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EFFICACY AND SAFETY OF DRUG TREATMENT OF BRONCHOPNEUMONIA IN LOCAL PEDIATRICS HOSPITAL AND ITS CONFORMANCE TO THE GUIDELINES OF BRITISH THORACIC SOCIETY

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Abstract

Community-acquired pneumonia (CAP) is a major cause of death in developing countries and of morbidity in developed countries. Bronchopneumonia is the most common clinical indicator of pneumonia in pediatric population. It is the leading cause of death in children under 5 years. Efficacy of treatment involves the improvement of symptoms and the discharge from hospital. Safety of drug treatment involves the monitoring of adverse drug reactions and their management. Choice of drug therapy is based on assessment of severity of symptoms and microbial susceptibility of the population. The purpose of this study was to determine the most commonly used antibiotics at the local Pediatric Hospital, its efficacy and safety, the concomitant therapy in the treatment of bronchopneumonia and the conformance of local therapy to the guidelines of British Thoracic Society. A cross-sectional study of 3-months duration was conducted by recruiting a total of 200 Bronchopneumonia patients of age between 1 month and 5 years. Efficacy and safety was analyzed using questionnaire based on literature survey. Analysis was done by using descriptive

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statistics. Majority of the participants were Male (52.5%) with age greater than 1 month and less than 5 years. The most common symptom observed was cough which was present in 96.5% of patients. Majority of the patients (79%) were given augmentin as the first choice of treatment which was found to be effective. All the drugs were given through intravenous route. Augmentin was prescribed to majority of the patients (79%) for follow up treatment. Only 11.9% of the patients were found to have adverse drug reactions. The average duration of hospital stay was 7 days. The mortality rate was found to be 2%. No significant association was found between demographic variables and efficacy and safety of drug therapy. There was no strict conformance to the guidelines of British Thoracic Society. However the local guidelines were developed and found effective in the treatment of bronchopneumonia at the local pediatric hospital.

INTRODUCTION

Community Acquired Pneumonia

Community-acquired pneumonia (CAP) is a significant global health threat, particularly for children. In the United States, it accounts for 5.6 million annual cases, with mortality rates escalating from <1% in outpatients to 2-30% in hospitalized patients (Moussaoui et al., 2004). A major cause of childhood mortality, pneumonia resulted in approximately 1.3 million deaths in 2011, with over 90% occurring in developing nations (Dona et al., 2017). Identifying the causative pathogen is challenging due to limitations in culture yields and specimen contamination. Molecular diagnostics like PCR have improved viral identification, and the introduction of conjugate vaccines (HiB, PCV7, PCV13) has dramatically reduced bacterial pneumonia incidence (Gilani et al., 2012).

Etiology and Symptoms

Pneumonia is an inflammation of the lung parenchyma and a leading cause of death in children under five, with approximately 155 million annual cases and 2 million deaths (Bradley et al., 2011). The primary causative agents are bacteria, viruses, and fungi. *Streptococcus pneumoniae* is the most common bacterial cause, while Respiratory Syncytial Virus (RSV) is a dominant viral pathogen, especially in children under two. Clinical manifestations include fever, cough, shortness of breath, and chest pain, though these vary with age and pathogen. Complications can be severe, including pleural effusions, empyema, lung abscess, and metastatic infections like meningitis (Zec et al., 2016). Vaccination with PCV7 and PCV13 has led to significant reductions in CAP incidence in several countries.

Investigations for Pneumonia

Pulse oximetry is critical to detect hypoxemia. While acute-phase reactants like CRP and procalcitonin can assess severity, they are not routinely recommended for differentiating between bacterial and viral causes. Microbiological testing (e.g., blood culture, PCR) is reserved for severe, complicated, or ICU-admitted cases and is not advised for mild, community-managed CAP (Bradley et al., 2011).

BTS and Other Recommended Guidelines

The British Thoracic Society (BTS) guidelines emphasize that as the pathogen is often unknown, empiric antibiotic therapy must cover likely organisms. In Pakistan, pneumonia is a leading cause of under-five mortality. The World Health Organization (WHO) recommends oral amoxicillin or cotrimoxazole as first-line therapy for mild pneumonia in outpatients, with the latter adopted in Pakistan for its cost-effectiveness and availability (Khan et al., 2008; Rasmussen et al., 2005). Vaccination remains a cornerstone of prevention, though delivery and affordability are challenges in developing countries (Hussain et al., 2008).

Vaccination for Pneumonia

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The introduction of conjugate vaccines against *S. pneumoniae* and HiB has significantly reduced severe disease and hospitalization rates by 15% to 65% in various countries (David et al., 2017). Risk factors for pneumonia include incomplete vaccination, malnutrition, lack of breastfeeding, and indoor air pollution. As bacterial causes decline with vaccination, the proportion of viral pneumonia is increasing.

Atypical Pneumonia

Atypical pneumonia in older children and infants is primarily caused by *Mycoplasma pneumoniae* and *Chlamydia pneumoniae*, respectively. Macrolides are the preferred treatment, though resistance is a concern. For suspected methicillin-resistant *Staphylococcus aureus* (MRSA), guidelines recommend vancomycin or clindamycin (Bradley et al., 2011). Treatment regimens are age-dependent; for example, infants under two months may receive ampicillin and an aminoglycoside. High-dose amoxicillin is recommended to overcome penicillin resistance in *S. pneumoniae* (Berti et al., 2013).

Treatment Recommendations

WHO guidelines are age and severity-specific. For example, non-severe pneumonia in children over two months is treated with oral cotrimoxazole or amoxicillin, while very severe cases require intravenous ampicillin and an aminoglycoside. Other national societies, including those in South Africa, Italy, Taiwan, India, and Canada, provide similar but varying recommendations, often centered on high-dose amoxicillin or ampicillin (Dona et al., 2017). A study by Zec et al. (2016) highlighted prescribing patterns in Bosnia and Herzegovina, where cephalosporins were frequently used, but recommended oral penicillins and first-generation cephalosporins for bronchopneumonia.

Pathogen Specific Treatment Regimes

The Pediatric Infectious Diseases Society of America (PIDS/IDSA) provides detailed guidelines based on patient setting, age, and immunization status. For outpatients, amoxicillin is first-line for presumed bacterial CAP in preschoolers, while macrolides are added for older children with suspected atypical pneumonia. For hospitalized, fully immunized children, ampicillin or penicillin G is recommended. For those not fully immunized or in areas with resistance, third-generation cephalosporins (ceftriaxone/cefotaxime) are first-line, with vancomycin or clindamycin added for suspected CA-MRSA (Bradley et al., 2011). A key principle is to switch from intravenous to oral therapy once the patient shows clinical improvement. Vaccination against influenza, pertussis, and RSV prophylaxis (with palivizumab) are crucial preventive measures.

Statistical Data of Pneumonia in Pakistan

Pneumonia places a heavy burden on Pakistan. A cohort study in northern areas reported a very high incidence rate of 38 episodes per 100 child-years, attributed to factors like indoor wood smoke and high-altitude living (Khan et al., 2009). A survey of Pakistani family physicians revealed knowledge gaps in antibiotic selection and duration, with over-reliance on quinolones despite high tuberculosis prevalence (Akhter et al., 2017). While oral cotrimoxazole was historically effective, increasing resistance has prompted a shift to amoxicillin, increasing annual costs by an estimated US$25 million (Zeba et al., 2004). The economic burden is substantial, with households spending significant amounts out-of-pocket on treatment, medications, and transportation (Hussain et al., 2008).

METHODOLOGY

This study was conducted after obtaining formal ethical approval from both the Human Ethical Committee of the University College of Pharmacy, University of the Punjab, Lahore, and the Institutional Review Board of the Children's Hospital, Lahore. Informed written consent was procured from all participants prior to their enrollment. The research employed a cross-sectional design, carried out over a three-month period from January to March 2018, at a tertiary care hospital in Lahore, Pakistan. The study aimed to achieve three primary objectives: a) evaluating the efficacy of drug treatments for pneumonia, b) assessing the safety of these drug treatments, and c) analyzing their conformance with international treatment guidelines.

The study population consisted of 200 eligible pneumonia patients who were randomly enrolled from the hospital's indoor patient department. The inclusion criteria encompassed confirmed pneumonia patients aged between one month and five years, with no other co-morbid conditions, and presenting with raised Total

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Leukocyte Count (TLC) and C-Reactive Protein (CRP). Patients were excluded if they were above five years of age, had received any previous antibiotic therapy, were terminally ill, had mental health problems affecting cognitive functions, or failed to provide informed consent.

The sample size of 200 was determined using a standard statistical formula, with a 95% confidence level (Z=1.96), a precision (d) of 5%, and a prevalence (P) of bronchopneumonia of 16% based on UNICEF data from 2012-2013, yielding a calculated sample size of 206, which was rounded to 200. Data collection was performed using a comprehensive questionnaire administered through face-to-face interviews by a field administrator. This instrument was designed to gather information on sociodemographic covariates (age, gender) and clinical covariates (symptoms like cough and fever, immunization history, lab values, duration of hospital stay). The primary outcome variables were the efficacy of drug therapy, measured by the alleviation of symptoms and the time taken for this relief, and safety, assessed by monitoring any adverse drug reactions and their management.

For data analysis, descriptive statistics were used to determine the means of demographic and clinical variables. The Chi-square test was employed to determine frequency distributions and associations between demographic features and clinical variables, with a p-value of less than 0.05 considered statistically significant. All analyses were performed using IBM SPSS Statistics, Version 20.

Results

Frequency distribution of Socio-demographic and Clinical variables of Bronchopneumonia patients

The frequency distribution of sociodemographic and clinical variables of Bronchopneumonia patients is summarized in Table 7. A total of 200 patients were taken who met criteria for enrollment. In the total sample, there was a higher number of male subjects 105 (52.5%) than female patients 95 (47.5%).

According to the formed age groups, the highest number of patients were between 1 to 3 years of age (89 patients each or 44.5%), followed by the age group of less than one year (59 or 29.5%). Age group of 3 to 5 years included 52 or 26% of total patients. Average age in sample was 31 months. The youngest patient was 2 months old and the oldest was 60 months old (5 years). According to the data collected from in patients, some of the symptoms were dominant in clinical features. Cough was present in 193 or 96.5% of patients in which 56 were under one year of age, 86 were between 1 to 3 years of age and 51 were between 3 to 5 years of age. Raised body temperature was observed in 100% of patients. Chest pain was experienced by 94 or 47% of patients among which 30 were less than 1 year of age, 36 were between 1 to 3 years and 28 were between 3 to 5 years of age. Vomiting was experienced by 55 or 27.5% of patients among which 14 were under 1 year of age, 24 were between 1 to 3 years and 17 were between 3 to 5 years of age. Shortness of breath was observed in 180 or 90% of patients among which 59 were less than 1 year of age, 81 were between 1 to 3 years of age and 40 were between 3 to 5 years of age. Sputum production was present in 47 or 23.5% patients, of which 5 or 2.5% patients had bloody sputum, 21 or 10.5% patients had copious amount of sputum with foul smell and 26 or 13% patients had rusty colored sputum. There was no significant association between the formed age groups and symptoms of the disease.

Table 1. Frequency Distribution of Socio-demographic and Clinical Variables of Patients with Bronchopneumonia

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	N	%
Total	**200**	
Gender		
Male	105	52.5
Female	95	47.5
Age	Mean 1.9 Months	
<1 year	59	29.5
1-3 years	89	44.5
3.1-5 years	52	26
Symptoms		
Cough		
Present	193	96.5
Absent	7	3.5
Chest pain		
Present	94	47
Absent	106	53
Fever		
Present	200	100
Absent	0.0	
Vomiting		
Present	55	27.5
Absent	145	72.5
Shortness of breath		
Present	180	90
Absent	90	10
Sputum		
Present	47	23.5
Absent	153	76.5
Blood in sputum		
Present	5	2.5
Absent	195	97.5
Characteristic of Sputum		
Cupious with offensive smell	21	10.5
Pus Like	0	0
Rusty	26	13.0

N = Frequency, % = prevalence

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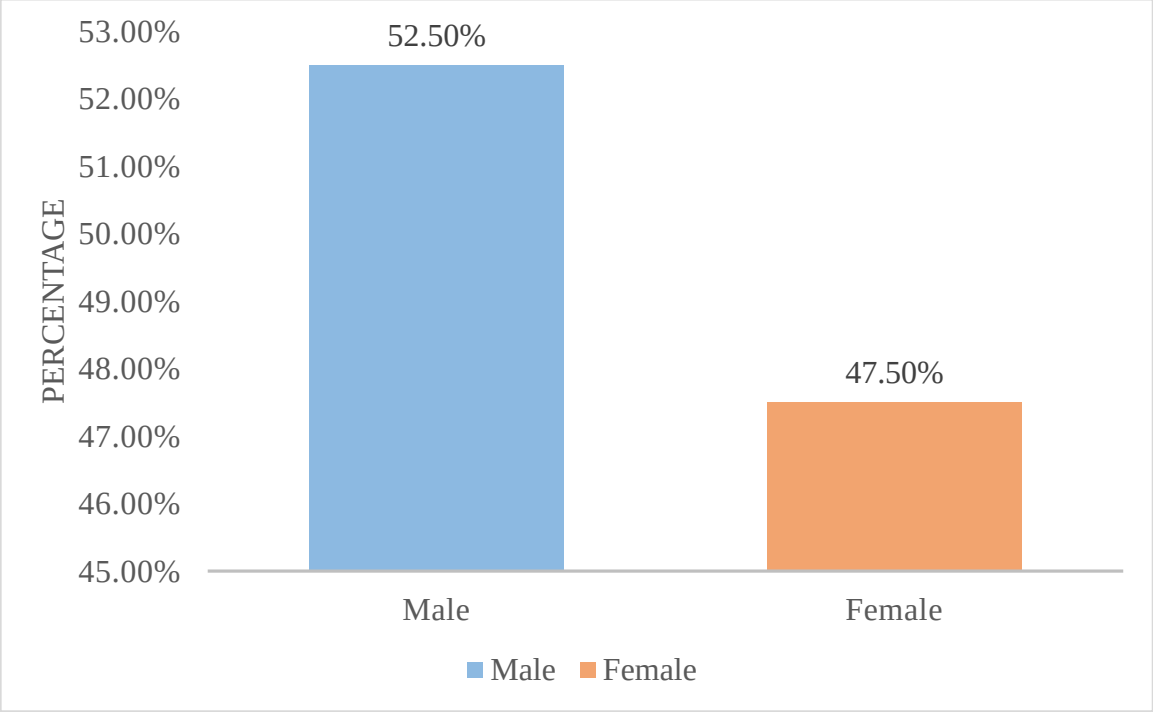

Figure 1: Percentage distribution of gender

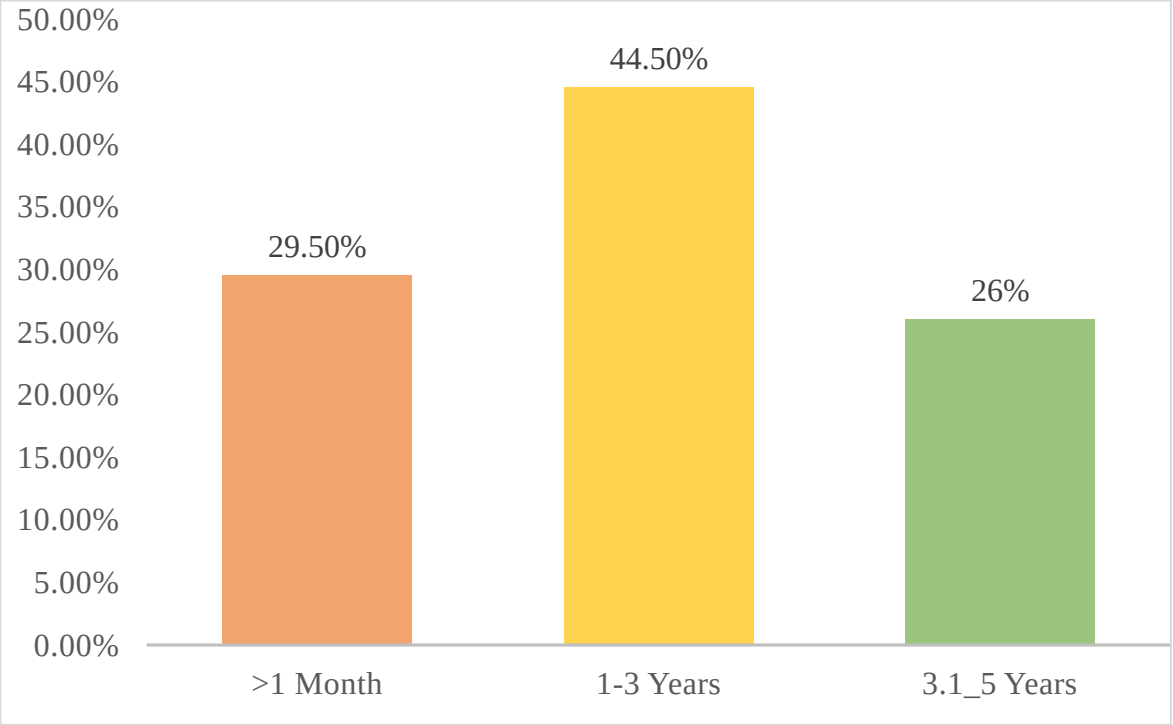

Figure 2: Percentage distribution of Age

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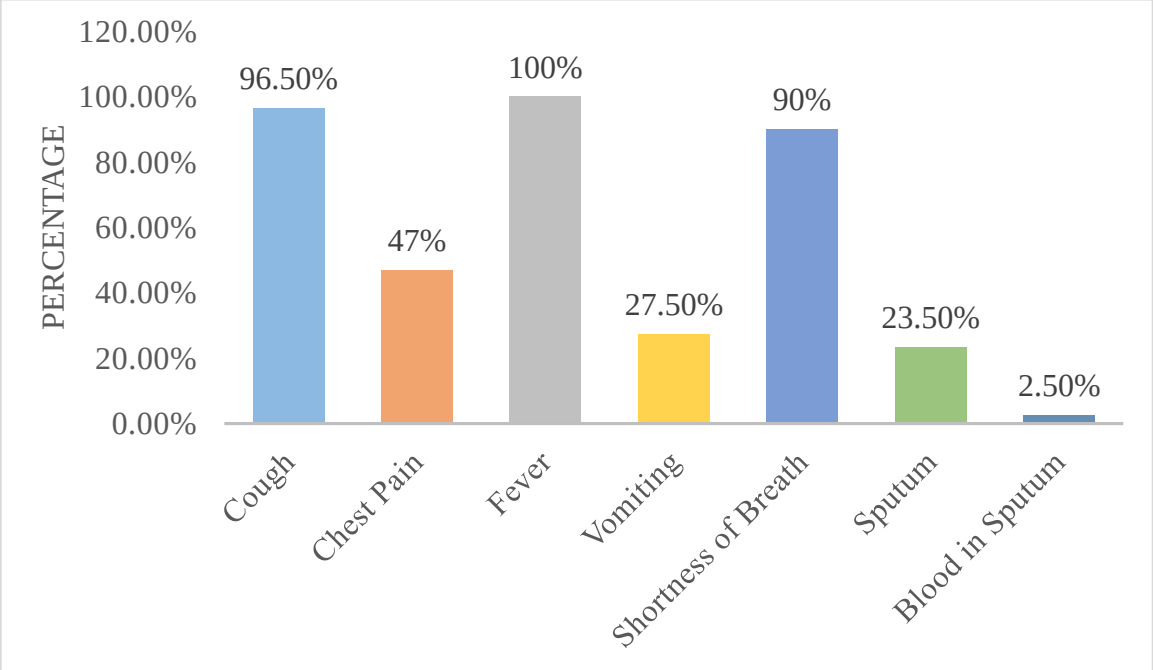

Figure 3: Percentage distribution of Symptoms

Duration of hospital stay (number of days of hospitalization) averaged 7.0 days, with shortest stay of 3 days and longest stay of 19 days. Out of total number of patients, 77 or 38.5% were immunized regularly. In the period of the study (January-March 2018), there was no readmission to hospital due to bronchopneumonia. Blood culture test was found positive in 7 or 3.5% of patients as demonstrated in Table 8.

Table 2. Frequency Distribution of duration of Hospital stay, immunization and blood culture test of Patients with Bronchopneumonia

	N	%
Total	**200**	
Duration of Hospital Stay		
Average	7 days	
Min-Max	3-19 days	
Immunization		
Yes	77	38.5%
No	123	61.5%
Blood Culture Test		
Positive	7	3.5%
Negative	193	96.5%

N = Frequency, % = prevalence

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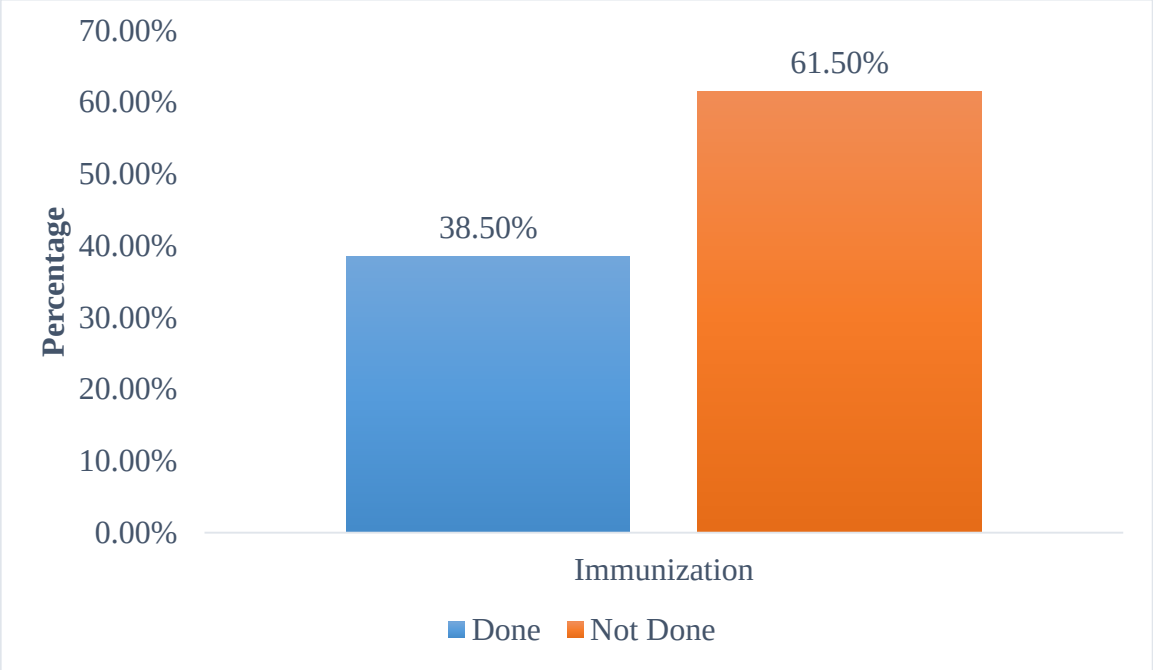

Figure 4: Immunization Frequency

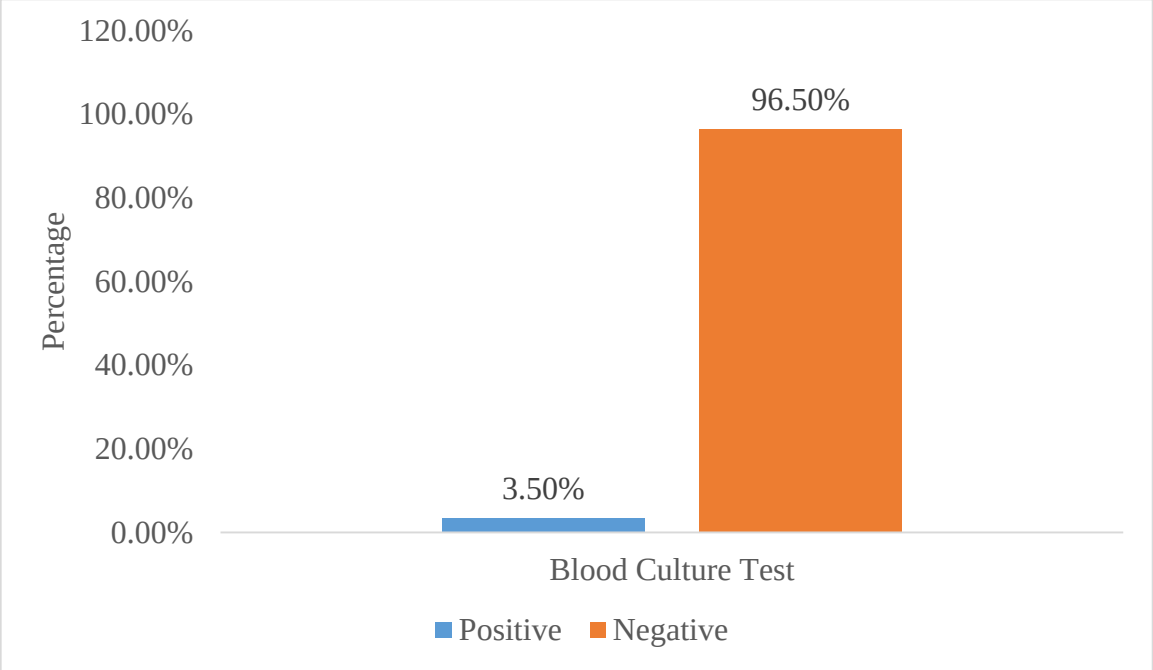

Figure 5: Frequency distribution of Blood Culture Test

Frequency distribution of Laboratory Parameters of Bronchopneumonia patients

Next, Laboratory parameters of patients of bronchopneumonia were examined as demonstrated in Table 9. Data demonstrated that average oxygenation level was 96.9±2.67, and ranged from 88 to 99%. A largest number of patients–193 of them (96.5%)–had normal average oxygenation value while only 7 or 3.5% patients had lower average oxygenation levels. On admission, CRP was elevated in 100% of patients, white blood cells count was also elevated in 100% of children. Red blood cells were low in 28 or 14% patients with an average of 4.82±0.63. Platelets were found to be normal

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in 100% patients. Hemoglobin level was lower range in 162 or 81% patients with an average of 11.05±1.04.

Table 3. Frequency Distribution of Laboratory parameters of Patients with Bronchopneumonia

	N	%	Mean	Min-Max	S.D	S.E
	200					
Average Oxygenation Value			96.96	88-99	2.67	0.189
Normal (>92%)	193	96.5%				
Higher	NIL					
Lower	7	3.5%				
C Reactive Protein			16.484	12-48	3.11	0.220
Normal (<10)	NIL					
Higher	200	100%				
Lower	NIL					
WBC's			17.493	15-22	1.538	0.108
Normal (5-15,000)			NIL			
Higher	200	100%				
Lower	NIL					
RBC's			4.821	2.9-5.9	0.633	0.044
Normal ($4\text{-}5.5 *10^6$)	172	86%				
Higher	NIL					
Lower	28	14%				
Platelets ($150\text{-}450*10^3$)			304.05	180-499	56.831	4.018
Normal	200	100%				
Higher	NIL					

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Lower						
	NIL					
Haemoglobin (11.5-13.5)			11.05	8.4-14.1	1.041	0.073
Normal	38	19%				
Higher	NIL					
Lower	162	81%				

Chi-square test, N = Frequency, % = prevalence, Mean±S.D

Antibiotic Therapy Criteria for the Treatment of Bronchopneumonia

The antibiotic therapy being used at the local pediatric hospital was observed.

First line treatment included 1) Augmentin or 2) Augmentin+ Ceftriaxone or 3) Ceftriaxone.

Second line treatment included 1) Vancomycin+ Sulbactam or 2) Vancomycin+ Ceftriaxone or 3) Vancomycin+ Tazobactem or 4) Linezolid+ Sulbactem.

Third line of treatment included 1) linezolid+ meropenem or 2) linezolid+ imipenem (depending upon patient symptoms). The frequency distribution of these used antibiotic therapies is demonstrated in Table 10.

Majority of the participants were found to be treated on first line therapy. 27 or 13.4% of patients received Augmentin as first line of treatment at an average dose of 30mg/kg/dose. 172 or 85.6% patients were administered Augmentin and Ceftriaxone. Only 1 or 0.5% patients were given ceftriaxone alone at an average dose of 50mg/kg/dose. All these drugs were administered intravenously.

47 or 23.9% patients were given second line treatment- 36 or 17.9% were administered with vancomycin+ sulbactem. The average dose of vancomycin was 20mg/kg/dose. 6 or 3% were given vancomycin+ ceftriaxone, 3 or 1.5% were given vancomycin+ Tazobactem and only 2 or 1% were administered Linezolid+ Sulbactem.

12 or 6.5% patients were given third line treatment. 11 or 5.5% were administered Linezolid+ Meropenem and 1 or 0.5% were administered Linezolid+ Imipenem. The average dose of linezolid was 10mg/kg/dose and of meropenem and imipenem was 20mg/kg/dose. The mortality was found to be 4 or 2%.

153 or 76.5% of patients were found to be treated by first line of treatment as demonstrated in Table 10.

Table 4. Frequency Distribution of Antibiotic Therapy criteria for the Treatment of Bronchopneumonia Patients

		N	%
	Total	200	
First Line Therapy			
Augmentin		27	13.4
Augmentin+ Ceftriaxone		172	85.6
Ceftriaxone		1	2.5
Second Line Therapy	**Total**	47	23.9
Vancomycin+ Sulbactem		36	17.9
Vancomycin+ Ceftriaxone		6	3
Vancomycin+ Tazobactem		3	1.5
Linezolid+ Sulbactem		2	1

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Third Line Therapy	**Total**	12	6.5
Linezolid+ Meropenem		11	5.5
Linezolid+ Imipenem		1	0.5

N = Frequency, % = prevalence

3.1. Drugs Recommended for Follow Up Treatment

Medicines from the group of penicillins were recommended for continuation of treatment of 158 patients (79%). The most commonly recommended medication in the above mentioned group was Augmentin (Amoxicillin+ Clavulanic Acid) in suspention form. Drugs in cephalosporins group were recommended in total of 23 subjects (11.5%). The most recommended medication in this group was cefixime. Few patients (19 or 9.5%) were prescribed both augmentin and cefixime for treatment continuation at home (Table 11). Among other drugs, antipyretics, montelukast and analgesics were recommended to some of the patients for treatment continuation at home.

Table 5. Frequency Distribution of Drugs Recommended for Follow Up Treatment to Patients with Bronchopneumonia

	N	%
Total	**200**	
Augmentin	158	79%
Cefixime	23	11.5%
Augmentin+Cefixime	19	9.5%

N = Frequency, % = prevalence

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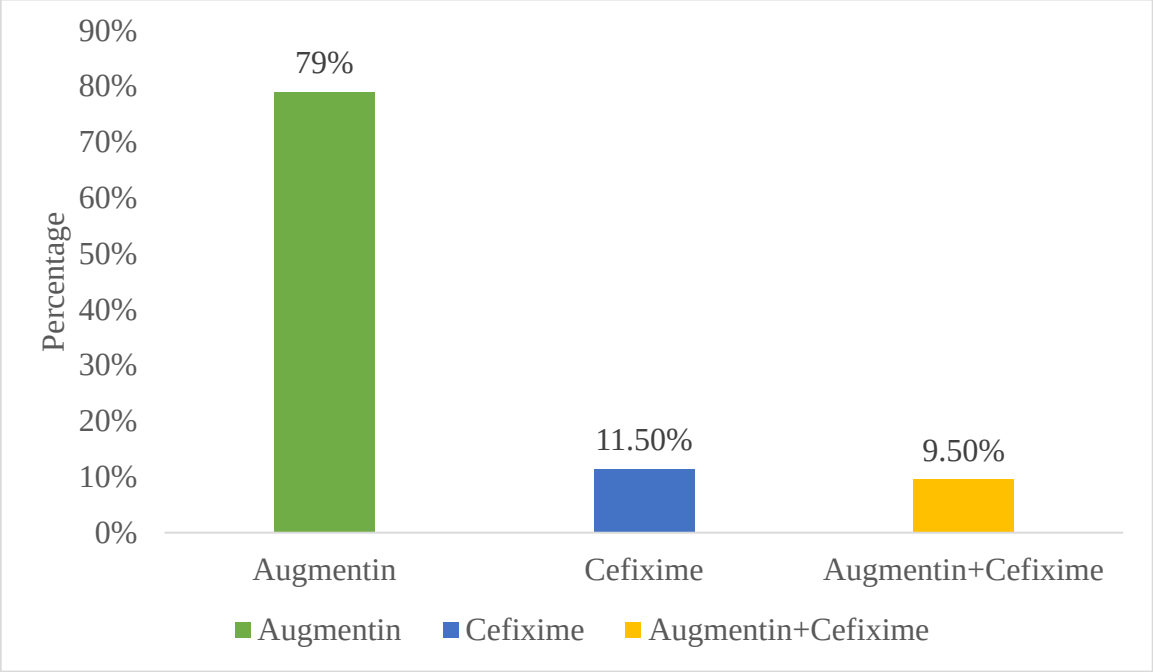

Figure 6: Drugs Recommended for Follow up Treatment

Adverse Drug Reactions

The patients were monitored regularly for developing any signs of adverse drug reaction during the course of treatment. 23 or 11.9% of the total patients experienced adverse drug reactions. 13 or 6.5% of which were due to allergy to penicillin and 10 or 5% were due to the reaction from vancomycin as demonstrated in Table 12.

Table 6. Frequency Distribution of Adverse Drug Reactions experienced by Patients with Bronchopneumonia

	N Total 200	%
Allergy to penicillin	13	6.5%
Reaction to Vancomycin	10	5%
Total	23	11.9%

N = Frequency, % = prevalence

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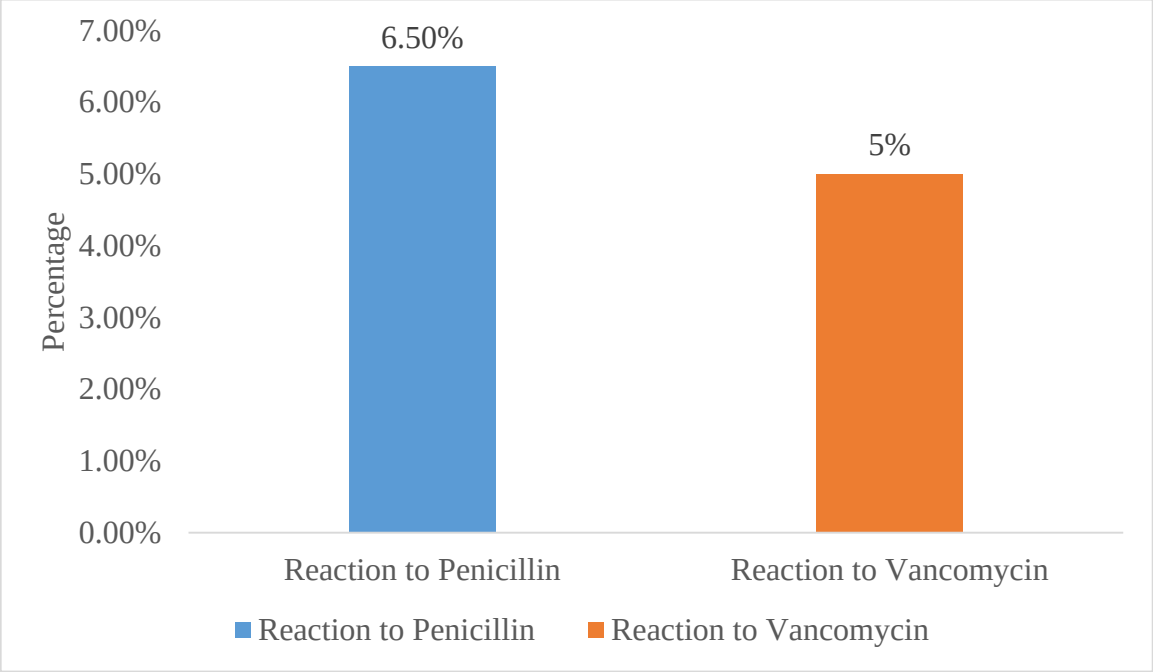

Figure 7: Percentage Distribution of Adverse Drug Reactions

177 or 88.1% of the patients did not experience any adverse reaction from the drug therapy being used for the treatment of bronchopneumonia.

Conformance to the guidelines of British Thoracic Society

The doctors were asked about the awareness of the guidelines of British Thoracic Society for treating Bronchopneumonia. All of them were aware of the British thoracic society guidelines but they were not following these guidelines.

Mortality

The mortality rate found at the local pediatric hospital was 4 or 2%- 50% of which were receiving second line therapy (Vancomycin+ Sulbactem) and 50% were on third line of treatment (Linezolid+ Meropenem)

.

Table 7. Frequency Distribution of Mortality rate in Bronchopneumonia Patients

	N Total 200	%
Mortality	04	2%
N = Frequency, % = prevalence		

Discussion

This cross-sectional study investigated the results of 200 patients who were hospitalized at medical unit of the Pediatric Hospital with diagnosis of bronchopneumonia and the safety and efficacy of drug treatment given to these patients was evaluated by comparing it with the international guidelines. Previously, the drug treatment of bronchopneumonia has been evaluated involving the diagnostic procedures and the assessment of disease severity, its treatment according to the population's vulnerability (Svjetlana Loga Zec1, 2016).

According to the present study, the safety and efficacy of drug treatment of bronchopneumonia in pediatric patients was determined with the help of a questionnaire using literature survey. The drug treatment being used in the local pediatric hospital was compared to the guidelines of British Thoracic Society. Guidelines for managing community-acquired pneumonia (CAP) in adults have been found to

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decrease the death rates. These guidelines were created for the assistance of clinicians so that they are able to develop strategies for the care of a child with CAP. They are not the only approach for diagnosing and treating CAP; there are significant differences between children in the clinical progression of pediatric CAP, even when the infection is due to same pathogen. The goal of these guidelines is to reduce the rate of death and incidence of pneumonia in children by giving recommendations for the management of CAP that can be applied in individual cases if considered appropriate by the treating physician (Michael Harris, 2011).

In the last many years, a lot of research has been done with the aim to achieve a more effective treatment of bronchopneumonia in the pediatric population and thus a reduction in the mortality caused by bronchopneumonia. In the year 1985, the World Health Organization undertook activities to establish a combined strategy to fight pneumonia worldwide (M., 2003). The local Pediatric Hospital has also based its principles of treating bronchopneumonia on observing guidelines and protocols, as well as principles of good clinical practice. So, the empirical treatment is usually according to the population dependent causative agents in a certain area. The etiological treatment is occasional because of the difficulty in determining the causative agent and the initial therapy is established according to the occurrence of pathogens in different age groups, local antibiotic resistance patterns of the organisms, clinical presentation and epidemiological data.

For the management of bronchopneumonia, there is a pre-definedcriteria for admission of a child in hospital: in case of moderate to severe CAP, including respiratory distress and hypoxemia, Children and infants should be hospitalized. For the infants who are less than 3–6 months of age and there is a suspected bacterial CAP, such cases should be benefitted from hospital. Children and infants for whom there is apprehension to observe carefully at home or who are in a state of poor compliance or cannot be followed up, such children should be hospitalized. A child having high body temperature or fever persistently, should be considered as a possible patient of pneumonia; if symptoms continue to occur or if there is lack of response to the treatment being given by pediatricians or family doctors, it is necessary to review and to consider the significance of the clinical situation; kids having under 92% oxygen saturation or children who give serious indications of respiratory distress ought to be hospitalized; children with raised parameters of acute inflammation; children<6 months with signs of CAP and children having bad health (Bradley JS, 2011).

Treatment of bronchopneumonia comprises of administering medicines and high calorie dietary regimes along with sufficient amount of fluids. Patients with vomiting or with severe respiratory distress may be requiring iv fluids and Na+/K+ monitoring. Pharmacological measures suggest administration of antimicrobial and concomitant therapy. Antimicrobials used in the treatment of bronchopneumonia as recommended by British Thoracic Society guidelines include amoxicillin, co-amoxiclave, cefuroxime, and cefotaxime/ceftriaxone, which can be rationalized according to culture sensitivity reporting. In our study, use of penicillin antibiotic and third generation cephalosporin was useful for bronchopneumonia treatment in the pediatrics. The antibiotic therapy continued for an average of 7 days in hospital and range from 3 to 19 days.

Prevention is important to decrease the frequency of morbidity. With the introduction of conjugate pneumococcal vaccines, indirect evidence of vaccine efficacy for the prevention of pneumonia can be used to assess the contribution of S pneumoniae to CAP as compared to the other causative agents (Principi N, 2002). Vaccination of 38.5% patients has been observed in the present study.

In this study, augmentin (Amoxicillin+ Clavulanic acid) in the group of penicillins was administered to 27 patients or 13.4% of the total patients. Ceftriaxone in the group of third generation cephalosporins alongwith augmentin was administered in 172 patients, or in 85.6% of all subjects. Ceftriaxone alone was administered in 1 or 0.5% of patients. In all patients, augmentin was administered intravenously at a dose of 30mg/kg/dose. The average duration of treatment was 7.0±3.33 days. Third-generation cephalosporins have been administered intravenously. The most commonly used medicine in the group of third-generation cephalosporins was ceftriaxone at a dose of 50mg/kg/dose. The doses were given according to the weight of the child, it has been shown that dose increases linearly with age, so the infants received lowest dose and the children between age group 3 to 5 years received the highest dose.

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Vancomycin was being used in second line of treatment along with other drugs including sulbactem, Tazobactem, linezolid and ceftriaxone. 17.9% were administered with vancomycin+ sulbactem. 3% were given vancomycin+ ceftriaxone, 1.5% were given vancomycin+ Tazobactem and only 1% were administered Linezolid+ Sulbactem.

Linezolid was used in third line of treatment of bronchopneumonia along with meropenem and imipenem. 5.5% were administered Linezolid+ Meropenem and only 0.5% were administered Linezolid+ Imipenem. Orally administered antibiotics and concomitant therapy are recommended for continuation of treatment. Orally administered antibiotics and concomitant therapy are recommended for continuing treatment. There was no significant relationship between age and drug therapy being used.

There were no statistically significant differences in average duration of treatment in relation to age group (in all $p<0.05$). The symptoms were also not significantly related to the formed age groups.

The conformance to the Guidelines of British Thoracic Society was not found to be observed as the local guidelines were made according to the pathogens in various age groups, local antibiotic resistance patterns of the organisms, clinical presentation and epidemiological data. These local guidelines were found to be effective in treating 98% of patients. The drug therapy used at the local pediatric hospital was found efficacious in alleviating the symptoms of pneumonia. The mortality rate on using these guidelines was found to be 2% which is non-significant.

Study results showed that the local Pediatric hospital has access to modern diagnostic tests. The latest antimicrobials and concomitant therapy for treatment are available.

Limitations

Among others, one limitation is it's a cross-sectional design, which did not allow us to observe these patients for a longer period of time. Also our sample size was small (n = 200), which reduced our span for measuring long term effects. Nevertheless, we were able to evaluate the drug treatment of bronchopneumonia. This also led to the issue of generalization of data, as this study was only Lahore based (even though patients from other areas also attended the hospital) a generalized nationwide assessment cannot be made. When assessing comorbidities majority of the patients had no other disease thus we were not able to fully measure the impact of these covariates on other variables. Most of the patients included in the study had lower values of hemoglobin which may also interfere with the outcome of therapy.

Conclusion

The study shows the results of bronchopneumonia treatment at the Pediatric Hospital of Lahore are comparable to the results of other studies that were conducted at Pediatric clinics. Penicillin antibiotics (augmentin) and third generation cephalosporins (ceftriaxone) were most commonly used antimicrobial agents with the average duration of antibiotic therapy of 7 days, all of which were not in strict conformance to the guidelines of the British Thoracic Society. Associated therapy consisted of antipyretics (paracetamol) and leukotriene receptor antagonists (montelukast). The adverse drug reactions were due to patient specific factors including allergies to a specific class of drug. All these reactions were monitored carefully and the symptoms were managed accordingly. Availability and performance of diagnostic tests conform to the guidelines of the British Thoracic Society.

This study has shown a brief picture of drug treatment evaluation of bronchopneumonia patients in second largest metropolitan city of Pakistan i.e. Lahore, which depicts that there is need of new programs policy and decision making within the country when considering the implementation and monitoring of CAP preventive measures.

Recommendations

The prevention of bronchopneumonia in pediatric population can be done if specific epidemiological actions are taken, and these actions should involve all health care levels. There should be awareness programs for public about early signs and symptoms of bronchopneumonia, especially parents. This can help in the treatment initialization at early stages which may help inn reducing the death rates due to pneumonia. Another way of reducing incidence of the disease is to introduce pneumococcal vaccination, as pneumococcal infection is the leading cause of bronchopneumonia.

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