOM are 78% central, 16% sub-total and 6% total.

DISCUSSION

In our study there were slightly more children than adults. This is similar to results of studies in Pakistan and Ethiopia [8, 9]. This could be attributed to frequent URTI and the short and more horizontal eustachian tube found in a child which means infections are more easily spread.

Medical seeking behaviour is usually commoner in females than males but in this study 58% were males and

Table 3. Sensitivity of bacterial isolates to antimicrobials

	Drugs tested showing percentage (%) of sensitivity									
	Chloramphenicol	Gentamicin	Co-trimoxazole	Ciprofloxacin	Amikacin	Ceftriaxone	Cefuroxime	Amoxicillin-clavulanic acid	Ampicillin	Piperacillin tozabactum
Klebseilla pneumoniae	50	60	21.4	57.1	69.2	74	77	5	10	80
Pseudomonas aeruginosa	57.1	41.2	0	64.7	81.3	-	-	-	-	63.2
Proteus mirabilis	46.7	92.9	33.3	88.2	90	77.8	71.4	50	33	100
Acintobacter spp	33.3	60	0	85.7	90.8		0	100	100	80
Escherichia coli	54.5	70	0	87.5	71.4	82	57	9	0	100
Staphylococcus aureus	83.3	83.3	0	75	-	-	-	-	-	-
Citrobacter spp	66.7	60	40	55.6	85.7	60	25	20	14.3	100
Morganella spp	33.3	50	0	66.7	50	75	100	0		100
Streptococcus viridians	50	-	-	0	-	50	-	-	100	-
Enterobacter spp	66.6	66.7	0	100	100	66.7	0	33.3	-	100
Serratia spp	50	100	50		100	0	50	0	0	-
Haemphilus influenza	0	-	-	50	-	-	0	0	0	-
Providencia spp	100	-	0	100	-	100	100	-	-	-
Moraxella spp	-	100	-	-	100	-	-	-	-	-

42% were females. However other studies showed a higher ratio of females to males [10, 11]. This gender variation could be just an incidental finding.

The commonest isolates identified were Pseudomonas aeruginosa 22(17.32%), *Klebsiella pneumoniae* 22 (17.32%), *Proteus mirabilis* 17 (13.39%), *E.coli* 12 (9.5%), and *Staphylococcus aureus* 12(9.5%). These are similar to findings in Ethiopia [9] India [12], Nigeria [13] and Singapore [14]. A 2008 study in Uganda on the bacteriological profiles of patients aged under 12 years diagnosed with CSOM showed no difference in microbial colonization among those with or without HIV infection [7].

In this study 67% of the samples showed polymicrobial isolates compared to 33% mono-microbial. This is contrary to studies in India and Indonesia where 30.6% had more than one organism, 64% had a single isolate and 5% had no growth [12, 15]. However, another Indian study concurred with our results [16].

Finding poly-microbial isolates can pose a challenge when selecting a relevant antimicrobial agent due to different sensitivities and resistance within the same sample. In this study the isolates were tested for susceptibility with the most common antimicrobial agents. We found that *Pseudomonas aeruginosa* has a sensitivity of 64.7% to ciprofloxacin, 81.3% to amikacin, 57.1% to chloramphenicol, and 41.2% to gentamicin. These findings are similar to a Nigerian study [13]. *Klebsiella pneumoniae* was 80% sensitive to piperacillin, 74.1 % to ceftriaxone, 69.2% to amikacin, 60% to gentamicin, 57.1% to ciprofloxacin, 50% to chloramphenicol and 5 % to amoxicillin-clavulanic acid. The susceptibility of Proteus mirabilis to ciprofloxacin was 88.2%, 90% to amikacin, 92.9% to gentamicin, 77.8% to cephalosporin and 46.7% to chloramphenicol. *Staphylococcus aureus* is susceptible to ciprofloxacin in 75% of the isolates, 83.3% sensitive to chloramphenicol. Among the three common topical antibiotics tested the order of susceptibility decreases from ciprofloxacin, gentamicin to chloramphenicol. This finding matches those of Abera et al and Singh et al [12, 9].

Table 4. Clinical features of CSOM in 89 patients

Feature	n	%
Discharge offensive	86	91.5
Reduced/affected hearing	59	62.8
Pain in the ear	25	26.6
Dizziness, fever or headache	12	12.9
Perforation of the ear drum	94	100
Meningitis	1	1.1
Facial palsy	2	2.1
Mastoiditis	2	2.1
Treatment was given before?	89	100.0

Klebsiella pneumoniae, Pseudomonas aeruginosa and Staphylococcus aureus show some degree of resistance across all the antibiotics tested. Meroxella spps were however tested for amikacin and gentamicin and found to show no resistance. The rest of the organisms show selective resistances. There was complete resistance reported by Haemophilus influenza to chloramphenicol, ceftriaxone, amoxicillin- clavulanic acid, and ampicillin but 100% sensitive to gentamicin only.

This study demonstrated that most patients with CSOM presented with an offensive mucoid ear discharge and reduced hearing. This tallies with a 2004 global WHO study in which 60% of CSOM patients suffered hearing impairment[1]. Among the patients who complained of pain, headache, dizziness and fever, 3.2% developed a complication – which is similar to the 4.1% of patients with complications found by Mamon et al [10]. The commonest complications were mastoiditis, facial palsy and meningitis.

Bilateral disease was seen in 5.6% of our patients; Mohit et al in India found 7% bilateral disease [17]. Most of the microbes we found were different in both ears and this concurred with a study in South Africa [18].

All the participants had perforation of the ear drum; 78% had central perforation, 16% subtotal and 6% total perforation. This is similar to studies conducted by Memon et al in which the frequency of central perforation was 89% compared to 11% subtotal [10]. Other studies had the same finding where 22.1% were subtotal perforations and 77.9% central perforations [18].

CONCLUSION

- The commonest isolates implicated in causation of CSOM in this study was Klebsiella pnuemoniae and Pseudomonas aeruginosa, followed by Proteus mirabilis, E.coli and Staphylococcus aureus. Polymicrobial isolates were seen in 67% of the patients.
- Susceptibility patterns to antimicrobial agents greatly varied but most demonstrated sensitivity to ciprofloxacin, followed by chloramphenicol, and gentamicin.
- The major clinical features of patients were mucoid offensive ear discharge associated with reduce hearing in more than 60% and mainly having central perforation.

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