



MEDICO RESEARCH CHRONICLES

ISSN NO. 2394-3971

DOI No. 10.26838/MEDRECH.2021.8.3.499

Contents available at www.medrech.com

FACTORS DETERMINING CHANGE OF ANTIBIOTIC AND PROLONG HOSPITAL STAY IN CHILDREN WITH SEVERE PNEUMONIA IN A TERTIARY CARE HOSPITAL, DHAKA, BANGLADESH

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ARTICLE INFO

Article History

Received: April 2021

Accepted: May 2021

Keywords: Antibiotics Change, Cyanosis, Hypoxemia, Anaemia, Leukocytosis, Positive CRP.

ABSTRACT

Background: Pneumonia is one of the most common infections in the pediatric age group and one of the leading diagnoses that results in hospital admission for children. Severe pneumonia remains a common and serious condition worldwide. Various micro-organisms can cause pneumonia, and etiologies differ by age. Clinical manifestations vary, and diagnostic testing is frequently not standardized. **Objective:** To identify the factors determining the need of antibiotic change and prolong hospital stay in children Under Five Years of Age Hospitalized with Severe Pneumonia. **Study design:** Prospective observational cohort study. **Study place and period:** Dhaka Shishu (Children) Hospital, Dhaka, from December 2012 to May 2013. **Study population:** Children under 5 years of age admitted with severe pneumonia. **Sample size:** n= One Hundred Fifty included. **Methods/ Procedure:** All the data was collected and recorded systematically in a questionnaire and was analyzed using computer software SPSS (Statistical package for social sciences) and analysis was multivariate to find out the significant factors. **Main outcome measures:** Change of antibiotic and prolong hospital stay, in children Under Five Years of Age Hospitalized with Severe Pneumonia of this study. **Results:** The mean age was found 9.49 ± 6.83 months with range from 2 months to 36 months and Male to female ratio was 2:1. The duration of hospital stay was >5 days in almost two third (62.7%) of the patients. The mean age of the mothers was 24.67 ± 4.19 years. Regarding study of association of different factors with prolong hospital stay it was observed that patients who needed prolong hospital stay 53.2% of them live in an overcrowded environment and 32.1% patients live in an overcrowded environment

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who didn't need prolong hospital stay. Among 150 study patients, 98(65.3%) needed a change in antibiotics, 94(62.7%) patients needed more than 5 days' hospital stay. 34.7% patients were exclusively breast fed of those who needed a change in antibiotic and 80.8% among those who didn't need any change. 85.7% presented with head nodding among those who needed antibiotic change, on the other hand, 19.2% with head nodding among those who didn't need antibiotic change. Leukocytosis was found 57.1% and 19.2% among patients those who needed a change of antibiotics and didn't need antibiotic change respectively. In patients who needed a change of antibiotic, positive blood culture was found in 20.4% cases and it was 0% among patients who didn't need a change. Radiological abnormality was found in 87.8% of patients who needed antibiotic change and 42.3% in patients who didn't need antibiotic change. Statistically significant ($p < 0.05$) factors associated with two groups of patients those who needed a change of antibiotic and those who didn't need are overcrowding, exclusive breast feeding, head nodding on presentation, leukocytosis, positive blood culture and abnormal CXR. **Conclusion:** Children hospitalized with severe community acquired pneumonia [as defined by World Health Organization (WHO)] who had not received exclusive breastfeeding, had stayed in overcrowded homes, and had an abnormal chest radiograph were more likely to fail to respond with the primary antibiotic regimen and require change of antibiotics and prolonged hospital stay.

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I INTRODUCTION

Pneumonia is one of the most common infections in the pediatric age group and one of the leading diagnoses that result in hospital admission for children. Various micro-organisms can cause pneumonia, and etiologies differ by age. Clinical manifestations vary, and diagnostic testing is frequently not standardized. Pneumonia is an inflammation of the parenchyma of the lungs.¹ It is usually caused by viruses or bacteria. Most serious episodes are caused by bacteria. Pneumonia is classified as very severe, severe, and non-severe based on the clinical features with specific treatment for each of them.² Children with severe and very severe pneumonia require hospital admission for their treatment. According to WHO severe or very severe pneumonia is diagnosed when a child develops a cough or difficult breathing plus at

least one of the following signs- lower chest wall in drawing, nasal flaring, grunting, central cyanosis, inability to breastfeed or drink or vomit everything, convulsion, lethargy or unconsciousness.² Pneumonia is a substantial cause of morbidity and mortality in childhood (particularly among children <5yrs of age) throughout the world, with an estimated 146-159 million new episodes per year in developing countries. Pneumonia is estimated to cause approximately 4million deaths among children worldwide.¹ Pneumonia kills more children than any other illness- more than AIDS, malaria, and measles combined. Each year more than 2 million children under five die of pneumonia in the developing world.³ Recent estimates from the WHO suggest that pneumonia is responsible for 20% of deaths in the above age group, leading to 3million deaths per year. Of these deaths, two-thirds

occur during infancy and more than 90% occur in developing countries.⁴ In Bangladesh, recent estimates in under-fives suggest that 21% death is due to pneumonia which is also a major cause of death in total population.⁵ Various interventions have been done to reduce pneumonia-related morbidity and mortality. In 1983, the World Health Organization (WHO) initiated the Acute Respiratory Infection Control program which led to a decline in the infant mortality rate by 10.7 (4.8-16.7) deaths per 1000 live births and a decline in the mortality of under-fives by 36 deaths per 1000 live births.⁶ The ARI control program includes the identification of children with pneumonia by clinical features and administration of antimicrobials with a presumption that the majority of pneumonia in developing countries is because of bacterial pathogens. For further impact on morbidity and mortality, a thorough knowledge of the determining factors affecting the outcome of the disease is important. Reducing pneumonia deaths requires implementing effective prevention measures so that children are healthier and less likely to develop pneumonia in the first place. So, for both the prevention and also for effective treatment we need to evaluate the relevant factors that determine the outcomes including the need for a change of antibiotics, prolonged hospital stay, need for mechanical ventilation, and mortality. Various studies have evaluated the determinants for mortality in children due to pneumonia. Factors associated with increased mortality include the young age of the mother and lack of proper education, lack of breastfeeding, late hospitalization with cyanosis, altered sensorium, grunting, associated chest in drawing, and inability to drink.⁶⁻⁸ Inadequate nutrition and acute lower respiratory infection (ALRI) are overlapping and interrelated health problems affecting children in developing countries. Based on a critical review of randomized trials of the effect of nutritional interventions on ALRI morbidity and

mortality, Roth *et al.*⁹ For more than 30 years, vaccines have played an important part in pneumonia prevention. Recent advances have created opportunities for further improving child survival through the prevention of childhood pneumonia by vaccination¹⁰. Childhood pneumonia is the leading single cause of mortality in children aged less than 5 years¹¹. The incidence in this age group is estimated to be 0.29 episodes per child-year in developing and 0.05 episodes per child-year in developed countries. This translates into about 156 million new episodes each year worldwide, of which 151 million episodes are in the developing world. Most cases occur in India (43 million), China (21 million), and Pakistan (10 million), with additional high numbers in Bangladesh, Indonesia, and Nigeria (6 million each). Of all community cases, 7–13% are severe enough to be life-threatening and require hospitalization.

II MATERIALS AND METHODS

Study design: This study was a prospective observational cohort study

Place of study: The study was carried out at Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh.

Study period: December 2012 to May 2013.

Study population: Children under 5 years of age admitted with severe pneumonia.

Sample size: n= One Hundred Fifty included.

Inclusion criteria:

1. Children under 5 years of age who were admitted with the diagnosis of severe pneumonia according to WHO criteria.

Exclusion criteria:

1. Co-morbidities like chronic respiratory disease or meningitis.
2. Those with a history of admission in another hospital before the presentation.
3. Those who will develop various complications during treatment like pneumothorax or pleural effusion.

Procedures of collecting data: Data was collected from the legal guardians by interview and by physical examination of the

child and from investigation reports. The number of people staying together and the number of available rooms in the house were recorded. Overcrowding was determined by calculating the number of family members per room. A child who was not found to be in the following norm: 1 room 2 persons, 2 rooms 3 persons, 3 rooms 5 persons, 4 rooms 7 persons, 5 or more rooms 10 persons (additional 2 for each further room) was labeled as staying in overcrowded house¹³. Immunization status was assessed by verifying the immunization records or asking parents. An infant who received only breastfeeding till the age of 6 months was considered to be exclusively breastfed. The treatment is given and progress notes were recorded daily including any change of antibiotics. Day of discharge or death was recorded. Hospital stay was considered to prolong if it is more than 5 days as according to WHO guidelines severe

pneumonia usually needs three to five days of hospital treatment. The antibiotics were changed if the patient did not improve after 48 hours of initiation of treatment or deteriorated in form of the increasing chest in drawing or worsening hypoxemia. Mechanical ventilation was indicated if the child had a respiratory failure or had impending respiratory failure.

The procedure of data analysis: Statistical analyses were carried out by using the Statistical Package for Social Sciences version 16.0 for Windows (SPSS Inc., Chicago, Illinois, USA). The mean values were calculated for continuous variables. The quantitative observations were indicated by frequencies and percentages. The Chi-Square test was used to analyze the categorical variables, shown with cross-tabulation. An unpaired t-test was used for continuous variables. P values <0.05 were considered statistically significant.

III RESULTS

Table-1: Distribution of the study patients by age (n=150)

Age (months)	Number of patients	Percentage
≤12	102	68.0
13-24	46	30.7
>24	2	1.3
Mean±SD	9.49±6.83	
Range (min, max)	(2 ,36)	

Table 1 shows the age distribution of the study patients. It was observed that the majority 102(68.0%) patients belonged to age ≤12

months. The mean age was found 9.49±6.83 months with a range from 2 months to 36 months.

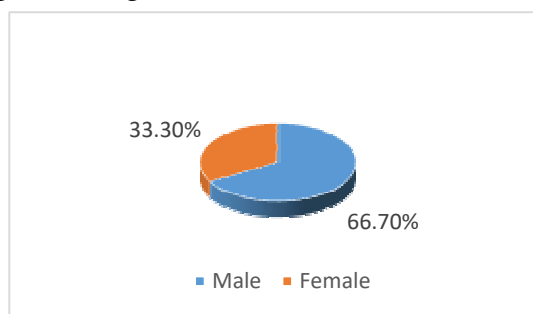


Figure 1: Pie chart showing the distribution of the study patients by sex (n=150).

The pie chart shows the sex distribution of the study patients. It was observed that more than two-thirds (66.7%) of patients were male and

50(33.3%) were female. The male-to-female ratio was 2:1.

Table-2: Distribution of the study patients by duration of hospital stay (n=150)

Hospital stay (day)	Number of patients	Percentage
≤5	56	37.3
>5	94	62.7
Mean±SD	7.09±3.00	
Range (min, max)	(1 ,13)	

Table 2 shows the hospital stay of the study patients. It was observed that almost two-thirds (62.7%) of patient’s duration of hospital

stay >5 days. The mean duration of hospital stay was 7.09±3.00 days.

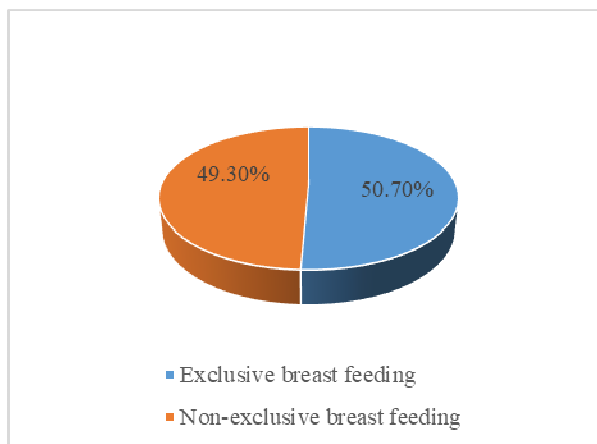


Figure 2: Pie chart showing the distribution of the study patients by exclusive breastfeeding (n=150).

The pie chart shows the trend of exclusive breastfeeding of the study patients. It was

observed that at least half (50.7%) of the patients got exclusive breastfeeding.

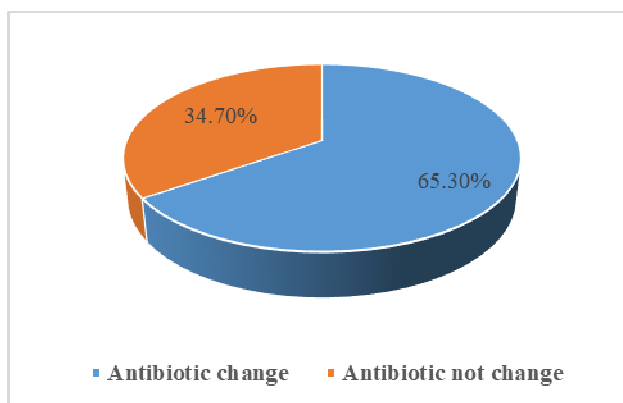


Figure 3: Pie chart showing Distribution of the study patients by Need of change of antibiotics.

The pie chart shows antibiotic change was needed in 98(65.3%) and not needed in 52(34.7%) patients.

Table 3: Distribution of the study patients by the association of different factors with prolonging hospital stay (n=150)

Factors	Prolong Hospital stay (>5days)				P-value
	Yes (n=94)		No (n=56)		
	n	%	n	%	
Over Crowding	50	53.2	18	32.1	^a 0.012 ^s
Mothers age (years)					
≤20	16	17.0	10	17.9	
21-25	42	44.7	28	50.0	
26-30	34	36.2	14	25.0	
>30	2	2.1	4	7.1	
Mean±SD	24.51±3.76		24.93±4.82		^b 0.562 ^{ns}
Range (min,max)	18,35		19,40		
Mothers education					
Cannot read & write	22	23.4	12	21.4	
Can only read & write	36	38.3	14	25	
upto class five	18	19.1	14	25	^a 0.283 ^{ns}
Upto class eight	8	8.5	10	17.9	
SSC & more	10	10.6	6	10.7	
Smoking by family member	68	72.3	32	57.1	^a 0.056 ^{ns}
Exclusive breast feeding	31	33.0	45	80.4	^a 0.001 ^s
Low birth weight	12	12.8	2	3.6	^a 0.061 ^{ns}
Incomplete Immunization	8	8.5	2	3.6	^a 0.205 ^{ns}
Altered sensorium	13	13.8	3	5.4	^a 0.103 ^{ns}
Head nodding	78	83.0	16	28.6	^a 0.001 ^s
Cyanosis	14	14.9	10	17.9	^a 0.632 ^{ns}
Hypoxemia (SPO ₂ <90%)	12	12.8	10	17.9	^a 0.393 ^{ns}
Anemia	14	14.9	10	17.9	^a 0.632 ^{ns}
Leukocytosis	54	57.4	12	21.4	^a 0.001 ^s
Positive CRP	62	66.0	40	71.4	^a 0.487 ^{ns}
Positive blood C/S	18	19.1	2	3.6	^a 0.006 ^s
Abnormal CXR	78	83.0	30	53.6	^a 0.001 ^s

s=significant; ns=not significant

^aP value reached from chi-square test

^bP value reached from unpaired t-test

Regarding the study of the association of different factors with prolong hospital stay it was observed that patients who needed prolong hospital stay 53.2% of them live in an overcrowded environment and 32.1% of patients live in an overcrowded environment

who didn't need prolong hospital stay. 33.0% of patients were exclusively breastfed of those who needed to prolong hospital stay and 80.4% among those who didn't need to prolong hospital stay. 83% presented with head-nodding among those who needed to

prolong hospital stay, on the other hand, 28.6% presented with head nodding to those who didn't need to prolong hospital stay. Leukocytosis was found in 57.4% and 21.4% among patients who needed prolong hospital stay and not needed to prolong hospital stay respectively. In patients who needed prolong hospital stay, positive blood culture was found in 19.1% of cases and it was only 3.6% among patients who didn't need prolong hospital stay.

Radiological abnormality was found in 83% of patients who needed prolong hospital stay and 53.6% in patients who didn't need prolong hospital stay. Statistically significant ($p < 0.05$) factors associated with two groups of patients those who needed to prolong hospital stay and those who didn't need are overcrowding, exclusive breastfeeding, head nodding on presentation, leukocytosis, positive blood culture, and abnormal CXR.

Table 4: Distribution of the study patients by an association of different factors with the need for antibiotics change (n=150)

Factors	Status of antibiotics change				P-value
	Yes (n=98)		No (n=52)		
	n	%	n	%	
Over crowding	54	55.1	14	26.9	^a 0.001 ^s
Mothers age (years)					
≤20	16	16.3	10	19.2	
21-25	44	44.9	26	50.0	
26-30	36	36.7	12	23.1	
>30	2	2.0	4	7.7	
Mean±SD	24.57	±3.72	24.85	±4.96	^b 0.697 ^{ns}
Range (min, max)	18	,35	19	,40	
Mothers education					
Cannot read & write	24	24.5	10	19.2	
Can only read & write	36	36.7	14	26.9	
Upto class five	18	18.4	14	26.9	^a 0.153 ^{ns}
Upto class eight	8	8.2	10	19.2	
SSC & more	12	12.2	4	7.7	
Smoking by family member	68	69.4	32	61.5	^a 0.331 ^{ns}
Exclusive breast feeding	34	34.7	42	80.8	^a 0.001 ^s
Low birth weight	12	12.2	2	3.8	^a 0.077 ^{ns}
Incomplete Immunization	8	8.2	2	3.8	^a 0.260 ^{ns}
Altered sensorium	8	8.2	8	15.4	^a 0.172 ^{ns}
Head nodding	84	85.7	10	19.2	^a 0.001 ^s
Cyanosis	19	19.4	5	9.6	^a 0.120 ^{ns}
Hypoxemia (SPO ₂ <90%)	18	18.4	4	7.7	^a 0.078 ^{ns}
Anemia	14	14.9	10	17.9	^a 0.431 ^{ns}
Leukocytosis	56	57.1	10	19.2	^a 0.001 ^s
Positive CRP	64	65.3	38	73.1	^a 0.331 ^{ns}
Positive Blood C/S	20	20.4	0	0.0	^a 0.001 ^s
Abnormal CXR	86	87.8	22	42.3	^a 0.001 ^s

s=significant; ns=not significant,

^aP value reached from chi-square test, ^bP value reached from unpaired t-test

Regarding the study of the association of different factors with the need for antibiotic change, it was observed that patients who needed change in antibiotic, 55.1% of them live in an overcrowded environment and 26.9% of patients live in overcrowded environments those who didn't need any change of antibiotic. 34.7% of patients were exclusively breastfed of those who needed a change in antibiotic and 80.8% among those who didn't need any change. 85.7% presented with head-nodding among those who needed antibiotic change, on the other hand, 19.2% with head-nodding among those who didn't need antibiotic change. Leukocytosis was found in 57.1% and 19.2% among patients who needed a change of antibiotics and didn't need antibiotic change respectively. In patients who needed a change of antibiotic, positive blood culture was found in 20.4% of cases and it was 0% among patients who didn't need a change. Radiological abnormality was found in 87.8% of patients who needed antibiotic change and 42.3% in patients who didn't need antibiotic change. Statistically significant ($p < 0.05$) factors associated with two groups of patients those who needed a change of antibiotics and those who didn't need is overcrowding, exclusive breastfeeding, head nodding on presentation, leukocytosis, positive blood culture, and abnormal CXR.

IV DISCUSSION

This prospective observational cohort study was carried out to find out the factors upon which the need for a change of antibiotics or prolong hospital stay depends on children hospitalized with severe pneumonia. A total of 150 children under 5 years of age admitted with severe pneumonia according to WHO criteria in the Paediatrics Department of Dhaka Shishu Hospital, Dhaka, between December 2012 to May 2013 were included in this study. Childhood pneumonia is the leading single cause of mortality in children aged less than 5 years¹¹. The incidence in this age group is estimated to be 0.29 episodes per child-year

in developing and 0.05 episodes per child-year in developed countries. Community-acquired pneumonia (CAP) remains a common and serious condition worldwide. The mortality from severe CAP remains high, and this has reached 50% in some series. Lee *et al.*¹² conducted a study to determine the mortality and predictors that contribute to in-hospital mortality for patients who exhibit CAP and acute respiratory failure that requires mechanical ventilation. The present study findings were discussed and compared with previously published relevant studies. In this present study, it was observed that more than two-thirds (68.0%) of the patients belonged to age ≤ 12 months and the mean age was found 9.49 ± 6.83 months with a range from 2 months to 36 months. Similarly, Tiewsoh *et al.*⁴ showed that the mean age of the children with severe pneumonia was 11.74 ± 2.44 months and among them, 71.5% of infants were less than 12 months of age, Uddin *et al.*¹⁴ found in their study that 2-6 months old infants were 62.5% and rest 37.5% age belonged to $> 6 - 12$ months. Ramachandran *et al.*¹⁵ mentioned in their study that the majority (48.0%) of the children were in the age group 1-6 months and Andersson and Olomi¹⁶ found the mean age was 11 months, which are comparable with the current study. In this current study, it was observed that more than two-thirds (66.7%) of the patients were male and 33.3% were female. The male-to-female ratio was 2:1, which indicates that severe pneumonia is predominant in male subjects. Uddin *et al.*¹⁴ found out of 192 children, 70.8% and 29.2% were male and female respectively. Similar observations regarding the male predominant in severe pneumonia were also made by Ramachandran *et al.*¹⁵, Andersson & Olomi¹⁶ and Tiewsoh *et al.*⁴, which are closely resembled agree with the present study. In this series, it was observed that the duration of hospital stay was > 5 days in almost two-third (62.7%) of the patients and the mean duration of hospital stay was 7.09 ± 3.00 days varied

from 1–13 days, which is consistent with Tiewsoh *et al.*⁴ study, where the investigators found that 51.0% stayed for more than 5 days in the hospital. In this study, it was observed that 54.7% of patients lived in an overcrowded environment at home and 45.3% lived in a not crowded environment, which is closely resembled with Tiewsoh *et al.*⁴ study, where the authors found 68.0% lived in from overcrowded families, which may indicate that severe pneumonia in children develops an overcrowded environment. In this current study, it was observed that 46.7% of infants' mothers belong to the 21-25 years' age group, and the mean age of the mothers was 24.67±4.19 years varied from 18 – 40 years. Uddin *et al.*¹⁴ found the maternal age under 18 years 5.7% and more than 18 years 94.3%. In this series, it was observed that most of the mothers had no institutional background, where 22.7% mother cannot read and write at all and 33.3% mother can only read and write and rest of other had poor level of formal education. Regarding the clinical evaluation, it was observed in this present study that 10.7% of patients had altered sensorium, 62.7% head nodding, 16.0% cyanosis, 14.7% presented with $SPO_2 < 90\%$. In another study, Andersson and Olomi¹⁶ found cyanosis 3.0% in their study, which is a little lesser than the current study. In this current study, it was observed that most (84.0%) of the patients had normal hemoglobin level, normal total leukocyte count was found in 56.0%, normal CRP level was found in 32.0% of the patients. Positive blood culture was found in 13.3% and there was no growth in blood culture in 86.7% of the patients. Almost similar findings were obtained by Andersson & Olomi¹⁶ and Tiewsoh *et al.*⁴. In this present study, it was observed that normal CXR was found in 28.0% and abnormal CXR was found in 72.0% of the patients. In this current study, it was observed that antibiotic change was needed in 65.3% and not needed in 34.7% of the patients. Similarly, Tiewsoh *et al.*⁴ showed that

56.5% needed a change in antibiotics, which is consistent with the present study. In another study, Andersson and Olomi¹⁶ reported in their study that second-line treatment with antibiotics was given in 27.8% of cases; single treatment with parenteral ceftriaxone was most common, followed by parenteral cloxacillin, 2.0% of patients were given a third-line of parenteral antibiotics, 4.3% of patients were treated with oral antibiotics only, all received amoxicillin. In this present study, it was observed that most (88.0%) of the patients were improved and 12.0% expired. Similarly, Uddin *et al.*¹⁴ and Tiewsoh *et al.*⁴ found died 10.5% and 10.5% in their respective studies. Almost similar mortality was also found by Andersson and Olomi¹⁶, where it was 7.1% of their study. In another study, Ramachandran *et al.*¹⁵ found the mortality in the age group of 1 month to 59 months was 3.9% in their study period. Regarding the association between different factors with prolong hospital stay it was observed in this current study that patients who needed prolong hospital stay 53.2% of them live in an overcrowded environment and 32.1% of patients live in an overcrowded environment who didn't need prolong hospital stay. Almost one-third (33.0%) of patients were exclusively breastfed of those who needed to prolong hospital stay and 80.4% among those who didn't need to prolong hospital stay. Most (83%) of the patients with head nodding and 28.6% among those who didn't need to prolong their hospital stay. Leukocytosis was found in 57.4% among patients who needed prolong hospital stay and 21.4% who didn't need prolong hospital stay. In patients who needed prolong hospital stay, positive blood culture was found in 19.1% of cases and it was only 3.6% among patients who didn't need prolong hospital stay. Radiological abnormality was found in 83% of patients who needed prolong hospital stay and 53.6% in patients who didn't need prolong hospital stay. Overcrowding, head nodding on presentation, leukocytosis, positive blood

culture, and abnormal CXR were significantly ($p < 0.05$) higher in patients with prolonging hospital stay and exclusive breastfeeding significantly ($p < 0.05$) higher who didn't need prolong hospital stay, which indicates that the above factors are significantly associated with a prolonged hospital stay, but other factors like Mothers age, Mothers education, Smoking by a family member, Low birth weight, Incomplete Immunization, Altered sensorium, Cyanosis, Hypoxemia ($SPO_2 < 90\%$), anemia and Positive CRP were almost similar. Tiewsoh *et al.*⁴ mentioned in their study that factors associated with prolonged hospital stay included overcrowding at home [RR (95%CI)- 2.59 (1.78–3.23)], lack of exclusive breastfeeding [RR (95%CI)- 2.56 (2.0– 2.93)] and an abnormal chest radiograph [RR (95%CI)- 2.99 (1.65–4.38)] on multivariate analysis, which is consistent with the present study. Regarding the association between different factors with the need for antibiotics change it was observed in this series that patients who needed a change in antibiotic, 55.1% of them live in an overcrowded environment and 26.9% of patients live in an overcrowded environment those who didn't need any change of antibiotic. More than one-third (34.7%) of patients were exclusively breastfed of those who needed a change in antibiotic and 80.8% among those who didn't need any change. Most (85.7%) of the patients with head-nodding among those who needed a change of antibiotics and 19.2% among those who didn't need a change of antibiotics. Leukocytosis was found in 57.1% and 19.2% who needed a change of antibiotics and those who didn't need a change of antibiotics respectively. Positive blood culture was found in 20.4% of cases and it was 0% among patients who didn't need a change. Radiological abnormality was found in 87.8% of patients who needed antibiotic change and 42.3% in patients who didn't need antibiotic change. Overcrowding, head nodding on presentation, leukocytosis, positive blood

culture, and abnormal CXR were significantly ($p < 0.05$) higher in patients who needed change antibiotic and exclusive breastfeeding significantly ($p < 0.05$) higher in patients who didn't need change antibiotic, which indicates that the above factors are significantly associated with antibiotic change, but other factors like mothers age, mothers education, smoking by a family member, low birth weight, incomplete immunization, altered sensorium, cyanosis, hypoxemia ($SPO_2 < 90\%$), anemia and Positive CRP were almost alike. Similarly, Tiewsoh *et al.*⁴ mentioned that factors associated with treatment failure requiring a change of antibiotics included overcrowding at home [RR (95% CI)- 1.94 (1.35–2.38)], lack of exclusive breastfeeding [RR (95% CI)- 2.63 (2.16– 2.86)] and an abnormal chest radiograph [RR (95% CI)- 2.29 (1.22–3.44)], which support the current study. Shah *et al.*¹⁷ and Coles *et al.*¹⁸ reported that low birth weight has been associated with the development of severe pneumonia. In another study, Suwanjutha *et al.*¹⁹ found Low birth weight has also been reported to be a risk factor for increased mortality. Maternal education emerged as an important determinant in radiographically confirmed pneumonia for prolonging hospital stay and the need for mechanical ventilation. There are not reports linking maternal education with the outcome of pneumonia⁴. However, Gálvez *et al.*²⁰ and Anh *et al.*²¹ mentioned that maternal knowledge of symptoms of pneumonia is associated with early recognition and utilization of health care facilities for their children.

V CONCLUSION

Children hospitalized with severe community-acquired pneumonia [as defined by World Health Organization (WHO)] who had not received exclusive breastfeeding, had stayed in overcrowded homes, and had an abnormal chest radiograph were more likely to fail to respond with the primary antibiotic regimen and require a change of antibiotics

and prolonged hospital stay. Lack of exclusive breastfeeding, overcrowding, head nodding on presentation, leukocytosis, positive blood culture, abnormal CXR, and exclusive breastfeeding were significantly associated with the need for antibiotic change and hence prolong hospital stay, therefore may be treated aggressively with second-line antibiotics from the beginning that may reduce their hospital stay.

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