A study of clinical, bacteriological and radiological profile of severe pneumonia in children

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Abstract

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. Universality, vulnerability and frequency of occurrence of ALRTI in children are well recognized all over the world.

Methods: This prospective clinical study of severe pneumonia conducted on n=150 children who were admitted to pediatric wards and PICU in PIMS, Nagunoor, Karimnagar. A detailed examination of each child including anthropometry was carried out. During the general physical examination, emphasis was laid on assessing general condition of the child, respiratory rate (counted over 1 minute), presence of fever and other signs such as cyanosis and pallor. Detailed systematic examination of the respiratory, cardiovascular and central nervous system was done. Any associated illness such as septicemia, meningitis and congestive cardiac failure if present was noted.

Result: In this prospective study, n=150 cases of severe pneumonia were studied. In the present study, majority of cases (53%) were less than one year of age. majority of the cases were diagnosed as Bronchopneumonia (66.67%), Lobar pneumonia was diagnosed in 18.6% of cases and pneumonia and its complications in 9.3% of cases. In the present study, radiological findings were present in 80.66% of cases Bacterial pneumonia was detected in 62.67%, viral pneumonia in 14%. Culture was positive in only of cases. *S. pneumonia* was the most common organism isolated (6 cases) followed by *S. aureus* (n=5 cases) and *Klebsiella* (n=3 case). n the present study, antibiotics were given in all cases.

Conclusion : In this study we found Bronchopneumonia is the predominant form of presentation in infants and preschool children. Among the risk factors studied, previous history of similar illness, inappropriate immunization for age, anemia, PEM grade 3 and 4, were found significant causes for severe pneumonia.

Keywords: Severe Pneumonia, Children, Radiological Diagnosis

Introduction

Infections of respiratory tract are very common especially in children. They are the cause of discomfort, disability, loss of working time in adults; they are substantial cause of morbidity and mortality in children. [1] In developing countries severe acute respiratory infections are the common cause of death in children. It has been estimated that approximately 4 million deaths occurs worldwide due to acute respiratory infections. In almost all SRI deaths in young children are due to acute lower respiratory infections mostly due to pneumonia. [2] Some of the factors affecting the children today are industrialization and urbanization which has compounded the problems associated with acute respiratory infections leading to increase morbidity and mortality. Therefore the future health of children relies greatly on the prevention, diagnosis and treatment of cases of acute lower respiratory tract infections. The use of simple clinical signs like rapid breathing and chest drawing for the diagnosis of pneumonia in infants and young children has been well established. The use of clinical sings for the early detection and treatment of children with pneumonia by primary health workers forms the case management which has been formulated by the World Health Organization (WHO) to decrease the mortality and morbidity. [3] The etiology of pneumonia in children in difficult to establish especially in children empirical antibiotic therapy is commonly used to treat pneumonia. Clinical and radiological examination cannot adequately reflect the etiology of childhood pneumonia. [4] ARI is preventable however; socioeconomic factors are the major obstacle in the prevention of ARI. The epidemiological factors and management varies from one geographical area to other and a large gap exists between the application knowledge and management is scanty. The present study is designed to clinically evaluate children with pneumonia, correlate it with radiological bacteriological finding, to identify the risk factors and to study the efficacy of various antibiotics that are used routinely in our sector.

Material and Methods

This prospective clinical study of severe pneumonia conducted on n=150 children who were admitted to pediatric wards and PICU in PIMS, Nagunoor, Karimnagar. Permission for the study was obtained from the institutional Ethical committee after following the due protocol. A written permission was obtained from all the parents of children involved in the study. Epidemiological factors affecting the same were studied and bronchoscopy was done whenever it was needed.

Inclusion criteria:

Children in the age group of one month to 5 years with clinical features of severe

pneumonia as per WHO recommendations for the control of ARI were included.

Exclusion criteria:

Children with congenital anomalies of heart and lungs, anatomical defects like cleft lip and cleft palate, immunocompromised states like human immunodeficiency virus infection (HIV) and infants less than one month of age were excluded from the study.

A detailed history of the relevant symptoms such as fever, cough, rapid breathing, refusal of feeds, wheezing etc was taken. Based on WHO ARI criteria, children were considered tachypnoeic if respiratory rate (RR);

-RR > 60 in < 2 months

-RR > 50 in 2 months-1 yr.

-RR > 40 in 1 yr-5 yrs.

A detailed examination of each child including anthropometry was carried out. During the general physical examination, emphasis was laid on assessing general condition of the child, respiratory rate (counted over 1 minute), presence of fever and other signs such as cyanosis and pallor. Detailed systematic examination of the respiratory, cardiovascular and central nervous system was done. Any associated illness such as septicemia, meningitis and congestive cardiac failure if present was noted. Socio-economic history regarding the type of house (Pucca or Kutcha), family size (overcrowding), sanitary facilities and fuel based for cooking (LPG or non LPG) were recorded. Socio economic status was classified according to modified Kuppu swamy's scale. Other pertinent information such as immunization status (Immunized, partially immunized or unimmunized according to universal immunization program), feeding practices and degree of malnutrition (IAP classification) were also recorded. According to WHO ARI criteria, children were classified into 2 groups: severe pneumonia and very severe pneumonia. For analytic purpose, risk factors were studied amongst severe and very severe pneumonia. Regarding risk factors for mortality, children who died during the course of hospitalization served as cases, while those survived were taken as controls. Following Investigations were carried out complete blood Investigations like Hb, TLC, DLC, ESR was done in all cases. Chest X-ray was taken in all patients. Blood culture was done in all cases. Based on radiological findings, children were divided into Bacterial (consolidations, alveolar infiltrates) and Viral (interstitial infiltrates, hyper aeration) pneumonias. Follow up X-rays were taken in relevant cases with bacterial pneumonia, to look for radiological clearance after treatment. All patients received antibiotics. Supportive care (IV fluids, oxygen, nebulization etc) was given as and when required.

Antibiotics that were used:

1. First line antibiotics: Amoxicillin with Gentamycin.

2. Second line antibiotics: Amoxicillin Clavulunic Acid with Amikacin.

3. Others: Cloxacillin, Ceftriaxone/Cefotaxime, Vancomycin.

Majority of patients (except pneumonia with complications) received first line antibiotics. Those children who failed to respond to 1st line antibiotics within 48hrs-72hrs received second line antibiotics. Cloxacillin and vancomycin were considered in case of empyema/massive consolidation. Closed tube drainage was considered in cases of empyema. All children were evaluated during the hospital stay and the response to treatment was noted. Statistical Analysis was done Continuous data was represented as mean ± standard deviation. Categorical data was expressed as numbers in percentage. Chi square test was used to determine significant differences between two groups. Odds ratio was determined whenever required. Significance for the statistical tests was pre determined at a probability value of 0.05 or less. ($p< 0.05$)

Results

In this prospective study, n=150 cases of severe pneumonia were studied. In the present study, majority of cases (53%) were less than one year of age given in table 1.

Table 1: showing the age distribution of children

Age group (months)	Female (%)	Male (%)	Total (%)
1 – 6	21(14)	36 (24)	57(38)
7 – 12	07(4.67)	16 (10.67)	23(15.33)
13 – 60	33(22)	37 (24.67)	70(46.67)
Total	61(40.67%)	89 (59.33)	150 (100)

In our study, rapid breathing (100%), cough (100%), fever (99.3%) were the most common symptoms. Refusal of feeds was present in 19.3% of cases. In our study, chest retractions were present in all cases (100%), crepitations were heard in 74.67%, ronchi in 51.33% and abnormal breath sounds (bronchial breathing diminished breath sounds) in 25.33% of cases. In the present study, mean duration of cough (6.5±4.40), fever (5.67±4.26), tachypnoea (2.38±1.40) and chest retractions (2.12±1.14) during hospital stay (table 2).

Table 2: Showing the mean duration and range of symptoms/ signs:

Symptoms/ signs	At admission	Duration in Hospital (m±s.d)	Range
Cough	150	6.5±4.40	2-28
Fever	149	5.67±4.26	1-20
Tachypnoea	150	2.38±1.40	1-10

Chest retractions	150	2.12±1.14	1-10
Added sound (crepts/ ronchi)	113	4.78±1.42	0-14

In the present study, tachypnoea was present in all cases (100%), 60.2% had respiratory rate of >60 cycles per min. Mean duration of tachypnoea was 2.12±1.15 days. In the present study, a previous history of similar illness was present in 10.8% (36 cases). A family history of ALRT was present in 6% (20 cases). Pneumonia was associated with diarrhea in 6.6%, septicemia in 3.3% cases, meningitis in 2 cases and congestive cardiac failure (CCF) in 1.3 cases.

Diagnosis	No.	Percentage
Bronchopneumonia	100	66.66
Lobar pneumonia	28	18.6
Pneumonia and its complications	14	9.3
Post Measles Bronchopneumonia	08	5.3

In the present study, majority of the cases were diagnosed as Bronchopneumonia (66.67%),

Lobar pneumonia was diagnosed in 18.6% of cases and pneumonia and its complications in 9.3% of cases

Table 5: Radiological findings

Diagnosis	No.	Percentage
Bacterial pneumonia (%)	46	30.67
Lobar consolidation	37	24.67
Alveolar Infiltrates	11	7.33
Complications	27	18
Viral pneumonia	21	14
Normal	08	5.33

In the present study, radiological findings were present in 80.66% of cases.

Bacterial pneumonia was detected in 62.67%, viral pneumonia in 14%. Among bacterial pneumonia, consolidation was seen in 18%, alveolar infiltrate in 24.67% and complications of pneumonia in Complications include empyema (n=8), pleural effusion (n=3), collapse (n=2), and pneumothorax (n=2). Chest X –ray was normal in n=8 cases. In the present study, among bacterial pneumonias defined radiologically, 63.15% had elevated WBC count 88.42% had neutrophilia 67.27% had elevated ESR. There was no correlation of laboratory findings with bacterial and viral pneumonia defined radiolagically (low sensitivity and specificity).

Table 6: Blood Culture findings of the cases

Culture report	Number	Percentage
Culture sent	150	100
Not sent	00	00
No growth	107	71.33
Positive	14	9.33
Contaminated	29	19.33

In the present study, culture was positive in only of cases. *S. pneumonia* was the most common organism isolated (6 cases) followed by S. aureus (n=5 cases) and *Klebsiella* (n=3 case). n the present study, antibiotics were given in all cases. 95.33% Received first line Antibiotics, 16% received second line antibiotics,. Antibiotics were changed from first to second line in 13.33% cases. Antibiotics were added in n=08 cases and oral antibiotics were used at discharge in 60.67% cases. Closed tube drainage was considered in cases of empyema (n=11 cases). Case fatality rate was 6.3% (n=9 cases). 55.5% (n=5 cases) of deaths occurred within 24 hours of presentations to hospital. Septicemia with shock was seen in n=4 (44.4%) cases and meningitis in n=3 (33.33%) cases. All 9 cases belonged to very severe pneumonia class. Anemia was present in 06 (66.6%) and malnutrition (Grade III and IV) in n=7 (77.7%) cases.

Discussion

In the present study, conducted between the age group of one month to five years, majority (53%) was less than one year. This was in comparison with studies done by Reddaiah VP et al; [5] (63.2%) and Sehgal V et al; [6] (52.2%). In our study it was observed that male (59.33%) outweighed females (40.67%). Male: female ratio was 1.45.This was in comparison with studies done by Sehgal V et al; [6] (58.25) and Drummond P et al; [7] (58%). In our study, tachypneoa (100%) and chest retractions (100%) were the important signs for making a clinical diagnosis of pneumonia. Crepitations (74.67%), ronchi (51.33%) and abnormal breath sounds (14.6%) were the other associated signs. Gupta D et al; [8], Margolis P et al; [9], Palafox M et al; [10], and Gadomski AM et al; [11] have observed that tachypnoea and chest retractions were highly specific signs in detecting pneumonia. Reddaiah VP et al; [5] have reported that crepitations were found in 76% and ronchi in 23.2% of patients with pneumonia. In our study Bronchopneumonia was the most common diagnosis made at admission (60.6%), Lobar pneumonia in 18.6%, pneumonia with complications in 9.3% and post measles Bronchopneumonia in 5.3% of cases. Complications of pneumonia include empyema (5.3%), pleural effusion (2%), collapse (1.3%) and pneumothorax (1.3%). In a study conducted by Reddaiah V.P et al; [5] Bronchopneumonia was diagnosed in 64%, Lobar pneumonia in 6.4% and post measles bronchopneumonia in 4.0% of cases. 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 80.6% of cases. Evidence of bacterial infection was found in 78.0% and viral in 14.0% of cases. In a study conducted by Virkki R et al; [12] it was found that radiological changes were seen in 85%, with evidence of bacterial infection in 64% and viral in 36% of cases.

Macintyre C. R. et al; [13] have also reported radiological confirmation in 85% of cases of pneumonia. The reasons for higher incidence of radiologically detected bacterial pneumonia in our study may be due to high incidence of bacterial pneumonia in countries like ours.

Also there may be variations in intra observer and inter observer agreement on the radiographic features used for interpreting the radiogram. In our study, follow up radiographs were taken in 60% of cases; 80% showed complete resolution after treatment and 20% partial resolution. 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 our study, blood culture was positive in 14 cases (9.33%). S pneumonia was the most common organism isolated (6 cases) followed by S.aureus. Kabra SK et al; [14] and Bahl R et al; [15] 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. Because of very low positivity of blood culture, we could not correlate our clinical findings with etiological diagnosis. In our study, case fatality rate was 6.3% (9 cases). 55.5%, (5 cases) of deaths occurred within 24 hrs of presentation to hospital. This is in comparison with studies conducted by Sehgal V et al; [6] Suwanjutha S et al; [16] Reddaiah VP et al; [5] and Mishra S et al; [17] who have reported a case fatality rate of 10.45%, 3.4%, 12.8% and 7.7% respectively. Underlying congenital heart disease (CHD) is a significant risk factor for pneumonia mortality. As we had excluded pneumonia associated with CHD, this may be the probable reason for low case fatality rate seen in our study. In the present study significant independent predictors of mortality was determined by comparing dead subjects with survived children. It was found that severity of pneumonia (very severe) malnutrition grade 3 and 4 and associated illness (septicemia, meningitis) were significantly associated with mortality.

Conclusion

In this study we found Bronchopneumonia is the predominant form of presentation in infants and preschool children. Among the risk factors studied, previous history of similar illness, inappropriate immunization for age, anemia, PEM grade 3 and 4, were found significant causes for severe pneumonia. Chest X-ray is valuable aid in the diagnosis of pneumonia in children. Follow up chest roentgenogram is vital for evaluating the response to treatment in pneumonia. Severity of pneumonia (very severe), is associated illness (septicemia, meningitis) were the important risk factors for mortality. Amoxicillin and Gentamicin are still the antibiotics of choice in pneumonia. Indiscriminate use of higher antibiotics is not justified, in view of emergence of drug resistant organisms.

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