ORIGINAL ARTICLE

A Retrospective Study on Factors Associated with Severe Childhood Community-Acquired Pneumonia

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ABSTRACT

Background and Aim: Globally, community-acquired pneumonia (CAP) is the most common source of mortality among children. Early diagnosis and effective management need the identification of risk factors. The purpose of this study was to characterize the clinical symptoms and investigation of various risk factors for severe CAP in children.
Patients and Methods: A retrospective study was conducted on 186 children in the Pediatric Department of Niazi Welfare Teaching Hospital, Sargodha from March 2022 to November 2022. Children with pneumonia who had radiological confirmation were included. Community-acquired pneumonia cases were categorized into two groups: Group-I composed of severe CAP cases whereas Group-II non-severe CAP cases. Baseline characteristics such as age, nutritional status, and gender were collected. Vital signs, fever, duration of symptoms, and physical findings such as chest retraction, cyanosis, wheezing, and nasal faring were clinical data recorded. Laboratory findings such as serum electrolyte, full blood count, and inflammatory markers such as C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) were recorded. SPSS version 27 was used for data analysis.
Results: Of the total 186 children, there were 74 (39.8%) females and 112 (60.2%) male. Age-wise distribution of patients were as follows: 146 (78.5%) in 0-5 years, 26 (14%) in 6-10 years, and 14 (7.5%) in 11-15 years. Out of 186 children, the incidence of severe and non-severe CAP was 58 (31.2%) and 130 (68.8%) respectively. The most common clinical signs in both categories are fever and cough, followed by reduced appetite, vomiting, and shortness of breath. A seizure is present in 14 (24.1%) severe CAP cases. Based on physical examination, Rhonchi is found in 94 (72.3%) non-severe and 46 (79.3%) severe CAP patients. Among patients with severe pneumonia, over half have chest retractions, but only 22% have non-severe pneumonia. Tachypnea was experienced by approximately 33% of severe pneumonia patients against 14% of individuals with non-severe pneumonia. As inflammatory indicators, ESR and CRP are high in all groups.
Conclusion: The present study concluded that a fever persisting for >7 days and an elevation in RR are risk factors for severe pneumonia. Severe pneumonia is also prevented by a normal hematocrit level and BMI. There was a higher rate of severe pneumonia in CAP hospitalizations in children who had fevers lasting longer than seven days as well as tachypnea. According to these findings, RR should be utilized to determine both the severity of pneumonia and the identification of pneumonia.
Keywords: Sever community-acquired pneumonia, Risk factors, Childhood pneumonia

INTRODUCTION

Community-ac quired pneumonia is frequent among children, severe pneumonia, especially, a severe sickness with an abrupt start and progression endangering children's health. If not recognized and treated promptly, it is the primary cause of child mortality [1]. Pathogenic infections with high pathogenicity are the most common cause of severe community-acquired pneumonia (CAP). Children with severe CAP is generally challenging to treat in clinical practice due to their underdeveloped immune system and weak mucociliary clearance capability to eliminate germs. Many infections such as viruses, fungus, bacteria, and, atypical pathogens cause severe pneumonia. The primary contributor to the severe CAP pathophysiology is bacterial infection, however fungal infection causes severe pneumonia in children with compromised immune systems. However, the number of CAP cases caused viral infections has grown considerably in recent years, resulting in a greater proportion of severe pneumonia patients. A virus accounts for over half of CAP cases in infants and children under five, and its prevalence declines as they grow older [2, 3]. Pediatric CAP has become more prevalent as macrolide resistance has increased [4].

Pediatric CAP caused by MP is more common during the epidemic season [5, 6]. Children aged 2 to 59 months who have pneumonia typically cough or have difficulty breathing, as well as rapid breathing or chest tightness. The condition is defined as severe pneumonia when the patient does not drink, has continuous vomiting, seizures, lethargy, stridor, or is severely malnourished [7]. According to research, clinical definitions of severity correspond with case fatality rates. The majority of pediatric pneumonia fatalities are caused by severe pneumonia [8]. Cases must be identified early using basic clinical symptoms and treated appropriately. It may be necessary to provide more rigorous treatment or closer surveillance to children who are at risk of pneumonia-related deaths [9, 10]. As a result, the purpose of this study is to examine the factors associated with CAP.

METHODOLOGY

A retrospective study was conducted on 186 children in the Pediatric Department of Niazi Welfare Teaching Hospital, Sargodha from March 2022 to November 2022. Children with pneumonia who had radiological confirmation were included. Community-acquired pneumonia cases were categorized into two groups: Group-I composed of severe CAP cases whereas Group-II non-severe CAP cases. Baseline characteristics such as age, nutritional status, and gender were collected. Vital signs, fever, duration of symptoms, and physical findings such as chest retraction, cyanosis, wheezing, and nasal faring were clinical data recorded. Laboratory findings such as serum electrolyte, full blood count, and inflammatory markers such as C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) were recorded. A children having difficulty in breathing, cough, fever, tachypnea, and lower chest wall in drawing were considered to have pneumonia. Severe pneumonia was considered as pneumonia accompanied by the following general risk signs: lethargy or unconsciousness, drinking difficulty, prolonged vomiting, severe malnutrition, and convulsions. SPSS 27 was used to process the collected data. Quantitative data were expressed as mean and standard deviation. In the absence of it, the median and range will be utilized. The chi-square test was used for bivariate analysis, and variables with P-values less than 0.25 would be included in the multivariate logistic regression analysis.

RESULTS

Of the total 186 children, there were 74 (39.8%) females and 112 (60.2%) male. Age-wise distribution of patients were as follows: 146 (78.5%) in 0-5 years, 26 (14%) in 6-10 years, and 14 (7.5%) in 11-15 years. Out of 186 children, the incidence of severe and non-severe CAP was 58 (31.2%) and 130 (68.8%) respectively. The most common clinical signs in both categories are fever and cough, followed by reduced appetite, vomiting, and shortness of breath. A seizure is present in 14 (24.1%) severe CAP cases. Based on physical examination, Rhonchi is found in 94 (72.3%) non-severe and 46 (79.3%) severe CAP patients. Among patients with severe pneumonia, over half have chest retractions, but only 22% have non-severe pneumonia. Tachypnea was experienced by approximately 33% of severe pneumonia patients against 14% of individuals with non-severe pneumonia. As inflammatory indicators, ESR and CRP are high in all groups. Gender's distribution is shown in Figure-1. Age-wise distribution is shown in Table-I. The prevalence of severe and non-severe CAP is illustrated in Figure-2. Clinical manifestation of severe and non-severe CAP is shown in Figure-3. The incidence of different physical findings in severe and non-severe CAP cases are shown in Figure-4. Table-II represents the baseline characteristics of severe and non-severe CAP. Laboratory findings of severe and non-severe CAP cases are shown in Table-III.
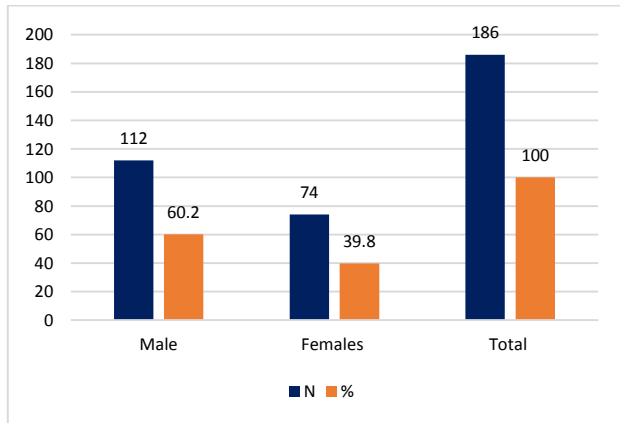

Figure-1: Gender's distribution (n=186)

Table-1: Age-wise distribution of children (n=186)

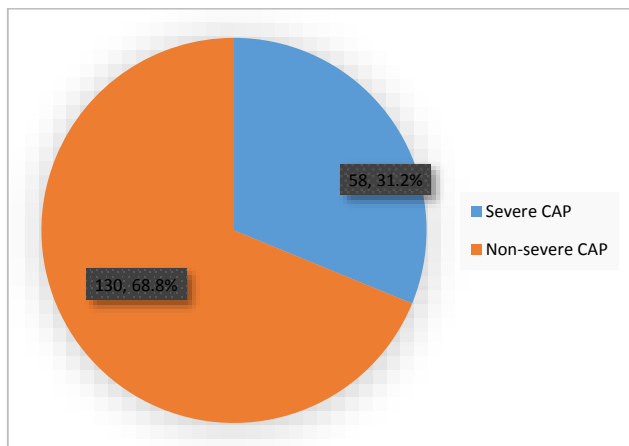| Age group (years)	Frequency N	Percentage %
0-5	146	78.5
6-10	26	14
11-15	14	7.5
Total	186	100

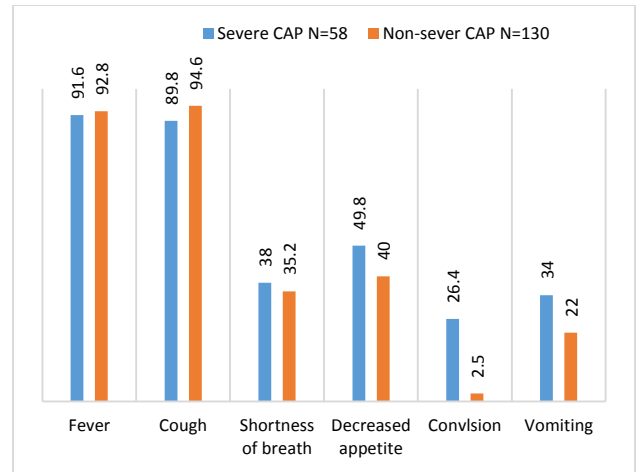Figure-2: Prevalence of severe and non-severe CAP cases (n=186)

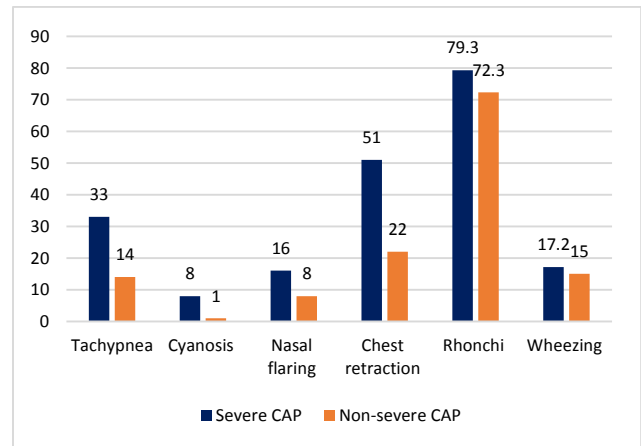Figure-3: Clinical manifestation of severe and non-severe CAP (n=186)

Figure-4: Physical findings in severe and non-severe CAP (n=186)

Table-2: Baseline characteristics of severe and non-sever CAP cases (n=186)

Parameters	Severe CAP N=58	Non-severe CAP N=130	P-value
Age (years) Median	2.3 (0.01–16)	1.6 (0.1–16.4)	
BMI (kg/m2) N (%) Normal Overweight Obese	26 (44.6) 2 (3.4) 1 (1.7)	98 (75.4) 10 (7.5) 6 (4.6)	0.070
Cough duration (days)	7 (1–90)	7 (1–60)	0.07
Temperature (°C)	37.9 (34.6–41)	37.7 (35.4–40.1)	0.08
Respiratory rate (bpm)	31 (21–96)	25 (12–87)	<0.01
Oxygen saturation (%)	97 (67–100)	98 (81–100)	0.07
Heart rate (beats per unit)	132 (76–192)	124 (82–204)	0.05

Table-3: Laboratory findings of severe and non-severe CAP cases

Parameters	Severe CAP N=58	Non-severe CAP N=130	P-value
Hemoglobin (g/dL)	12 (8.2–16)	12.6 (5.2–16.9)	0.007
Hematocrit (%)	32.6 (12.4–46.3)	35 (4.59–50.4)	0.03
Red blood cell count (106 cells/ µL)	4.7 (2.8–17.9)	4.8 (1.9–15)	0.6
Lymphocyte (%)	34 (5–71)	33 (3–80)	0.7
ESR (mm/h)	22.9 (1–103)	23.4 (2–118)	0.68
CRP (mg/L)	14.8 (1–229)	13.1 (0.1–116.5)	0.42
Random blood glucose (mg/dL)	103 (4–515)	105 (62–238)	0.21
Platelet (/mm3)	384 (101–988)	352 (25–1000)	0.29

DISCUSSION

The present study mainly focused on various factors associated with severe CAP and found that pathogens types, gender, and age

were determined factors affecting the severe CAP among children. Other factors were increasing respiratory rates and fever for >7 days. Normal hematocrit levels and body mass index are also defensive parameters against severe pneumonia. Children with fever for >7 days and tachypnea were more likely to progress to severe pneumonia. The diagnosis of CAP among children during their childhood and predicting consequences are more challenging [11]. Clinicians use their expertise to identify pediatric pneumonia [12]. The inaccuracy of doctors' gestalt is exacerbated by a lack of consensus among physicians in diagnosing CAP [13].

Fever is one of the cardinal indications of pneumonia, according to medical students [14]. A recent research, however, discovered that fever alone did not consistently distinguish juvenile CAP from other respiratory infections [15, 16]. A previous investigation reported that temperature of 39 °C was associated with pediatric pneumonia mortality at an adjusted risk ratio of 1.9 [17]. Furthermore, the length of illness, particularly fever, has been linked to a poor prognosis in children with pneumonia [18, 19]. Another study found that the existence of symptoms for >3 days enhance the probability of pediatric CAP unfavorable outcomes [20].

The ratio of red blood cell to plasma is calculated by blood statistics known as hematocrit. Reduced hematocrit is caused by RBC volume decreases and plasma volume increases. Individual with hypovolemic and edematous were more susceptible to hemodilution [21]. A low hematocrit, particularly when combined with genuine anemia, increases the risk of sepsis and congestive heart failure [22, 23].

Acute systemic infections induce inflammatory reactions, which significantly limit the quantity of circulation of entering red blood cells [24]. The formation of reactive oxygen species may be involved in the suppression of red blood cell oxygen transport and membrane abnormalities [25]. Hooli et al. [26] reported that mortality among severe CAP cases could be independently associated with respiratory rate (70 bpm). The categorization distinguishes the pneumonia severity based on distinct respiratory rate ranges and may be better suitable for identifying children at high risk of mortality [27].

According to epidemiological findings, respiratory illnesses in children caused by viral infection [28]. Though the majority of infections are minor, self-limiting, and rescindable, with a favorable diagnosis and low transience [29, 30]. Severe pneumonia is caused by viral infection (MP), and increased considerably. According to our findings, the proportion of MP infection was highest in severe CAP cases in children, and MP infection was mostly identified in children older than one year old.

CONCLUSION

The present study concluded that a fever persisting for >7 days and an elevation in RR are risk factors for severe pneumonia. Severe pneumonia is also prevented by a normal hematocrit level and BMI. There was a higher rate of severe pneumonia in CAP hospitalizations in children who had fevers lasting longer than seven days as well as tachypnea. According to these findings, RR should be utilized to determine both the severity of pneumonia and the identification of pneumonia.

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