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Original Research Article

Clinical and aetiological profile of Pneumonia in age group between 1 month to 1 year: a hospital based prospective study

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ABSTRACT

Background: Pneumonia is one of the leading causes of morbidity and mortality in children under five years of age across the world. The present study was designed to clinically evaluate the children of age 1 month to 1 year with pneumonia, correlate it with bacteriological, radiological findings and to study the risk factors.
Methods: Clinical, bacteriological, radiological features and risk factors of community acquired pneumonia in children of age group 1 month to 1 year were noted and analysed.
Results: As per WHO ARI control programme, 72% had pneumonia, 25.3 % had severe pneumonia and 2.6% had very severe pneumonia. Bacterial pneumonia was detected radiologically in 4.6% and viral pneumonia in 88.6% of cases. Chest X-ray was normal in 6.6% of cases. Tachypnoea, chest retractions, crepitations alone and crepitations with rhonchi correlated well with positive radiological findings. Inappropriate immunization for age, lack of breast feeding, preterm birth, smoking in family were significant risk factors for severe Pneumonia. 39.3% had leucocytosis and 24% had positive CRP. Culture was positive in 23 cases (15.3% culture positivity).
Conclusions: Radiologically confirmed Pneumonia should be treated with antibiotics because, in clinical practice, it is virtually impossible to distinguish exclusively between viral pneumonia and bacterial pneumonia. As the viruses are most common causative agents of Pneumonia in 1 month to 1 year, PCR kits should be used to identify viral etiological agents. Early and exclusive breast feeding should be promoted to decrease the risk of pneumonia.

Keywords: Bacterial, Clinical, Pneumonia, Radiological, Risk factors, Viral

INTRODUCTION

Pneumonia is one of the leading causes of morbidity and mortality in children under five years of age across the world.[1] With an estimated 146-159 million new episodes per year in developing countries, pneumonia is estimated to cause approximately 4 million deaths among children. 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).[2] In the states and districts with high infant and child mortality rates, 13% of deaths in children are due to pneumonia and 24% of National Burden of Disease is due to pneumonia.[3] Socio environmental factors are acting as major obstacles in prevention of ARI. The utility of simple clinical signs like rapid breathing and

chest indrawing in the early detection and treatment of children with pneumonia by primary health care workers forms the basis for case management strategy formulated by World health organization (WHO) to control mortality and morbidity.[4]

METHODS

This was a hospital based prospective study done at Pragna Children hospital, a tertiary centre at Punjagutta, Hyderabad, India for 2 years from August 2014 to July 2016 with sample size of 150 after taking informed consent from parents.

Inclusion criteria

- All the admitted children of age from 1 month to 12 months who met the WHO criteria of pneumonia.
- Lower respiratory tract infections include very severe pneumonia, severe pneumonia and pneumonia.
- No pneumonia is included in upper respiratory tract infection.

Exclusion criteria

- Neonates, children of age more than 1 year, children having pneumonia as a part of multi system sepsis and children having pre-existing chronic illness, or a co-morbidity or congenital anomalies or congenital heart diseases were excluded.

Method of collection of data (Methodology)

To study the risk factors, birth history about any preterm birth (<37 weeks), low birth weight (<2.5 kg), immunization history (particularly about measles, pneumococcal and haemophilus influenzae type b vaccines), feeding practices (exclusively breast fed or not) was noted. History of smoking in the family, any contact with tuberculosis patient in the family was taken. Socio economic history regarding the type of house (Pucca or Kutcha), family size, overcrowding (based on WHO definition), fuel used for cooking as liquid petroleum gas or solid fuels was recorded. Socio economic status was classified according to modified kuppuswamy scale.[5] Degree of malnutrition based on IAP classification was noted.[6] Based on clinical findings, children were classified into 3 groups were pneumonia, severe pneumonia and very severe pneumonia. Risk factors were studied among these groups. Complete blood count, C-reactive protein, blood culture using BACTEC 9050 system and chest X-ray was done. Degree of malnutrition (based on IAP classification) was noted. Respiratory rate and other signs such as pallor, cyanosis were examined and detailed systemic examination of the respiratory, cardiovascular, abdomen and central nervous system was done.[7]

Complete white blood cell count (TC) and differential counts (DC) were used. Based on radiological findings, children were divided into Bacterial (lobar or segmental consolidations, alveolar infiltrates (described as fluffy, cotton wool-like, or cloud-like), pneumatoceles), Viral (bilateral interstitial infiltrates (can be linear, reticular, nodular or reticulonodular), hyper aeration, perihilar infiltrates, peribronchial cuffing) pneumonias and complications of pneumonia like pleural effusion, empyema, collapse and pneumothorax.[8]

To differentiate viral from bacterial pneumonia.[9] In bacterial pneumonia, WBC counts are in the range of 15000-40,000 cells/cu.mm with a granulocytic predominance. In the viral pneumonia, WBC count may be normal or elevated but usually not higher than 20,000 cells/cu.mm with lymphocytic predominance. Leucopenia can also be seen sometimes in viral infection. Blood culture was used to isolate the bacterial agent. For analytic purpose clinical features, laboratory findings like leucocytosis, positive c-reactive protein were correlated with radiological features. Then bacterial etiology obtained with blood culture was correlated with radiological findings. Continuous data was represented as mean±standard deviation. Categorical data was expressed as numbers in percentage. All analyses were performed using SSPE 20 software. Chi square test was used to determine significant differences between two groups. Odds ratio was determined whenever required. Significance for the statistical tests was predetermined at a probability value of 0.05 or less ($p < 0.05$).

RESULTS

In the present study, 150 cases of pneumonia were studied, majority of cases 98 out of 150 (65.3%) were between 7 months to one year of age and majority 87 out of 150 (58%) were male infants. Hurried breathing (100%), cough (100%) and fever (100%) were the most common symptoms.

Table 1: Showing various signs.

Signs	No.	Percentage
Tachypnea	150	100
Chest retractions	42	28
Crepitations	98	65.3
Rhonchi	43	28.6
Abnormal breath sounds	82	54.6

In this study, tachypnea was present in in all cases (100%), chest retractions were present in 42 (28%), crepitations were heard in 98 out of 150 (65.3%), rhonchi in 43 (28.6%) and abnormal breath sounds (bronchial breathing or diminished breath sounds) in 54.6% of cases (Table 1).

Past history

In the present study, a previous history of similar illness was present in 6.6% (10 cases).

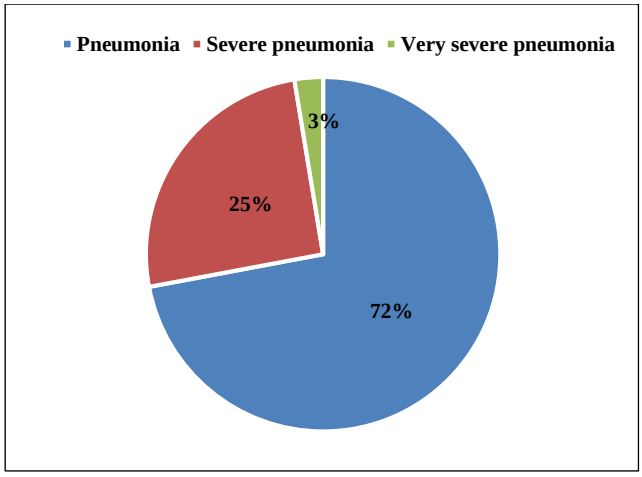

Figure 1: Classification according to WHO ARI programme.

Based on WHO ARI programme, 108 (72%) were with pneumonia (fever, cough fast breathing: (RR ≥60/min if <2 months, RR ≥50/min if 2 to 12 months), 38 (25.33%) were with severe pneumonia(fever, cough ,fast breathing, chest indrawing nasal flaring, grunting, cyanosis) and 4 (3%) were with very severe pneumonia(fever, cough, fast breathing, chest indrawing, not able to drink, convulsions, abnormally sleepy or difficulty to wake ,stridor in a calm child (Figure 1).

Table 2: Clinical diagnosis.

Diagnosis	No.	Percentage
Bronchopneumonia	143	95.3
Lobar pneumonia	7	4.6

Table 3: Radiological findings.

Diagnosis	No.	Percentage
Bacterial pneumonia	7	4.6%
Viral pneumonia	133	88.6%
Normal X ray	10	6.6%

Based on clinical findings 143 out of 150 cases were with Bronchopneumonia. Lobar pneumonia was seen in 7 out of 150 cases (Table 2). In the present study, radiological findings were present in 93.3% of cases. Bacterial pneumonia (Consolidation, alveolar infiltrates) was detected in 4.6%, viral pneumonia (Interstitial infiltrates) in 88.6%. Chest X-ray was normal in 10 cases (Table 3).

In infants with positive radiological findings chest retractions were present in 100%, abnormal breath sounds (bronchial breathing or diminished breath sounds) were seen in 95.1%, crepitations alone in 92.7% and crepitations with ronchi in 97.6% (Table 4).

Table 4: Showing clinical data in comparison with radiological findings.

Clinical data	No.	Radiological findings	
		Positive findings	Normal
Tachypnoea	150	140 (93.3%)	10 (6.6%)
Chest retractions	42	42 (100%)	0
Abnormal breath sounds	82	78 (95.1%)	4 (4.8%)
Crepitations only	55	51 (92.7%)	4 (7.27%)
Crepitations+ Ronchi	43	42 (97.6%)	1(2.3%)

Table 5: Laboratory findings in comparison with radiological findings.

Findings	Total (150)	Bacterial pattern on X-ray	Viral pattern on X-ray	P value	Significance
Neutrophilia	45	3 (6.6%)	42 (93.3%)	1.0	-
Lymphocytosis	14	0	14 (100%)		
Positive CRP	36	3 (8.3%)	33 (91.6%)	0.3	-
Negative CRP	114	4 (3.5%)	110 (96.4%)		

Out of 45 with neutrophilia 3 were with consolidation and alveolar infiltrates, 42 were with interstitial infiltrates on X-ray. Lymphocytosis was seen in 14 cases and all were with interstitial infiltrates on X-ray.

Positive CRP was seen in 36 cases, 33 were with interstitial infiltrates on X-ray. Fischer's Exact t-test was used to find the strength between the variables. The P values were >0.05 so statistically not significant. This proves that there was no correlation of laboratory findings with bacterial and viral pneumonia defined radiologically (Table 5).

Blood culture

In the present study, culture was positive in only 23 of 150 cases (15.3 % culture positivity). Staphylococcus aureus was the most common organism isolated in 9 cases followed by Klebsiella (7 cases), Pseudomonas (3 cases), other staphylococcal species (3 cases), Proteus (1 case) (Figure 2).

Among 23 positive blood cultures only 3 (13%) had bacterial pattern of radiological findings. Remaining 127 were culture negative.

Of which 4(3.1%) were with bacterial pattern chest Xray. Fisher's Exact t-test was used to find the strength between the variables. The P value was 0.07, statistically not significant. In the present study, 28 out of 150 (18.6 %) were prematurely born.

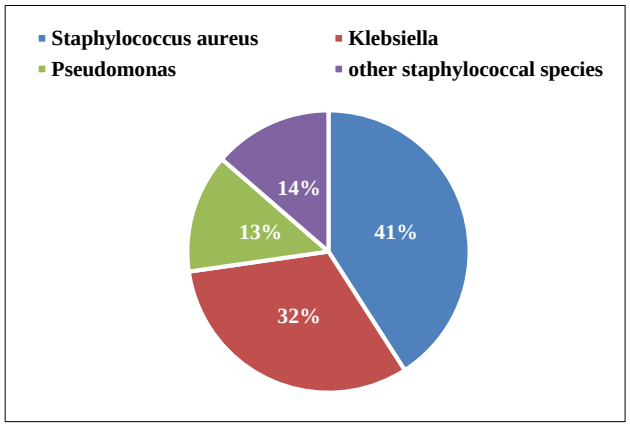

Figure 2: Blood culture in comparison with radiological findings.

In the present study, 71 (47.3%) were completely immunized, 1 (0.6%) were unimmunized and 78 (52%) were partially immunized (Table 6).

Table 6: Immunization status.

Immunization	No.	%
Completely immunized including measles, PCV, Hib vaccines	71	47.3
Partially immunized	78	52
Unimmunized	1	0.6

Table 7: Protein energy malnutrition.

IAP	No.	Percentage
Normal	124	82.6
Grade I	11	7.3
Grade II	12	8
Grade III	03	2
Grade IV	00	00

Table 8: Socioeconomic status.

Grade	No.	Percentage
Grade I	16	10.6
Grade II	72	48
Grade III	53	35.3
Grade IV	09	6
Grade V	00	00

Table 9: Risk factors associated with severity of Pneumonia.

Factor		Pneumonia (108)	Severe pneumonia (38)	Very severe pneumonia (04)	X^2	P	Significance
Age	1-6 months	36	13	3	2.961	0.227	N S
	7-12 months	72	25	1			
History of ARI	Yes	09	0	01	5.357	0.068	N S
	No	99	38	03			
Preterm	Yes	21	04	03	10.06	0.006	S
	No	87	34	01			
Immunization	Complete	58	13	00	7.978	0.018	S
	Incomplete	50	25	04			
Anemia	Yes	29	07	00	2.393	0.302	N S
	No	79	31	04			
Feeding	Breast fed	81	19	02	8.685	0.013	S
	Bottle fed	27	19	02			
Malnutrition	Grade N, I	96	35	04	0.779	0.677	N S
	Grade II, III, IV	12	03	00			
Overcrowded houses	Yes	08	04	00	0.728	0.694	N S
	No	100	34	04			
Fuel for cooking	LPG	99	37	04	1.762	0.414	N S
	Non-LPG	09	01	00			
Smoking in family	Yes	06	09	00	10.72	0.004	S
	No	102	29	04			
Kuppuswamy socioeconomic class	Grade I, II, III	103	34	04	1.99	0.368	N S
	Grade IV, V	05	04	00			

X^2 test (Pearson Chi-Square test), P <0.05-S (significant), P >0.05-NS (Not significant).

Among 71 immunized, 58 were with pneumonia, 13 were with severe pneumonia, among 79 partially immunized/ Unimmunised 50 were with pneumonia, 25 were with severe pneumonia and 4 were with very severe pneumonia. The P value was 0.018 which was statistically significant (Table 9). In the present study, breast-fed were 102 (68%) and bottle fed were 48 (32%). The P value was 0.013 which was statistically significant (Table 9). In the present study, Grade I, II PEM was present in 15% and Grade III in 2% (Table 7). 24% of the patients were anemic. In the present study, majority of children (72%) belonged to Grades II according to modified Kuppuswamy classification (Table 8). Socioeconomic status didn't show significant association with pneumonia in this study (Table 9). In the present study, all people lived in pucca houses. 12 out of 150 (8%) of children had overcrowding in their houses. Only few people 10 out of 150 (6.6%) used fuel other than LPG for cooking.15 out of 150 children had h/o smoking in the family. 9 out of 15 (60%) of them had severe pneumonia. Significant risk factors for Pneumonia were prematurity, lack of immunization, bottle feeding, history of smoking in family as shown in Table 9.

In the present study, mean duration of hospital stay for pneumonia was 2.7 days, in severe pneumonia was 5.3 days and in very severe pneumonia was 8.5 days.

DISCUSSION

Pneumonia continues to pose a threat to health of children in developed and developing countries despite improvements in socioeconomic status, immunization and early diagnosis and treatment.

Age distribution

Age is an important predictor of morbidity and mortality in pediatric pneumonias. In the present study, conducted between the age group of one month to 1 year, majority of cases (65.3%) were between 7 months to one year of age**.**

Sex distribution

In this study, it was observed that males (58%) outweighed females. Male: female ratio was 1.38. This was in comparison with studies done by Sehgal V et al, (58.25) and Drummond P et al, (58%).[10,11]

Symptomatology

The WHO protocol puts forward two signs as the "entry criteria" or basis for examining a child bellow five years of age for possible pneumonia: cough or difficult breathing.

The incidence of presenting symptoms in our study are comparable with studies conducted by Kumar N et al (Table 10).[12]

Table 10: Symptomatology.

Symptoms	Kumar N et al[12]	Present study
Cough	100%	100
Hurried breathing	100%	100
Fever	88%	100

Signs

Tachypnea has been improved to be a sensitive and specific indicator of the presence of pneumonia. Also, the traditional, method of making a clinical diagnosis of pneumonia has been by the recognition of auscultatory signs, in particular crepitations, in a child with cough.

In this study, tachypnea (100%) was the important sign for making a clinical diagnosis of pneumonia. Crepitations (65.3%), ronchi (28.6%) and abnormal breath sounds (54.6%) were the other associated signs. Margolis P et al, Palafox M et al, and Gadomski AM et al, have observed that tachypnoea and chest retractions were highly specific signs in detecting pneumonia.[13-15] Reddaiah VP et al, have reported that crepitations were found in 76% and ronchi in 23.2% of patients with pneumonia.[16]

Clinical diagnosis

In this study, bronchopneumonia was the most common diagnosis (95.3%), Lobar pneumonia in 4.6%. In a study conducted by Reddaiah VP et al, Bronchopneumonia was diagnosed in 64%, Lobar pneumonia in 6.4%.[16]

Radiological findings

Although clinical symptoms and signs are helpful indicators of the presence of disease as well as etiology, radiographic investigation is often used to confirm a clinical diagnosis and to help sort out whether or not antibiotics or more extensive work up is necessary. In our study Chest x-ray showed radiological changes consistent with pneumonia in 93.4% of cases. Bacterial pneumonia was detected in 4.6%, viral pneumonia in 88.6%.

In a study conducted by Virkki R et al, it was found that radiological changes were seen in 85%.[17] Macintyrec R et al, has also reported radiological confirmation in 85% of cases of pneumonia.[18]

Clinical data in comparison with radiological findings

Clinical symptoms and signs can help the clinician determine the need for chest radiography. In this study, author compared the clinical data with radiological findings and found that tachypnoea (93.3%), chest retractions (100%), crepitations (92.7%), crepitations with ronchi (97.6%) and abnormal breathe sounds (95.1%) (Bronchial breathing, diminished breath sounds) correlated well with positive radiological findings.

In a study conducted by Zukin DD et al, it was found that the sign with highest positive predictive value for the presence of any radiographic abnormalities was tachypnoea and chest examination findings such as crepitations and abnormal breath sounds comprised of a high-risk group, which increased significantly the likelihood of pneumonia.[19]

There is frequent disagreement between pneumonia diagnosed by clinical examination and that diagnosed by chest radiography. Radiographs appear to have greater impact on diagnosis and management when any inconsistencies arise.

Laboratory investigations

Our observation showed that only 6.6% cases with neutrophilic leukocytosis, 8.3% of positive CRP had bacterial pattern of radiological findings. There was no correlation of laboratory findings with bacterial and viral pneumonia defined radiologically. This was in comparison with studies done by Virkki R et al.[17]

In study conducted by Virkki R et al, seventeen infective agents (10 viruses and seven bacteria) were searched for and causative agent was found in 215 (85%) of the 254 cases. Half of the children with solely interstitial infiltrates on the chest radiograph had evidence of bacterial infection. The proportion of patients with increased WBC did not differ between bacterial and viral pneumonias, but differences in the CRP levels were significant although the sensitivity for detecting bacterial pneumonia was too low for use in clinical practice. So, it was concluded that most children with alveolar pneumonia, especially those with lobar infiltrates, have laboratory evidence of a bacterial infection. Interstitial infiltrates are seen in both viral and bacterial pneumonias.

Blood culture

In recent years, the best information on the bacterial etiology of pneumonia in young children has been obtained through blood culture, despite the fact that the sensitivity of this method is somewhat lower.

In this study, blood culture was positive in 23 cases (15.3%). *Staphylococcus aureus* was the most common organism isolated in 9 cases followed by *Klebsiella* (7 cases), *Pseudomonas* (3 cases), other *staphylococcal* species (3 cases).

Kabra SK et al, and Bahl R et al, have reported positive blood culture in 16% and 11% of patients respectively. The yield of blood culture varies from 5-15% for bacterial pathogens and cannot be relied upon.[20,21]

Risk factors of pneumonia

In the present study, it was found that incomplete immunization, preterm birth, lack breast feeding, smokers in family were significant risk factor for severe pneumonia. Broor S et al, have reported that lack of breast feeding, severe malnutrition, cooking fuel other than LPG and history of ALRTI in family were significant contributors of severe ALRTI in children.[22]

In a case control study conducted by Hassan MK et al, it was found that age less than 6 months, smoking at home, anemia, lack breast feeding, and malnutrition were significant risk factors for severe pneumonia.[23]

Childhood community acquired pneumonia is a common illness. Several bacteria and viruses and their combinations can cause the infection, but there is a lack of rapid and commercially available laboratory tests for most pathogens which may explain why the aetiology is rarely established in clinical practice and why antibiotic treatment is empirical in most cases. Up to 60% of the cases are associated with respiratory virus infections, so unnecessary and ineffective antibiotic treatment may often be used.[24]

Many published studies have addressed the differentiation of bacterial from viral pneumonia using clinical, radiological and routine hematological tests but these methods have not been found to be sufficiently reliable in differential diagnosis.[25,26] These studies have been hampered by incomplete aetiological approaches. Some studies have looked only for a limited number of microbes, some have used insensitive techniques, and some have used only serological tests or bacterial antigen tests. It is therefore not well established whether bacterial and viral pneumonia can be differentiated by routine radiological and laboratory tests.

In all these studies, it was concluded that Interstitial infiltrates are seen in both viral and bacterial pneumonias. With the exception of serum CRP levels, routine hematological tests have very little practical value in addition to a chest radiograph. It is evident that all children with radiologically confirmed pneumonia should be treated with antibiotics because, in clinical practice, it is virtually impossible to distinguish exclusively between viral pneumonia and bacterial pneumonia.

CONCLUSION

Among the risk factors studied, inappropriate immunization for age, lack of breast feeding, preterm birth, smoking in family were found significant for severe pneumonia. Symptoms and signs mentioned in the WHO ARI control programme were very sensitive and can be applied to hospitalized children. Early and exclusive breast feeding should be promoted to decrease the risk of pneumonia. As the viruses are most common causative agents of pneumonia in 1 month to 1 year, PCR kits should be used to identify viral etiological agents. Radiologically confirmed pneumonia should be treated with antibiotics because, in clinical practice, it is virtually impossible to distinguish exclusively between viral pneumonia and bacterial pneumonia.

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