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Otitis Media; Etiology and Antibiotics Susceptibility among Children under Ten Years Old in Hillah city,Iraq

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Abstract:

Background: This is an aerobic bacteriological study of acute otitis media to identify common pathogens and to evaluate their antibiotic susceptibility pattern. Otitis media is a major health problem of children in low income countries.

Objectives: This study was done to determine the bacterial isolates and antimicrobial susceptibility of otitis media from children under 10 years old.

Methods: Infected samples were collected from sixty (190) children under ten years old suffering from otitis media from out clinic and Al-Hillah education Hospital in babil, Iraq. Over a 9 months period (September 2012 to May 2013). Antimicrobial susceptibility tests were performed using disc diffusion technique as per the standard Kirby-Bauer method.

Results:

In this study, 48% of patients were males and 52% were females. Patients ranged in age from 0 to 8 years old. 34 percent of patients had no previous visit and regular treatment. The results of the bacteriological studies on the 190 cases showed that microbiological culture was yielded from 190 samples. Pure cultures consist of (166/30.1%) had a single organism isolated from the middle ear discharge, while the remaining or Mixed growth (367/66.37%) had two or more organisms isolated. There were (20/3.62%) samples who had a no culture with any microorganism isolated

Conclusion: Otitis media linked with high levels of multiple antibiotic resistant bacteria is a major health concern in all age groups of the study population. There is a need for culture and susceptibility test facilities for appropriate antimicrobial therapy of otitis media and antimicrobial resistant infections.

Introduction:

Otitis media (OM) is an inflammation of the middle ear, and is a very common infection in children with a peak incidence between 4-7 years of age [1]. Children below the age of seven years are much more susceptible to otitis media since the Eustachian tube is shorter and at more of a horizontal angle than in the adults and this is also because they have not developed the same resistance to microbes as found in adults [2]. Several risk factors have been associated with OM such as previous acute otitis media, hereditary, parental smoking, attending day care centers and seasonality [3, 4]. The incidence rate is higher in male than female [5]. The most common bacterial pathogens in OM are *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis* [6, 7].

Other pathogens responsible for OM are *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella spp.*, *Pseudomonas aeruginosa*, and *Proteus* spp [8]. Literature reported that the geographical area and respiratory infections may affect the type of OM pathogens [9]. In a study done on 917 children with OM in the US and Eastern Europe, *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis* recovered in 18%, 5%, 1% of the patients respectively showing variable incidence of those microorganisms according to geographical area. In an Iranian study, the most frequently isolated microorganisms were *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Proteus* spp [10]. **C**hronic **S**upportive **O**titis **M**edia (**CSOM**) is a perforated tympanic membrane with persistent drainage from the middle ear. It is defined as infection of the middle ear that lasts

more than 3 months and is accompanied by tympanic membrane perforation [11]. Inadequate antibiotic treatment and poor hygiene conditions are related to the development of CSOM [12]. Bacterial predominance and their antibiotic sensitivity pattern change over time [13].

So, knowledge of the local pattern of infection is essential to enable efficacious treatment of this disorder. As topical antibiotic treatment is often effective and seldom harmful, most experts would start with a wide-spectrum antibiotic on an empiric basis and make a request for cultures if drug resistance is suspected. The purpose of this study was to identify the common bacterial pathogens and to evaluate their antibiotic susceptibility [12].

Materials and Methods:

Collection of samples

Infected samples were collected from sixty (**190**) children under ten years old suffering from otitis media from out clinic and Al-Hillah education Hospital in babil, Iraq. Over a 9 months period (September 2012 to May 2013).The samples were collected with sterile swab sticks which labeled for source indicating, age of patients, time of collection, date and personal history. The samples were transported in cooler boxes to the Microbiology Laboratory for analysis within 6 hours after collection. Bacterial Isolation and Identification Culture plates (MacConkey Agar (Himedia), Nutrient Agar (Oxoid), Mannitol salt agar (Himedia) Blood Agar (Oxoid) was used also to confirm the detection we used VITIC technology to identified the isolates. The swab sticks used for the collection of the samples were streaked directly on the labeled agar plates and incubated at 37°C for 24 h. Subcultures were prepared into plates of nutrient agar, and incubated for another 24 h. Biochemical tests were performed to identify microbes that could not be characterized by morphology; color or type of colony after Gram's staining. Biochemical tests applied were standard catalase test, citrate utilization, coagulase, oxidase, Voges-Proskauer, Indole production, motility, sucrose, maltose, lactose, nitrate reduction, mannitol, xylose.

Results and Discussion

In this study, 48% of patients were males and 52% were females. Patients ranged in age from 0 to 8 years old. 34 percent of patients had no previous visit and regular treatment. The results of the bacteriological studies on the 190 cases showed that microbiological culture was yielded from 190 samples. Pure cultures consist of (166/30.1%) had a single organism isolated from the middle ear discharge, while the remaining or Mixed growth (367/66.37%) had two or more organisms isolated. There were (20/3.62%) samples who had a no culture with any microorganism isolated as showed in Table 1.

The prevalence of microorganisms that infect ear in this study was as showed in table 2 as follow; *S. aureus* 187, 35.1%/ *Streptococcus pyogenes* 6, 1.1%/ *E. coli* 85, 15.9%/ *Providencia spp.* 39, 7.3%/ *Pseudomonas* 49, 9.2%/ *Klebsiella* 35, 6.6%/ *H. influenzae* 21, 3.9%/ *Proteus* 82, 15.4%/ *Corynebacterium spp.* 7, 1.3%/ *Streptococcus pneumonia* 5, 0.9% and *Moraxella spp.* 17, 3.2%. There is no significant difference between male and femal in otitis infection as showed in table 3.

Figure 1 and 2 revealed that some microorganisms have resistance to many antibiotics which used in susceptibility test while others were more sensitive. We used (AK \Amikacin, AX \Amoxicillin, AMC \Amoxicillin + Clavulanic acid, AZM \Azithromycin, , B \Bacitracin, PY \Carbenicillin, CDZ \Cefodizime, FOX \Cefoxitin, ZOX \Ceftizoxime, CL \Cephalexin, C \Chloromphenicol, CLR \Clarithromycin, DA \Clindamycin).

Staphylococcus aureus 187 (35.1%) was the commonest microbial organism to cause ear discharge followed by *Escherichia coli* 85 (15.9%) and *Proteus* 82 (15.4%). 3.62% of the cultures did not reveal any microbiological agent. *Pseudomonas* species was isolated in 49 (9.2%) of the total samples that yielded multi- organisms, *Providencia spp.* 39 (7.3%), *Klebsiella* 35 (6.6%), *H. influenzae* 21 (3.9%), *Corynebacterium spp.* 7 (1.3%), *Streptococcus pneumonia* 5 (0.9%) and *Moraxella spp.* 17 (3.2%) (Table 1).

Based on results from present study, the most common aerobic organisms of CSOM were *P. aeruginosa, S.aureus, Escherichia coli, P. mirabilis*. and *Klebsiella*. These findings correlate with earlier studies. [14-15] Similarly, P. aeroginosa was the most prevalent organism followed by S. aureus, isolated from CSOM cases reported in several studies.[16, 17,18] With the development and widespread use of antibiotics, the types of pathogenic microorganisms and their resistance to antibiotics have changed. Knowledge of the species and resistance rates of current pathogens is important for determining the appropriate antibiotics for patients with chronic suppurative otitis media [17].

The mainstay of treatment for uncomplicated CSOM is twofold: meticulous aural toilet and instillation of a topical antimicrobial agent. The therapeutic use of antibiotics is usually started empirically before the results of microbiological culture are obtained. Selection of any antibiotic is influenced by its efficacy, resistance to bacteria, safety, risk of toxicity, and cost. Knowledge of the local micro-organismal pattern causing CSOM and

their antibiotic sensitivity is therefore essential to start an effective and cost-saving treatment. Various bacteriological studies on CSOM have shown that the most frequently isolated bacteria were *P. aeruginosa*, *S. aureus*, coagulase-negative *Staphylococcus*, *Proteus species*, and *Klebsiella* species [19, 20, 21, 22, 23 and 24].

In the present study, *S. aureus* revealed a high level of resistance to amoxycillin which is in agreement with a report from Pakistan [25]. *S. aureus* showed low rate of resistance to ceftriaxone which is in parallel with a finding from Addis Ababa but 50% resistance rate was reported from Nigeria [26]. Most of *S. aureus* exhibited low levels of resistance (4.6-10%) to ciprofloxacin, norfloxacin which is also reported by [27]. However, 23% gentamicin resistance was reported from Felege Hiwote Hospital and Gondar University hospital [22]. *Pseudomonas* spp. was the most antibiotic resistant isolates in otitis media. Most of the isolates were resistant to amoxycillin, erythromycin, tetracycline, cotrimoxazole and chloramphenicol. This is comparable with other results from Ethiopia [27, 22], Nigeria [22] and Iraq [28]. However, *Pseudomonas* spp. was highly sensitive to norfloxacin and ciprofloxacin, similar to reports of findings in Gondar in Ethiopia as mention above, Brazil [23] and Pakistan [25]. Also, Ihsan from Iraq reported 25% and 50% resistance rate for ciprofloxacin and gentamicin, respectively [24]. Regarding anibiograms, a statistically significant difference was noted among bacterial isolates (p=0.001). *Pseudomonas* spp. was the most antibiotic resistant isolates in other studies which estimate twenty-five (80.6%) of Citrobacter spp. and 128 (86.5%) of *Pseudomonas* spp. were multiple resistant to two and more antimicrobials.

Because of the retrospective nature of the study we could not trace patients' detail clinical data thus the study was limited to describing types of otitis media. In conclusion, the present study indicated that otitis media is common health problem in children imply a major healthcare burden in the area.

Enterobacteriaceae, *S. aureus* and *Pseudomonas* spp. were the dominant isolates in otitis media. Most of the isolates showed high levels of antimicrobial resistance to commonly prescribed antimicrobials like AX, CDZ, CLR and AK. Therefore, culture and susceptibility testes have paramount importance for better management of otitis media and drug-resistant infections.

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Table 1.Organism cultured from ear discharge

Type of microorganism	Total Isolates	%
Pure growth	166	30.01
Mixed growth	367	66.37
No growth	20	3.62
Total	553	100.00

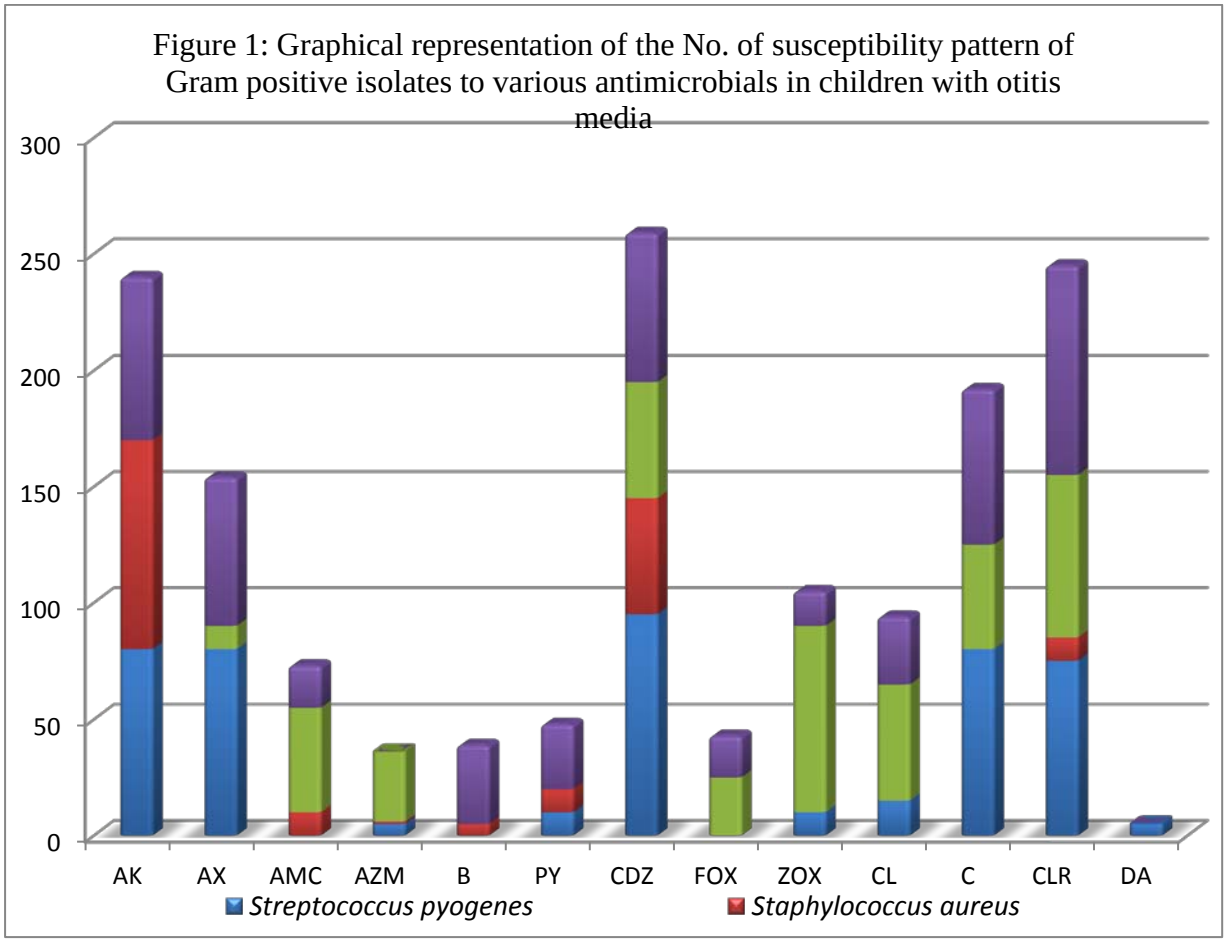
Table 2: Frequency of isolation of causative organisms of otitis media in children

Organism	No.	Total
S. aureus	187	35.1
Streptococcus pyogenes	6	1.1
E. coli	85	15.9
Providencia spp.	39	7.3
Pseudomonas	49	9.2
Klebsiella	35	6.6
H. influenzae	21	3.9
Proteus	82	15.4
Corynebacterium spp.	7	1.3
Streptococcus pneumonia	5	0.9
Moraxella spp.	17	3.2
Total	533	100.0

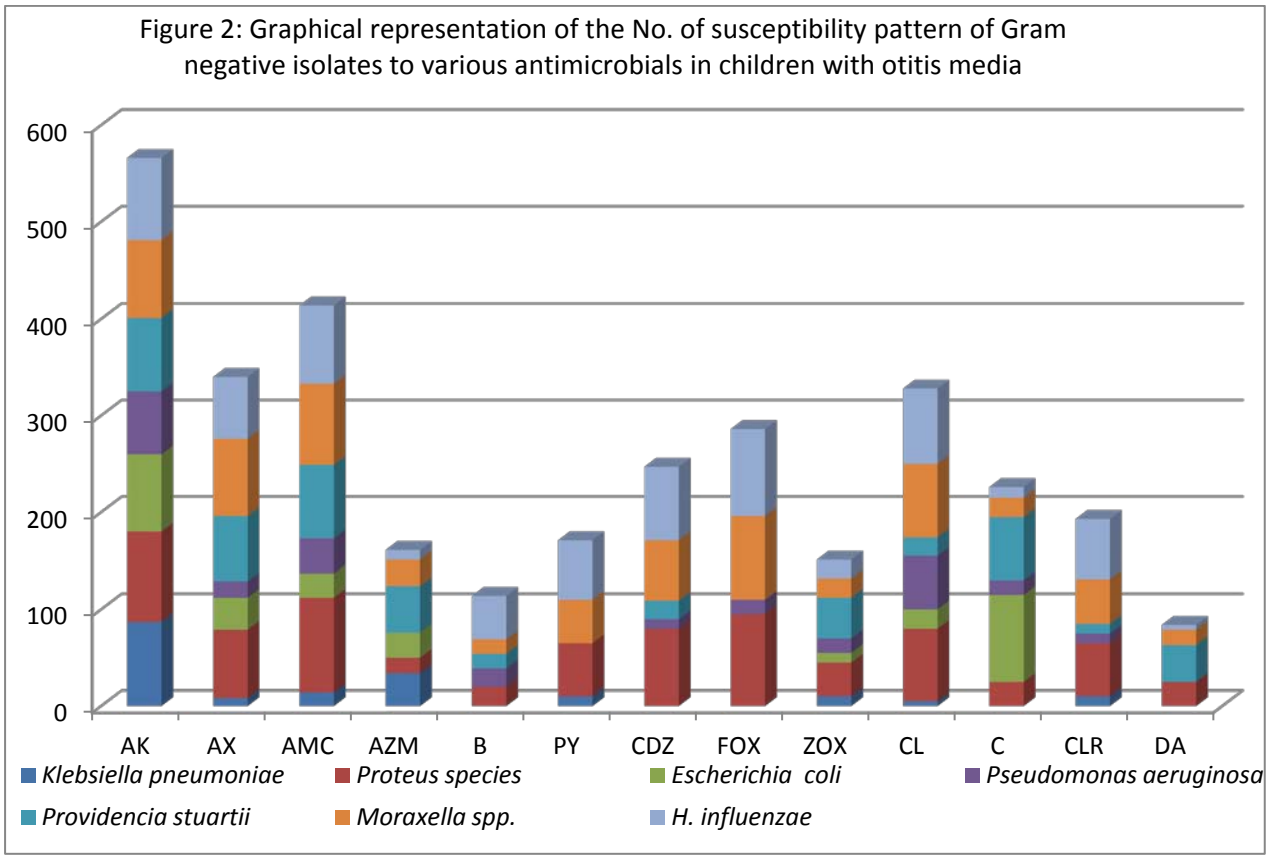
Table 3: Age and sex distribution of bacterial isolates of otitis media

Age	Sex	Types of Bacterial species											Total
		S. aureus	*S. pyogenes*	*E. coli*	*Providencia spp.*	*Pseudomonas*	*Klebsiella*	*H. influenzae*	*Proteus*	*Corynebacterium spp.*	*S. pneumonia*	*Moraxella spp.*	
0-2 y	Male	22	0	8	1	7	1	8	18	0	1	0	66
	Female	16	2	12	0	0	0	1	2	0	0	0	33
3-5 y	Male	39	0	17	0	16	0	0	6	2	0	7	87
	Female	46	0	6	24	4	8	7	27	0	0	1	123
6-8 y	Male	34	1	22	14	9	10	3	7	1	1	2	104
	Female	30	3	20	0	13	16	2	22	4	3	7	120
Total		187	6	85	39	49	35	21	82	7	5	17	533

Figure 1: Graphical representation of the No. of susceptibility pattern of Gram positive isolates to various antimicrobials in children with otitis media



AK \Amikacin, AX \Amoxicillin, AMC \Amoxicillin + Clavulanic acid, AZM \Azithromycin, , B \Bacitracin, PY \Carbenicillin, CDZ \Cefodizime, FOX \Cefoxitin, ZOX \Ceftizoxime, CL \Cephalexin, C \Chloromphenicol, CLR \Clarithromycin, DA \Clindamycin



AK \Amikacin, AX \Amoxicillin, AMC \Amoxicillin + Clavulanic acid, AZM \Azithromycin, , B \Bacitracin, PY \Carbenicillin, CDZ \Cefodizime, FOX \Cefoxitin, ZOX \Ceftizoxime, CL \Cephalexin, C \Chloromphenicol, CLR \Clarithromycin, DA \Clindamycin

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