ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 04 | April - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

APPLICATION OF SIRS CRITERIA IN ACUTE BRONCHIOLITIS: RATIONALE FOR ANTIBIOTIC USE

Paediatrics

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ABSTRACT

Background: Acute bronchiolitis (AB) is a common lower respiratory tract infection in infants, primarily caused by viral pathogens such as Respiratory Syncytial Virus (RSV). Despite its viral origin, antibiotics are frequently prescribed, leading to antimicrobial resistance and increased healthcare costs. Systemic Inflammatory Response Syndrome (SIRS) criteria are often used to assess infection severity, but their role in distinguishing viral from bacterial infections in bronchiolitis remains uncertain. **Objective:** This study aims to evaluate the proportion of children with acute bronchiolitis who meet SIRS criteria and assess their need for antibiotic therapy to minimize unnecessary antibiotic use. **Methods:** A prospective observational study was conducted on 30 children aged 1 month to 2 years with bronchiolitis. Patients were categorized as SIRS-positive or SIRS-negative based on clinical and laboratory parameters. Antibiotic use, hospital stay, and clinical outcomes were analysed. **Results:** Among the participants, 46.6% met SIRS criteria, and 50% received antibiotics, mostly among SIRS-positive cases. The average hospital stay was significantly longer in SIRS-positive children (8.07 ± 5.12 days) than in SIRS-negative cases (4.63 ± 1.78 days). Chest X-rays showed lung infiltrates in 85.7% of SIRS-positive cases, while 75% of SIRS-negative cases exhibited hyperinflation. **Conclusion:** The study highlights the rationale of antibiotics usage in children with fever and respiratory distress who could be bronchiolitis using the SIRS criteria .This can prevent associated disease severity and prolonged hospitalization. Implementing a SIRS-based assessment may help reduce unnecessary antibiotic prescriptions and prolonged hospitalization while ensuring appropriate and timely management.

KEYWORDS

Acute bronchiolitis, SIRS, Respiratory Syncytial Virus, Antibiotic overuse, Paediatric pneumonia, antimicrobial stewardship.

INTRODUCTION

Acute Bronchiolitis (AB) is the most common lower respiratory tract illness among infants.[1] It is characterized by acute inflammation of bronchioles, edema, and increased mucus production after an acute viral infection.[1,2] It is a clinically diagnosed condition presenting with tachypnoea, chest indrawing following mild coryzal symptoms.[3]

Respiratory Syncytial Virus (RSV) is responsible for approximately 40% to 50% of all hospitalizations for bronchiolitis and 25% of all Paediatric hospitalizations for pneumonia.[4] Other viruses causing bronchiolitis are Parainfluenza virus, influenza virus, rhinovirus, and human metapneumovirus. Up to 3% of all children are hospitalized with bronchiolitis in their first year of life. Despite the high prevalence of bronchiolitis, little consensus exists on the optimal management of the disease.[6] Management of bronchiolitis is mainly supportive, and no role of antibiotics in the management of bronchiolitis.[3,7] Though the risk for serious bacterial infections among children with bronchiolitis is low[8], antibiotics are still being used in 34% to 99% cases of uncomplicated bronchiolitis.[7] Antibiotic use causes significant harm, including common adverse reactions (rash, abdominal pain, diarrhoea, and vomiting), cost, and resistance among pathogens.[7]

Sepsis is Systemic Inflammatory Response Syndrome (SIRS) due to a confirmed or suspected infection. Clinically, SIRS is identified by two or more symptoms, including fever or hypothermia, tachycardia, tachypnoea, and abnormal leukocyte counts.[9] It has been found that children with SIRS have a high risk of having sepsis.[10] As per WHO guidelines for the management of Acute Respiratory Infections (ARI)[11], children with cough associated with tachypnoea may have a bacterial infection, i.e., pneumonia which is the major cause of mortality among children < 5years and hence antibiotics are indicated in the treatment of such children.

However, many studies[12,13] done in controlled setups have shown that antibiotics are unnecessary if the disease with cough with tachypnoea is bronchiolitis. In relatively resource-poor settings, any method of differentiating bacterial from viral causes of cough associated with tachypnoea will significantly help in limiting antibiotic usage. Evidence of SIRS could be one such differentiating tool because sepsis is a common cause of SIRS and bacterial infections are common and treatable causes for sepsis.[14] Therefore, antibiotic therapy may be justified in the presence of SIRS in the absence of other shreds of evidence of definitive viral disease (like a positive viral culture or serological tests for viruses).

The current study was conducted to determine the proportion of children with Acute Bronchiolitis who had SIRS and required antibiotic therapy.

METHODS

The present study was conducted in the Paediatric ward of tertiary care hospital.

A Prospective hospital-based time-bound study was carried out wherein all children between 2 months to 2 years who were admitted to the ward with a clinical diagnosis of Acute Bronchiolitis were enrolled in the study after taking consent from the parents. Acute Bronchiolitis was clinically diagnosed when upper respiratory prodrome is followed by an increased respiratory effort and wheezing with or without fever.

Children with congenital heart disease, other respiratory problems, who received antibiotics prior to admission, and children who had more than one episode of wheeze were excluded. Data was collected using a proforma which had questions regarding clinical history, physical findings, total leucocyte count and differential count. Saturation at admission and 6th hourly monitoring of vitals. Chest X ray and urine routine were done in all patients. Children with no evidence of Systemic Inflammatory Response Syndrome (SIRS) were grouped under No SIRS category and were given supportive treatment. Children having evidence of SIRS and those with Severe Acute Malnutrition were treated with systemic antibacterial drugs, along with supportive treatment. Oxygen was supplemented when spo2 < 92%. Any other proven bacterial infection was treated with systemic antibacterial drugs, whenever indicated. SIRS was defined as: The presence of at least 2 of the following 4 criteria, 1 of which must be abnormal temperature or leukocyte count: core-temperature of >38.5'C or 36'C, tachycardia, tachypnoea, leukocyte count elevated or depressed for age or >10% immature neutrophils.

Data was analysed using SPSS 17. Statistical methods used were descriptive statistics like means, percentages and test of significance like chi square test and Fischer's t test.

Study Design And Sample Size Calculation:

This was a prospective observational study conducted in a tertiary care hospital, aimed at evaluating the proportion of children with bronchiolitis who meet SIRS criteria and their need for antibiotics.

The Sample Size Was Determined Using A Prevalence-based Calculation:

- Estimated prevalence of bronchiolitis = 20.27% (as reported in a study by Gupta S et al.)
- Absolute precision = 14.5%
- Confidence level = 95%

Using the standard formula:

$$N = \frac{Z^2 P(1-P)}{d^2}$$

Where:

- n = Sample size
- Z = Z-score for 95% confidence (1.960)
- P = Expected prevalence (0.2027)
- d = Precision (0.145)

Applying these values, the required sample size was 30 participants.

Inclusion And Exclusion Criteria

Inclusion Criteria:

- Infants aged 1 month to 2 years diagnosed with bronchiolitis.
- Clinical presentation of cough, tachypnoea, wheezing, or chest indrawing.

Exclusion Criteria:

- Congenital heart disease or chronic lung disease.
- Severe malnutrition.
- Prior antibiotic use within 48 hours of admission.

RESULTS

Total numbers of cases enrolled in our study were 30. Of the 30 cases, 18 (60%) were male and 12 (40%) were female. Male to female ratio was 1.5. In our study there were 14 children each in < 6months and 6 months to 12months age group i.e., 46.6% and 2 (6.6%) children between 1-2 years of age. Mean age of presentation was 6.56± 4.33 months.

The most common presenting complaint in our study was cough 30 (100%) followed by cold, rhinorrhoea 28(93.3%) and fast breathing 22(73.3%). Fever was present in 20(66.7%), wheeze in 16(53.3%) and chest indrawing in 9(30%). The most common sign among the cases in our study was chest indrawing – 26(86.6%) followed by tachypnoea 23 (76.6%), feeding difficulty 20 (66.6%), SpO_2 < 92% -13 (43.3%) and tachycardia 12 (40%).

In our study, a total of 15 (50%) out of the 30 cases received antibiotics. Out of these 15 cases, 14 children had SIRS and 1 child (3.3%) received antibiotic as he had bacillary dysentery. None of the children had Severe Acute Malnutrition. Equal number of children required initiation of antibacterial therapy in our study.

The most common criterion among those children with SIRS was tachypnoea 14 (100%), followed by tachycardia 12 (85.7%). Fever was noted in 11(78.5%) and abnormal leucocyte counts were seen in 06 (42.8%).

Out of the 13 children who needed oxygen in our study, 6(42.9%) had SIRS while 7(43.8%) did not have SIRS. Presence or absence of SIRS did not affect the need for oxygen therapy in our cases.

In our study, chest X ray revealed a patch in 12 (85.7%) and only-hyperinflation in 2 (14.3%) among those children with SIRS while those children in No SIRS showed a patch in 4 (25%) and hyperinflation-only in 12 (75%). The proportion of children having a patch on X ray was significantly higher in SIRS group than those in No SIRS group; No SIRS group had significantly higher number of hyperinflation-only.

DISCUSSION

The mean LOS among children with SIRS was 8.07±5.121 days and those with No SIRS was 4.63±1.783 days; the difference being statistically significant. The mean length of stay among those children who had tachycardia, abnormal temperature, and an abnormal leucocyte count was 8.17±5.557, 8.55±5.67 and 7.0±1.549 days respectively and that of those who did not have the same was 7.5±0.707, 6.3±2.808 and 8.88±6.728 days respectively; the difference being statistically not significant. The Mean LOS was significantly higher among those children with SIRS but the various SIRS criteria independently did not influence the mean LOS among our cases.

Thirteen children among those who had SIRS in our study had chest indrawing while 1 child did not. Similarly, 13 children among No SIRS had chest in drawing while 3 did not. There was no significant difference in the proportion of children having chest indrawing (the sign which defines severe pneumonia according to WHO criteria) in SIRS and No SIRS group.

All of our cases would have received antibiotics if WHO criteria for pneumonia were applied. However, by applying SIRS criteria to differentiate potential bacterial infections from viral infection, we were able to avoid antibiotic usage in 16 of our 30 cases.

CONCLUSION

Half of our study population required initiation of antibacterial therapy; the most common indication being SIRS. The mean LOS was higher among the SIRS group. Application of SIRS criteria helps prevent unnecessary usage of antibiotics in children with bronchiolitis. Due to non-availability of viral polymerase chain reaction (PCR) and expensive nature of the investigation SIRS criteria would be a better method in a resource limited setting.

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