

Clinical Profile of Severe Acute Respiratory Infection in Children Aged 1-12 Years in a Tertiary Care Centre, Tamil Nadu

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Abstract

Background: Severe Acute Respiratory Infection is a major public health problem especially among children aged less than five years. The burden of childhood pneumonia in India is around 30 million episodes of ARI and 0.14 million deaths annually. It is because of poor coverage of protection and preventive interventions in children that leads to increased risk of pneumonia. Knowledge on the common clinical presentation of children presenting with severe acute respiratory illness will help us to improve the survival.

Methods: This observational study was conducted for a period of one year in a tertiary care hospital among children aged 1-12 years. Socio-demographic details, clinical features, laboratory investigation details obtained. Descriptive statistics used to describe the variables and chi-square test was used to study the factors associated with outcome of Severe Acute Respiratory Illness.

Results: Most common symptoms were cough & cold (88.0%), fever (79.5%). Majority of the study participants had abnormal total count (57.5%), abnormal chest x ray findings (66.0%). Most of the participants were found to have bronchiolitis (25%), bronchopneumonia (24%). The factors such as female gender, preterm, participants with severe PRESS score, high CRP, and on mechanical ventilation found to be significantly associated with poor outcome.

Conclusion: Children aged 1-5 years, male, and children from rural areas found to be more in the study. In our study female children, preterm, children with severe PRESS score, high CRP and children who were on mechanical ventilation showed a poor outcome.

Key-words: Clinical profile, pneumonia, Severe Acute Respiratory Infection, pediatric respiratory severity score, children

Introduction

Severe Acute Respiratory Infection (SARI) is a major public health problem, especially among children aged less than five years. It was found that

120 million cases of pneumonia occurred globally and 11.9 million cases of Acute Lower Respiratory Infections (ALRI) which need hospitalization¹. In Asia, an estimated 1.3 million children aged less than 5

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years expire from ALRI annually. In India, the burden of ALRI is high. The burden of childhood pneumonia in India is due to poor coverage of protection and preventive interventions leads to increased risk of pneumonia in children, around 30 million episodes of Acute Respiratory Infections (ARI) / pneumonia annually and around 0.14 million of child death due to pneumonia annually.

Around 3.6 million episodes of severe pneumonia and 0.35 million all cause pneumonia deaths in children under 5 years in India². The major contributors to India's pneumococcal pneumonia burden were Uttar Pradesh, Bihar, Madhya Pradesh and Rajasthan in that order. The total number of deaths due to pneumococcal pneumonia would range from 19,850 to 138,950 deaths per year.

There are many effective vaccines against streptococcus pneumonia, Hemophilus influenza and influenza viruses. Acute respiratory infection that may interfere with normal breathing. The definition of SARI is acute respiratory illness which includes a history of fever or measured temperature of ≥ 38 °C, cough, onset of illness within the last 10 days, requiring hospitalization (inpatient/admission)³. Respiratory infection may present as influenza-like illness, rhinitis (common cold), pharyngitis, croup (Laryngotracheobronchitis), bronchiolitis and pneumonia. Knowledge on the common clinical presentation, severity, and complications of children presenting with severe acute respiratory illness will help us to improve survival by reducing severity and complications. Hence this study was conducted with the objective to describe the clinical profile of children with Severe Acute Respiratory Infections.

Materials and Methods

This observational study was conducted in the department of paediatrics at Mahatma Gandhi Memorial Government Hospital, K.A.P.V. Govt. Medical College, Trichy for a period of one year from Oct 2020 to Sep 2021. The study participants were all children in the age group of 1-12 years admitted in the Paediatric Intensive Care Unit (PICU) / High Dependent Unit (HDU) / SARI ward with a history of respiratory symptoms during the study.

Inclusion criteria includes, all children (1-12 years) presenting to the paediatric emergency service with acute respiratory infection and requiring admission with the duration of illness <10 days. Exclusion criteria includes children with trauma or

road traffic accidents, children returned within 72 hours of discharge or children with chronic systemic illness or children on immunosuppressive drugs or children with previous thoracic surgeries. Children meeting the inclusion and exclusion criteria were studied regarding age, gender, residence, history of respiratory symptoms -fever, cough, & cold, breathlessness, lethargy, similar illness in past, neonatal intensive care unit graduate, immunisation status, socioeconomic status, nutritional status and clinical signs tachypnoea, increased work of breathing, added sounds (wheeze), oxygen saturation level using pulse oximetry, shock, PRESS scoring system (based on respiratory rate, wheeze, accessory muscle use, SpO₂, and feeding difficulties; mild 0-1, moderate 2-3 severe 4-5), oral cavity, laboratory investigation- total count, CRP; chest x ray; oxygen requirement; oxygen delivery devices, diagnosis made and its outcome. Supportive care and specific treatment were given depending on the severity of respiratory illness. Institutional ethical committee clearance was obtained before commencement of the study (Ref No. I.E.C.No.54/2020). Informed consent was obtained from parents. Strict patient confidentiality was maintained throughout the study. Descriptive statistics were used to describe the socio-demographic characters, clinical profile, and lab investigations. Chi-square test was used to study the factors associated with outcome of Severe Acute Respiratory Illness.

Results

A total of 200 participants were included in the study. Majority (74.5%) of the study participants were aged less than five years and males (59.5%) than females. Majority of the study participants were from rural areas (53.5%) and belonged to the upper lower class (57.5%).

Participants presented with multiple clinical features. Most common symptoms were cough & cold (88.0%), fever (79.5%) followed by tachypnea and other signs and symptoms. In our study, the majority (82.5%) of the participants were immunised up to the age (Table 1).

Majority of the study participants had abnormal total count (57.5%), abnormal chest x ray findings (66.0%). Most of the participants were found to have bronchiolitis (25%), bronchopneumonia (24%) and followed by other diagnoses. Majority of the study participants required oxygen therapy (Table 2).

Socio-demographic factors and other factors related to outcome of SARI were compared and the results are shown in Table 3. The factors such as female gender, preterm, participants with severe PRESS score, high CRP, and on mechanical ventilation were found to be significantly associated with death.

Table 1: Clinical features of Respiratory Infection among study participants

| Clinical features | Frequency (n) | Percentage (%) |
|---------------------------------------|---------------|----------------|
| Signs/symptoms | | |
| Fever | 159 | 79.5 |
| Cough and cold | 176 | 88 |
| Breathlessness | 115 | 57.5 |
| Lethargy | 42 | 21 |
| Tachypnea | 138 | 69 |
| Wheeze | 20 | 32 |
| Increased work of breathing | 35 | 56 |
| Spo2 <92% | 58 | 29 |
| Shock | 27 | 13.5 |
| Past history | 25 | 12.5 |
| Preterm | 18 | 9 |
| Immunized up to the age | 165 | 82.5 |
| PRESS score | | |
| Mild | 72 | 36 |
| Moderate | 41 | 20.5 |
| Severe | 87 | 43.5 |
| Oral cavity | | |
| B/l tonsillitis | 3 | 1.5 |
| B/l tonsillitis pharyngeal congestion | 2 | 1 |
| Enlarged tonsils | 1 | 0.5 |
| Pharyngeal congestion | 10 | 5 |
| Normal | 184 | 92 |
| C-Reactive protein | | |
| <5 | 86 | 43 |
| 5-30 | 63 | 31.5 |
| >30 | 51 | 25.5 |

Table 2: Investigation findings and outcome of study participant

| Parameters | Number of participants | Percentage (%) |
|---------------------------------|------------------------|----------------|
| Total count | | |
| Leucocytosis | 61 | 30.5 |
| Leukopenia | 54 | 27 |
| Normal | 85 | 42.5 |
| Chest X ray | | |
| Cardiomegaly | 1 | 0.5 |
| Collapse | 1 | 0.5 |
| Consolidation | 5 | 2.5 |
| Patches | 5 | 2.5 |
| Pneumonia | 6 | 3.0 |
| Infiltrates | 54 | 27 |
| Hyperinflation | 60 | 30 |
| Normal | 68 | 34 |
| Oxygen requirement | 128 | 64 |
| Oxygen delivery | | |
| Face mask | 10 | 5 |
| HHHFNC | 50 | 25 |
| Mechanical ventilation | 16 | 8 |
| Nasal prongs | 21 | 10 |
| Non rebreathing mask | 33 | 16 |
| No | 70 | 36 |
| Diagnosis | | |
| ARDS 1 0.5 | 1 | 0.5 |
| Bronchopneumonia / septic shock | 3 | 1.5 |
| URTI | 3 | 1.5 |
| CROUP | 4 | 2 |
| ASOM | 8 | 4 |
| Bronchial asthma | 10 | 5 |
| Sepsis | 11 | 5.5 |
| Lobar pneumonia | 12 | 6 |
| Viral fever | 25 | 12.5 |
| Others | 25 | 12.5 |
| Bronchopneumonia | 48 | 24 |
| Bronchiolitis | 50 | 25 |
| Outcome | | |
| Expired | 10 | 5 |
| Recovered | 190 | 95 |

Table 3: Factors associated with the outcome

| Characteristics | Outcome | | P value |
|--------------------------------|---------------|-----------------|---------|
| | Expired N (%) | Recovered N (%) | |
| Age | | | |
| <5 years | 9 (6.0) | 140 (94.0) | 0.249 |
| > 5 years | 1 (2.0) | 50 (98.0) | |
| Gender | | | |
| Female | 8 (9.9) | 73(90.1) | 0.009 |
| Male | 2(1.7) | 117(98.3) | |
| Residence | | | |
| Rural | 8(7.5) | 99(92.5) | 0.085 |
| Urban | 2(2.2) | 91(97.8) | |
| Socio economic status | | | |
| Upper middle | 0 | 3(100.0) | 0.843 |
| Lower middle | 2(3.3) | 59(96.7) | |
| Upper lower | 7(6.1) | 108(93.9) | |
| Lower | 1(4.8) | 20(95.2) | |
| Preterm | | | |
| No | 6 (3.3) | 176(96.7) | <0.001 |
| Yes | 4(22.2) | 14(77.8) | |
| Immunized up to the age | | | |
| No | 3(8.6) | 32(91.4) | 0.286 |
| Yes | 7(4.2) | 158(95.8) | |
| PRESS Score | | | |
| Mild | 0 | 72(100) | 0.001 |
| Moderate | 0 | 41(100) | |
| Severe | 10(11.5) | 77(88.5) | |
| C-Reactive Protein | | | |
| <5 | 0 | 85(100) | 0.008 |
| 5-30 | 4(6.3) | 59(93.7) | |
| >30 | 6(11.8) | 45(88.2) | |
| HHHFNC | | | |
| No | 9(6.0) | 141(94.0) | 0.261 |
| Yes | 1(2.0) | 49(98.0) | |
| Mechanical ventilation | | | |
| Yes | 9(56.3) | 7(43.8) | <0.001 |
| No | 1(0.5) | 183(99.5) | |

Discussion

This study was primarily designed to determine the clinical profile of severe acute respiratory infection in children aged 1-12 years admitted in the pediatrics department. In this study, preschool children and toddlers represent the maximum number of children around 74.5%. In a study by BroorS et al⁴., it was found that the rates of ALRI highest in the age group of 12-23 months. The prevalence of Acute Respiratory Infection was found to be high among under 5 children.⁵

The majority of the children reported with respiratory illness were male children with a male to female ratio of 1.4:1. In a study by Krishnan A et al.,⁶ boys had 2.4 times higher Acute Respiratory Infection related hospitalization. The distribution of respiratory viruses is higher among males.⁷ Higher proportion of boys (62.9%)⁸ reported to have ARI compared to girls. But however in a study by Suguna E et al⁹., there was no significant association found with sex with ARI. Rural children were represented by 53.5% of children and urban children were represented by 46.5 % of children. However, in a study at Puducherry by Kumar SG et al⁸., the prevalence of ARI was found to be high (63.7%) among urban areas. In this study, around 57.5% fell into lower middle socioeconomic status which implies the overcrowding, poor educational level, poor hygiene, sanitation and low per capita income. These factors might have led to more number of children acquiring respiratory infections in these populations.

In this study, around 79.5% of children presented with complaints of fever and around 20.5 percent of children presented without a history of fever with respiratory complaints. This was supported by Malhotra B et al⁷ fever was the most common symptom followed by cough. In another study by Kumar SG et al., running nose and cough found to be the most common symptom of Acute Respiratory Infection⁸. Present study also found that 88% of children presented with cough and cold symptoms

as major complaints. In this study group, 57.5 % of children presented with breathlessness and approximately 30% of children presented with cough and cold alone, without breathlessness complaints. In this study, 21 % of Children presented with complaints of Lethargy.

Around 12.5% of Children were presented with similar episodes in the past which indicate an immunocompromised state, malnutrition in the child, incomplete treatment of previous illness. In a study by Broor S et al¹⁰ it was found that family history is a risk factor for Severe Acute Respiratory Infections. Around 9% of Children were presented with birth history of preterm and low birth weight. Acute respiratory infection was found to be high among children born with a birth weight of <2.5kg^{8,11}. In this study, 82.5 % of Children properly immunised up to age as per the schedule, but 17.5 % of children were not completed their immunisation schedule, they were partially immunized. They were unaware about the importance of immunisation against respiratory illness. Similar findings were observed in other studies that inadequate or partial immunization was found to be a risk factor for Acute Respiratory Infections^{10,12}. But in another study there was no association between immunization and ARI.¹³

In this study, 69% of children presented with increased respiratory rate according to the age group. According to World Health Organization classification of pneumonia, 69% of children had pneumonia. In this study, 29% of children have oxygen saturation less than 92% which indicates all need for oxygen support to prevent hypoxic state. In this study, 13.5% of children had shock and 43.5 % of children had a severe PRESS score, which implies the poor outcome of the child presented with a high PRESS score value. 92% of children presented with a clear throat. Only 8% of children had abnormal findings. In this study, we observed the children presented with severe respiratory complaints need not have abnormal findings.

Regarding the total count, 30.5 % had leukocytosis and 27 % had leukopenia, and normal value in 42.5%. Hence there is no significant association with total count. 25.5% of children had high CRP value, which shows high inflammatory changes and infection in these children. 30% of children with chest x-rays showed bilateral hyperinflation which implies highly a viral etiology.

About 64% of Children required oxygen support. Most of the children presented with respiratory illness had respiratory distress and low oxygen saturation. Around 25% of children presented during the study period had bronchiolitis (viral etiology). 24% of children presented with bronchopneumonia. In a study by MK AK et al., it was found that 56.5% required oxygen and the most common acute lower respiratory tract infection among two months to five years was found to be bronchopneumonia (33.5%) and bronchiolitis (21%)¹⁴.

Out of 200 children admitted during the study period, 10 children expired and 190 children were discharged successfully. Mortality is higher in children 1-5 years of age compared to children above five years which is statistically not significant. Mortality is significantly high in female children as compared to male children (P value 0.009). Though not statistically significant the mortality is slightly higher in rural areas compared to urban areas. Mortality was higher in low socioeconomic status though statistically not significant. Preterm babies found to have significantly (P value <0.001) higher mortality as compared to term babies. In our study the immunization status does not influence the outcome. The mortality was inevitable when the children presented with a severe PRESS score (P value 0.001). Children presented with high CRP value found to have significantly higher mortality (P value 0.008). The mortality was found to be less among those children who received Heated Humidified High Flow Nasal Cannula though not statistically significant. Children admitted in PICU and received mechanical ventilation showed significantly higher mortality (P value <0.001).

Conclusion

Severe acute respiratory infection is the most common illness affecting the children. From our study, we are able to conclude that children aged 1-5 years are more commonly affected. Male children are affected more than female children. The children resided in rural areas were presented higher than urban areas. In this study more children were diagnosed to have bronchiolitis and bronchopneumonia. In our study, female children, preterm, children with severe PRESS score, high CRP and children who were put on mechanical ventilation showed a poor outcome.

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