

Isolation and Antibiotic Susceptibility of Bacteria from Otitis Media Infections in Children in Rabat Morocco

Imane Es-said ^{1*}, Rachid Mahdoufi ², Maâmar Yagoubi ³, Mimoun Zouhdi ⁴

1. Department of Microbiology, Faculty of Medicine and Pharmacy, University Mohammed V, Souissi, Rabat, Morocco
 2. Division of ORL and Neck Surgery, Hospital 20August 1953, CHU Ibn Rushd, Casablanca, Morocco
 3. Department of Microbiology, Faculty of Medicine and Pharmacy, University Mohammed V, Souissi, Rabat, Morocco
 4. Microbiology Laboratory of of Ibn Sina Hospital, Rabat, Morocco
- * E-mail of the corresponding author: imane_es-said@hotmail.com

Abstract

An inflammation of the middle ear by bacteria, viruses or champignons is called otitis media. The objective of this study was to determine the microbial etiology of otitis media in children in Rabat, and susceptibility pattern commonly prescribed antibiotics. Samples of ear swabs were collected from patients at the pediatric hospital, CHU Ibn Sina Rabat, during the period between February 2012 and March 2013. The total number of isolates was 67 (66 bacteria and *Candida* spp 1). Of these 66 bacteria spp, *Streptococcus pneumoniae* was the highest number (27) followed by *Pseudomonas aeruginosa* (16), *Staphylococcus aureus* (15), *Escherichia coli* (3), *Klebsiella* spp (3), *Proteus* species (2), and *candida* spp (1). This study out showed that the peak incidence was found in the age group 0-5 years (62,69%), followed by the group 5-10 years (20.90%), by cons, the group age 10-16 years was a rate of 16.41%. All bacteria were resistant to penicillin. . *Pseudomonas aeruginosa*, *Escherichia coli* and *Klebsiella* spp were resistant to certain antibiotics such as ofloxacin, amoxicillin, amoxicillin+clavulanic-acid, levofloxacin and cefuroxime. All strains of streptocoques pneumoniae were sensitive to ciprofloxacin, but all resistant to amoxicillin, cefuroxime and penicillin. All strains of *Proteus* spp were susceptible to ciprofloxacin, levofloxacin, ofloxacin, only resistant to amoxicillin. Accordingly, sufficient knowledge of the antibacterial susceptibility of bacteria, the judicious use of antibiotics and the periodic evaluation of the resistance profile of antibiotic sensitivity in the region is very important in order to avoid failure in the treatment of otitis media in children.

Keywords: Otitis media, bacteria, antibacterial susceptibility, resistance, children

1. INTRODUCTION

The ear is an organ of the sense of hearing and also maintaining balance. Anatomically, it is divided into outer, middle and inner ear. The outer and middle regions are more prone to injury and infection (Richard. E. B. et al. 1996).

An inflammation of the middle ear by bacteria, viruses or champignons is called otitis media (OM). There are main categories of OM; acute otitis media, middle ear secretion, also known as chronic otitis media with effusion and chronic otitis media with or without cholesteatoma (Harkness P et al. 2013).

Ear infections may also occur when you have allergies. Viral infection or allergic reaction can cause swelling of the duct between your ear and your throat (the Eustachian tube). The swelling can house bacteria in the middle ear and cause bacterial infection (McKesson 2013, Atlas RM 1998).

Acute otitis media is an acute condition with middle ear effusion with standard symptoms such as fever, pain, restless sleep, irritability, a feeling of blockage in the ear, dizziness. Acute otitis Media is defined as a state with at least three or four episodes a year (Klein JO 1994, Alho OP 1997).

Chronic suppurative otitis media is the chronic inflammation of the middle ear and mastoid mucosa in which the tympanic membrane is perforated and discharges of grayish-white, homogeneous, turbid, and viscous secretions are present (Gül HC et al. 2006, Nelson JD 1988, Verhoeff M et al. 2006). Effusion of OM may be serous, mucoid or purulent (Abera B et al. 2008). OM may be associated with infection or may be sterile. The sterile variety is usually called serous OM and is often attributed to allergy, but may also occur from numerous other potential sources including radiation treatment or virus (Alho OP 1997, Daly KA 1991).

OM is very common in children, with a peak incidence between 4-7 years (Bluestone CD et al. 1995). Nearly half of these children will have three ear infections or more during their first three years. The reasons for the high incidence in these populations are anatomical differences in the skull base and biological susceptibility of the Eustachian tube (Chan KH et al. 1993).

OM is a disease of infants and young children, but it also affects adults. Its incidence is higher in men than in women (GateGA 1996, Paradise JL et al. 1997).

Seasonal cultural socio-economic status, and age factors, and family history of the disease of the middle ear, are the most important factors of risk (Rotowa NA et al. 1989).

The pathogens responsible for OM are *Streptococcus pneumoniae*, *Haemophilus influenza*, *Moraxella catarrhalis*, *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella*, *Pseudomonas aeruginosa* and *Proteus* (Klein JO 1994, Kilpi T et al. 2001, Jacobs MR et al. 1998).

The objective of this study was to determine the microbial etiology of OM in children in Rabat, and susceptibility pattern commonly prescribed antibiotics.

2. MATERIALS AND METHODS

2.1. Sample collection

Samples of ear swabs were collected from patients at the pediatric hospital, CHU Ibn Sina Rabat, during the period between February 2012 and March 2013,

Swabs were, immediately sent to the microbiology laboratory of the hospital Avicenna Rabat.

These samples were inoculated onto MacConkey and blood agar after incubated at 37 ° C aerobically, also inoculated on chocolate agar and incubated in a jar of CO₂ at 37 ° C under anaerobic conditions.

Then a review of live Gram was done for all samples, and observed under an optical microscope at a magnification of 400 times.

The characteristics of the bacteria were determined thanks to the appearance of the bacterial colony, the reaction of a gram, cultural characteristics and biochemical tests using the API 20E galleries, API 20NE, API Staph, Api Api and Strep A (Cheesbrough 2005).

2.2. Antibiotic sensitivity testing

Antimicrobial susceptibilities to antibiotics were determined by disk diffusion as recommended by the Clinical and Laboratory Standards Institute (CLSI) guidelines (Clinical Laboratory Standards Institute 2011).

Antifungal sensitivity test was not included in the study.

3. RESULTS

The results of this study are shown in Tables 1, 2 and 3:

- Number of pathogens (bacteria and *Candida* spp) isolated
- Distribution of patients according to their ages
- Antibiotic sensitivity profile of all bacteria involved

Table 1. Distribution of pathogens in otitis media(OM)

Pathogenic Agent	OM number	OM rate %
Streptococcus pneumoniae	27	40,30
Pseudomonas aeruginosa	16	23,89
Staphylococcus aureus	15	22,39
Escherichia coli	3	4,47
Klebsiella species	3	4,47
Proteus species	2	2,99
Candida species	1	1,49
Total	67	100

Table No. 1 shows the distribution of pathogens isolated. The total number of isolates was 67 (66 bacteria and Candida spp 1). Of these 66 bacteria spp, Streptococcus pneumoniae was the highest number (27) followed by Pseudomonas aeruginosa (16), Staphylococcus aureus (15), Escherichia coli (3), Klebsiella spp (3), Proteus species (2), and candida spp (1).

Table 2. Distribution of otitis media (OM) by the patient age

AGE (years)	Number of sufferers	Rate of sufferers %
0 - 5	42	62,69
5 - 10	14	20,90
10 - 16	11	16,41
Total	67	100

Table No. 2 shows the distribution of OM according to age brackets. Children two to five years are the most affected (50.75%).

Table 3. Antibiotic susceptibility-resistance profile (number) of all the bacteria isolated from children suffering from otitis media (OM)

Pathogenic Agent		Gentamicine	Ciprofloxacin	Levofloxacin	Ofloxacin	Amoxycilline	Ceftriaxone	Augmentin	Cefuroxime	Penicillin
Streptococcus pneumoniae (n=27)	S	6	20	22	2	0	17	0	14	0
	R	21	7	5	25	27	10	27	13	27
Pseudomonas aeruginosa (n=16)	S	4	6	2	0	0	3	0	0	0
	R	12	10	14	16	16	13	16	16	16
Staphylococcus aureus (n=15)	S	10	15	7	4	0	10	1	0	0
	R	5	0	8	11	15	5	14	15	15
Escherichia coli (n=3)	S	3	2	3	2	0	1	2	0	0
	R	0	1	0	1	3	2	1	3	3
Klebsiella species (n=3)	S	1	1	0	0	1	0	1	0	0
	R	2	2	3	3	2	3	2	3	3
Proteus species (n=2)	S	1	2	2	2	0	1	1	1	0
	R	1	0	0	0	2	1	1	1	2

KEY: S = Sensitive R = Resistant n = Number of bacteria

Table No. 3 shows the antibiotic susceptibility-resistance profile (%) of all the OM bacteria isolated.

4. DISCUSSION

Our study found that *Streptococcus pneumoniae* was found to be the most common bacterial pathogen in infections of OM (40.30%), followed by the pathogen *Pseudomonas aeruginosa* (23.89%), followed by *Staphylococcus aureus* (22.39%), *Escherichia coli* (4.47%), finally, *Klebsiella* spp (4.47%) and bacteria *Proteus* spp with a rate of (2.99%). (Table 1)

These results are consistent with research conducted in the United States of America and Bulgaria (Kilpi T et al.2001, Jacobs MR et al. 1998).

We isolated *Candida* spp in a child which is comparable to result found by some researchers (Miguel et al. 2005, Saini S et al. 2005). (Table 1)

This study out showed that the peak incidence was found in the age group 0-5 years (62,69%), followed by the group 5-10 years (20.90%), by cons, the group age 10-16 years was a rate of 16.41%. (Table 2)

There has been a decline in the rate of OM with increasing age children.

Two studies carried out in Eastern and Western Nigeria confirmed the result of the inverse relationship between age of the child and the incidence of OM (Okesola AO et al. 2012, Adonu et al. 2013).

This could, perhaps, due to the anatomy of the Eustachian tube, which is horizontal, wide and short especially in children. These features, enabling advantage to pathogens to mount from the nasopharynx to the middle ear cavity (Bluestone CD et al. 2001).

Table 3 shows the percentage antibiotic susceptibility-resistance profile of all bacteria isolated from children suffering from OM.

Bacterial resistance to antibiotics becomes, over time, a major health problem. This problem limits the choice of the treatment of otitis media infections (Alsaimary IE et al. 2010).

All bacteria were resistant to penicillin; including Staphylococci spp, resistance to this antibiotic has become a serious problem worldwide (Aslam MA et al. 2004, Borg MA et al.2008, Park DC et al. 2008).

Multi-drug resistance has not ruled gram-negative bacilli. Certain strains of some species of bacteria were resistant to more than one antimicrobial agent. *Pseudomonas aeruginosa*, *Escherichia coli* and *Klebsiella* spp were resistant to certain antibiotics such as ofloxacin, amoxicillin, amoxicillin+clavulanic-acid, levofloxacin and cefuroxime. (Table 3)

Pseudomonas aeruginosa showed a remarkable resistance. All *Pseudomonas* strains were resistant to ofloxacin, amoxicillin, amoxicillin-clavulanic acid +, to cefuroxime and penicillin.

Multi-drug resistance was revealed by other studies by researchers (Miguel MI et al.2005, Saini S et al. 2005, Aslam MA et al.2004, EUCAST 2009).

Regarding the streptococques pneumoniae, all strains were sensitive to ciprofloxacin, but all resistant to amoxicillin, cefuroxime and penicillin.

An established research in Bulgaria has supported our findings for *Streptococcus pneumoniae*.

This research found that the level of antibiotic resistance of gram-positive bacteria that causing severe OM in children is very high (Lena P Setchanova et al.2013).

Escherichia coli and *Klebsiella* spp showed great sensitivity to levofloxacin, while they show a high resistance to amoxicillin, ceftriaxone and cefuroxime. (Table 3)

Proteus spp bacteria is apparently the least affected by the problem of multidrug resistance, her profile sensitivity is higher compared to other pathogens. All strains of *Proteus* spp were susceptible to ciprofloxacin, levofloxacin, ofloxacin, only resistant to amoxicillin. (Table 3)

The choice of therapeutic OM, depends of the sensitivity profile of the pathogen. Since the problem of multiple antibiotic resistances is increasing consistently, it has been summarized that OM due to *Escherichia coli* could be treated with gentamicin and levofloxacin, whereas *Streptococcus pneumoniae* could be treated with levofloxacin. *Staphylococcus* spp or *Proteus* spp infections, of middle ear, could be treated effectively by ciprofloxacin.

Pseudomonas aeruginosa and *Klebsiella* spp have not escaped the problem of multidrug resistance, therapy face these bacteria remains difficult.

5. CONCLUSION

The results of this study showed a high rate of resistance of all bacteria (particularly *Pseudomonas aeruginosa* and *Klebsiella*.spp) Isolated from samples of children's ears to commonly used antibiotics.

Accordingly, sufficient knowledge of the antibacterial susceptibility of bacteria, the judicious use of antibiotics and the periodic evaluation of the resistance profile of antibiotic sensitivity in the region is very important in order to avoid failure in the treatment of otitis media in children.

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