INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

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Research Article

Drug Utilization and Rational Use of Anti-Bacterials in Childhood Pneumonia - a Retrospective Pharmacovigilance Study

Amal Fathima E., Aslaha M. P., Fathima Hiba M. T., Sithara P., Dr. J. Nandhakumar, Alphonsa Mathew*

Department of Pharmacy Practice, Indira Gandhi Institute Of Pharmaceutical Sciences Perumbavoor (Affiliated to kerala university of health sciences, Thrissur).

ARTICLE INFO

Published: 26 Nov 2026

Keywords:

Childhood pneumonia, antibacterial utilisation, rational drug use, prescribing pattern, pharmacovigilance, adverse drug reactions, antimicrobial stewardship

DOI:

10.5281/zenodo.24555141

ABSTRACT

Introduction: Childhood pneumonia is a major cause of paediatric morbidity and requires appropriate antibacterial therapy to ensure effective treatment and minimise medication-related risks. Evaluating antibacterial utilisation and adverse drug reactions is essential for promoting rational prescribing and improving treatment safety. Methods: A hospital-based retrospective observational study was conducted using the medical records of 75 paediatric patients aged 0–12 years diagnosed with pneumonia at the Department of Paediatrics, Tertiary care Hospital, Thodupuzha. Data on demographic characteristics, clinical presentation, antibacterial prescribing patterns, routes of administration, treatment duration, adverse drug reactions and clinical outcomes were collected. The data were analysed using IBM SPSS Statistics version 20.0, employing descriptive statistics. Results: Among the 75 patients, 60 (80%) were aged 0–5 years. Community-acquired pneumonia was the most frequently documented diagnosis (46.7%), followed by bronchopneumonia (37.3%). Combination antibacterial therapy was prescribed to 65.3% of patients, while cephalosporins were the most frequently used antibacterial class (90%). Intravenous administration was documented in 96% of patients, and treatment duration of 3–6 days was most common (65.3%). Adverse drug reactions were recorded in three patients (4%), comprising two cases of rash and one case of diarrhoea. Clinical outcomes were generally favourable, with most patients recovering and the remaining patients showing improvement. No deaths were documented. Conclusion: The study identified a predominant use of cephalosporins, combination antibacterial therapy and intravenous administration in paediatric pneumonia management.

***Corresponding Author:** Alphonsa Mathew
Address: Department of Pharmacy Practice, Indira Gandhi Institute Of Pharmaceutical Sciences Perumbavoor (Affiliated to kerala university of health sciences, Thrissur)
Email ✉: alphonsamathew@igips.in

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Although favourable clinical outcomes and a low frequency of documented adverse drug reactions were observed, the findings highlight the importance of appropriate antibacterial selection, weight-based dosing, adherence to treatment guidelines and systematic safety monitoring. Strengthening antimicrobial stewardship and improving clinical documentation may support safer and more rational antibacterial use in children.

INTRODUCTION:

Pneumonia is an acute inflammatory condition of the lung parenchyma that primarily involves the alveoli-the tiny air sacs responsible for gas exchange and the surrounding interstitial tissue. These structures are often filled with fluid, pus, or cellular debris, which impairs gas exchange and causes respiratory distress. Clinically, pneumonia is characterized by such symptoms as sudden onset of high fever, chills, malaise (a general feeling of illness), cough (which may be dry or productive), chest discomfort, and shortness of breath. In children, additional signs like rapid breathing, nasal flaring, chest retractions, poor feeding, and irritability may also be present, making early recognition crucial in this population. Pneumonia in pediatric patients is a significant cause of morbidity and mortality worldwide, particularly in developing regions. Its aetiology is diverse and encompass a wide range of infectious agents such as bacteria (e.g., streptococcus pneumonia), viruses (e.g., respiratory syncytial virus and influenza), fungi (particularly immune-compromised children), and, rarely parasites. The causative organisms of an can vary depending on the child's age, immune status, vaccination history, and environmental exposures. Therefore, the etiology of pediatric pneumonia is often categorized into age-specific groups (e.g., neonates, infants, and older children) and pathogen-specific categories. This classification can be useful in guiding diagnosis and management strategies. Early identification and treatment can help prevent complications such as pleural effusion, respiratory failure, or lung damage, emphasizing the importance of awareness and timely medical intervention. Pneumonia is a lung infection that causes inflammation of the tiny air sacs (alveoli), which can be filled with fluid or pus and make breathing difficult. It is commonly associated with symptoms such as high fever, cough, shortness of breath, and a general feeling of illness or weakness. Pneumonia can be caused by a variety of organisms, including bacteria, viruses, fungi, and, rarely, parasites. In children, the causative agent often varies depending on their age and the type of pathogen involved. According to the World Health Organization, pediatric pneumonia is characterized by cough, difficulty breathing, and rapid breathing. Children are more vulnerable to pneumonia because their immune and respiratory systems are still developing. The incidence is much higher in developing countries than in developed countries. Despite its seriousness, pneumonia can often be prevented through vaccination, good nutrition, and proper hygiene, and many cases can be effectively treated, especially when diagnosed early. Antibiotics are widely used treatments for childhood pneumonia when the causative agent is unknown or confirmed to be bacterial. The most prevalent antibiotics for treating childhood bacterial pneumonias are amoxicillin and ampicillin, whereas the ceftriaxone and cefotaxime are primarily used for hospitalized children with severe cases of pneumonia. Azithromycin is an option for atypical bacterial infection.The proper use of antibacterial drugs plays an important role in the pharmacological treatment of childhood pneumonia considering the child's age, the severity of the course of the disease, the accompanying pathological conditions, the causative agents, and the development of resistance. One of the options for the treatment of bacterial pneumonia in children is the use of aminopenicillins: ampicillin or amoxicillin, the prescription of which is justified in the initial stage of the disease, while intravenous administration of ampicillin or a third-generation cephalosporin (ceftriaxone, cefotaxime) is indicated in the case of hospitalization of the child, especially with a complicated form of pneumonia. Macrolides, among which azithromycin is one of the most popular antibacterial drugs, can also be used to treat uncomplicated bacterial pneumonia, for example, caused by atypical bacteria, but with caution and mainly in school-age children. A more extended spectrum of antibacterial agents with activity against atypical pathogens, including respiratory fluoroquinolones, is not recommended for use in children. However, they can be used in the treatment of hospital-acquired pneumonia. Gentamicin, a representative of the

aminoglycoside class of antibiotics, can be used in the treatment of severe forms of pneumonia in combination with other antibacterial drugs, but its use should be monitored due to possible side effects. Doxycycline, a tetracycline antibiotic, can be used in some cases for children of a certain age, but it is not recommended to use it for the treatment of common childhood pneumonia. The rational use of antibiotics in childhood pneumonia requires their careful selection and observation of the previously mentioned schemes. It is especially important to start the treatment only when there is a suspicion or confirmation of a bacterial infection and to choose the most appropriate antibacterial drug, which implies the narrowest possible spectrum of action.On the other hand, the creation of dosing and administration schemes for these drugs is based on the child's weight and the severity of the disease. In addition, doctors must constantly monitor the effect of the drugs and, where appropriate, change the dose of the drug or switch from parenteral administration to oral. It is also necessary to avoid the use of various combinations of antibiotics, which is especially important for childhood bacterial pneumonia [1,2,3].

STANDARD TREATMENT GUIDELINES:

Table.N.o: 1 standard treatment guideline[4]

Inpatient childhood pneumonia antibiotic treatment guidelines		
Age/Category	**Preferred/First-Line**	**Alternative/Second-Line**
0–6 mo		
Bacterial	IV penicillin derivative and third-generation cephalosporin	Aminoglycoside with PCN derivative; macrolide if suspect atypical organism
6 mo–5 y		
Bacterial	IV penicillin derivative (PCN or ampicillin)	Third-generation cephalosporin
MRSA	Vancomycin or clindamycin (in addition to beta-lactam antibiotic)	Vancomycin or clindamycin (in addition to beta-lactam antibiotic)
Atypical bacterial infection	Macrolide	Macrolide (in addition to beta-lactam antibiotic)
Allergy to any of the above	Third-generation cephalosporin/ clindamycin	Quinolone
5–16 y		
Bacterial	IV penicillin derivative (PCN or ampicillin)	Third-generation cephalosporin
MRSA	Vancomycin or clindamycin (in addition to beta-lactam antibiotic)	Vancomycin or clindamycin (in addition to beta-lactam antibiotic); linezolid in children aged 12 y or older
Atypical bacterial infection	Macrolide	Macrolide (in addition to beta-lactam antibiotic)
Allergy to any of the above	Third-generation cephalosporin/ clindamycin	Quinolone
Severe pneumonia/ ICU admission	Third-generation cephalosporin and macrolide/vancomycin + third-gen ceph + macrolide	Third-generation cephalosporin and doxycycline/vancomycin + third-gen ceph + macrolide + (optional) Nafcillin + antiviral

TYPES[1,2]:

A. BY LOCATION

1. Community-acquired pneumonia
2. Hospital-acquired pneumonia
3. Ventilator-acquired pneumonia

B. BY IMMUNE STATUS

1. Immunocompetent
2. Immunocompromised

C. BY MICROBIOLOY

1. Viral
2. Bacterial
3. Fungal
4. Mycobacterial
5. Parasitic

.

AIM:

To evaluate utilization pattern, rational use and pharmacovigilance profile of Anti-bacterial therapy among pediatric patients with pneumonia in a tertiary care hospital.

OBJECTIVES:

1. To evaluate the utilization pattern of Anti-bacterial agents in pediatric pneumonia
2. To assess the rational use of of Anti-bacterial therapy based on standard treatment guidelines
3. To evaluate the appropriateness of Anti-bacterial therapy with respect to drug selection, dose, route and duration
4. To identify documented adverse drug reactions associated with Anti-bacterial therapy
5. To assess the clinical outcomes of Anti-bacterial therapy in pediatric pneumonia

METHODOLOGY:

MATERIALS AND METHODS

1. STUDY TITLE

"Drug utilization and rational use of anti-bacterial in childhood pneumonia - a retrospective Pharmacovigilance study **"**

2. RESEARCH APPROCHES

The study will adopt a quantitative retrospective observational approach to evaluate anti-bacterial utilization , rational use and safety in pediatric pneumonia patients.

3. STUDY DESINGS

A hospital –based retrospective observational study.

4. STUDY SITE

Department of Pediatric in tertiary care hospital.

5.STUDY POPULATIONS

Pediatric patients diagnosed with pneumonia and admitted to the Department of Pediatrics.

6. SAMPLES SIZE.

Formula

$$n= \frac{z^2 1-\frac{\alpha}{2} P(1-P)}{d^2}$$

Where,

P: Expected proportion

D: Absolute precision

1-α/2: Desired Confidence level

Inputs:

Expected proportion = 0.051

Precision (%) =5

Desired confidence level (%)=95

Required sample size =75

As per the above, a minimum sample size of 75 is recommended.

7. STUDY MATERIALS

- Pediatric patient case records/medical charts
- Medication charts and treatment records
- Data collection form (CRF) developed for the study.

8. INCLUSION CRITERIA

- Pediatric patients aged 0 month-12 years
- Pediatric patients diagnosed with pneumonia

9. EXCLUSION CRITERIA

- Pediatric Patients diagnosed with pulmonary tuberculosis.
- Pediatric Patients with chronic respiratory diseases such as bronchial asthma, cystic fibrosis.
- Patients who did not receive antibacterial therapy.

10. METHOD OF DATA COLLECTION

After obtaining approval from the Institutional Ethics Committee and hospital authority, data will be collect retrospectively from medical records of eligible pediatric pneumonia patients. Relevant information regarding demographic details, clinical characteristics, antibacterial therapy, documented ADRs, and treatment outcomes will be extracted using a pre- designed Case Record Form (CRF). All collected data will be coded and maintained confidentially without recording patient identifiers.

11. STATISTICAL ANALYSIS

Data were analyzed using Microsoft Excel 2016 and SPSS version 22.0. The chi-square test were used to analyze factors associated with treatment outcomes.

RESULT

Study population and demographic characteristics

A total of 75 peadiatric medical records meeting the available study criteria were analysed. The study population consisted of children between infancy and 12 years of age. The reconstructed age distribution showed that 48 patients (83.3%) were aged 0–5 years, while 5 (8.3%) were aged 6–12 years. The approximate median age category was 3–4 years. There was an almost equal distribution by sex, with 26 females (52.0%) and 24 males (48.0%).The most frequent weight category was 10–18 kg (28; 56.0%), followed by 2–10 kg (15; 30.0%). The majority of patients therefore belonged to the younger peadiatric age groups and lower weight categories.

Table 2: Demographic Characteristics of the Study Population (N=75)

Characteristics	Category	Frequency(n)	Percentage (%)
	Neonates (<28days)	2	2.67
	Infants (28days-<2 years)	25	33.33
Age	Toddler (2-<4 years)	8	10.67
	Early childhood (4-<6 years)	19	25.33
	Middle childhood (6 years-12 years)	21	28.00
Total		75	100

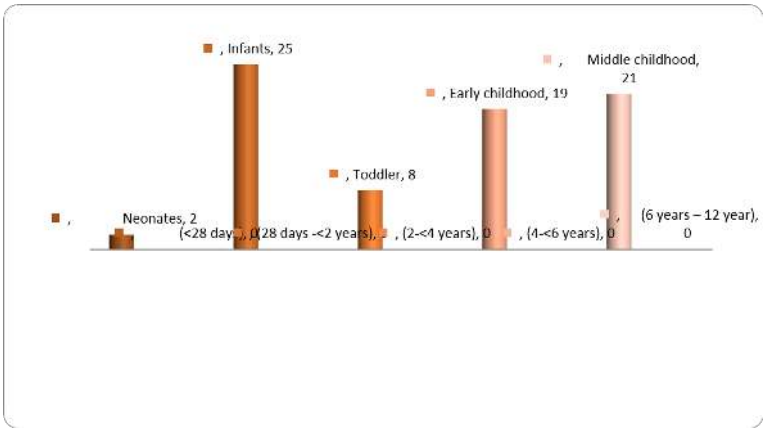

Figure 1: Graphical Representation of Distribution of Patients According to Age

Tablet No.3: Distribution of patients according to Gender

Gender	Frequency(n)	Percentage(%)
Male	37	49.3
Female	38	50.7

There was almost equal distribution by gender, with 38 females (50.7%) and 37 males (49.3%)

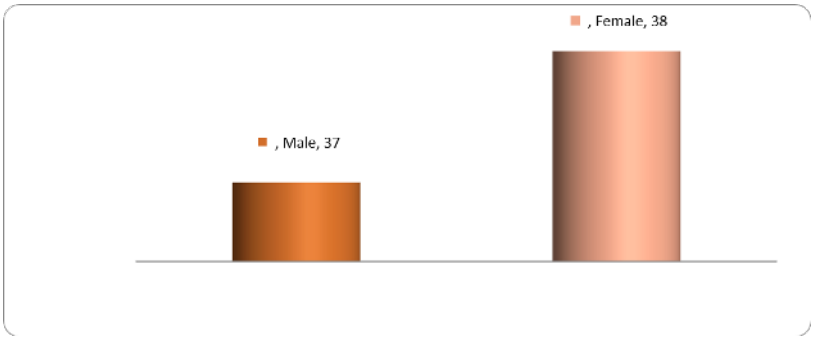

Figure 2: Graphical Representation of Distribution Pf Patients According to Gender

Table None: 4 Distribution of Patients According to Weight

Weight(kg)	Frequency(n)	Percentage(%)
2-10	20	**26.7**
10.1-18	37	49.3
8.1-26	8	10.7
26.1-34	6	8.0
34.1-42	4	5.3

The most frequently represented weight category was 10-18 kg (37;49.3%), followed by 2-10 kg (20;26.7%).The majority of patient therefor belonged to the younger pediatric age groups and lower weight categories

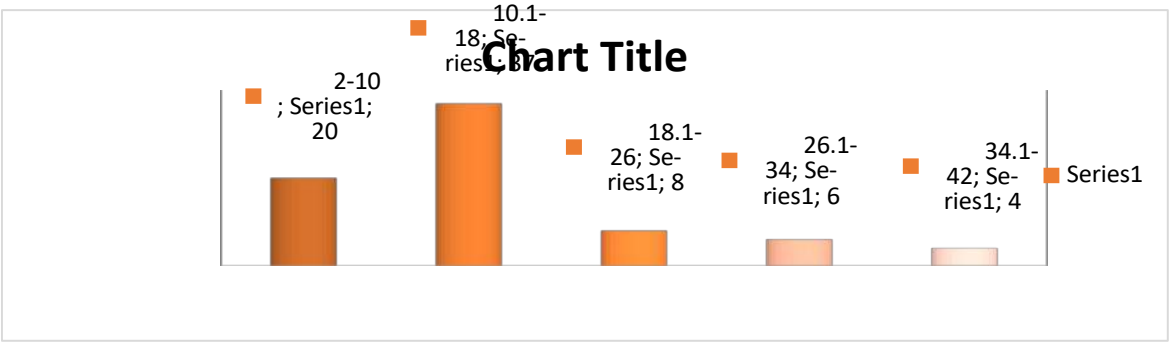

Figure 3: Graphical Representation of Distribution of Patients According to Weight

Table 5: Distribution of Patients According to Diagnosis

Diagnosis	Frequency(n)	Percentage(%)
Community –acquired pneumonia	35	46.7
Bronchopneumonia	28	37.3
Severe pneumonia	5	6.7
Hospital-acquired pneumonia	2	2.7
Viral pneumonia	2	2.7
Right-sided pneumonia	1	1.3
Right lower lobe pneumonia	1	1.3
Right middle lobe pneumonia	1	1.3

Among the documented diagnoses, community-acquired pneumonia (CAP)was the most frequent diagnosis, accounting for 35 patients (46.7%).Followed by bronchopneumonia in 28 (37.3%). severe pneumonia was documented in 5 patients (6.7%), while hospital-acquired pneumonia and viral pneumonia were each documented in 2 patients (2.7%).Right sided, right

lower lobe and right middle lobe pneumonia accounted for 1 patient each.

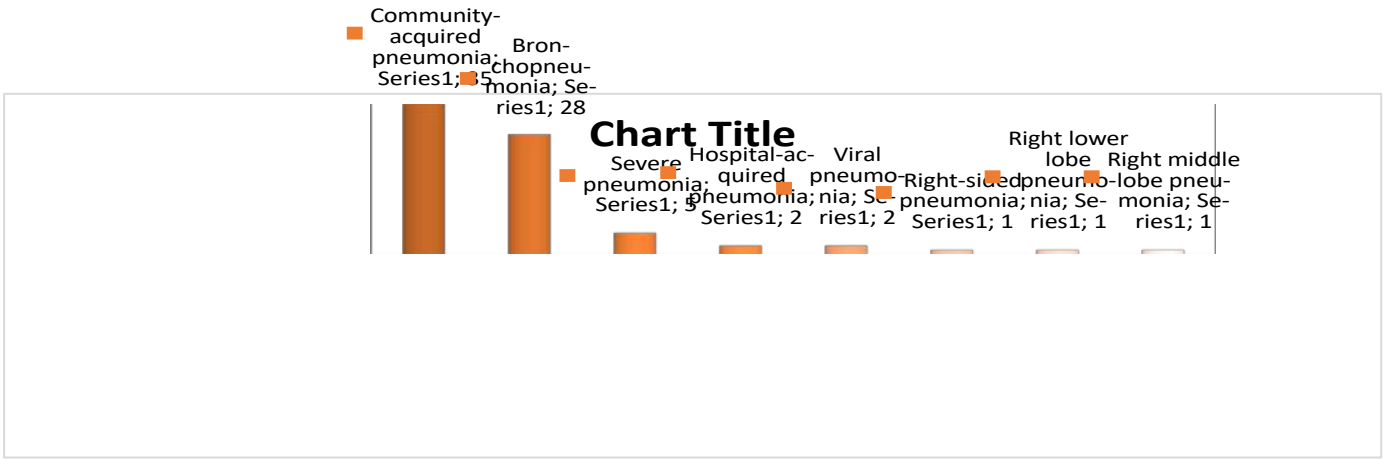

Figure 4: Graphical Representation of Patients According to Diagnosis

Tablet No.6: Distribution of patient according to symptoms

Symptoms	Frequency(n)	Percentage(%)
Cough	73	97.3
Fever	65	86.7
Breathing difficulty	24	32.0
Nasal discharge	21	28.0
Other symptoms	20	26.7
Nasal block	9	12.0
Fast breathing	6	8.0
Poor feeding	3	4.0

The predominant presenting symptom was cough, reported in 73 patients (97.3%), followed by fever in 65 (86.7%). Breathing difficulty was present in 24 (32.0%), while nasal discharge was reported in 21 (28.0%). other symptoms were documented in 20 patients (26.7%).

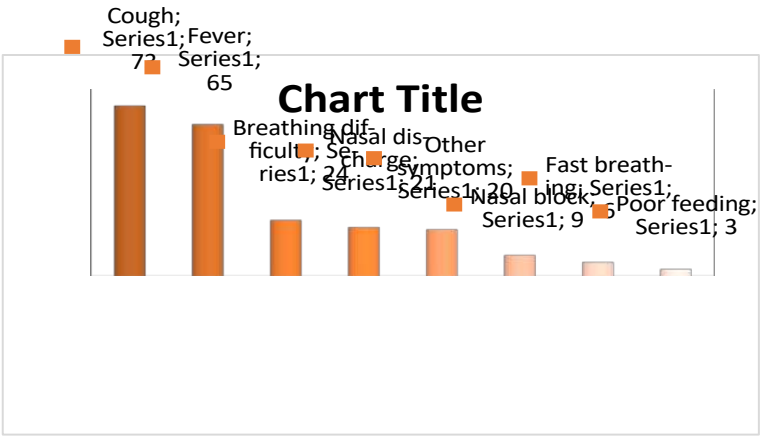

Figure 5: Graphical Representation of Distribution Ofpatients According to Symptoms

Symptoms were recorded as multiple responses; therefore, percentages do not total 100%

Table 7: Distribution of Patients According to X-ray Findings.

X-ray Findings	Frequency (n)	Percentage(%)
Not Documented	44	58.7
Patchy Infiltrate	6	8.0
B/L Crepitation	10	13.3
Non-homogenous opacities	1	1.3
Bilateral infiltration	9	12.0
Peripheral opacity	3	4.0
Bilateral peripheral opacity	1	1.3
Pleural effusion	1	1.3

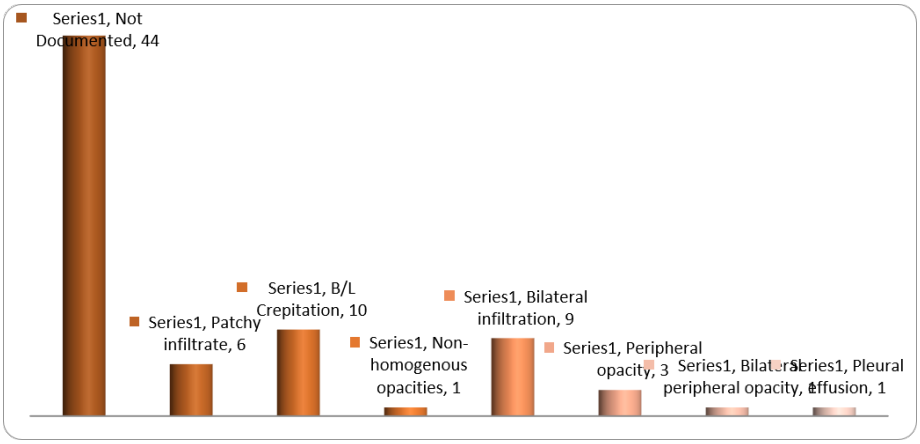

Figure 6: Graphical Representation of Distribution of Patients According to X-ray Findings

Table 8: Distribution of Patients According to CRP (at the Time of Admission)

CRP at time of admission	Frequency(n)	Percentage(%)
Not documented	23	30.7
0-10	33	44.0
10.1-20	8	10.7
20.1-30	3	4.0
30.1-40	2	2.7
40.1-50	2	2.7
50.1-60	2	2.7
60.1-70	1	1.3
>100.1	1	1.3

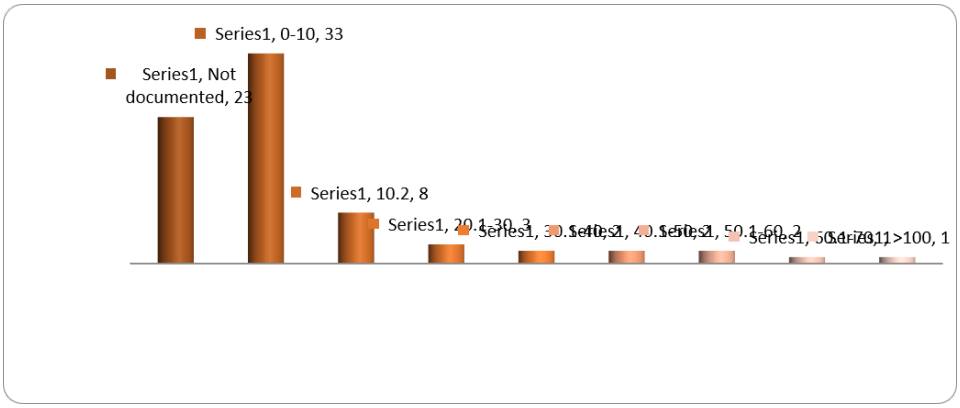

Figure 7: Graphical Representation of Distribution of Patients According to CRP (C-Reactive Protein)(at Time of Admission)

Table 9: Distribution of Patients According to CRP (at the Time of Discharge)

CRP at the time of discharge	Frequency(n)	Percentage(%)
Not documented	59	30.7
0-10	10	44.0
10.1-20	5	10.7
20.1-30	0	4.0
30.1-40	0	2.7
40.1-50	0	2.7
50.1-60	1	2.7
60.1-70	0	1.3
>100	0	1.3

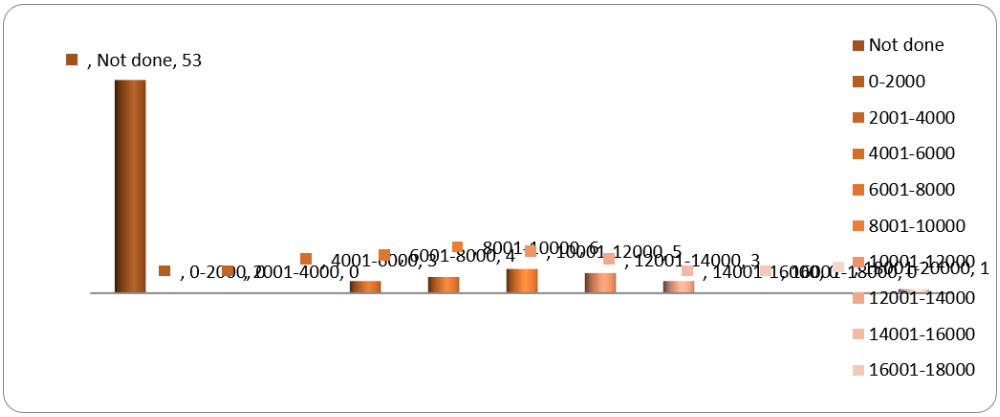

Figure 8: Graphical Representation of Distribution of Patients According to CRP (C-Reactive Protein)(at the Time of Discharge)

Table 10: Distribution of Patients According to TC (at the Time of Admission)

Total Count	Frequency(n)	Percentage(%)
Not done	91	25.3
2000-4000	1	1.3
4001-6000	6	8.0
6001-8000	9	12.0
8001-10000	13	17.3
10001-12000	10	13.3

Total Count	Frequency(n)	Percentage(%)
12001-14000	6	8.0
14001-16000	4	5.3
16001-18000	1	1.3
18001-20000	2	2.7
20001-22000	1	1.3
22001-24000	2	2.7
24001-26000	0	0
26001-28000	0	0
28001-30000	1	1.3

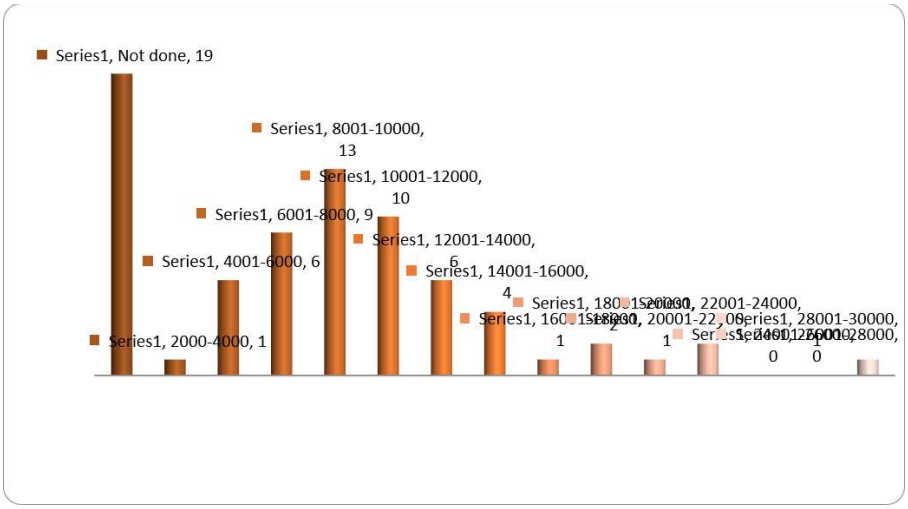

Figure 9: Graphical Representation of Distribution of Patient According to Total Count (at the Time of Admission)

Table 11: Distribution of Patient According to TC (at the Time of Discharge)

Total count	Frequency(n)	Percentage(%)
Not done	53	70.67
0-2000	0	0
2001-4000	0	0
4001-6000	3	4.0
6001-8000	4	5.3
8001-10000	6	8.0
10001-12000	5	6.66
12001-14000	3	4.0
14001-16000	0	0
16001-18000	0	0
18001-20000	1	1.33

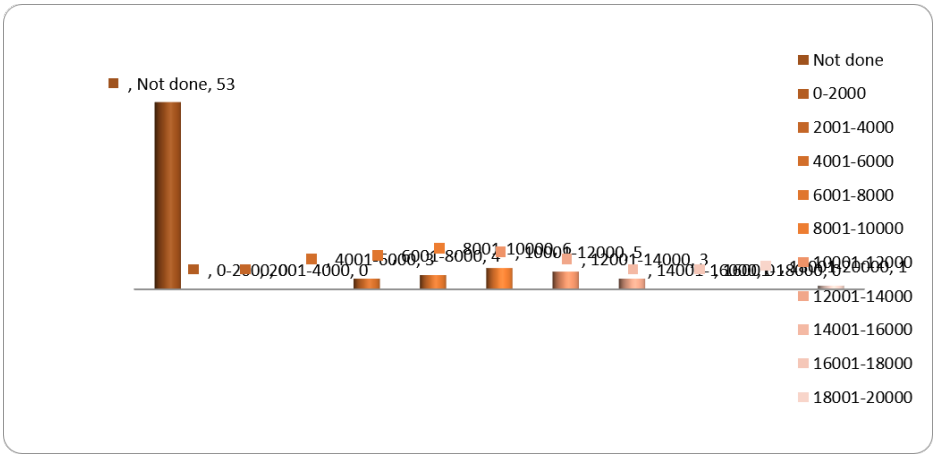

Figure 10: Graphical Representation of Distribution of Patient According to Total Count (at the Time of Discharge)

Evaluation of the utilization pattern of anti-bacterial agents.

All 75 records were reviewed for anti-bacterial utilization.Among the 75 records monotherapy was documented in 25 patients (33.03% of the total sample)and combination therapy in 49 patients (65.03%).

Table 12: Anti-bacterial Utilization Pattern According to Antibacterial Regimen Type

Regimen type	Frequency(n)	Percentage(%)
Monotherapy	26	34.7
Combination therapy	49	65.3

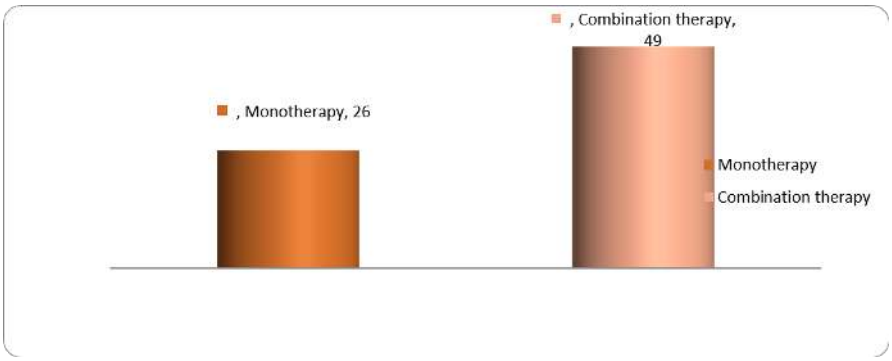

Figure 11: Graphical Representation of Distribution of Patients According to Anti-Bacterial Regimen Type

Table 13: Distribution of Patient According to Anti-Bacterial Therapy

Antibacterial code	Patients receiving the agent	Percentage(%)(among the total patients)
Amino-penicillin class of antibiotics	30	40.0
Cephalosporin class of antibiotics	68	90.6
Glycopeptide class of antibiotic	2	2.66
Aminoglycoside	16	21.33
Macrolides	21	28.0
Oxazolidinone class of antibiotics	1	1.33

Cephalosporin (cefotaxime,cefriaxone and cefpdoxim) given to 68 patients (90.6%),while Aminopencilline class of antibiotics (amoxicilline and clavulanic acid,amoxicilline and potassium clavulanate and ampicilline) given to 30 patients (40.0%).Aminoglycosides (amikacin,gentamycin) was present in 16 patients (22.33%) ,macrolide was given to 21 patients (28.0) followed by glycopeptides and oxazolidinone given to 2 (2.66%) and 1 respectively.

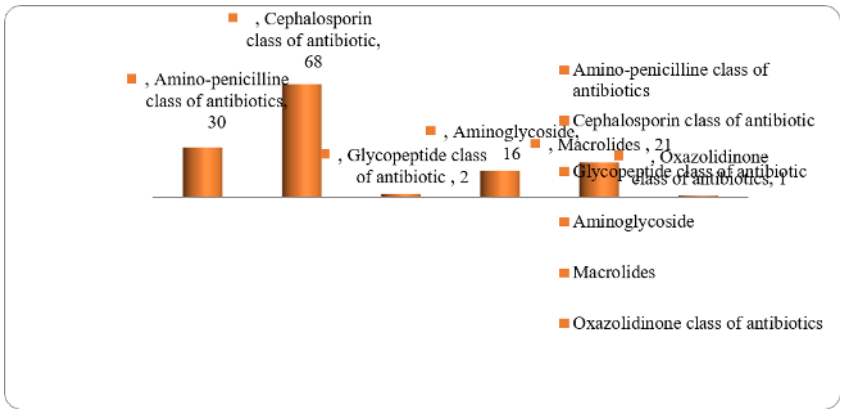

Figure 14: Graphical Representation of Patients According to Antibacterial Therapy

The predominance of combination therapy was particularly evident among patients receiving 2 antibacterial agents, which constituted **36 of the 75 records (48.0%)**.Elevent patients received three agents and two patients received four agents.

Assessment of rational use of antibacterial therapy

Route of administration showed a predominance of intravenous therapy seventy-two patients (96.0%) received atleast one intravenous antibacterial administration wheras 39 patients (52.0%) had an oral route documented .The route pattern indicate that intravenous therapy along was recorded in 25 patients (33.3%), while intravenous plus oral therapy was documented in 26 (34.7%).The remaining patients had multiple route entries reflecting changes or combinations during treatment.

Distribution of patients according to antibacterial dose. Among the doses measured in milligrams ,the highest frequency was observed in the 100-200mg category (27 patients,36.0%),followed by 401-500mg (18 patients,24.0%)and 301-400mg (16 patients,21.3%).No patients received doses between 1001 and 1500 mg category, which included 13 patients (17.3%).Regarding doses measured in milliliters, the 2.1-4.0ml category was the most common, accounting for 15 patients (20.0%).

Table 14: Distribution of Patients According to Antibacterials

Dose (mg)	Frequency(n)	Percentage(%)
100-200	**27**	**36.0**
201-300	**12**	**16.0**
301-400	16	21.3
401-500	18	24.0
501-600	8	10.7
601-700	5	6.7
701-800	6	8.0
801-900	1	1.3
901-1000	13	17.3
1001-1100	0	0
1101-1200	0	0
1201-1300	0	0

Dose (mg)	Frequency(n)	Percentage(%)
1301-1400	0	0
1401-1500	0	0
Dose(ml)	**Frequency(n)**	**Percentage(%)**
0-2.0	3	4.0
2.1-4.0	15	20.0
4.1-6.0	2	2.7
6.0-8.0	2	2.7

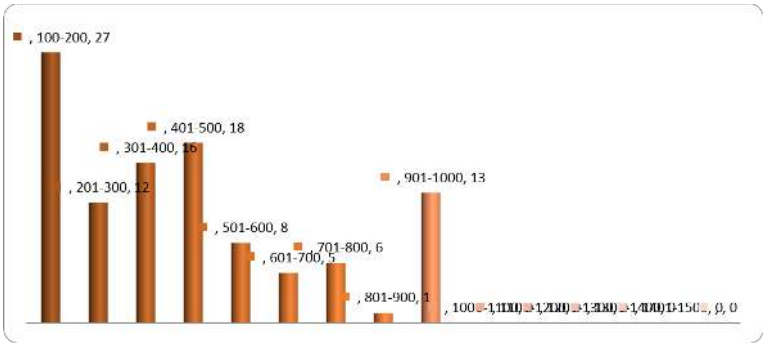

Figure 13: Graphical Representation of Distribution of Patients According to Antibacterial Dose

Table 15: Distribution of Patients According to Antibacterial Route of Administration.

Parameter	Category/pattern	Frequency(n)	Percentage(%)
Patients with IV therapy	Any IV use	72	96.0
Patients with oral therapy	Any oral use	34	52.0
Common route pattern	IV only	25	33.3
	IV+ oral	26	34.7
	Oral only	2	2.7

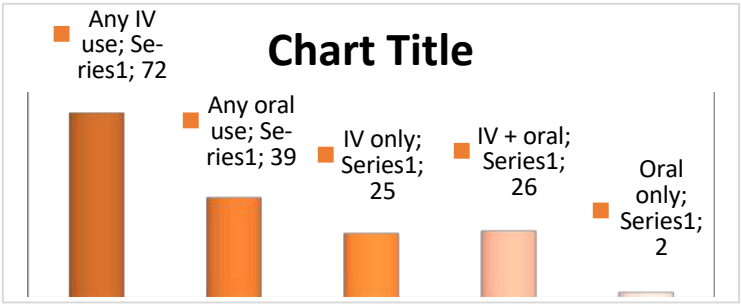

Figure 14: Graphical Representation of Distribution of Patients According to Antibacterial Route of Administration.

With regard to duration, the represented treatment periods as 1-3 days, 3-6 days and 7-10 days. A 3-6 day duration was represented in 49 patients (65.3%), whereas 39 patients (52.0%)had at least one antibacterial course coded as 1-3 days.6 patients (8.0%) had at least 1 antibacterial course as 7-10 days.

Table 16: Distribution of Patients According to Antibacterial Duration.

Duration	Frequency(n)	Percentage(%)
Any 1-3 day course	**39**	**52.0**
Any 3-6 day course	49	65.3
Any 7-10 day course	6	8.0

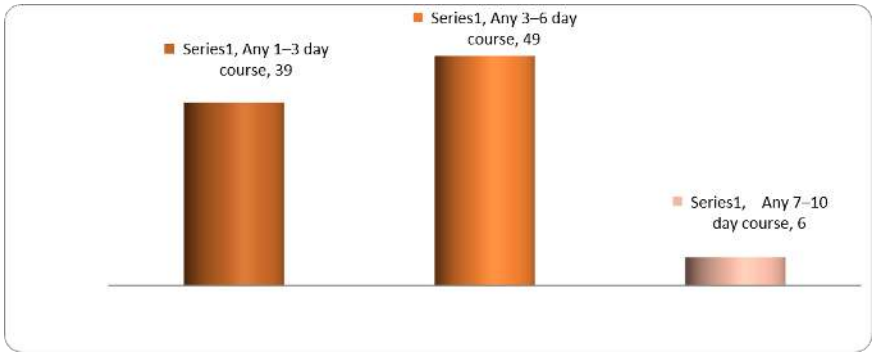

Figure 15: Graphical Representation of Distribution of Patients According to Antibacterial Duration.

Documented adverse drug reaction associated with antibacterial therapy

Adverse drug reaction were documented in 3 of the 75 patients (4.0%),while no ADR was documented in 72 patients (96.0%)

Table 17: Distribution of Patients According to Documented ADR

ADR Characteristics	Frequency(n0	Percentage(%)
Any documented ADR	3	96.0
No documented ADR	72	4.0

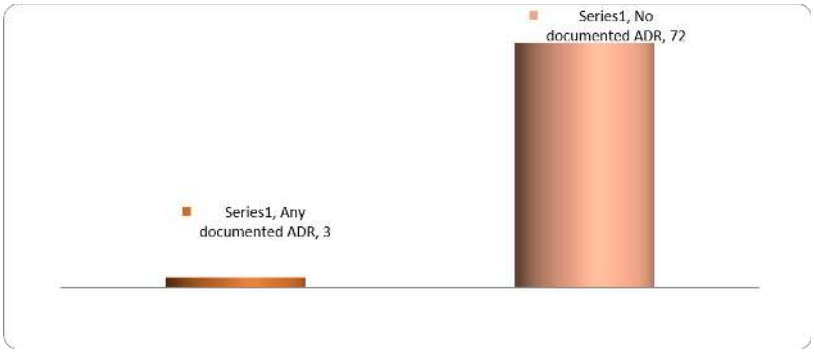

Figure 16: Graphical Representation of Patients According to Documented ADR

Among the 3 patients with documented ADRs , two were female and one was male. Two ADRs were documented as rashes, while one was documented as diarrhea

Table 18: Distribution of Patients According to Type of ADR

Type of ADR	Frequency(n)	Percentage(%)
Rashes	2	66.7
Diarrhea	1	33.3

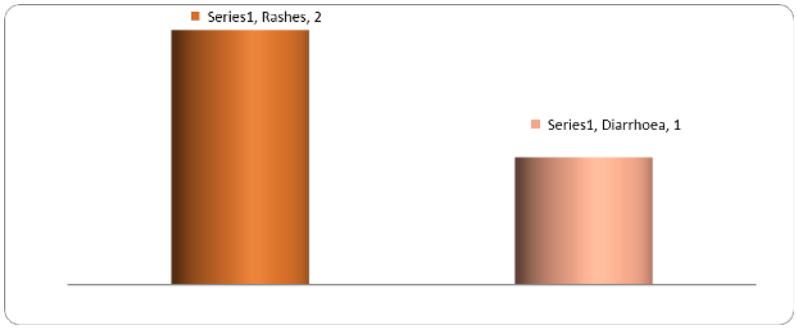

Figure 17: Graphical Representation of Distribution of Patients According to Type of ADR

The suspected antibacterial agent was documented as ceftriaxone in 2 patients (66.7% ADR cases) and cefotaxim in 1 patient (33.3%).All three ADR cases occurred among patients receiving combination antibacterial therapy**.**

Table 19: Distribution of Patients According to the ADR Suspected Drug

Suspected Drug	Frequency(n)	Percentage(%)
Ceftriaxone	2	66.7
Cefotaxim	1	33.3

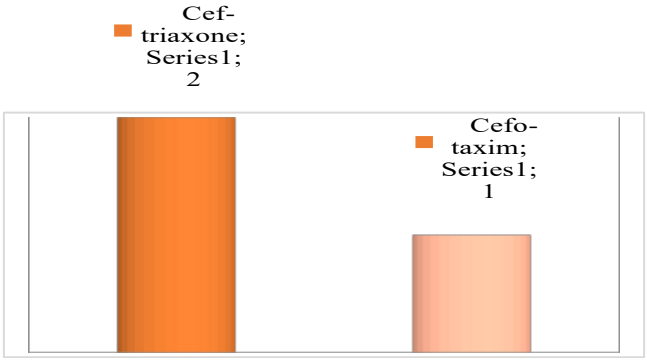

Figure 18: Graphical Representation of Distribution of Patients According to ADR Suspected Drug

Clinical outcome of antibacterial therapy

The overall clinical outcome was favourable in the study population.56 patients (74.4%) were documented as recovered, while 19 (25.3%) were documented as improved. No death was recorded among the 75 patients.

Table 20: Graphical Representation of Distribution of Patients According to Clinical Outcome

Clinical outcome	Frequency(n)	percentage(%)
recovered	56	74.7
improved	19	25.3
dead	0	0

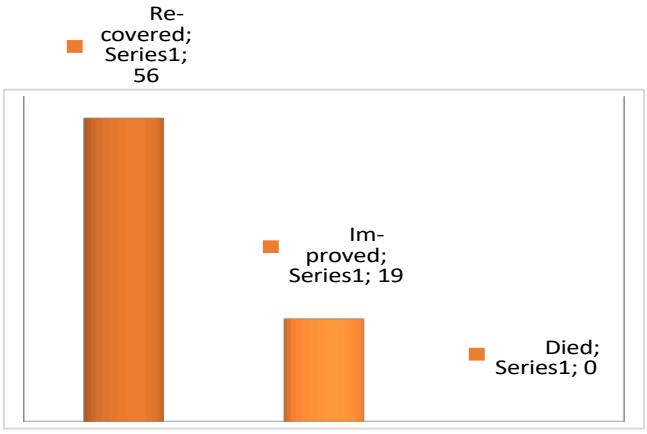

Figure 19: Graphical Representation of Distribution of Patients According to Clinical Outcome

The most frequently documented length of hospital stay was 4-5 days (32 patients ; 42.7%), followed by 5-6 days in 15 patients (20.0%) and 2-3 days in 13 patients (17.3%).Only 2 patients had a recorded stay of 8-9 days.

Table 21: Distribution of Patients According to the Length of Hospital Stay

Length of hospital stay	Frequency(n)	Percentage(%)
2-3 days	13	17.3
3.1-4 days	4	5.3
4.1-5 days	32	42.7
5.1-6 days	15	20.0
6.1 -7 days	4	5.3
7.1 -8 days	5	6.7
8.1-9 days	2	2.7

Figure 20: Graphical Representation of Distribution of Patients According to Length of Hospital Stay

DISCUSSION:

Demographic Characteristics of the Study Population

The current study investigated 75 medical records of children who have been diagnosed with different types of pneumonia. The result has revealed that the majority of cases of pneumonia refers to younger children. In the sample which consisted of 75 children, 60 of them (80.0%) belonged to the 0-5 age group and the rest of 15 children (20.0%) were between 6-12 years old. The predominance of younger children within the investigated group determines the need for the right diagnosis, selection of the medication and dose adjustment in treating pneumonia in children. As for the patients' sex distribution in the sample, it was almost equal, with 38

females (50.7%) and 37 males (49.3%). In terms of the body weight distribution, the most represented group was the one with children weighing 10-18 kg (49.3% of all the sample), and the second most represented group was the one with patients whose body weight is between 2 and 10 kg (26.7%).

Clinical Characterization and Diagnosis

Community-acquired pneumonia (CAP) was the leading diagnosis, affecting 35 patients (46.7%) of the total study group, followed by bronchopneumonia in 28 patients (37.3%). Five patients (6.7%) were diagnosed with severe pneumonia, whereas hospital-acquired pneumonia and viral pneumonia affected two patients (2.7%) respectively. Other distinct types of pneumonia affected one patient each. Cough was the most common symptom experienced by 73 patients (97.3%) while fever was experienced by 65 patients (86.7%). Breathing difficulty was noted in 24 patients (32.0%) whereas nasal discharge was recorded in 21 of the patients (28.0%). Other symptoms included nasal obstruction, rapid breathing, poor feeding and chest pain. The high prevalence of cough and fever reflects the typical presentations observed in children with these conditions in this study. The presence of breathing difficulty in about one third of the patients indicates that checking the respiratory status and the severity of the disease is critical in the process of treatment. Overall, the distribution of diagnosis shows that community-acquired pneumonia and bronchopneumonia were the two main diagnosis categories among the study population.

Utilisation Pattern of Antibacterial Therapy

The research on antibiotic usage patterns has demonstrated that a combination therapy is applied more frequently than a monotherapy. According to the patient's treatment information, "49 patients (65.3%) received a combination therapy as compared to 26 patients (34.7%) who underwent a monotherapy." The most widespread form of combined therapy involved the use of two antibiotics, delivered to 36 patients (48.0%). In addition, three antibiotics were administered to 11 people and four antibiotics were used for two patients. The prevalence of combined therapies can be explained by different aspects of the clinical case being addressed, ranging from the clinical history of the patient, the course of the disease, expected infections and the need to have a wider spectrum of action of the treatment. However, the obtained results do not clarify what was the cause for using the combination method in every particular case. Therefore, justifying any treatment method should rely on particular characteristics of the disease (cause and course of it) and other affected factors. The research revealed that there is a big variety of antibiotics being used in the treatments. Among the antibiotics, cephalosporins were the most widespread type being used with patients (68 patients (90.0%)), while aminopenicillins were administered to 30 patients (40.0%) and macrolides to 21 patients (28.0%).

Route of Administration and Duration of Antibacterial Therapy

The route of administration was predominantly that of intravenous therapy. Seventy-two patients (96.0%) received at least one intravenous antibacterial administration, while 39 patients (52.0%) were treated with oral route. The route categories suggest that intravenous therapy alone was used in 25 patients (33.3%), and intravenous and oral therapy in 26 patients (34.7%), while other patients had more than one administration route either reflecting the changes or combinations of administration routes used during treatment. In terms of treatment duration, the 3-6 day category was most common, being used in 49 patients (65.3%). At least one course of 1-3 day duration was reported in 39 patients (52.0%), whereas only six patients (8.0%) had at least one course from 7-10 day category. Note that these categories can overlap in some patients that received multiple antibacterial agents with different treatment duration. Hence, given percentages should not be regarded as separated groups. Thus, the results show the variability of antibacterial therapy duration. The reasonableness of the treatment duration can only be assessed on the basis of diagnosis, clinical outcome, seriousness of infection, and treatment recommendations.

Adverse Drug Reaction Associated with Antibacterial Therapy

The occurrence of adverse drug reactions (ADRs) was documented in three individuals (4.0%), while, no such

event was reported in 72 patients (96.0%). Among the three participants who suffered from ADRs, two had a rash (66.7% of reported ADRs), and one had diarrhoea (33.3%). Ceftriaxone was the suspected antibacterial agent in two cases, while cefotaxime was suspected in one case. All of them were patients who were treated with antibiotics in combination with other antibiotics. Patients with ADRs experienced cutaneous and gastrointestinal effects. Therefore, it is important to monitor adverse effects in children receiving antibiotic therapy and properly document suspected drug-related effects. Despite the relatively high suspicion rate for ceftazidime, the low number of cases prevents making any conclusions about cause-effect relationships regarding drug-related adverse events in the present study.

Clinical Outcome and Length of Hospital Stay

The clinical outcomes obtained in the study with 75 patients were satisfactory. 56 patients were documented to have recovered while 19 patients were in an improved state. There were no cases of mortality. Thus, each of the patients was either classified as recovered or having improved. The successful outcome indicated that the children were able to recover or improve during hospital treatment in general. However, the design of the study does not prove that the recovery was achieved due to the use of antibacterial drugs, as it might well have been caused by the severity of the disease, some support treatment, characteristics of the patients, and other clinical variables.

The length of hospital stay that was most often counted was 4–5 days with a number of patients involved equaling 32 (42.7%). Following that was the length of 5–6 days that made up 15 patients (20.0%) while another range was 2–3 days with a total of 13 patients (17.3%). Only two patients out of those who were engaged in the study (2.7%) stayed in hospital for 8–9 days. The distribution suggests that a 4–5 day length of stay prevailed. However, the data obtained can't help establish any clear connection between the length of hospital stay and an antibacterial treatment, duration of treatment or severity of disease.

Laboratory Investigations and Radiological Findings

Laboratory and radiological tests were essential in clinical evaluation of the sample. Some of the performed diagnostic tests were total leukocyte count (TC), and C-reactive protein (CRP). The finding of TC count comparison computed upon admission and discharge shows that total count results were more available upon admission than during the discharge period. The rate of total count documentation dropped visibly from 74.7% at the time of admission to 29.33% at discharge. This could be caused by a different laboratory monitoring approach, clinical rationale, or the use of documentation upon discharge. In the list of documents available at the time of discharge, the TC test showed that some patients had normal or almost normal values which could indicate the positive evolution in terms of the inflammatory process.

The comparison of CRP levels at the time of admission versus discharge indicates that fewer patients had elevated CRP levels based on the discharge data. This suggests there may have been a reduction in inflammatory activity as a result of treatment. However, due to a lack of documented discharge values for many patients, evaluating the overall difference in CRP levels and efficacy of antibacterial therapy on this basis alone is impossible.

Radiological examination results revealed that 54 individuals (72.0%) received diagnosis according to the X-ray frequency table as not documented. Of the specific conditions identified, nine patients (12.0%) have bilateral infiltration, while patchy infiltrates were seen in six patients (8.0%). Furthermore, three patients (4.0%) had peripheral opacity. As for the other types of radiological findings, there was a case of non-homogeneous opacities, bilateral peripheral opacity and pleural effusion noted in one patient (1.3%). In fact, there are variations in the groups of radiological findings; however, even though category 0 is not carefully defined in the provided table, it does not necessarily imply that the X-ray results can be interpreted as normal X-ray or pure absence of findings.

In general, laboratory and radiology results afford descriptive data relative to the clinical research carried out in the studied cohort. Illustrations of such results

should take account of patients' symptoms, diagnoses, general status and response to treatment.

Overall Interpretation of the Finding

The study at hand presents findings concerning the usage of antibiotics, adverse drug reactions, radiological data, laboratory results, and clinical outcomes among children suffering from pneumonia. The most common diagnoses were community-acquired pneumonia and bronchopneumonia, and the most common recorded symptoms included cough and fever. Treatment strategies usually included the use of antibiotics in combinations and intravenous administration of medicines. In terms of adverse drug reactions, the study documented very few recorded cases of side effects, with skin rash and diarrhea being the most common reports. Nevertheless, there is a risk of underreporting in the case of retrospective studies. Clinical outcomes were successful, with more than 70% of patients being treated successfully and recovering their health.

Additionally, the paired analysis showed that a difference between CRP and leukocyte count values at the admission and discharge was significantly different. An analysis of the factors associated with recovery failed to show statistically significant relationships for sex, age, use of combination therapy, use of route of administration, and administration for a period of 7–10 days. In conclusion, this shows that it is important to consult a trained professional about the prescriptions of antibiotics, monitor the treatment outcomes systematically, document adverse drug reactions accurately, and correlate the lab results with clinical evaluation. Further research using larger cohorts of potential patients and complete medication and laboratory variables would assist in fortifying the evaluation of application of antibiotics in pediatrics.

SUMMARY AND CONCLUTION:

SUMMARY

The goal of this study is to examine the use of antibacterial agents in child patients diagnosed with pneumonia. In total, 75 medical records were assessed to determine the socio-demographic profile, clinical findings, use of antibacterial agents, mode of delivery, duration of therapy, side effects, laboratory findings, imaging studies, and outcome. According to the results of the study, pneumonia is more common in the younger population. Of the 75 studied subjects, 60 (80%) belong to the younger children, and 15 (20%) belong to the group aged 6–12 years. The ratio of males to females is nearly equal as well. Thus, 38 females (50.7%) and 37 males (49.3%) are present in the study. With regard to weight, the majority of subjects (37 patients (49.3%) belong to the weight category of 10–18 kg, with the second largest group (20 patients or 26.7%) falling into 2–10 kg. The results indicate the importance of taking into account age and weight while choosing antibacterial therapy and dosing in children. As for clinical data, the most frequent diagnosis is community-acquired pneumonia (CAP) with 35 patients (46.7%) followed by bronchopneumonia diagnosed in 28 subjects (37.3%). The most frequent symptom is cough (73 patients (97.3%), followed by fever (65 patients (86.7%). The significance of respiratory symptoms assessment during and severity of illness in managing pneumonia treatment has also been confirmed .The investigation of the patterns of antibacterial use showed that combination therapy was used more often than monotherapy. Out of the total number of patients included in the study, 49 patients (65.3%) were treated with combination therapy, while 26 patients (34.7%) were treated with monotherapy. The most frequently used combination therapy consisted of two antibacterial agents, as this pattern was documented for 36 patients (48.0%). The antibacterial classes most often prescribed were cephalosporins (68 patients, 90.0%), followed by aminopenicillins (30 patients, 40.0%) and macrolides (21 patients, 28.0%). This high use of cephalosporins reflects the important role of this class of antibiotics in treating paediatric pneumonia at the site of study. Regarding the route of antibacterial administration, intravenous treatment was the most common, as we found that 72 patients (96.0%) received at least one intravenous dose of antibiotic. Oral therapy was used by 39 patients (52.0%), while 25 patients (33.3%) did not receive oral antibiotics, but were prescribed only intravenous treatment. Out of all patients receiving antibacterial therapy, only 26 required both intravenous and oral treatment. With regard to the duration of therapy, the 3 to 6 day category was the most frequently observed, involving 49 patients

(65.3%). The variation in the duration of therapy indicates the need to provide individualised treatment according to the clinical condition, effectiveness and medical recommendations related to treatment.

According to the assessment of adverse drug reactions, it was found that three patients (4.0%) experienced documented ADRs whereas 72 patients (96.0%) did not experience any adverse reactions. Of all the possible reactions, rash was the most commonly reported with two cases and diarrhea only with one case. Ceftriaxone and cefotaxime were both suspected drugs in two and one case respectively and these observations reflect the significance of monitoring as well as documenting any possible adverse drug reactions during the course of antibacterial therapy of patients.

Generally, clinical outcomes were considered positive. Out of the total number of patients that participated in the study, 56 patients (74.7%) were confirmed to have recovered and 19 patients (25.3%) improved. No deaths were registered. The majority of patients had their length of hospitalisation to fall within 4–5 days, which was the case for 32 patients (42.7%). A lesser group of 15 patients (20.0%) spent 5–6 days in the hospital. The analysis of laboratory data gave all the required information on the total leukocyte count and the level of CRP upon hospitalisation and discharge; however, significantly less information of laboratory tests upon discharge was available. Paired analysis allowed demonstrating the existence of statistically significant difference between total leukocyte count and CRP values at the moment of hospitalisation and at discharge. This means that there were changes in inflammatory parameters, although the interpretation of all trends is limited by insufficient data received through laboratory tests.

Radiological findings were not noted in 54 patients (72.0%). Among the noted findings, bilateral infiltrates accounted for the highest proportion, with 9 (12.0%) patients reporting this finding. Other findings include patchy infiltrates (6 patients, or 8.0%), peripheral opacities, non-homogeneous opacities, bilateral peripheral opacities, and pleural effusion.

The published research helps to understand the practice of prescribing antibiotics as well as the clinical outcomes in childhood pneumonia. The study stresses that the choice of the right antibacterial agent, dose adjustments, selection of the administration route, the duration of the treatment, performing laboratory tests, monitoring possible adverse drug reactions must be considered in pediatric patients.

CONCLUSION

According to the results of this research, antibacterial treatment is a crucial component of pediatric pneumonia management in the hospital setting. The research found that pneumonia is most prevalent in children aged under five years old, with the predominant types being community acquired pneumonia or bronchopneumonia. Antibacterial therapy most frequently employed was combination therapy rather than monotherapy, while cephalosporins were the leading group of antibacterial agents used. The predominant mode of administration was through intravenous route, meaning there was a massive use of parenterally administered antibiotic therapy in the studied group. The results also showed differences in duration of antibacterial therapy, emphasizing the importance of choosing it according to a patient's individual characteristics and clinical response.

Adverse drug reactions reported in the literature were quite scarce, with the most commonly cited side effects being rashes and diarrhoea. However, constant surveillance is important in order to detect and handle any drug-related complications, especially in a group of children treated with several antibacterial drugs. The clinical outcomes were positive, with most patients being cured or improved; in addition, the study population suffered no fatalities during the research. The changes in CRP levels and total leukocyte counts could be observed in paired data analysis, showing the differences in inflammation during the treatment. However, some insufficient discharge laboratory tests make the evaluation of these changes in the whole study population impossible.

The paper shows how it's important to ensure good process of rational prescribing of antibacterial solutions in case of cases of pneumonia in children by choosing suitable drugs, dosing according to approximate principles, applying the best method of mixing therapy, switching from intravenous medications to oral in due

course and following set lengths of treatment. It is further shown that monitoring of how effective the treatment is and if there are any complaints connected with it is also important. Finally, the research explores positive aspects of current prescribing of antibacterials for pneumonic diagnosis in children and shows how antimicrobial management system can be improved.

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HOW TO CITE: Amal Fathima E., Aslaha M. P., Fathima Hiba M. T., Sithara P., Dr. J. Nandhakumar, Alphonsa Mathew, Drug Utilization and Rational Use of Anti-Bacterials in Childhood Pneumonia - a Retrospective Pharmacovigilance Study, Int. J. of Pharm. Sci., 2026, Vol 4, Issue 11, 5168-5189. https://doi.org/10.5281/zenodo.24555141