

Original Research Article

Bacterial profile and antimicrobial susceptibility patterns of otitis media among children in Qatar

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ABSTRACT

Background: Otitis Media (OM) common diseases affecting children below 5 years of age with a harmful effect on their hearing and health status. Data about the bacterial profile and current antimicrobial resistance status of Otitis Media in the region is scarce. Objective of this study determine the causative organisms of Otitis Media and antimicrobial susceptibility patterns among children in a Primary Health Care Corporation (PPHC) centers, Qatar.

Methods: A cross-sectional study was conducted in PPHC from Jan 2016 to Dec 2017. A total of 181 patients with Otitis Media presented to PHCC centers were enrolled in the study. Socio-demographic and clinical data were documented and analysed.

Results: A total of 181 children, an almost equal number of male (49.7%) and female (50.3%) participants were involved in the study. 51.4% of participants were ≤5 years of age. Bacteria isolated were: *Pseudomonas Aeruginosa* (27.6%), *Hemophilus Influenza* (13.3%), *Staphylococcus Aureus* (11.6%), *Methicillin-Resistant Staphylococcus Aureus* (MSRA) (11.0%), *Streptococcus Pyogenes* (10.5%), *Streptococcus Pneumonia* (6.6%), *Moraxella Catarrhalis* (2.2%), *Klebsiella Pneumonia* (0.6%). The sensitivity of *Pseudomonas Aeruginosa* was (100%) to cotrimoxazole, vancomycin, and piperacillin, (96%) to cefepime and gentamicin, and was (88.2%) to ciprofloxacin. *MRSA* sensitivity was (100%) to vancomycin, rifampicin, and teicoplanin, (89%) to clindamycin.

Conclusion: *Pseudomonas Aeruginosa* was the most frequent isolated bacteria. An overall antimicrobial resistance pattern seen in bacteria isolates ranges from 0% to 66.7%. The antimicrobial-resistant rate was observed for Ampicillin, Augmentin, and cefuroxime whereas ciprofloxacin, cefepime, chloramphenicol, cotrimoxazole, gentamicin, vancomycin, and amikacin were found effective for the isolated resistant bacteria.

Keywords: Antibiotic sensitivity, Bacterial isolates, Otitis Media, Primary Health Care Corporation, Qatar

INTRODUCTION

Acute otitis media (AOM) one of the most common infections in children aged <5 years, OM is characterized by the presence of middle-ear effusion together with symptoms including ear discharge (otorrhea), fever, irritability, and earache.^{1,2} The cumulative worldwide AOM incidence rate is 10.85%, which is about 709 million cases per year, out of which 51% occur in

children aged <5 years.¹ Approximately 80% of children are affected by AOM during their first 5 years of life, the incidence rate is higher in males than females.³ Estimates for 2005 suggest that the incidence rates of AOM in South Asia and North Africa (Middle East regions) were 14.52% and 8.67%, respectively.¹ The disease burden is greatest between 6 months and 18 months of age and if left untreated, may lead to permanent hearing loss.⁴ Furthermore, recurrent AOM episodes may lead to

chronic suppurative otitis media potentially resulting in severe complications, such as intracranial infection, hearing impairment and facial paralysis.^{2,5} Bacteria and viruses are responsible for most OM cases, and OM is one of the main reasons for primary-care physician consultations and antibiotic prescriptions.⁶⁻⁹ The most common bacterial pathogens in OM are *Streptococcus pneumoniae*, *Hemophilus influenzae*, and *Moraxella catarrhalis*.^{10,11} Other pathogens responsible for OM are *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella spp.*, *Pseudomonas aeruginosa*, and *Proteus spp.*⁴ Literature reported that the geographical area and respiratory infections may affect the type of OM pathogens.¹² In a study done on OM in the US, UK, and Eastern Europe, *Streptococcus pneumoniae*, *Hemophilus influenzae*, and *Moraxella catarrhalis* recovered in 18%, 5%, 1% of the patients respectively showing the variable incidence of those microorganisms according to the geographical area.¹² In an Iranian study, the most frequently isolated microorganisms have been *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Proteus sp.*¹³ Commonly prescribed antimicrobials for the treatment of OM infection include penicillin, cephalosporins, vancomycin, and macrolides (clarithromycin and azithromycin).¹⁴ Bacterial resistance to antimicrobial agents has become an increasing problem in the treatment of OM.^{8,15} A multicenter surveillance study, carried out in Asia and Europe, demonstrated a high prevalence of antimicrobial resistance among respiratory pathogens and important differences in antimicrobial resistance profiles between countries.¹⁶ Pathogens that cause acute OM to become resistant to commonly used antibiotics.^{15,17,18} The increasing rates of antibiotic resistance are due to repeated exposure to these bacteria to antibiotics and the geographic spread of resistant strains.¹⁹ The rapid emergence of multidrug-resistant OM in developing countries is a new potential threat to the survival of newborn babies and children.¹² Bacterial resistance to commonly prescribed antimicrobial agents has become a worldwide increasing problem in the treatment of otitis media. There are some verities on published information about the etiology and antimicrobial susceptibility and resistance patterns of OM bacteria according to geographical distribution. There is little published information about the etiology and antimicrobial susceptibility and resistance pattern of OM bacteria available in our region. The current study aimed to study and analysis the causative organisms and antimicrobial susceptibility patterns of OM pathogens isolated by ear culture from children with discharging OM during the years of 2016-2017 in PHCC centers.

METHODS

A cross-sectional retrospective study was conducted by Physicians in Primary Health Care Corporation (PPHC) the main provider of primary health care in Qatar. Researchers collected and reviewed clinical data of 181 children with OM who undergone ear culture in PHCC centers from 1st January 2016 to 31 December 2017. Data

were extracted from electronic patients' files with the help of the HIM (health information management) section in PHCC. Data collected includes demographic characteristics, ear culture reports isolated bacteria, and their antibiotic susceptibility test results. Cases of discharging OM >18 years old and Patients who have received antimicrobial therapy within 7 days before specimen collection were excluded from the study. Data were analyzed using the Statistical Package of Social Study SPSS software. The discrete variable was expressed in the form of frequencies and percentages. Permission and Ethical clearance No: PHCC/RS/18/08/003 were obtained from the Research Section Committee in PHCC and followed necessary rules of keeping patient's data anonymous and confidential. Result findings published to help the patients.

RESULTS

The total number of children with OM was 181 patients. Age range from 1-18 years and mean age with standard deviation was ± 4.8 years. Children ≤ 5 years old were 93 patients (51.4%), children 6-12 years old were 58 patients (32%) and the remaining 30 patients (16.6%) were above 12 years old. Males were 90 patients (49.7%) and female were 91 patients (50.3%) Table (1).

Table 1: Socio demographical data of patients with discharging otitis media who did ear culture at PHCC (2016-2017) (n=181).

Variables	No	%	Valid percent	Cumulative %
Sex				
Male	90	49.7	49.7	49.7
Female	91	50.3	50.3	100
Age				
≤ 5.9 years	93	51.4	51.4	51.4
>6-12 years	58	32.0	32.0	83.4
>12-18 years	30	16.6	16.6	100.0
Total	181	100%	100	

The pattern of culture and organisms isolates in all 181 patients were as following: *Pseudomonas Aeruginosa* (27.6%), *Hemophilus Influenza* (13.3%), *Staphylococcus Aureus* (11.6%), *MRSA* (11.0%), *Streptococcus Pyogenes* (10.5%), *Streptococcus Pneumonia* (6.6%), *Moraxella Catarrhalis* (2.2%), *Klebsiella Pneumonia* (0.6%) Table (2).

The sensitivity of *Pseudomonas Aeruginosa* was (100%) to cotrimoxazole, vancomycin, and piperacillin, (96%) to cefepime and gentamicin, and was (88.2%) to ciprofloxacin. *Hemophilus Influenza* sensitivity was (100%) to Augmentin, cefuroxime, cefepime,

tetracycline, and ciprofloxacin, was (84.2%) to ampicillin, and was (70%) to clarithromycin. *Staphylococcus Aureus* sensitivity was (100%) to

Augmentin, cefuroxime, cefepime, and chloramphenicol, (93%) to ciprofloxacin, cotrimoxazole, and gentamicin, (85%) to erythromycin and clarithromycin.

Table 2: Frequency of isolated organisms from ear swab culture of children with otitis media at PHCC (2016-2017) (n=181).

	No	%	Valid Percent	Cumulative Percent
<i>Pseudomonas Aeruginosa</i>	50	27.6	4.4	4.4
<i>Hemophilus Influenza</i>	24	13.3	13.3	17.7
<i>Staphylococcus Aureus</i>	21	11.6	0.6	18.2
<i>MRSA</i>	20	11.0	10.5	28.7
<i>Streptococcus Pyogenes</i>	19	10.5	11.6	40.3
<i>Streptococcus Pneumonia</i>	12	6.6	27.6	68.0
<i>Moraxella Catarrhalis</i>	4	2.2	11.6	79.6
<i>Klebsiella Pneumonia</i>	1	0.6	11.0	90.6
<i>Turicella otitidis</i>	1	0.6	6.6	97.2
No bacterial growth	21	11.6	2.2	99.4
Fungus	8	4.4	.6	100.0
Total	181	100.0 %	100.0	

Table 3: Susceptibility patterns to antibiotics of isolated bacterial species from ear swabs of children with otitis media at PHCC (2016-2017) (n=181).

Antibiotic	Bacteria								
	P A	HI	S A	M RSA	S Py	S Pn	M C	K P	T C
AMP	-	84.2	57	0.00	94.7	66.7	0.00	0.00	100
AUG	-	100	100	11	100	80	100	100	
CEFA	-	100	100	10	100	100	100	-	-
CEFU	-	100	100	0.00	100	58.3	100	100	-
CEFE	96	100	100	0.00	100	100	100	-	-
CIP	88.2	100	93	50	0.00	100	100	-	-
GEN	96	-	93	52	100	-	100	100	100
ERY	-	-	85	60	100	58.3	100	-	-
CLA	-	70	86	10	93.8	-	100	-	-
CLI	-	-	100	89	100	-	-	-	-
PIP	100	-	-	33	-	-	-	-	-
VAN	100	-	-	100	-	-	-	-	-
COT	100	33.3	94	64.7	100	83.3	-	-	100
CHL	-	-	100	100	-	100	-	-	-
TET	-	100	100	81	-	75	-	-	-
RIF	-	-	100	100	-	-	-	-	-
TEI	-	-	-	100	-	-	-	-	-
AMI	97.2	-	-	0.00	-	-	100	-	-

Key: HI *Hemophilus Influenza*, KP *Klebsiella Pneumonia*, S Py *Streptococcus Pyogenes*, Nil No bacteria, PA *Pseudomonas Aeruginosa*, SA *Staphylococcus Aureus*, MRSA *Methicillin Resistant Staphylococcus Aureus*, S Pn *Streptococcus Pneumonia* MC *Moraxella Catarrhalis*, TC *Turicella otitidis*, F Fungus. AMP Ampicillin, AUG Augmentin, CEFA Cefazolin, CEFU Cefuroxime, CEFE Cefepime, CIP Ciprofloxacin, GEN Gentamicin, ERY Erythromycin, CLA Clarithromycin, CLI Clindamycin, PIP Piperacillin, VAN Vancomycin, COT Cotrimoxazole, CHL Chloramphenicol, TET Tetracycline, RIF Rifamycin, TEI Teicoplanin, AMI Amikacin.

MRSA sensitivity was (100%) to vancomycin, rifampicin, and teicoplanin, (89%) to clindamycin, 50% to ciprofloxacin and gentamicin, resistant to penicillin and cephalosporin antibiotics. *Streptococcus Pyogenes*

sensitivity was 100% to Augmentin, cefazolin, cefuroxime, cefepime, gentamicin, erythromycin and cotrimoxazole, 94% to ampicillin and clarithromycin, resistant to ciprofloxacin. *Streptococcus Pneumonia*

sensitivity was 100% to cefazolin, cefepime, and ciprofloxacin, 80% to Augmentin and cotrimoxazole, 66.7% to ampicillin and 58.3 to cefuroxime and erythromycin (Table 3).

DISCUSSION

OM is a common disease, especially in the pediatric population all over the world. In the current study male to female ratio was almost equal in contrast to the previous study reported male gender associated with a higher incidence of OM.²⁰⁻²² This may be explained by the health care, lifestyle, behavioral, and socioeconomic status provided to all children without sex discrimination.

In current study Children ≤ 5 years old 93 patients (51.4%), while children 6-12 old 58 patients (32%), and the remaining 30 patients (16.6%) were above 12 years old. This agreed with previous studies that mentioned acute OM is the most common disease in children below 5 years old.^{21,23,24}

Frequency of bacterial isolates in the current study

Pseudomonas Aeruginosa (27.6%), *Staphylococcus Aureus* groups (22.6%) (which was *Staphylococcus Aureus* (11.6%) and Methicillin-Resistant *Staphylococcus Aureus* MRSA (11.0%)), *Hemophilus Influenza* (13.3%), *Streptococcus Pyogenes* (10.5%), *Streptococcus Pneumonia* (6.6%), *Moraxella Catarrhalis* (2.2%). This is in agreement with previous studies reported *Pseudomonas Aeruginosa* as the predominant agent in OM pathogens as in the study which revealed that the prevalence of *Pseudomonas Aeruginosa* was (23%) and *Staphylococcus Aureus* (18%).^{25,26} As well as studies from India, Nigeria and Pakistan show the most prevalent microorganism was *Pseudomonas Aeruginosa*.^{17,27-29} Also study by Orji and Dike the most common bacteria were *Pseudomonas Aeruginosa* (44%), *Staphylococcus Aureus* (17%). In contrast other studies show *Staphylococcus Aureus* more than *Pseudomonas Aeruginosa* as in study in Yemen by Bin Mohanna and Bahannan which found OM pathogens was *Staphylococcus Aureus* (44%), *Pseudomonas Aeruginosa* (12.6%), *Enterococcus* (12.6%), *Streptococcus Pneumonia* (10%), also Jordanian study by Al-Shara found the most common bacterial species isolated was *Staphylococcus Aureus* (59.9%), *streptococcus pneumonia* (22.4%), *Pseudomonas Aeruginosa* (7.7%), also Ethiopian study showed that OM agents were *Staphylococcus Aureus* (20%) *Pseudomonas Aeruginosa* (14.5%), *Klebsiella Pneumonia* (10%), also study show *Staphylococcus Aureus* (48.9%), and Saudi study by reported *Staphylococcus Aureus* was the most frequently isolated bacteria in OM below 5 years old. However other studies that reported S pneumonia as the predominant agents in children with OM.^{6,7,9,13,21,22,30,31}

The sensitivity of *Pseudomonas Aeruginosa* was (100%) to cotrimoxazole, vancomycin, and piperacillin, (96%) to

cefepime and gentamicin, and was (88.2%) to ciprofloxacin. *Hemophilus Influenza* sensitivity was (100%) to Augmentin, cefuroxime, cefepime, tetracycline, and ciprofloxacin, was (84.2%) to ampicillin, and was (70%) to clarithromycin. *Staphylococcus Aureus* sensitivity was (100%) to Augmentin, cefuroxime, cefepime, and chloramphenicol, (93%) to ciprofloxacin, cotrimoxazole, and gentamicin, (85%) to erythromycin and clarithromycin. MRSA sensitivity was (100%) to vancomycin, rifampicin, and teicoplanin, (89%) to clindamycin, 50% to ciprofloxacin and gentamicin, resistant to penicillin and cephalosporin antibiotics. *Streptococcus Pyogenes* sensitivity was (100%) to Augmentin, cefazolin, cefuroxime, cefepime, gentamicin, erythromycin, and cotrimoxazole, (94%) to ampicillin and clarithromycin, resistant to ciprofloxacin. *Streptococcus Pneumonia* sensitivity was (100%) to cefazolin, cefepime, and ciprofloxacin, (80%) to Augmentin and cotrimoxazole, (66.7%) to ampicillin and (58.3%) to cefuroxime and erythromycin. Bin Mohanna and Bahannan, noted the sensitivity of *Staphylococcus Aureus* to cefotaxime and azithromycin was (98%) to Augmentin (92%) and (82%) to gentamicin, *Pseudomonas Aeruginosa* sensitivity to cefotaxime was (100%), to azithromycin and gentamicin was (98%) and it was (80%) to cefaclor, *Streptococcus pneumonia* sensitivity to cefotaxime, azithromycin, Augmentin (100%). Reported Amikacin (90%) and Gentamicin (89%) had a high level of antibacterial effect on all OM bacterial agents.^{21,31} Found the sensitivity of *Pseudomonas Aeruginosa* to ceftazidime and imipenem was 1(00%), to ciprofloxacin (92%), to amikacin and gentamicin (85%). *Staphylococcus aureus* sensitivity to methicillin and vancomycin was (100%) to ciprofloxacin (91%).²⁶ To sulbactam-ampicillin (73%) and to gentamicin and cotrimoxazole was (63%). Our result findings comparable to other studies, it shows further evidence the microbial profile and antimicrobial susceptibility test pattern of OM has been changeable with time from the past maybe because of geographical difference, vaccination programs, in patients groups studied and local antibiotics prescribed. Emerging of antibacterial resistant is continue and in part is due to random, overuse of antibiotics in viral infections and indiscriminate of its use in bacterial infections. A small sample of the current study makes limitation in its conclusion and call for further studies with large sample size.

CONCLUSION

In the current study, OM was more common in children younger than 5 years old. *Pseudomonas Aeruginosa* was the most frequent isolated bacteria in OM followed by *staphylococcus aureus* and *Hemophilus influenza* then *streptococcus pyogenes* in all age groups. An over-all antimicrobial resistant pattern seen in all bacteria isolates range from 0% to 66.7%. A high level of antimicrobial-resistant rate was observed for Ampicillin, Augmentin, and cefuroxime whereas ciprofloxacin, cefepime,

chloramphenicol, cotrimoxazole, gentamicin, vancomycin, and amikacin were found effective against isolated resistant bacteria. Therefore, the treatment of chronic and refractory cases advice to be guided by antibiotics susceptibility testing.

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