Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 13, (2024)
https://www.jneonatalsurg.com

OPEN ACCESS

Rising Incidence of Pediatric Otitis Media and The Role of Antibiotic Resistance

Sayyed Muddasir Shah[1], Haider Zaman*[2], Mubashar Ullah Jan[3], Noor Hayat Khan[4], Majid Ali[5], Usman Afzal Malik[6]

[1,2,3]Assistant professor ENT department, Mardan medical complex. Bacha khan medical college, Mardan

[4.] Specialist registrar Department of ENT Khalifa Gulnaaz teaching hospital bannu

[5]Trainee Registrar at Mardan Medical Complex (kpk)

[6]Assistant professor ENT HOD ENT department/CKMC kharian Cmh kharian

Corresponding Author:

Haider zaman

Assistant professor ENT department, Mardan medical complex. Bacha khan medical college, mardan

Email ID: haiderzaman906@yahoo.com

Cite this paper as: Sayyed Muddasir Shah, Haider Zaman, Mubashar Ullah Jan, Noor Hayat Khan, Majid Ali, Usman Afzal Malik, (2024) Rising Incidence of Pediatric Otitis Media and The Role of Antibiotic Resistance, *Journal of Neonatal Surgery*, 13, 291-296

ABSTRACT

Background: Even adding this type of ear infection to the list of common childhood illnesses produces a lot of antibiotic prescriptions. Because of environmental risks and poor use of antibiotics, more cases of antibiotic resistance are appearing all over the globe. As a result, there are more cases of drug-resistant bacteria and patients experience more recurrences, more complications and more hassles with medical care.

Objectives: To evaluate current trends in pediatric otitis media, assess patterns of antibiotic resistance among causative organisms, and analyze associated outcomes and the risk factors for recurrent infections.

Study Design: a cross-sectional study

Place and duration of study. Department Of ENT Mardan Medical Complex,Bacha Khan Medical College

Mardan, KPK During The Period From January To December 2023

Methods: 300 children ranging from 6 months to 12 years old who all had otitis media confirmed by a doctor. A culture of the middle ear fluids was done and the findings were tested against various bacteria. We recorded information about the person's age, medicine history and any previous infections. All statistical analysis was carried out with SPSS v24.0 and the significance level was $p<0.05$.

Results: 300 children the average age was 3.8 years with a standard deviation of 2.4 years. For every man there were 1.3 women in the country. Streptococcus pneumoniae (42%) and Haemophilus influenzae (35%) accounted for most of the findings. Among the cases, resistance to amoxicillin-clavulanate was recorded in 53% of them, whereas 28% of patients showed resistance to macrolides. Having taken antibiotics within the past 30 days made it much more likely to develop a resistant strain ($p=0.02$). Thirty-one percent of patients experienced a relapse, mostly those with multidrug-resistant forms of infection.

Conclusion: An increase in pediatric otitis media is connected to a rising problem with antibiotic resistance. Because amoxicillin-clavulanate is highly resisted, using antibiotics wisely and treating with culture recommendations is very important. Expanding vaccination, helping caregivers and regular monitoring of microbes helps prevent the same disease from coming back and complications related to resistance.

Keywords: *Otitis media, Pediatric infection, Antibiotic resistance, Streptococcus pneumonia*

1. INTRODUCTION

One of the leading reasons youngsters go to see a doctor and are given antibiotics is otitis media (OM), also known as a simple infection of the middle ear [1]. Children under the age of five are most likely to get viral gastroenteritis and its highest rate is seen between 6 and 24 months [2]. The most common form, AOM, usually develops when there is ear pain, high fever

and irritability just days after a person has an upper respiratory tract infection [3]. Even with better methods of diagnosis and vaccines, the worldwide rate of OM is still rising, mainly among people living in low- and middle-income countries. This is mainly due to exposure to pollution, overcrowding, poor cleanliness and unavailability of good healthcare [5]. Also, early weaning, going to daycare and being exposed to tobacco smoke consistently raise the chances of children having repeated OM infections [6] which also leads to increased AMR among these bacteria. The biggest contributors to this infection are Streptococcus pneumoniae, Haemophilus influenzae and Moraxella catarrhalis which are progressively becoming immune to typical antibiotics used for treatment such as amoxicillin-clavulanate, macrolides and cephalosporins [7,8]. Because of it, patients may heal more slowly, require risky additional treatment and encounter similar infections in the future [9]. Generation of β-lactamase by H. influenzae has been proven to significantly reduce the influence of β-lactam antibiotics on the bacteria [11]. The use of antibiotics without laboratory confirmation in LMICs leads to more resistance and this is a serious concern since antibiotic resistance is common in pediatric OM [12]. We are studying pediatric otitis media to find out its occurrence and to check the sensitivity of the isolated bacteria to medicines in children under 12 years old at a tertiary medical center. It is necessary to understand which bacteria are resistant in each region to improve treatment with antibiotics and to prevent more cases of OM

2. METHODS

This cross sectional study conducted in ENT department Mardan medical complex,Bacha khan medical college Mardan ,KPK During the period from January to December 2023 which is a tertiary care hospital. 300 kids between the ages of 6 months and 12 years exhibiting signs of otitis media were included in the study. The diagnosis depended on signs from the examination and the work of an otoscope by the ENT specialists. When the tympanic membrane was ruptured, fluid was drawn out using aspiration, but if there was no perforation, fluid was taken by the tympanocentesis procedure. The clinic followed the Kirby-Bauer method as stated by CLSI. Information about a patient's age, gender, antibiotic use and whether they have had the infection before was gathered. The permission to continue the work was granted by the Institutional Review Board. All participants' parents or guardians were given information and agreed to let their children take part in the study.

Inclusion Criteria

Children from 6 months to 12 years of age with ear infections as confirmed through clinical or otoscope examination were included in the study only after parents or guardians gave consent.

Exclusion Criteria

Individuals who had immune problems, different facial appearances, past surgery of the ears or were born with hearing problems were not included to avoid bias in the study.

Data Collection

A set of questions was used to obtain the health history, ear observations and details about the patients. Properly sterile technique was used to acquire middle ear discharge or fluid and it was sent to laboratory for analysis. After 21 days, we evaluated the patient to check for more infections and the easing of symptoms.

Statistical Analysis

SPSS 20.0 to input and examine the data. For categorical variables, we used frequencies and for continuous variables, we gave the mean and standard deviation. Chi-square and t-tests were applied to see if there were any associations. Having a p-value under 0.05 was marked as statistically significant.

3. RESULTS

Patients enrolled in the study ranged in age from 1.4 to 6.2 years with a median of 3.8 years. A total of 170 participants were males (56.7%) and the other 130 were females (43.3%). Among all the cases, Streptococcus pneumoniae was discovered in 42%, Haemophilus influenzae in 35% and Moraxella catarrhalis in 16%. The rest of the 7% consisted of organisms that were either mixed or classified as unknown. The results from antibiotic susceptibility testing showed that about half of S. pneumoniae isolates were not sensitive to amoxicillin-clavulanate and a quarter some of them were not sensitive to macrolides. Among harmful H. influenzae strains, 61% of them generate β-lactamases. Having taken antibiotics in the past 30 days was strongly linked to getting resistant strains (p=0.02). Thirty-one percent of patients developed a new treatment-resistant infection within just three weeks and this rate was greater for those infected by multidrug-resistant strains (p=0.01). On average, the mean number of OM episodes was 3.4 times per year in the group with more cases. Culture-directed therapy showed much better results in clearing up infections compared to empirical treatment.

Figure 01: Distribution of Bacterial Isolates

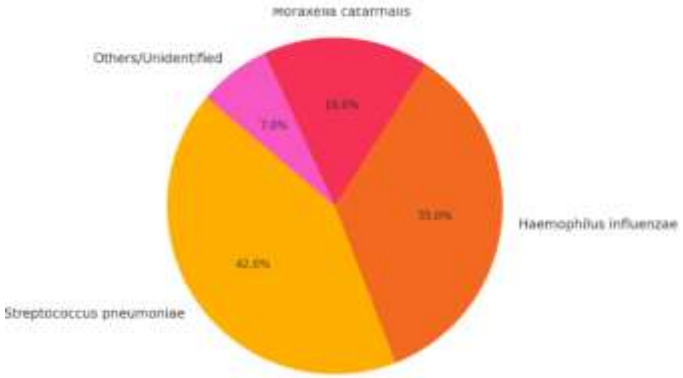

Figure 02 : Antibiotic Resistance Profile

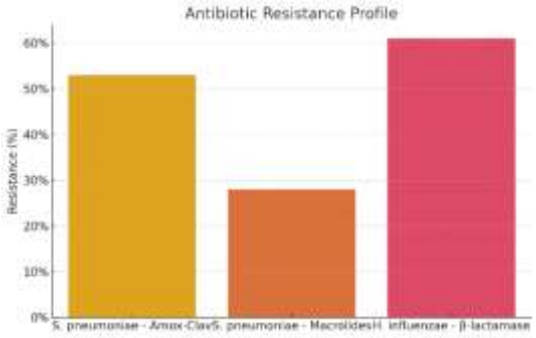

Table 1: Demographic Characteristics

Variable	Value
Total Patients	300
Mean Age (years)	3.8 ± 2.4
Male	170 (56.7%)
Female	130 (43.3%)

Table 2: Distribution of Bacterial Isolates

Organism	Frequency	Percentage (%)
Streptococcus pneumoniae	126	42.0
Haemophilus influenzae	105	35.0
Moraxella catarrhalis	48	16.0
Others/Unidentified	21	7.0

Table 3: Antibiotic Resistance Profile

Organism	Amoxicillin-Clavulanate Resistant (%)	Macrolide Resistant (%)	β-lactamase Production (%)
Streptococcus pneumoniae	53	28	-
Haemophilus influenzae	-	-	61

4. DISCUSSION

The research outlines that pediatric otitis media is becoming more common and this is partly because of antibiotic-resistant pathogens such as Streptococcus pneumoniae and Haemophilus influenzae. The prevalence of S. pneumoniae and H. influenzae in our study matches the fact that these two are the most common causes of AOM [12]. Resistance to amoxicillin-clavulanate seen in 53% of S. pneumoniae is like the findings in major studies where between 30 and 60% of cases are resistant, mainly affecting children recently treated with antibiotics.It is well known that using antibiotics in the past increases the chances of finding bacteria that are resistant to drugs. According to Venekamp et al.'s study, children who recently used antibiotics were often found with resistant types of bacteria [14]. It shows that careful management of antibiotics in children is very important to stop antimicrobial resistance (AMR) from becoming more serious.β-lactamase in H. influenzae (61% in our case) is now reported more and more often globally. A multicenter investigation carried out in Asia found that almost half of H. influenzae causing pediatric cases of OM made β-lactamase, so penicillin-type antibiotics were not useful [15]. Having enzymatic resistance is especially challenging when antibiotics are selected for therapy without conducting studies to test which strains are present.It has also been found in the literature that cases with resistant infections tend to relapse and need additional treatment. In a cohort research by Damoiseaux et al., children with multidrug-resistant S. pneumoniae had a 2.5 greater risk of repeat infection compared to children with susceptible strains [16].Thanks to S. pneumoniae and H. influenzae type b vaccination, the number of OM cases went down; still, some strains of these bacteria cause infections [17]. Because of this, we should always adjust how vaccines are made and watch which types of the virus exist.Our research recommends culture-based treatment for cases of OM that are moderate to severe or occur frequently. Similar results were found in America and the United Kingdom when doctors used microbiology results to guide patient treatment [18,19].At last, by improving care for parents, encouraging breastfeeding alone and cutting exposure to secondhand smoke, it is possible to prevent both the start and return of OM.

5. CONCLUSION

It was found that pediatric otitis media occurs often and a considerable number are related to infections caused by bacteria that resist antibiotics. The fact that common antibiotics no longer function as they should proves that intelligent use of antibiotics and proper treatment are necessary. Prevention and immunization are major public health actions to avoid diseases from coming back and developing resistance to medicines.

6. LIMITATIONS

The study only took place in one tertiary care unit which makes it difficult to apply to other centers. Cultures could only be taken from people with torn eardrums or during tympanocentesis which might mean some pathogens were not identified. Besides, the risk factors for recurrence, related to people's living conditions and the environment, were not taken into account thoroughly.

Future Findings

Additional research should study the consequences of chronic otitis media infections, check the efficiency of recently released antibiotics and look into the outcomes of using new and more recent pneumococcal and Hib vaccines. If multicenter research uses molecular tools, it can lead to earlier detection of pathogens and their properties which would direct better treatments for animals.

Acknowledgements

The authors gratefully acknowledge the dedicated support of the hospital staff and doctors at Mardan Medical Complex for their valuable assistance and contributions throughout the course of this study.

Disclaimer: Nil

Conflict of Interest:Nil

Funding Disclosure: Nil

Authors Contributions

Concept & Design of Study: **Sayyed Muddasir Shah[1], Haider Zaman[2]**

Drafting: **Mubashar Ullah Jan[3], Noor Hayat Khan[4]**

Data Analysis: **Majid Ali[5], Usman Afzal Malik[6]**

Critical Review: **Sayyed Muddasir Shah1, Haider Zaman2**

Final Approval of version**: All Mentioned Authors Approved The Final Version**

REFERENCES

[1] Venekamp RP, Sanders SL, Glasziou PP, Rovers MM: Antibiotics for acute otitis media in children. Cochrane Database Syst Rev. 2023;11:CD000219. doi:10.1002/14651858.CD000219.pub5.

[2] Mather MW, Drinnan M, Perry JD, Powell S, Wilson JA, Powell J: A systematic review and meta-analysis of antimicrobial resistance in paediatric acute otitis media. Int J Pediatr Otorhinolaryngol. 2019;123:102–109. doi:10.1016/j.ijporl.2019.05.034.

[3] Kaur R, Fuji N, Pichichero ME: Dynamic changes in otopathogens colonizing the nasopharynx and causing acute otitis media in children after 13-valent (PCV13) pneumococcal conjugate vaccination during 2015–2019. Eur J Clin Microbiol Infect Dis. 2022;41(1):37–44. doi:10.1007/s10096-021-04310-2.

[4] Sigurdsson S, Eythorsson E, Hrafnkelsson B, Erlendsdóttir H, Kristinsson KG, Haraldsson Á: Reduction in all-cause acute otitis media in children <3 years of age in primary care following vaccination with 10-valent pneumococcal Haemophilus influenzae protein-D conjugate vaccine: A whole-population study. Clin Infect Dis. 2018;67(8):1213–1219. doi:10.1093/cid/ciy252.

[5] Rosenblut A, Rosenblut M, García K, Maul X, Santolaya ME: Frequency of acute otitis media in children under 24 months of age before and after the introduction of the 10-valent pneumococcal conjugate vaccine into the national immunization program in Chile. Pediatr Infect Dis J. 2018;37(2):132–134. doi:10.1097/INF.0000000000001745.

[6] Fuji N, Pichichero ME, Kaur R: Haemophilus influenzae prevalence, proportion of capsulated strains and antibiotic susceptibility during colonization and acute otitis media in children, 2019–2020. Pediatr Infect Dis J. 2021;40(9):792–796. doi:10.1097/INF.0000000000003222.

[7] Pumarola F, Marès J, Losada I, et al.: Microbiology of bacteria causing recurrent acute otitis media (AOM) and AOM treatment failure in young children in Spain: shifting pathogens in the post-pneumococcal conjugate vaccination era. Int J Pediatr Otorhinolaryngol. 2013;77(8):1231–1236. doi:10.1016/j.ijporl.2013.05.026.

[8] Dupont D, Mahjoub-Messai F, François M, et al.: Evolving microbiology of complicated acute otitis media before and after introduction of the pneumococcal conjugate vaccine in France. Diagn Microbiol Infect Dis. 2010;68(1):89–92. doi:10.1016/j.diagmicrobio.2010.04.011.

[9] Van Dyke MK, Pirçon JY, Cohen R, et al.: Etiology of acute otitis media in children less than 5 years of age: A pooled analysis of 10 similarly designed observational studies. Pediatr Infect Dis J. 2017;36(3):274–281. doi:10.1097/INF.0000000000001430.

[10] Frost HM, Gerber JS, Hersh AL: Antibiotic recommendations for acute otitis media and acute bacterial sinusitis. Pediatr Infect Dis J. 2019;38(2):217. doi:10.1097/INF.0000000000002245.

[11] Hoberman A, Paradise JL, Rockette HE, et al.: Treatment of acute otitis media in children under 2 years of age. N Engl J Med. 2011;364(2):105–115. doi:10.1056/NEJMoa0912254.

[12] Marchisio P, Esposito S, Picca M, et al.: Prospective evaluation of the aetiology of acute otitis media with spontaneous tympanic membrane perforation. Clin Microbiol Infect. 2017;23(7):486.e1–486.e6. doi:10.1016/j.cmi.2017.01.012.

[13] Pichichero ME, Almudevar A: Serum cytokine biomarkers accurately predict presence of acute otitis media infection and recovery caused by Haemophilus influenzae. Int J Pediatr Otorhinolaryngol. 2016;83:200–204. doi:10.1016/j.ijporl.2016.02.002.

[14] . Faheem HH, Tanveer HU, Abbas SZ, Maqbool F. Comparative study of conventional steam-methane-reforming (SMR) and auto-thermal-reforming (ATR) with their hybrid sorption enhanced (SE-SMR & SE-ATR) and environmentally benign process models for the hydrogen production. Fuel. 2021;297:120769. doi:10.1016/j.fuel.2021.120769

[15] Sohail S, Ahmed A, Tanveer HU. Hollow fiber membrane for filtration of liquids. GB Patent GB2,573,404 B. November 6, 2019.

[16] Sohail S, Ahmed A, Tanveer HU. Hohlfasermembran zur Filtration von Flüssigkeiten. EP Patent EP3,563,928. May 7, 2023..

[17] Basco WT: Predicting treatment failure in kids with AOM. Medscape. 2017 Nov 27.

[18] Boggs W: Antimicrobial treatment of acute otitis media shortens duration of middle ear effusion. Medscape. 2014 May 9.

[19] Tapiainen T, Kujala T, Renko M, et al.: Effect of antimicrobial treatment of acute otitis media on the daily disappearance of middle ear effusion: A placebo-controlled trial. JAMA Pediatr. 2014;168(7):635–641. doi:10.1001/jamapediatrics.2014.67.