Antibiotic use for pneumonia in children under-five at a pediatric hospital in Jeddah city, Saudi Arabia.

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Abstract

Background: Pneumonia has been a severe cause of morbidity and mortality among children below five years. Almost 1.3 million deaths occur in children due to pneumonia. The common signs and symptoms of pneumonia include fever, cough, and Shortness of Breath (SOB). Antibiotics are commonly used to treat Pneumonia, but it should be used in appropriate doses and duration.

Aim: We aimed to review the results of antibiotic usage for treating pneumonia in children at a tertiary hospital in Jeddah, Saudi Arabia.

Method: A retrospective cohort study was done in November 2019 that involved 41 participants between (0-5) years of both gender diagnosed with Community-Acquired Pneumonia (CAP).

Result: In this study, we use about 14 kinds of antibiotics. There was no significant between the antibiotic and age group (p=0.269). Also, the relationship between the antibiotics and the frequency used of antibiotics was significant (P=0.002). On the other hand, there was an association between antibiotics with inpatient and antibiotic (p=0.001), and the combination of Clarithromycin with Cefuroxime (17.7%) was the most commonly used in both in-patients and out-patients.

Conclusion: Our study found the combination of clarithromycin and cefuroxime the most common antibiotic used (17.7%), shortness of breath common presentation. Interestingly, none of our patients were diagnosed with severe pneumonia. Using antibiotics to treat bacterial pneumonia in children should always be considered to prevent severe complications even though if the pneumonia is not severed.

Introduction

Pneumonia is known as an inflammation of the alveoli and the distal airways of the lung. It is considered a common disease that occurs due to infection by pathogenic microorganisms or even due to physical and chemical factors breathes [1]. Bacteria, viruses, and fungi, called germs, may cause pneumonia [2]. The common signs and symptoms of Pneumonia include hyperthermia, cough, and shortness of breath [1]. The risk factors of pneumonia are brain disorders, chronic lung diseases, cigarette smoking, trauma or recent surgery, and other serious illnesses [2].

Nowadays, the rate of pediatric patients who got infected with Mycoplasma Pneumoniae (MP) are increased every year across the world and patient age has shown a younger trend [3].

Childhood morbidity and mortality can be caused by pneumonia. Each year, 1.3 million deaths occur in children under five years of age due to Pneumonia. In 2010, it was estimated that almost 120 million patients with Pneumonia are younger than five years) [4].

World Health Organization Standard guidelines recommend that the treatment of pneumonia needs to use antibiotics for both primary and hospital-based care [5].

Children with non-severe pneumonia can be treated at home with oral antibiotics and children with severe pneumonia admitted and given parenteral antibiotics (benzylpenicillin or ampicillin) [6]. The incorrectly used antibiotics can cause antibiotic resistance, which means the bacteria are harder to be treated; it occurs when the bacteria in the body change or when the body is exposed repeatedly to the same medicine [7].

Also, the recurrent use of an antibiotic can cause side effects such as dizziness, nausea, diarrhea, and more severe side effect like Clostridium painful infection which leads to damage of colon and death [8].

Therefore, the resistant of bacterial pathogens has resulted in increased interest in developing more effective Vaccines, and it's an essential tool against the spread of pneumococcal disease [9].

In a Cross-Sectional (CS) study that discusses the use of antibiotics for Pneumonia among children under-five that was done in 2017 in a pediatric hospital in Dhaka city, Bangladesh,

80 children under five years old were included in the study; they found that the most commonly prescribed antibiotics among that patient are ceftriaxone by 50%, followed by cefotaxime plus amikacin (17.5%) [5].

Another study was done in 2013, a multicenter retrospective study in America, which was done to Comparative Effectiveness of Empiric Antibiotics for Community-Acquired Pneumonia (CAP). A total of 492 patients with CAP were included using medical records included children aged two months to 18 years divided into two groups: 256 (52%) received a narrow-spectrum antibiotic, and 236 (48%) received a broad-spectrum antibiotic. They found the narrow-spectrum therapy was not inferior to broad-spectrum antibiotics in all measured outcomes. The results of this study support the recently published PIDS IDSA guideline, which recommends the empiric use of aminopenicillins in CAP of hospitalized pediatric patients [10].

In 2004, a randomized, non-blinded equivalency trial study done in some countries: Ghana, India, Pakistan, Colombia, South Africa (two sites), Zambia, Vietnam, and Mexico. The total of 1702 children ages 3-59 months to evaluate through five days of treatment with ampicillin plus gentamicin injection compared with chloramphenicol in children with very severe CAP. They found that treatment failure was 19% in each group, injectable penicillin, and oral amoxicillin are equivalent to severe pneumonia treatment in controlled settings [11].

There was a randomized control trial study done in 2008 at some countries: Dhaka, Bangladesh, Guayaquil, Ecuador, Chandigarh, India, Mexico City, Mexico, Multan and Rawalpindi, Pakistan, Sana'a, Yemen, and Lusaka, Zambia. To evaluate through five days treatment with ampicillin plus gentamicin injection compared with chloramphenicol in children with very severe CAP and their age between 2-59 months. A total of 958 children involved in the study, and they found the injection of ampicillin plus gentamicin is better than chloramphenicol for the treatment of CAP in low resource settings [12].

In 2016, a retrospective study conducted in Al-Nasr hospital in Al-Madinah, Saudi Arabia, by the participation of 1059 patients from different age groups with a mean age of 56.8 years, found that the primary causative organisms of Pneumonia were *Klebsiella pneumoniae*, *Streptococcus pneumoniae*, and *Haemophilus influenzae*. They reported that the organisms which caused pneumonia were different during Hajj. As a consequence, the usual standard guideline for pneumonia treatment was ineffective for fighting these organisms [13].

However, in Saudi Arabia and mainly in the western region, the studies that investigated the use of antibiotics for the treatment of pediatric patients with Pneumonia are still not enough. So, our study aimed to review the results of antibiotics used for treating Pneumonia in children at a tertiary hospital in Jeddah, Saudi Arabia.

Method

Our study aimed to review the results of antibiotics used for treating Pneumonia in children at a tertiary hospital in Jeddah, Saudi Arabia. A retrospective cohort study between the years 2014-2019 was done in November 2019 that included participants between (0-5) years of both genders diagnosed with CAP. We excluded children with known drug allergy or children who suffer from chronic respiratory disease, congenital diseases, such as congenital heart disease congenital immune deficiency disease, tuberculosis infection, and immune abnormalities, such as acquired immune deficiency syndrome, tumor, and those with clinical features of viral pneumonia. Demographics, clinical presentation, lab, and radiological investigations, and antibiotic used was collected from the electronic medical records using a data collection sheet. Data entry was performed by using Microsoft Excel 2019, and data analysis were performed by SPSS Version 21, T-test and chi-square test was used to find the relationship between variables. A significant relationship was considered when P-value <0.05.

Results

Demographics

Our study aimed to review the results of antibiotic usage for treating pneumonia in children at a tertiary hospital in Jeddah, Saudi Arabia. The study included 41 participants diagnosed with pneumonia, 22 (53.7%) of them were females with 19 (46.3%) males. The youngest patient was 0.2 months old, and the most past was 36 months old (3 years), and the mean age was 9.556 ± 9.8766. Regarding the nutritional state, 39 patients (95.1%) were underweight while two patients (4.9%) had average weight, and the mortality rate was 7.3% (3:41) (Table 1).

Among the participants the most common age group was (3-12) months 56.1% (23:41), 29.3% (12:41) for (0-2) months and 14.6% (6:41) for (13-36) months Table 2.

Sociodemographic characteristics						
Male	19	46.3%	0.2	36	9.556	9.8766
female	22	53.7%				
Normal weight patients	2	4.9%				
Underweight patients	39	95.1%				
Deceased patients	3	7.3%				

Table 1. Sociodemographic characteristics of hospitalized children with pneumonia children.

	Frequency	Percent%
0-2	12	29.3

03-12	23	56.1
13-36	6	14.6
Total	41	100

Table 2. Age groups of patients include in the current study.

Antibiotic used

Fourteen kinds of antibiotics were included in this study. The combination of Clarithromycin/Cefuroxime was the most common antibiotic used 8(19.5%) followed by the clarithromycin 4(9.7%), cefuroxime 3(7.3%), azithromycin/Clarithromycin combination 2(4.9%), azithromycin/ceftriaxone/cefuroxime combination 2(4.9%), clarithromycine/ceftriaxone combination 2(4.9%), clarithromycine/ceftriaxone/cefuroxime combination 2(4.9%), clarithromycine/azithromycin/ceftriaxone combination 2(4.9%) (Figure 1).
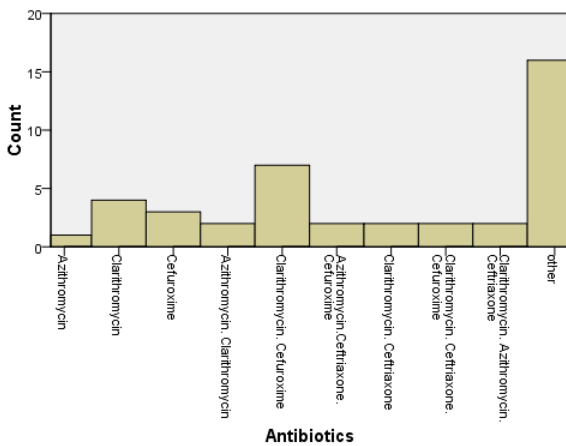

Figure 1. Antibiotic regimen used in this study.

Thirty-eight patients (92.7%) were admitted to the hospital, and the most commonly used antibiotic was Clarithromycin with Cefuroxime, which was prescribed for 7(17.7%) patients. In contrast, in the outpatients, Amoxicillin with Clarithromycin, Azithromycin, and Ceftriaxone was equally specified with (2.4%) for each Table 3 and Table 4.

There was a significant relation (p=0.001) between the admitted patients and the use of antibiotics.

Antibiotic and age groups

Between age 0-2 months Clarithromycin, Cefuroxime, Clarithromycin. Cefuroxime, Amoxicillin was the antibiotics that described while between ages 3-12, the standard medicine described as Clarithromycin. Cefuroxime and Clarithromycin. As for children aged from 13-36 months, Clarithromycin.Cefuroxime, Azithromycin.Ceftriaxone.Cefuroxime, Clarithromycin.Ceftazidime, Azithromycin.Clarithromycin.Ceftriaxone,

Cefatazidime.Amikacin. There was no significant relationship between the type of antibiotic and the age group (p=0.269).

Antibiotic	Inpatient		Total
	Yes	**No**	
Azithromycin	0	1	1
Clarithromycin	4	0	4
Ceftriaxone	0	1	1
Cefuroxime	2	0	2
Amoxicillin	1	0	1
Amoxicillin.Clarithromycin	0	1	1
Azithromycin.Clarithromycin	1	0	1
Cefatazidime.Amikacin	1	0	1
Clarithromycin.Cefuroxime	7	0	7
Clarithromycin.Cefatazidime	1	0	1
Clarithromycin.Ceftriaxone	1	0	1
Azithromycin.Ceftriaxone.Cefuroxime	1	0	1
Azithromycin.Clarithromycin.Ceftriaxone	2	0	2
Clarithromycin.Cefuroxime.Cefatazidime	1	0	1
Clarithromycin.Ceftriaxone.Cefuroxime	1	0	1
Other	15	0	15
Total	38	3	41

Table 3. Antibiotic used for inpatients.

Antibiotic	Outpatient		Total
	Yes	**No**	
Azithromycin	1	0	1
Clarithromycin	0	4	4
Ceftriaxone	1	0	1
Cefuroxime	0	2	2
Amoxicillin	0	1	1
Amoxicillin.Clarithromycin	1	0	1
Azithromycin.Clarithromycin	0	1	1
Cefatazidime.Amikacin	0	1	1

Clarithromycin.Cefuroxime	0	7	7
Clarithromycin.Cefatazidime	0	1	1
Clarithromycin.Ceftriaxone	0	1	1
Azithromycin.Ceftriaxone.Cefuroxime	0	1	1
Azithromycin. Clarithromycin.Ceftriaxone	0	2	2
Clarithromycin.Cefuroxime.Cefatazidime	0	1	1
Clarithromycin.Ceftriaxone.Cefuroxime	0	1	1
other	0	15	15
Total	3	38	41

Table 4. Antibiotics used for out-patients.

Age group	Antibiotics used
0-2 months	Clarithromycin, Cefuroxime, Clarithromycin.Cefuroxime, Amoxicillin
3-12 months	Clarithromycin.Cefuroxime and Clarithromycin.
13-36 months	Clarithromycin.Cefuroxime, Azithromycin.Ceftriaxone.Cefuroxime, Clarithromycin.Cefatazidime, Azithromycin. Clarithromycin.Ceftriaxone, Cefatazidime.Amikacin

Table 5. Antibiotic used for each age group.

Antibiotics and clinical findings

None of the study participants were diagnosed with severe pneumonia, Cerebral palsy, Febrile convulsion, Acute gastroenteritis, enteric fever septicemia, Breathlessness cold, and Fast breathing. However, five were diagnosed with very severe pneumonia and asthma, 15 have shortness of breathing SOB, Crying (4), cough (15), and (18) suffered from Fever. The clarithromycin with cefuroxime was the standard antibiotic used to treat five patients with fever, 4 with cough, 2 with asthma, and 6 with an SOB. On the other hand, there was no significant between the antibiotic and complications except crying, SOB (p=0.054, 0.053), respectively; also, there was a significant relation (p=0.002) between the use and frequency of the antibiotic (Table 5).

Age group	P value
Severity of pneumonia	0.33
Cerebral palsy	No significant
Febrile convulsion	No significant

Acute gastroenteritis	No significant
Enteric fever septicemia	No significant
Asthma	0.505
SOB	0.053
Breathlessness	No significant
Crying	0.054
Cough	0.488
Fast breathing	No significant
Fever	0.163

Table 6. Association of antibiotic use with-clinical findings of the patients admitted with pneumonia in pediatric patients.

Discussion

Our study aimed to review the results of antibiotic usage for treating pneumonia in children at a tertiary hospital in Jeddah, Saudi Arabia.

This study included 41 patients diagnosed with pneumonia between (0-5) years of both genders. The most common age group (3-12) months 56.1%. We used about 14 kinds of antibiotics. According to our results, we found a non-significant relation between age groups and antibiotics (p=0.269). In another hand, the relation between hospitalized patients and the antibiotics was highly significant (p=0.001).

A study similar done in 2017, Dhaka among 80 children most of them were male (72.5%) and the most common antibiotic among their patients was ceftriaxone on 40(50%) and they reported high rates of infant (3-12 months) patients (41.3%), but in our study the most of participants are female (53.7%) also, the most common used antibiotic is Clarithromycin with Cefuroxime (17.7%) and ceftriaxone is (2.4%), and the most participants are infant (3-12 months) (56.1%). However, they found a significant relation (p<0.001) between ceftriaxone and the age of participants, and there was found an association between antibiotic and frequency used antibiotics, which supports our study [5]. At the same time, our results show a non-significant relation (p=0.269) between age groups and the use of antibiotics. By comparing with the nutritional state, we have 2 participants with a healthy weight, but in Rashid's study, all participants are classified as underweight.

A study by Zec et al. in 2016 among 104 patients with bronchopneumonia, they reported that first generation of cephalosporins (40.4%) and ampicillin (17.68%) are considered the commonest antibiotic used for pediatric patients and most of the patients were in the preschool groups (37.5%), but the most common age group in our study is infants (3-12 months) (56.1%) [14].

RCT study was done in Taiwan, 97 children entered this study 26 with Mycoplasma pneumonia infection, 15 with Chlamydia pneumonia infection, and 6 with mixed mycoplasma and chlamydia infections. Fifty children received clarithromycin and erythromycin treatment, they found a significant relation

between clarithromycin and gastrointestinal problems, including vomiting, abdominal pain, and diarrhea (p=0.039) also, in 4 of 22 clarithromycin-treated children (18%) was noticed fever lasting for more than 72 h after treatment. While in our study, we only see the relationship between the use of antibiotics and crying, SOB (p=0.054, 0.053), respectively [15].

Another retrospective study in Saudi Arabia that included 1059 patients with pneumonia. They found that the most common sign and symptom among patients are cough (59.2%) and fever (63.4%) while in our study, the temperature is (43.9%), and cough is (36.6%). The mean age of their patients was 56.8 years, but in our study, it is 9.56 months. The rate of hospital admission in our study is (92.7%) while they reported a lower price (69%). Also, the mortality rate in the ward is (2.4%) and in ICU (21.45%) but, we have a lower mortality rate (7.3%), and this is contributed to the use of deferent age groups and small samples size [13]. Since our study was a retrospective cohort study, the most obvious limitation was a small sample size, which may affect our results. Another limitation was that not all antibiotics used to treat pneumonia are under this study also the data collected from one hospital, which makes the results severe to generalize in all pneumonia patients in the kingdom.

Conclusion

The most commonly used antibiotic was Clarithromycin with Cefuroxime (17.7%) in the age group between (3-12) months. There was a significant relationship between the frequency of medicines and antibiotics sig.=(0.002). Also, we found a significant relationships between the use of antibiotics and admitted patients (p=0.001).

Interestingly, none of our patients were diagnosed with severe pneumonia. Using antibiotics to treat bacterial pneumonia in children should always be considered to prevent severe complications even though if the pneumonia is not severed. We suggest conduction further studies that include a larger sample size for the more positive results, deferent age groups, and other antibiotics (Gentamycin, Amikacin, cephalosporin), which define the root of administration, also to include more hospitals in deferent regions.

Acknowledgment

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