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Research Article

Microbiology and Drug Sensitivity Pattern for Patients with Chronic Otitis Media in Aldiwanyia Teaching Hospital

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ABSTRACT

Background: Otitis media (OM) refers to a group of complex infectious and inflammatory diseases affecting the middle ear. OM in general is very common, as studies show that around 80 % of children should have experienced at least one episode by their third birthday. OM has been broadly classified into two main types, acute and chronic. Acute OM (AOM) is characterized by the rapid onset of signs of inflammation, specifically bulging and possible perforation of the tympanic membrane, fullness and erythema, as well as symptoms associated with inflammation such as otalgia, irritability and fever.

Aim of the study: The aim of this study is to find out the microbiological profile (bacteria and/or fungi) and their antibiotic sensitivity patterns in patients with chronic otitis media who were attended the ear, nose and throat (ENT) Department in Al-Diwaniyah Teaching Hospital.

Patients and Method: The sample of patients was collected from the pool of patients attending the Outpatient Department of ear, nose and throat (ENT) in Al-Diwaniyah Teaching Hospital, complaining of signs and symptoms suggestive of chronic otitis media. this study was started from 1st of January to 30th of June 2020 year in six months duration. The lab work was accomplished at the central laboratory of Al-Diwaniyah Teaching Hospital. The patients who had chronic pus discharging ears for at least 3 months from all age groups and who were not on antibiotics treatment (systemic or local) for at least 5 preceding days, were included in this study.

Results: The study included a total of 89 patients with chronic otitis media. Out of all cases 46 patients were females in a percentage of 51.68 % and 43 patients were males in a percentage of 48.31%. Culture examination showed that 86 patients (96.6 %) had positive single aerobic bacterial growth, two patients had negative culture (2.2 %) and a single patient had fungal growth in the form of Candida Albicans, as shown in figure 4.3. The 86 patients with positive bacterial growth were categorized into 30 (34.9 %) and 56 (65.1 %) as having gram positive and gram negative bacteria, respectively. Regarding gram positive bacteria, 22 patients had staphylococcus aureus and 8 patients had streptococcus species. Among 56 patients who had gram negative bacterial growth ,24 patients(42.85%) had Pseudomonas aerugenosa,18 patients(32.14%) had Proteus species , 9 patients (16.07%) had Escherichia coli (E. coli),5 patients(8.92%), had Klebsiella species

Conclusion: By knowing of the microbiological and drug sensitivity pattern of chronic otitis media we can achieve some objectives and aims as follows: We can get efficient treatment for the patients with complete eradication of infection and reduce the suffering of the patients from chronic discharging ears. Prevention of the complications of chronic otitis media and reduce the morbidity and mortality of the infection.

INTRODUCTION

Otitis media (OM) refers to a group of complex infectious and inflammatory diseases affecting the middle ear (1, 2). OM in general is very common, as studies show that around 80 % of children should have experienced at least one episode by their third birthday (2). OM has been broadly classified into two main types, acute and chronic. Acute OM (AOM) is characterized by the rapid onset of signs of inflammation, specifically bulging and possible perforation of the tympanic membrane, fullness and erythema, as well as symptoms associated with inflammation such as otalgia, irritability and fever (1, 2). Despite appropriate antibiotic therapy, AOM may progress to chronic suppurative OM (CSOM) characterized by persistent drainage from the middle ear associated with a perforated ear drum. When examined by otoscope, the middle ear looks red and inflamed with purulent discharge in CSOM patients (2). It is one of the most common chronic infectious diseases worldwide especially affecting children (3, 4). Hearing impairment is one of the most common sequelae of CSOM (5). The resultant hearing loss can have a negative impact on a child's speech development, education and behaviour (2). Mortality due to complications of CSOM is

typically higher than other types of OM. Intracranial complications like brain abscess and meningitis are the most common causes of death in CSOM patients (6).

The most common cause of OM is bacterial infection of the middle ear. *Pseudomonas aeruginosa* and *Staphylococcus aureus* are the most common aerobic microbial isolates in patients with CSOM, followed by *Proteus vulgaris* and *Klebsiella pneumoniae* (7-9). A number of studies from different countries including India, Nepal, Singapore and Nigeria have reported that *P. aeruginosa* is the most common pathogen that causes CSOM, followed by *S. aureus* (10-14). However, studies from Pakistan (Gilgit), Iran and Saudi Arabia reported *S. aureus* as the most predominant pathogen, followed by *P. aeruginosa* (15-17). The difference in the various studies could be due to the differences in the patient population studied and geographical variation. A cross-sectional study of bacterial microbiota in middle ear, adenoid and tonsil specimens from a paediatric patient with chronic serous OM utilizing 16S rRNA gene-based pyrosequencing analysis revealed *Pseudomonas* spp. as the most common pathogen present in the middle ear, whereas *Streptococcus* spp. dominated the tonsil microbiota at relative abundance rates of 82.7 and 69.2 %, respectively (18).

The current study was aiming at evaluating the microbiological profile (bacteria and/or fungi) and their antibiotic sensitivity patterns in patients with chronic otitis media who were attended the ear, nose and throat (ENT) Department in Al-Diwaniyah Teaching Hospital.

PATIENTS AND METHODS

The sample of patients was collected from the pool of patients attending the Outpatient Department of ear, nose and throat (ENT) in Al-Diwaniyah Teaching Hospital, complaining of signs and symptoms suggestive of chronic otitis media. this study was started from 1st of January to 30th of June 2020 year in six months duration. The lab work was accomplished at the central laboratory of Al-Diwaniyah Teaching Hospital. The patients who had chronic pus discharging ears for at least 3 months from all age groups and who were not on antibiotics treatment (systemic or local) for at least 5 preceding days, were included in this study.

RESULTS

Demographic characteristics of patients enrolled in the study

Demographic characteristics of patients enrolled in the study are shown in table 4.1. The study included a total of 89 patients with chronic otitis media. Out of all cases 46 patients were females in a percentage of 51.68 % and 43 patients were males in a percentage of 48.31%. The frequency distribution of patients according to age is shown in table 4.1. The distribution was as following: age range from 2 to 10 years accounted for 4 (4.5 %), age range from 11 to 21 years accounted for 8 (9.0 %), age range from 21 to 30 years accounted for 18 (20.22 %), age range from 31 to 40 years accounted for 34 (38.2 %), age range from 41 to 50 years accounted for 17 (19.1 %), age range from 51 to 60 years accounted for 4 (4.5 %) and age range from 61 to 80 years accounted for 4 (4.5 %). The frequency distribution of patients according to gender was as following: Males accounted for 43 (48.3 %) and females accounted for 46 (51.7 %) and the male to female ratio was 1: 1.07, as shown in table 4.1 and figure 4.2.

Table 1: Demographic characteristics of patients enrolled in the study

Characteristic	Value
Number of cases	89
Age (years)	
1 – 10, *n* (%)	4 (4.5 %)
11-20, *n* (%)	8 (9.0 %)
21- 30, *n* (%)	18 (20.2 %)
31- 40, *n* (%)	34 (38.2 %)
41- 50, *n* (%)	17 (19.1 %)
51-60, *n* (%)	4 (4.5 %)
61- 80, *n* (%)	4 (4.5 %)
Mean ±SD	34.45 ±11.69
Range	2-80"
Gender	
Male, *n* (%)	43 (48.3 %)
Female, *n* (%)	

Male: Female	1:1.07

n: number of cases; **SD**: standard deviation

Results of bacterial isolation according to culture: Culture examination showed that 86 patients (96.6 %) had positive single aerobic bacterial growth, two patients had negative culture (2.2 %) and a single patient had fungal growth in the form of Candida Albicans, as shown in figure 4.3. The 86 patients with positive bacterial growth were categorized into 30 (34.9 %) and 56 (65.1 %) as having gram positive and gram negative bacteria, respectively, as shown in figure 4.4. Classification of patients with aerobic bacterial growth according to isolated bacterial strains is shown in table 4.2.

Regarding gram positive bacteria, 22 patients had staphylococcus aureus and 8 patients had streptococcus species. Among 56 patients who had gram negative bacterial growth ,24 patients(42.85%) had Pseudomonas aerugenosa,18 patients(32.14%) had Proteus species , 9 patients (16.07%) had Escherichia coli (E. coli),5 patients(8.92%), had Klebsiella species, as shown in table 4.2.

Table 2: Classification of patients with aerobic bacterial growth according to isolated bacterial strains

	Gram positive *n* = 30	*N*	%	Gram negative *n* = 56	*N*	%
Isolated bacteria	Staphylococcus aureus	22	73.3	Pseudomonas aerugenosa	24	42.9
	Streptococcus species	8	26.7	Proteus species	18	32.1
				Escherichia coli	9	16.1
				Klebsiella species	5	8.9

Therefore in order to frequency, the most common bacterial isolate in this study is Pseudomonas aeruginosa for 24 patients, then Staphylococcus aureus for 22 patients, then the Proteus species for 18 patients, then *E. coli* for 9 patients, then Streptococcus species for 8 patients then Klebsiella for 5 patients.

Antibiotic sensitivity test

As in table 4.3 which shows the antibiotic sesnsitivity and resistance of Staphylococcus aureus ,the bacteria had highest sensitivity to Vancomycin by 95% ,followed by Amikacin in 91% ,then Clindamycin in 86%,then Cephalexin in 82%,then Gentamycin in 77%,then C hloramphenicol in73%,then Ciprofloxacin in 68%. The bacteria had more resistant to Erythromycin by77 %, followed by Ampicillin by 64%, then Cefoxitin by 55%.

As in table 4.4, the Pseudomonas aeruginosa had a highest sensitivity to Imipenem by 100% followed by Aztreonam by 89%, then Amikacin by 83%,Tobramycin by 72%.The bacteria had a highest resistance to Augmentin by 94%,followed by Tetracycline in 89%, then ceftriaxone in 67%.

Table 3: Shows the antibiotic sensitivity and resistance of Staphylococcus aureus

Antibiotic	Sensitivity *n* (%)	Resistance *n* (%)
Ampicillin	8(36%)	14(64%)
Amikacin	20(91%)	2(9%)
Cephalexin	18(82%)	4(18%)
Chloramphenicol	16(73%)	6(27%)
Ciprofloxacin	15(68%)	7(32%)
Cefoxitin	10(45%)	12(55%)
Clindamycin	19(86%)	3(14%)
Erythromycin	5(23%)	17(77%)
Gentamycin	17(77%)	5(23%)
Vancomycin	21(95%)	1(5%)

As in table 4.4, the Proteus species had a highest sensitivity to Amikacin in 92%, followed by Ciprofloxacin and Tobramycin in 85%,then Aztreonam in 76%,then Imipenem in 69%. The bacteria had a highest resistance to Augmentin in 69%, followed by tetracycline in 62%,then Ceftazidime in 54%.

Table 4: Shows antibiotic sensitivity and resistance of Pseudomonas aeruginosa

Antibiotic	Sensitivity *n* (%)	Resistance *n* (%)
Amikacin	20(83%)	4(17%)

Augmentin	1(6%)	23(94%)
Tobramycin	17(72%)	7(28%)
Imipenem	24(100%)	0(0%)
Piperacillin	13(56%)	11(44%)
Aztreonam	21(89%)	3(11%)
Ciprofloxacin	16(67%)	8(33%)
Ceftazidime	11(44%)	13(56%)
Ceftriaxone	8(33%)	16(67%)
Tetracycline	3(11%)	21(89%)

Table 5: Show the antibiotic sensitivity and resistance of Proteus species

Antibiotic	Sensitivity *n* (%)	Resistance *n* (%)
Amikacin	17(92%)	1(8%)
Ciprofloxacin	15(85%)	3(15%)
Imipenem	12(69%)	6(31%)
Ceftriaxone	10(54%)	8(46%)
Piperacillin	11(62%)	7(38%)
Aztreonam	14(76%)	4(24%)
Tobramycin	15(85%)	3(15%)
Augmentin	6(31%)	12(69%)
Ceftazidime	8(46%)	10(54%)
Tetracycline	7(38%)	11(62%)

As in table 4.6, the Klebsiella had a highest sensitivity to Imipenem in 100%. followed by Aztreonam and Ceftazidime in 80%, then Ciprofloxacin, Piperacilin, Amikacin and Tobramycin in 60%. The bacteria had highest resistance to Tetracycline in 80%, followed by Augmentin and Ceftriaxone in 60%.

Table 6: shows antibiotic sensitivity and resistance of klebsiella

Antibiotic	Sensitivity *n* (%)	Resistance *n* (%)
Amikacin	3(60%)	2(40%)
Ciprofloxacin	3(60%)	2(40%)
Imipenem	5(100%)	0(0%)
Augmentin	2(40%)	3(60%)
Ceftriaxone	2(40%)	3(60%)
Aztreonam	4(80%)	1(20%)
Tobramycin	3(60%)	2(40%)
Tetracycline	1(20%)	4(80%)
Ceftazidime	4(80%)	1(20%)
Piperacillin	3(60%)	2(40%)

As in table 6, *E coli* had a highest sensitivity Imipenem in 100%, followed by Aztreonam, Tobramycin, Amikacin and Ciprofloxacin in 89%. The bacteria had a highest resistance to Tetracycline and Augmentin in 67%.

Table 7: Shows antibiotic sensitivity and resistance of E. coli

Antibiotic	Sensitivity *n* (%)	Resistance *n* (%)
Amikacin	8(89%)	1(11%)
Ciprofloxacin	8(89%)	1(11%)
Imipenem	9(100%)	0(0%)
Ceftazidime	7(78%)	2(22%)
Piperacillin	5(56%)	4(44%)
Ceftriaxone	6(67%)	3(33%)
Tobramycin	8(89%)	1(11%)
Tetracycline	3(33%)	6(67%)
Augmentin	3(33%)	6(67%)

Aztreonam	8(89%)	1(11%)

As in table 4.8, Streptococcus species had a highest sensitivity for Cephalexin and Erythromycin in 88% ,followed by Clindamycin in 75%, then Chloramphenicol, and Ciprofloxacin in 63% . The bacteria had a highest resistance for Gentamycin in 75% , followed by Cefoxitin 63%.

Table 8: shows antibiotic sensitivity and resistance of Streptococcus species

Antibiotic	Sensitivity *n* (%)	Resistance *n* (%)
Amikacin	4(50%)	4(50%)
Ampicillin	4(50%)	4(50%)
Ciprofloxacin	5(63%)	3(37%)
Gentamycin	2(25%)	6(75%)
Clindamycin	6(75%)	2(25%)
Chloramphenicol	5(63%)	3(37%)
Cefoxitin	3(37%)	5(63%)
Vancomycine	4(50%)	4(50%)
Cephalexin	7(88%)	1(12%)
Erythromycin	7(88%)	1(12%)

As in table 4.9, the most effective antibiotic for gram positive bacteria is Vancomycin,Cephalexin and Clindamycin in (83%),followed by Amikacin in 80%,then Chloramphenicol in 70% . The gram positive bacteria had a greatest resistance to Erythromycin and Ampicillin (60%), followed by Cefoxitin (57%).

Table 9: Shows the antibiotic sensitivity and resistance of gram positive bacteria

Antibiotic	Sensitivity *n* (%)	Resistance *n* (%)
Amikacin	24(80%)	6(20%)
Ampicillin	12(40%)	18(60%)
Cephalexin	25(83%)	5(17%)
Cefoxitin	13(43%)	17(57%)
Chloramphenicol	21(70%)	9(30%)
Ciprofloxacin	20(67%)	10(33%)
Erythromycin	12(40%)	18(60%)
Clindamycin	25(83%)	5(17%)
Gentamycin	19(63%)	11(37%)
Vancomycin	25(83%)	5(17%)

The most effective antibiotic for gram negative bacteria isImipenem (89%), followed by Amikacin (86%), then Aztreonam (84%), then Tobramycin (77%), then Ciprofloxacin (75%). The gram negative bacteria had greatest resistance to Augmentin (79%), followed by Tetracycline (75%), then Ceftriaxone (54%), then Ceftazidime (46%), then piperacillin (43%), as shown in table 4.10.

Table 10: Shows antibiotic sensitivity and resistance of gram-negative bacteria.

Antibiotic	Sensitivity *n* (%)	Resistance *n* (%)
Amikacin	48(86%)	8(14%)
Augmentin	12(21%)	44(79%)
Ciprofloxacin	42(75%)	14(25%)
Ceftazidime	30(54%)	26(46%)
Ceftriaxone	26(46%)	30(54%)
Aztreonam	47(84%)	9(16%)
Imipenem	50(89%)	6(11%)
Piperacillin	32(57%)	24(43%)
Tetracycline	14(25%)	42(75%)
Tobramycin	43(77%)	13(23%)

DISCUSSION

One of major health issues is chronic suppurative otitis media,, and Iraq is one of the countries having high rate of this condition where urgent attention is necessary (19). It's a chronic disorder with high risk of complications that are irreversible. The disease is a major cause of hearing loss that is preventable especially in the developing countries (20) and a cause of serious attention, especially in children, as it may result in long-term sequelae on early language development, communication, educational process, auditory processing and cognitive and physiological evolution (19). Microbiological diagnosis that is early, enables prompt and efficient therapy to avoid such sequelae. The prevalence of culture positive cases of chronic otitis media was high in the current study. It has been found that the chronic otitis media was more common in second and first decade of life. This finding is in accordance with the observations previously made by other authors (21-25). High prevalence rate of chronic otitis media in pediatric age group may be related to the fact that they are more liable to "upper respiratory tract infections". In addition, weather that is cold predisposes children to upper respiratory tract infections (26, 27). The proliferation of pathogens that are opportunistic with blockage of Eustachian tube may follow Poor hygiene and treatment that is non-rational like use of concoctions such as oil and honey into the middle-ear may initiate and unconventional ear drops (28).

The male to female ratio was estimated to be 1.2:1. Cases of chronic otitis media were more frequent in females than in males. This observation is in line with the findings of some previous authors (25, 29) and in contradiction to other authors (23, 30). As the current study enrolled, a random choice of patients the female predominance over males may be just a statistical finding lacking scientific explanations. Furthermore, there is no established anatomical difference in the ear anatomy of female and male.

In this study, culture examination showed that 86 patients (96.6 %) had positive single aerobic bacterial growth, two patients had negative culture (2.2 %) and a single patient had fungal growth in the form of Candida Albicans. The 86 patients with positive bacterial growth were categorized into 30 (34.9 %) and 56 (65.1 %) as having gram positive and gram negative bacteria, respectively.

In line with these findings reports have been issued by other authors. Aslam, *et al*. from Pakistan (31) in their study on 142 samples showed that 23.9% were mixed cultures and 76% of patients were pure culture and only 2.1% have fungi, whereas, Poorey and Iyer from India (23) in their study on 100 cases have described mixed growth from 10, pure growth from 82, , and absent growth in 8 cases. Variation in results of different authors may have been due to the variation in the patient population studied and variations in geographical location. In the present study, mono-microbial cause was found to be more frequent (51.84%) and this observation was issued by previous authors (23, 24, 29). An Iranian study (32) described mono-microbial cause to be seen in 100% of 61 cases studied. In contrary, few authros found polymicrobial casue more frequent in association with chronic otitis media (28, 33).

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