Study of clinic etiological profile of lower respiratory tract infections at a tertiary care center in north- West Rajasthan

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Abstract

Methods: This hospital-based observational cross-sectional study was conducted on the patients presenting to the Department of Paediatric from August 2020 to July 2021. All children aged from 2 Months to 60 Months were included in the study fulfilling the inclusion criteria.

Results: The study included 66 cases. The majority of cases (62%) were in the age group of >2 months to 1 Year, remaining 38% were >1year to 5 years. Maximum cases were 2 months to 1 year. Majority of children admitted were males (56%), male to female ratio being 1.2:1.70% (46 cases) had Pneumonia and 30% (20 cases) had Severe Pneumonia. Significant association between Total Leukocyte Count and severity of pneumonia is seen (P value 0.009), Total leukocyte Count increased with increasing severity of pneumonia. In current study fever, cough and shortness of breath had seen in most of subjects. There is no significant difference between clinical characteristics and severity of pneumonia. Viruses were the most common pathogens (96.97%) detected in LRTIs.

Conclusion: Fever, cough and shortness of breath were most common clinical characteristics of lower respiratory tract infections. The viruses were most common pathogens responsible for lower respiratory tract infections in children of age group 2 months to 60 months. Mortality was high in cases of bacterial pneumonia. Total leucocyte count could be used as marker to differentiate viral and bacterial pneumonia.

Key words: ARI, LRTI, viral & bacterial pneumonia

Introduction

Acute respiratory infections (ARI) may cause inflammation of respiratory tract with a wide range of combination of symptoms and signs; this includes any infection of the upper and lower respiratory system as defined by international classification of diseases **(1)**. Where the upper respiratory tract infection (URTI) includes common cold, pharyngitis, tonsillitis, sinusitis and acute otitis media, the lower respiratory tract infections (LRTI) affect airway below the epiglottis which includes epiglottitis, laryngitis, laryngotracheitis, bronchitis, bronchiolitis and Pneumonia **(2,3,4)**.

Acute respiratory infections (ARI) of under 5 constitute a major public health problem all over the world especially in developing countries. There are nearly 156 million new episodes each year, of which India accounts for a bulk of 43 million **(5)**.

Acute respiratory infections (ARI) constitute a leading cause of morbidity and mortality in children **(6)**. It is one of the major causes of under 5 mortalities in the world and in India **(7)**. WHO estimated that 5.0 million children under age of 5 years died in 2020, almost 13800 children die every day **(8)**. Out of these 1.2 million deaths occurred in India. Of this, premature and neonatal birth complications (39%) were the biggest killers followed by pneumonia (14.9%), diarrhoea (9.8%) and sepsis (7.9%) in India **(9)**. About 30-60% of pediatric outpatient cases and 20-30% of hospital admissions are due to ARI **(10)**.

Clinical diagnosis of LRTI based on symptoms

Cough, fever, fast breathing, chest indrawing, refusal to feed, running nose, irritability, bluishness of face/feet/hands.

Etiology of LRTI (11)

Several microorganisms mainly viruses and bacteria cause ALRTI in infants and youngsters. Developing a microbial diagnosis for pneumonia is difficult.

Bacterial agents; Gram positive organism – streptococcus pneumoniae, staphylococcus.

Gram negative organism – haemophilus influenzae, klebsiella pneumoniae.

Viral agents- respiratory syncytial virus (RSV), influenza, parainfluenza, adeno virus.

Fungal agents- candida albicans, aspergillus species

Others agents – mycoplasma, Chlamydia, legionella

Subjects and methods

This hospital-based cross-sectional observational study was conducted in the Department of Pediatrics, Sardar Patel Medical College and P.B.M. Hospital, Bikaner.

Study duration was 12 months beginning from August 2020 to July 2021. The study population consisted of children aged 2 Months to 60 Months. The calculated sample size was 66, which was calculated based on the reported prevalence of acute respiratory infections in children. Prevalence of ARI as reported in previous studies was observed 59.1%. Sampling method used was simple random sampling.

Sample calculation was done by using the formula. Sample size- $n=4pq/\alpha^2$ Taking allowable error (20.00%) of the reported prevalence of 59.1% the sample size is calculated to be 66.

Inclusion criteria for the study included children age group 2months – 60months and infants and children admitted in paediatrics hospital with clinical signs and symptoms of LRTI meeting the criteria in ARI control program (WHO). Exclusion criteria included patients associated with surgical illness, CNS infections, Aspiration pneumonia, connective tissue disorder, malignancies, and foreign body aspiration. and age group <2months & >5years. The children of those parents who did not give consent to undergo study. The study was commenced after obtaining clearance from the institutional ethical committee. Patients presenting to the hospital who fulfilled inclusion criteria were enrolled in the study and written consent was obtained from guardians and parents. And those not willing were excluded from the study Additionally, verbal consent was taken from the patients. The detailed history, clinical examination, the blood investigation and radiological finding of the patient, to define the severity of the disease and the details are entered in proforma prepared, like age, sex, duration of fever, duration of cough, presence/absence of respiratory distress, patients' general condition at the time of admission, complete blood count, and two-dimensional chest x-ray, CRP, ESR, Blood

culture were recorded. Hemoglobin, platelet, leucocyte, neutrophil, and lymphocyte count measurements were performed within approximately 60 min after blood sampling with KX-21 hematology analyzer. This is the basic investigation to determine the significant infection of both viral and bacterial pneumonia. White blood cell (WBC) counts could be normal or elevated but not usually more than 20,000/mm³ with lymphocyte predominate in viral etiology. Whereas counts about 15,000-40,000 and predominantly polymorphonuclear neutrophilic leucocytes (PMNL) and high fever at onset suggestive of bacterial etiology **(12)**. Pleural effusion, lobar consolidation is suggestive of bacterial etiology. In the bacterial infections, CRP levels were moderately or highly increased whereas in viral infections, CRP levels were normal or slightly increased.

The ESR is elevated in most bacterial, mycobacterial, and fungal infections and is normal or mildly elevated in viral infections. If blood culture is positive indicates more possibility of bacterial infection.

Clinical severity of the disease was diagnosed based on the revised WHO ARI pneumonia classification into pneumonia and severe pneumonia.

Data were entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data were represented in the form of frequencies and proportions. Chi-square test was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation. MS Excel and MS word was used to obtain various types of graphs such as bar diagram, Pie diagram. **p value** (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests. **Statistical software:** MS Excel, SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyses data. Hemoglobin,

platelet, leucocyte, neutrophil, and lymphocyte count measurements were performed within approximately 60 min after blood sampling with KX-21 hematology analyzer.

Results

In this study, we included 66 cases. Majority of cases (62%) were in the age group of >2 months to 1 Year, remaining 38% were >1year to 5 years. Maximum cases were 2 months to 1 year. Majority of children admitted were males (56%), male to female ratio being 1.2:1.70% (46 cases) had Pneumonia and 30% (20 cases) had Severe Pneumonia. Significant association between Total Leukocyte Count and severity of pneumonia is seen (P value 0.009), Total leukocyte Count increased with increasing severity of pneumonia. Mortality was high in cases of severe pneumonia.

Significant association (p=value 0.0001) between outcome with respect to etiology of pneumonia. Mortality was high in cases of bacterial pneumonia. Viruses were the most common pathogens (96.97%) detected in LRTIs.In our study subjects with viral etiology, 71.80% subjects with pneumonia and 28.20% with severe pneumonia. In subjects with bacterial etiology 0% subjects with pneumonia and 100% with severe pneumonia. Severity of pneumonia increased with bacterial subjects. There was significant difference between etiology and severity of pneumonia (p-value 0.029).

Discussion

Acute respiratory infections (ARI) may cause inflammation of respiratory tract with a wide range of combination of symptoms and signs. Acute respiratory infections (ARI) of under 5 constitute a major public health problem all over the world especially in developing countries. Acute respiratory infections (ARI) constitute a leading cause of morbidity and mortality in

children (**6**). It is one of the major causes of under 5 mortalities in the world and in India (**7**).

This study was an attempt to evaluate the role of total leucocyte count, erythrocyte sedimentation rate, C-reactive protein and blood culture in differentiation of viral and bacterial pneumonia.

In the year 2020, Nandimalla Vinay kumar et al (**13**) conducted a study on **"Clinical profile of ARTI in children aged 2-60 months: An Observational study".** In this study, most of the presented symptoms were cough (100%), breathlessness (96.92%) and fever (92.3%), bronchiolitis (63%), bronchopneumonia (27%) and lobar pneumonia (25%) were the major the clinical outcomes. In the year 2020, Sophie julienne, Dines Prada et al (**14**) conducted a study on **"Pneumonia in children admitted to the national referral hospital in Bhutan".** This prospective study enrolled children aged 2-59 months admitted from july 2017 to June 2018,189 children were enrolled, of which 53.4% were infants. Chest radiographies were obtained in 149 children; endpoints included pneumonia in 39 cases (26.2%), other infiltrates in 31 (20.8%), and were normal in 79 children (53.0%). Non-contaminated bacterial growth was detected in 8/152 (5.3%) blood cultures, with only two cases of streptococcus pneumonia. Viral detection in upper respiratory secretions was common, with at least one virus detected in 103/115 (89.6%).

Our findings are consistent with previous research on WBC count as a marker for LRTI. In the current study we determined the patients with pneumonia 2.17% had WBC count <5000, 97.83% had WBC 5000 to 15000, 0.00% had WBC >15000. In cases with Severe pneumonia, 0% had WBC count <5000, 90% had WBC 5000 to 15000, 10% had WBC >15000. suggesting increase in severity of pneumonia in relation to increase in leucocyte count, which was statistically significant and

was similar to results of Usha et al (**15**), Sreenivasa et al (**16**) (2.72% had WBC<5000,71.8% had WBC 5000-15000),25.4% had WBC >15,000) and Durshera et al (2007) 3%,73.2% and 22% cases with WBC 5000,5000-15000 and >15,000 respectively, Zeze TH. Atwa et al (**17**) in 2014 showed 61.6% and 36.9% cases with leucocytosis. In our study all cases of viral etiology had normal value of ESR and CRP, all cases of bacterial etiology had high value of ESR and CRP. Hence high value of ESR and CRP indicate bacterial etiology. There was statistically significant association between ESR and CRP value with etiology of pneumonia. Simillar result in Massimiliano Don et al (**2007**). Study indicates high CRP and ESR more probability of bacterial etiology but low value do not rule out bacterial etiology. Showing viruses were the most common pathogens (96.97%) detected in LRTIs. Similar findings also had been reported in a study conducted in United States by Obasi et al in 2013. (**18**)

Limitations

We studied the prevalence and association of LRTI with etiology of pneumonia which were consistent with the other studies in literature, but we were unable to specify the different type of viral and bacterial causes of the infection. On the other hand diagnostic techniques with greater specificity were limited by technical difficulty invasive procedures and high cost. The inflammatory markers weren't studied during the course of infection like Procalcitonin and IL-6. Conventional methods for determining etiology of LRTI, such as nasopharyngeal swabs and selective application of serological test for organisms were limited.

Conclusion

Fever, cough and shortness of breath were most common clinical characteristics of lower respiratory tract infections. The viruses were most common pathogens responsible for lower respiratory tract infections in

children of age group 2 months to 60 months. Mortality was high in cases of bacterial pneumonia.

This study was an attempt to evaluate the role of total leucocyte count, erythrocyte sedimentation rate, C-reactive protein and blood culture in differentiation of viral and bacterial pneumonia.

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