



EVALUATION OF RISK FACTORS, ANTIBIOTIC USE AND OUTCOMES IN THE MANAGEMENT OF BRONCHOPNEUMONIA IN PEDIATRIC DEPARTMENT

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ABSTRACT

Pneumonia is the leading infectious cause of death in children around the world. The objectives of the study are 1. To evaluate influence of risk factors (age, pre-hospital antibiotic use, immunization status, mode of feeding and house overcrowding) on occurrence of pneumonia. 2. To evaluate the proportion of pneumonia caused by various organisms. 3. To determine the most commonly used antibiotics and concomitant therapy. 4. To monitor the ADR's associated with antimicrobial therapy. 5. To study the outcomes in these patients. The study was carried out in Inpatient hospital setting. Subjects of age less than or equal to 13 years of both gender with clinical features of pneumonia and without concurrent infections were included in the study. Of 300 patients no growth was seen in 52.6% of patients. House overcrowding was found to have significant association with the prevalence of pneumonia. Piperacillin-tazobactam was administered in 54.6% of patient and Piperacillin-tazobactam and linezolid were administered to 27.3% of patients and ceftriaxone was administered in 18% of patients. In mild to moderate bronchopneumonia, the effect of piperacillin-tazobactam and ceftriaxone showed good response with a small margin of difference. This study concludes that linezolid is a useful addition for the treatment of bronchopneumonia when there is no clinical improvement within 48 hours.

KEYWORDS : Bronchopneumonia, Risk factors, Antibiotics, Antimicrobial resistance, Immunization.

INTRODUCTION:

Pneumonia is the leading infectious cause of death in children around the world. ⁽¹⁾ Pneumonia killed 7, 40,180 children under the age of five in 2019, accounting for 14% of all deaths in this age group. ⁽²⁾ With the increasing threat of antimicrobial resistance, it is critical to understand the pattern of antibiotics used to treat bronchopneumonia. Hence, a research study was conducted among the most vulnerable age group with aim to evaluate risk factors, use of antibiotics and outcomes in the management of Bronchopneumonia.

MATERIALS AND METHODS:

Study design:

A prospective, observational, comparative study with unequal distribution between groups was conducted.

Inclusion criteria:

Subjects will be included in the study based on the following criteria: 1. Pediatric patients less than or equal to 13 years of both gender with clinical features of pneumonia as per WHO guidelines. 2. Patients without concurrent infections.

Exclusion criteria:

Subjects will be excluded in the study based on the following criteria: 1. Children in the age group of 1 year -13 years without clinical features of pneumonia as per WHO guidelines. 2. Patients with age more than 13 years of both genders. 3. Patients with concurrent bacterial/viral/parasitic infection (Malaria, Meningitis, and Enteric Fever or those with chronic complex conditions (e.g.: immunodeficiency, chronic corticosteroid use, heart disease, neuromuscular disease or cystic fibrosis.). 4. Patients / attenders who are not willing to participate in the study.

Procedure:

Patients were admitted based on the clinical interpretation of chest x-ray. Empiric antibiotic choice is based on the patient's age, the severity of the disease and the local resistance pattern of common pathogens. Parenteral ceftriaxone (50 mg/kg/dose BD) and piperacillin-tazobactam (100 mg/kg/dose TID) are administered for patients with non-severe to severe disease. Parenteral linezolid (10 mg/kg/dose BD) is administered in addition to piperacillin-tazobactam if there is no clinical improvement. Concomitant therapy used in the treatment of bronchopneumonia includes antipyretics, antihistamines, secretolytic agents, decongestants, nebulization, oxygen inhalation and prophylactic agents.

RESULTS:

In the total sample, there are higher number of male patients 59.6% (179) than female patients 40.3% (121). According to the formed age groups, the highest number of patients were children 61% (183) followed by the age group of infants 39 % (117). According to the data collected fever and cough and cold was present in 100% (300) and respiratory distress in 46.6% (140) of patients. House overcrowding was associated with pneumonia. Upon admission, CRP was elevated in 76.6% (230) of participants. Of 300 patients no growth was seen in 52.6% (158) of patients. Resistance to piperacillin-tazobactam was documented in 8 patients. Piperacillin-tazobactam was administered in 54.6% (164) of patients, and piperacillin-tazobactam and linezolid were administered to 27.3% (82) of patients and ceftriaxone was administered in 18% (54) of patients. Adverse drug reactions like antibiotic-induced diarrhea and nausea and vomiting were seen in 0.04% (13) of patients.

Results are analyzed using SPSS 25 (SPSS, Inc, 2020)

statistical program. Statistical analysis is done by using one-way ANOVA and chi-square test. For all the statistical tests, confidence interval is 95%, here p value <0.05 is considered significant.

Table 1. Comparison of distribution based on age

Age group Distribution						
Group	Group I		Group 2		Group 3	
Scale	Frequency	Percent	Frequency	Percent	Frequency	Percent
Infants	59	36.0	43	52.4	15	27.8

Table 3. Comparison Based On Risk Factors

Risk factors	Group						P value
	I		II		III		
	N	%	N	%	N	%	
Immunisation							0.3225
Partially	40	24	27	33	13	24	
Up to mark	124	76	55	67	41	76	
Pre-hospitalisation antibiotic use							0.1142
Yes	74	45	26	32	20	37	
No	90	55	56	68	34	63	
Birth weight							0.8694
Low birth weight	17	10	09	11	07	13	
Normal	147	90	73	89	47	87	
Birth order							0.4336
1	79	48	32	39	22	41	
2	73	45	42	51	24	44	
3	12	07	07	09	07	13	
4	0	0	01	01	01	02	
Mode of feeding							0.1463
Complementary	78	48	32	39	26	48	
Exclusive	27	16	20	24	06	11	
Mixed	44	27	27	33	20	37	
Top feeding	15	09	03	04	02	04	
House overcrowding							0.3008
Yes	82	50	33	40	23	43	
No	82	50	49	60	31	57	
Smoking							0.2457
Yes	43	26	14	17	11	20	
No	121	74	68	83	43	80	

Table 4. Comparison Based On Diagnosis

Diagnosis	Group						P value
	I		II		III		
	N	%	N	%	N	%	
CBP							0.2602
Normal	77	47	40	49	31	58	
Leucocytosis	30	18	27	34	11	20	
Lymphocytosis	30	18	08	10	06	11	
Neutrophilia	06	04	02	02	0	0	
Leucocytosis and lymphocytosis	13	08	02	02	04	07	
Leucocytosis and neutrophilia	05	03	02	02	01	02	
Lymphocytosis and neutrophilia	03	02	01	01	01	02	
CRP							0.2048
Normal	38	23	15	18	17	31	
Abnormal	126	77	67	82	37	69	
C/S							<0.0001*
Staphylococcus pneumoniae	27	16	0	0	0	0	
Streptococcus pneumoniae	47	29	16	20	0	0	
Haemophilus influenza type B	07	04	10	12	19	35	
Staphylococcus aureus	0	0	10	12	0	0	
Klebsiella pneumoniae	0	0	01	01	05	09	
No bacterial growth	83	51	45	55	30	56	
CXR							0.9140
Primary end point	26	16	11	14	06	11	
Non end point	135	82	70	85	47	87	
Both	03	02	01	01	01	02	

Children	105	64.0	39	47.6	39	72.2
Total	164	100.0	82	100.0	54	100.0

Table 2. Comparison of distribution based on gender

	Gender Distribution						P VALUE
Group	Group I		Group 2		Group 3		
Scale	Frequ ncy	Perce nt	Frequ ncy	Perce nt	Frequ ncy	Percent	
Female	73	44.5	30	36.6	18	33.3	0.2506
Male	91	55.5	52	63.4	36	66.7	
Total	164	100.0	82	100.0	54	100.0	

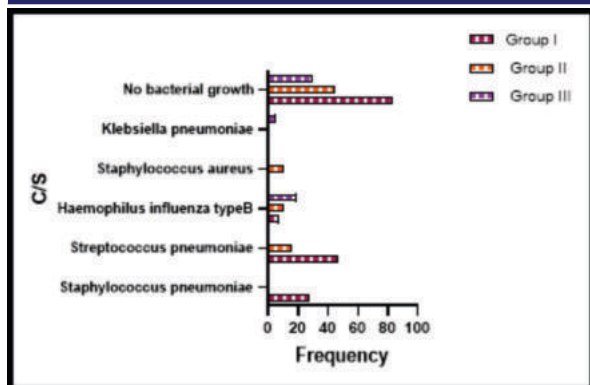


Figure 1. Graph of distribution of culture and sensitivity

Table 5. Comparison based on treatment outcome

Parameter	Group	Minimum	Maximum	Mean $\pm$ SEM	P value
Fever reduction (days)	I	01	10	3.90 $\pm$ 0.14	0.0555
	II	01	09	3.29 $\pm$ 0.19	
	III	01	16	3.53 $\pm$ 0.32	
Cough and cold reduction (days)	I	03	14	6.43 $\pm$ 0.17	0.0023*
	II	01	11	5.50 $\pm$ 0.24	
	III	02	19	5.57 $\pm$ 0.32	
Respiratory distress reduction (days)	I	01	09	4.16 $\pm$ 0.18	0.9952
	II	01	09	4.13 $\pm$ 0.26	
	III	02	09	4.16 $\pm$ 0.36	
Total symptom reduction (days)	I	03	10	6.38 $\pm$ 0.12	<0.0001*
	II	02	10	4.97 $\pm$ 0.21	
	III	03	08	5.48 $\pm$ 0.16	
Antibiotic association with CXR (days)	I	06	11	8.88 $\pm$ 0.08	0.1375
	II	06	12	9.02 $\pm$ 0.11	
	III	06	10	8.64 $\pm$ 0.13	

Table 6. Comparison based on duration of hospital stay

Group	Minimum	Maximum	Mean $\pm$ SEM	P value
I	06	11	9.14 $\pm$ 0.08	0.3041
II	07	12	9.25 $\pm$ 0.11	
III	06	11	8.96 $\pm$ 0.15	

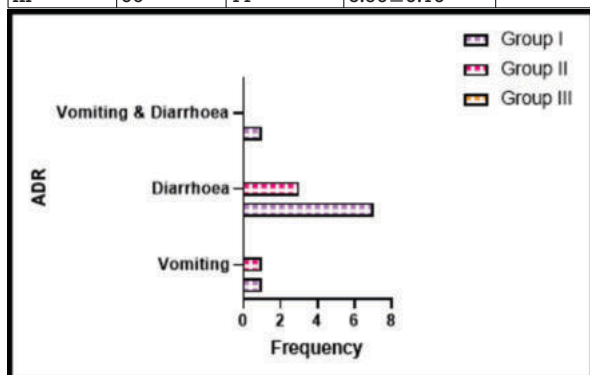


Figure 2. Graph of comparison based on adverse drug reactions

DISCUSSION:

In this study, 300 pediatric patients were admitted with bronchopneumonia with symptoms of fever (95%), cough and cold (100%), and respiratory distress (46.6%). Signs of respiratory distress are age-specific tachypnea, dyspnea, retractions, grunting, and nasal flaring and oxygen saturation <90. Males are more when compared to females which coincides with the study at a pediatric clinic in Sarajevo.⁽³⁾ This research emphasizes the significance of vaccines in preventing childhood pneumonia. Incomplete immunization has considerably enhanced the probability of acquiring bronchopneumonia as both baseline and booster vaccines serve to prevent childhood pneumonia. Out of 300

participants, 40% had a history of pre-hospital antibiotic use with the most commonly used antibiotic being ceftriaxone (17.3%), followed by amoxicillin (9.6%), azithromycin (9.3%) and amoxicillin+clavulanic acid (3.3%). This finding mirrors that reported in a study in Lagos State University Teaching Hospital, Nigeria, where amoxicillin, ampicillin/Cloxacillin, cotrimoxazole and Amoxil-clavulanic acid were the common antibiotics used for the treatment of children with fever.⁽⁴⁾ Breastfeeding lasting up to 6 months was found to be a protective factor against bronchopneumonia, thereby reducing the severity of the disease. These results are from the study conducted at the Philanthropic Children's hospital in Uberaba, Brazil.⁽⁵⁾ House overcrowding is correlated to bronchopneumonia demonstrating that the absence of crowding in the child's room was a factor preventing the disease. Overcrowding is defined as two or more people sleeping in the same room as the child. These findings are in agreement with the case control study conducted in Brazil.⁽⁶⁾ We found no direct relationship between parenteral smoking and the occurrence of bronchopneumonia. This finding is in agreement with the result of a previous study conducted in Brazil.⁽⁵⁾ Diagnostic tests performed include chest radiographs which identify complications, presence, size and character of infiltrates; C-reactive protein which provides useful information for clinical management in severe cases and is used to access response to therapy. Complete blood picture which provides useful information in clinical management. The yield of blood culture was found to be low. Interpretation of culture includes no growth (52.6%), Streptococcus pneumonia (21%), Haemophilus influenza type b (12%), Staphylococcus aureus (12.3%) and Klebsiella pneumonia (2%). Resistance to piperacillin-tazobactam was documented in 8 patients. The study recommends the use of parenteral ceftriaxone and piperacillin-tazobactam for patients with non-severe to severe disease. Linezolid is administered in addition to piperacillin+tazobactam if there is no clinical improvement. Concomitant therapy used in the treatment of bronchopneumonia includes antipyretics, antihistamines, secretolytic agents, decongestants, nebulization, oxygen inhalation and prophylactic agents. Ceftriaxone was administered to 18% of all patients. The average duration of treatment with ceftriaxone is 8.96 days. Piperacillin+tazobactam was administered in 54.6% of patients with an average duration of treatment of 9.14 days. Linezolid was added in 27.3% of patients with an average duration of treatment of 9.25 days. The dose of antibiotics administered increases linearly with age, with the lowest dose administered to infants. On clinical improvement, intravenous antibiotics were switched to either oral macrolide (azithromycin, erythromycin) or third-generation cephalosporins (Cefpodoxime proxetil). Adverse drug reactions like antibiotic-associated Diarrhoea, nausea and vomiting were seen.

CONCLUSION:

This study demonstrated the association of breastfeeding and complete Immunization as a protective factor for preventing and reducing the severity of childhood pneumonia. Of all the risk factors assessed in the study, house overcrowding was found to have a significant association with the prevalence of pneumonia. Treatment of bronchopneumonia varies from patient to patient and depends on factors like severity of disease condition, immunization status, pre-hospital antibiotic use and local resistance pattern. In mild to moderate bronchopneumonia, the effect of piperacillin-tazobactam and ceftriaxone showed good response with a small margin of difference. This study concludes that linezolid is a useful addition for the treatment of bronchopneumonia when there is no clinical improvement within 48 hours.

Conflict Of Interest: The authors have no conflicts of interest regarding this investigation.

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