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Original Research Article

Bacteriological Investigation of Children with Otitis Media in Al-Diwaniyah Governorate

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Abstract: (80) swabs were obtained from children with otitis media who visited the ENT consulting clinics at the Women's and Children's Hospital in Diwaniyah Governorate between 1-2-2025 and 1-4-2025. A specialist physician assisted in the collection of samples from patients of both sexes ranging in age from (1-6) years. Microscopy and biochemical testing were used to identify the isolated bacteria based on their cultural and physical traits. 80 bacterial isolates were recovered and diagnosed from children with otitis media, which are distributed as follows: 35 bacterial isolates from Pseudomonas aeruginosa with a growth rate of 43.75%, while 35 isolates from the Staphylococcus species were distributed as follows: There were 20 Staphylococcus aureus isolates with a growth rate of 25% and 15 Staphylococcus epidermidis isolates with a growth rate of 18.75%. 8 isolates from the Streptococcus pneumoniae genus were also collected with a growth rate of 10%, and two isolates from Klebsiella pneumoniae with a growth rate of 2.5% by biochemical tests. Antibiotic sensitivity testing was performed on every identified bacterial species, and the isolates' susceptibility to the antibiotics utilized varied significantly. P. aeruginosa showed 99% resistance to amoxicillin, it also demonstrated significant resistance to antibiotics (amikacin, ampicillin, and tetracycline), with rates of 75, 72, and 78%, respectively, and the lowest resistance rates to the drug cefotaxime, at 15%. St. aureus were resistant to antibiotics (amoxicillin, rifampicin, amikacin, ampicillin, and trimethoprim) at rates of 56, 50, 44, 39, and 36%, respectively, while cefotaxime sensitivity was documented at 98%. St. pneumoniae bacteria exhibited the highest resistance to amoxicillin, reaching 97%, while remaining sensitive to ampicillin at 88%. It also resisted the antibiotics (rifampicin, trimethoprim, cefotaxime, and ceftazidime) with rates of 40, 55, 59, and 64, respectively.

Keywords: Children, Otitis Media, Antibiotic, Bacteria.

INTRODUCTION

Bacterial infection refers to any form of bacteria that causes disease when it enters the body. The environment and society also play an important role in the spread of bacterial pathogens and the occurrence of various infections in the body, particularly bacteria found in hospitals, such as *Pseudomonas aeruginosa*, which causes hospital infections and is associated with ear and nose infections. It is a prevalent bacterium in developing countries like Iraq [1].

Otitis media is a disease that affects a vast number of individuals worldwide, particularly children, and causes serious health consequences. It has been discovered that 60-80% of children experience recurrent otitis media during their first years of life [2].

Common issues encountered by pediatricians. Approximately 80% of children have at least one attack of acute otitis media, and 80-90% have at least one attack of otitis media with effusion before starting school [3, 4].

Otitis media is the result of a bacterial, viral, or fungal infection. Gram-positive bacteria have been found to arise in the nasopharyngeal cavity during bacterial infections, the Gram-negative bacteria in the intestine are not from the nasopharyngeal cavity; rather, contamination of the auditory canal may be the source of the infection [5].

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A layer of ciliated, pseudostratified epithelial cells lines the middle ear. These cells have goblet cells and glands that make mucus [6]. The middle ear's link to the upper part of the respiratory system has caused it to become contaminated with pathogens such as bacteria, viruses, and others. This ear's accessibility to the external environment via the eardrum has exposed it to a variety of opportunistic bacteria that cause middle ear infections [7].

Otitis media of all forms is a prevalent health issue among individuals who visit medical clinics [8]. The community's environment and health culture have a significant impact on pathogen dissemination and otitis. Swimming in filthy water, incorrect ear canal cleaning, and a failure to maintain hygiene standards all contribute to infection and pathogen transmission [9].

METHODS AND MATERIALS

Sample Collection

(80) Swabs were obtained from children with otitis media who visited the ENT consulting clinics at the Women's and Children's Hospital in Diwaniyah Governorate between 1-2-2025 and 1-4-2025. Samples were collected using sterile cotton swabs, and information about each patient was entered on a form specifically designed for this purpose, with confirmation that the patient had not taken any antibiotics in at least three days. The swabs were then delivered directly to the laboratory. A specialist physician assisted in the collection of samples from patients of both sexes ranging in age from (1-6) years.

Culture Specimens

Medical swabs were grown on the following culture mediums (MacConkey agar medium and blood agar medium) using the planning technique. The dishes were incubated aerobically at 37 degrees Celsius for 24 hours.

Diagnosis

Microscopy and biochemical testing were used to identify the isolated bacteria based on their cultural and physical traits.

Antibiotic Sensitivity Test

The Bauer method was used to determine the sensitivity of isolated bacteria to some of the antibiotics utilized. This test included 8 different antibiotics and was conducted on the Mueller-Hinton culture medium. The plates were incubated at 37°C for 18-24 hours, allowing the antibiotic to spread to the agar and form a zone of bacterial growth inhibition surrounding the discs containing the active antibiotic [10]. The inhibitory zones were then measured in millimeters with a clear ruler. The laboratory constants specified whether the bacteria were resistant, moderately sensitive, or sensitive [11].

Isolation and Diagnosis

80 bacterial isolates were recovered and diagnosed from children with otitis media, which are distributed as follows: 35 bacterial isolates from *Pseudomonas aeruginosa* with a growth rate of 43.75%, while 35 isolates from the Staphylococcus species were distributed as follows: There were 20 *Staphylococcus aureus* isolates with a growth rate of 25% and 15 *Staphylococcus epidermidis* isolates with a growth rate of 18.75%. 8 isolates from the *Streptococcus pneumoniae* genus were also collected with a growth rate of 10%, and two isolates from *Klebsiella pneumoniae* with a growth rate of 2.5% by biochemical tests. The study's findings were similar with prior research, which found that P. aeruginosa bacteria caused the most infections, followed by St. aureus bacteria, which is compatible with the findings of [12]. A recent study indicated that P. aeruginosa bacteria are responsible for the majority of middle ear infections [13]. This study also supports the findings of [14], in his study on middle ear infections, which revealed that P. aeruginosa bacteria are the most common in cases of middle ear infections, followed by St. aureus [5], also stated that the source of infection with otitis media produced by Gram-negative enteric bacteria and P. *aeruginosa* bacteria does not always have to be the nasopharyngeal tract, but might be fecal contamination of the auditory canal. Observing the results, we discover that P. *aeruginosa* bacteria play a dominant role in the development of otitis media, which is consistent with what was discovered by [15]. This investigation also confirmed [16], that the bacteria causing this infection include P. *aeruginosa*, *St. aureus*, and *Klebsiella pneumoniae*. The strains of P. *aeruginosa* bacteria that cause otitis media are distinguished from other strains of the same species by their strong capacity to adhere to the epithelial cells lining the auditory canal [13-17]. St. *aureus* was identified as the second most prevalent microscopic bacterium isolated from otitis media.

Table 1: Lists the bacteria recovered from cases of otitis media in children under the age of seven.

Type of bacteria	number	%
Pseudomonas aeruginosa	35	43.75%
Staphylococcus aureus	20	25%
Staphylococcus epidermidis	15	18.75%
Streptococcus pneumoniae	8	10%
Klebsiella pneumoniae	2	2.5%
Total	**80**	**100%**

Sensitivity of Bacterial Isolates to Antibiotics

Antibiotic sensitivity testing was performed on every identified bacterial species, and the isolates' susceptibility to the antibiotics utilized varied significantly. P. *aeruginosa* showed 99% resistance to amoxicillin, which is consistent with Gerges' 2006 work [18]. It also demonstrated significant resistance to antibiotics (amikacin, ampicillin, and tetracycline), with rates of 75, 72, and 78%, respectively, and the lowest

resistance rates to the drug cefotaxime, at 15%. Bacterial resistance to this group of antibiotics is caused by the synthesis of beta-lactamase enzymes that are highly efficient against these medicines [19]. Bacterial resistance to these antibiotics is one of the medical issues and causes of treatment failure in the majority of middle ear infections [20]. This resistance can also be due to a change in one or more penicillin-specific enzymes (PBPs), which serve as the antibiotic's target site [21]. This type of resistance is induced by chromosomal changes that prevent the antibiotic from reaching its target within the bacterial cell. Furthermore, P. *aeruginosa* bacteria have a number of efflux pumps that transport the antibiotic out of the bacterial cell [22]. Holly *et al*., discovered that in persistent infections, some strains of P. aeruginosa create alginate, a mucopolysaccharide-based pericellular material that inhibits deadly antibiotic dosages from entering the bacterial cell [23]. It is worth noting that in 2000, Loudon discovered that harmful bacteria carry several antibiotic resistance genes on movable plasmids, particularly those resistant to new drug generations [24]. St. *aureus* were resistant to antibiotics (amoxicillin, rifampicin, amikacin, ampicillin, and trimethoprim) at rates of 56, 50, 44, 39, and 36%, respectively, while cefotaxime sensitivity was documented at 98%. This is owing to the presence of three key mechanisms by which staphylococcal bacteria resist beta-lactam drugs, in addition to manufacturing beta-lactamase enzymes, these bacteria can build internal resistance by lowering the affinity or quantity of penicillin-associated proteins, as well as withstand the antibiotics' fatal effect [25]. St. *pneumoniae* bacteria exhibited the highest resistance to amoxicillin, reaching 97%, while remaining sensitive to ampicillin at 88%. It also resisted the antibiotics (rifampicin, trimethoprim, cefotaxime, and ceftazidime) with rates of 40, 55, 59, and 64, respectively. These results are similar to those published by [26, 27], discovered that these bacteria had a resistance rate to amoxicillin of 92.31%. Resistance may result from incorrect antibiotic use, such as using antibacterial medications to treat viral infections [28], discovered that 20-50% of antibiotics used in hospitals and clinics are unnecessary, such as using medications designed for bacterial infections to treat undiagnosed infections caused by other microorganisms. This promotes the development of resistance among bacterial species, repeating these antibiotics over lengthy periods of time will spread resistance to new strains since the antibiotic promotes these strains to acquire and develop the resistance trait.

Table 2: Displays the antibiotic sensitivity of several bacterial isolates

Type of bacteria	Type of antibiotic	Resistance ratio
Pseudomonas aeruginosa	amoxicillin	99%
	amikacin	75%
	tetracycline	72%
	tetracycline	78%
	cefotaxime	15%
Staphylococcus aureus	amoxicillin	56%
	rifampicin	50%
	amikacin	44%
	ampicillin	39%
	trimethoprim	36%
Streptococcus pneumoniae	amoxicillin	97%
	rifampicin	40%
	trimethoprim	50%
	cefotaxime	59%
	ceftazidime	64%

CONCLUSIONS

Among the many types of bacteria that cause otitis media, Pseudomonas aeruginosa has emerged as the primary cause due to its ability to infect not only the nasopharyngeal tract but also the auditory tract via fecal contamination, as well as its high resistance to many antibiotics. Children aged six months to two years are more likely to develop otitis media than adults, particularly those who are bottle-fed while lying down and exposed to cigarette smoke or air pollution.

Recommendations

We advocate performing large investigations, like as this one in Diwaniyah Governorate, to detect various forms of bacteria that can cause ear infections. We also advocate performing research on the use of different types of antibiotics. We also advise against using antibiotics without first speaking with a doctor, and to take drugs exactly as prescribed. The dose must be completed, and the drug must not be discontinued, even if the health situation improves.

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