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PREVALENCE OF PNEUMONIA AMONG INFANTS HOSPITALIZED WITH SEVERE BRONCHIOLITIS IN BABYLON PROVINCE: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Hospitalization due to bronchiolitis is relatively common during infancy. Pneumonia is known to be present in some cases where infants are admitted to hospitals for severe bronchiolitis. The purpose of this study was to establish the incidence of pneumonia among infants admitted to hospital with severe bronchiolitis and the association of such incidences with age, type of feeding, sex as well as the weight.

Methods: A cross-sectional study was conducted among 220 children aged ≤ 2 years with severe bronchiolitis admitted to Babylon Teaching Hospital for Maternity and Children, Babylon Province, from February 1 to April 1, 2026. Bronchiolitis was diagnosed clinically, while pneumonia was diagnosed based on clinical assessment and chest X-ray findings showing consolidation. Data on age, sex, feeding type, and body weight at admission were collected. Associations between pneumonia status and categorical variables were assessed using the chi-square test, with $P < 0.05$ considered statistically significant.

Results: Of the 220 infants with severe bronchiolitis, 90 (40.9%) were diagnosed with pneumonia and 130 (59.1%) were not. Most infants were younger than 6 months (65.0%), and 60.0% were male. Bottle feeding was the most common feeding type (55.0%), while 50.5% had low body weight. Pneumonia was not significantly associated with age group, sex, feeding type, or weight status.

Conclusion: Pneumonia was diagnosed in 40.9% of infants hospitalized with severe bronchiolitis. No significant associations were observed between pneumonia and the demographic or clinical characteristics examined. Larger multicenter studies are needed to better characterize pneumonia among infants with severe bronchiolitis.

Keywords: Infants; Pneumonia; Prevalence; Evere bronchiolitis; Hospitalization

1 INTRODUCTION

Bronchiolitis is one of the most common viral lower respiratory tract infections in infancy and remains a major cause of hospital admission among infants [1]. It typically presents with cough, tachypnea, wheezing, and diffuse crackles, while signs such as chest hyperinflation, intercostal retractions, and nasal flaring are more often seen in severe disease [2, 3]. An estimated 150 million bronchiolitis cases occur worldwide each year, with approximately 2%–3% of affected infants requiring hospitalization [4]. In the case of severe bronchiolitis, the condition may lead to hypoxemia and respiratory failure, even though most of the time, the condition improves by itself [5]. Bronchiolitis is caused by a variety of viruses that affect the respiratory system, even though RSV is the most common pathogen found in the world [6]. Infections of RSV have a wide spectrum of diseases, including mild upper respiratory tract infections, severe lower respiratory tract disease, and even pneumonia.

Every year around the world reports show that acute lower respiratory tract infections linked to respiratory syncytial virus RSV lead to more than 33 million infections in children who are younger than five years old. These infections cause, about 3.2 million hospital visits and high death rates [8]. Other types of viruses are also often found in children who have bronchiolitis. These include rhinoviruses, human metapneumovirus, influenza viruses, coronaviruses, human bocavirus and adenoviruses [9]. Co-infections with viruses are frequent, although the role they play in determining severity might be virus-specific; for instance, RSV and hMPV co-infections have been associated with an increased risk of ICU admission as compared to RSV mono-infection [10]. However, despite the huge burden of viral bronchiolitis, treatments available for the condition remain largely supportive.

Prevention strategies, on the other hand, have evolved from palivizumab prophylaxis in high-risk infants to maternal RSV vaccination and long-acting monoclonal antibodies like nirsevimab [11, 12].

Various demographic and clinical variables have been found to correlate with the severity of bronchiolitis in infants [13]. Age, especially young age, is correlated with increased severity and hospitalization [14]. Male infants have been found [15] to be more prone to hospitalization owing to RSV infection than female infants. It has been found that low weight at hospital admission is associated with increased disease severity [16], whereas breastfeeding is known to be associated with a lower likelihood of acute bronchiolitis and hospital admission [17]. It is yet unknown whether any connection exists between these parameters and development of pneumonia in patients with severe bronchiolitis. This question is important from the medical point of view as infants suffering from severe bronchiolitis are predisposed to suffer from other pulmonary diseases.

Bronchiolitis is primarily caused by viruses, yet pneumonia may arise simultaneously or emerge subsequently as a secondary infection [18]. Among those admitted to hospitals suffering from bronchiolitis, bacterial pneumonia was observed in roughly 3.5 percent of instances.

However, this number changes between research projects, mostly due to variations in the groups examined and the rules applied for diagnosing pneumonia [19]. In clinical practice, it may prove hard to tell apart pneumonia from serious bronchiolitis because.

certain results exhibit overlap. chest x-rays can additionally display findings that overlap between these two disorders [18, 20].

While chest X-ray is not usually recommended for infants suffering from bronchiolitis without complications [14], this investigation may be considered necessary when there is suspicion of pneumonia or other complications [14]. Data on the prevalence of pneumonia among infants suffering from severe bronchiolitis are rare. The lack of local information on this topic in Babylon Province makes it necessary to study the problem of pneumonia in this particular population.

With no sufficient local information on this matter, this research was undertaken to find out how many infants with severe bronchiolitis suffer from pneumonia in Babylon Province.

We also examined whether age, sex, feeding type, and weight at admission were associated with pneumonia among these infants. By describing the occurrence of pneumonia in this population and identifying factors associated with its diagnosis, this study may provide useful local evidence for the clinical assessment of infants presenting with severe bronchiolitis.

2 MATERIAL AND METHODS

2.1 Study design

We conducted a cross-sectional study among children with severe bronchiolitis admitted to Babylon Teaching Hospital for Maternity and Children, Babylon Province, from February 1, 2026, to April 1, 2026. A total of 220 patients were included in the study.

2.2 Inclusion and exclusion criteria

Inclusion criteria were children aged ≤ 2 years admitted to the hospital with severe bronchiolitis. Children with congenital heart disease or chronic diseases, including diabetes mellitus, cerebral palsy, other neurological disorders, or known syndromes, were excluded from the study.

2.3 Clinical assessment and diagnosis

Bronchiolitis was diagnosed clinically by a pediatrician based on severe respiratory distress, including tachypnea, chest retractions, nasal flaring, grunting, and cyanosis, together with expiratory rhonchi. The clinical assessment also considered age and season, with most cases occurring in children younger than 1 year and during late winter. The diagnosis of pneumonia was done clinically and through CXR findings that showed presence of consolidation anywhere in the lungs. Radiography of the chest was conducted in all infants for the diagnosis of pneumonia.

2.4 Data collection

The data were gathered by means of a questionnaire and clinical examination. Age, gender, mode of feeding, and body weight at admission were some of the data collected. All the babies' body weight was measured with the use of an electronic scale. If a baby was under the 3rd percentile in the growth curve, he/she was deemed to have low body weight. Depending on whether or not the baby had pneumonia, the subjects were then divided into two groups – babies with severe bronchiolitis and pneumonia (n= 90) and babies with severe bronchiolitis but no pneumonia (n= 130).

2.5 Ethical statement

Approval was sought before starting the study and informed consent was gained from all subjects' families.

2.6 Statistical analysis

Data analysis was carried out using IBM SPSS Statistics(ver. 26). Categorical data were analyzed using frequencies and percentages. Chi-square test was applied to analyze the association between the status of pneumonia and the categorical data such as age category, gender, type of feeding, and weight status. Significance level of $P < 0.05$ was taken for statistical significance.

3 RESULTS

A total of 220 infants with severe bronchiolitis participated in the study. Demographic and clinical data are given in Table 1. The largest age group was infants less than 6 months old (143 or 65.0%), while 55 (25.0%) children were between 6 and 12 months old. There were only 22 (10.0%) babies older than 1 year. Male infants accounted for 132 (60.0%), while females accounted for 88 (40.0%) of the total number. Bottle feeding was the most common type of infant feeding practice, accounting for 121 (55.0%), whereas 53 (24.1%) and 46 (20.9%) practiced breastfeeding and mixed feeding respectively. Regarding weight status, normal weight infants were 109 (49.5%), and underweight infants were 111 (50.5%). Overall, 90 (40.9%) of the 220 infants with severe bronchiolitis were diagnosed with pneumonia, while 130 (59.1%) were not diagnosed with pneumonia.

Table 1: Overall characteristics of the study population (N=220).

Characteristics	No. patients	Percentage (%)
Age		
<6 months	143	65.0
6–12 months	55	25.0
>1 year	22	10.0
Sex		
Male	132	60.0
Female	88	40.0
Feeding type		
Breastfeeding	53	24.1
Bottle feeding	121	55.0
Mixed feeding	46	20.9
Weight status		
Normal weight	109	49.5
Under weight	111	50.5

Table 2 shows the distribution of age groups according to pneumonia status. Among infants without pneumonia, 84 (64.6%) were younger than 6 months, 32 (24.6%) were aged 6–12 months, and 14 (10.8%) were older than 1 year. Among infants with pneumonia, 59 (65.6%) were younger than 6 months, 23 (25.5%) were aged 6–12 months, and 8

(8.9%) were older than 1 year. Age group distribution did not differ significantly between infants with and without pneumonia ($P = 0.898$).

Table 2: Distribution of pneumonia by age group among infants with severe bronchiolitis.

Age group	No pneumonia N (%)	Pneumonia N (%)	<i>P</i> value
<6 months	84 (64.6)	59 (65.6)	0.898
6–12 months	32 (24.6)	23 (25.5)	
>1 year	14 (10.8)	8 (8.9)	
Total	130	90	

Table 3 shows the distribution of sex according to pneumonia status. Among infants without pneumonia, 76 (58.5%) were male and 54 (41.5%) were female. Among infants with pneumonia, 56 (62.2%) were male and 34 (37.8%) were female. Sex distribution did not differ significantly between infants with and without pneumonia ($P = 0.576$).

Table 3: Distribution of pneumonia by sex among infants with severe bronchiolitis.

Sex	No pneumonia N (%)	Pneumonia N (%)	<i>P</i> value
Male	76 (58.5)	56 (62.2)	0.576
Female	54 (41.5)	34 (37.8)	
Total	130	90	

We also assessed the effect of feeding style on pneumonia status distribution (Table 4). Among infants without pneumonia, 72 (55.4%) received bottle feeding, 35 (26.9%) were breastfed, and 23 (17.7%) received mixed feeding. Among infants with pneumonia, 49 (54.4%) received bottle feeding, 18 (20.0%) were breastfed, and 23 (25.6%) received mixed feeding. No statistically significant difference in feeding type was observed between the two pneumonia groups ($P = 0.267$).

Table 4: Distribution of Pneumonia by feeding type among infants with severe bronchiolitis.

Feeding type	No pneumonia N (%)	Pneumonia N (%)	<i>P</i> value
Breastfeeding	35 (26.9)	18 (20.0)	0.267
Bottle feeding	72 (55.4)	49 (54.4)	
Mixed feeding	23 (17.7)	23 (25.6)	
Total	130	90	

Table 5: Distribution of pneumonia by weight status among infants with severe bronchiolitis.

Weight	No pneumonia N (%)	Pneumonia N (%)	<i>P</i> value
Normal weight	70 (53.8)	39 (43.3)	0.125
Low body weight	60 (46.2)	51 (56.7)	
Total	130	90	

Table 5 shows the distribution of weight status according to pneumonia status. Among infants without pneumonia, 70 (53.8%) had normal weight and 60 (46.2%) were underweight. Among infants with pneumonia, 39 (43.3%) had normal weight and 51 (56.7%) were underweight. Although low body weight infants accounted for a higher proportion of the pneumonia group, the difference in weight-status distribution between infants with and without pneumonia was not statistically significant ($P = 0.125$).

4 DISCUSSION

Bronchiolitis is a common lower respiratory tract infection in infancy and an important cause of hospitalization in this age group [1]. In the present study, most infants with severe bronchiolitis were younger than 6 months, and males accounted for a greater proportion of cases than females. Bottle feeding was the most common feeding type, and about half of the infants were underweight. Notably, 40.9% of infants with severe bronchiolitis were diagnosed with pneumonia, indicating that pneumonia was common in this study population.

Most infants with severe bronchiolitis in the present study were younger than 6 months, accounting for 65.0% of the study population. This finding is consistent with previous evidence showing that early infancy is associated with an increased risk of severe bronchiolitis and hospitalization [20]. Other studies have found similar age distributions among other groups, including a large study conducted in China involving children hospitalized for bronchiolitis [4], as well as one conducted in Vietnam [21]. A recent Iraqi study from Duhok also reported greater bronchiolitis severity among children aged 3–6 months [22]. Overall, these findings suggest that early infancy is a particularly vulnerable period for severe bronchiolitis.

Male infants accounted for 60.0% of the severe bronchiolitis cases in our cohort. Similar male predominance among hospitalized infants and children with bronchiolitis has been reported in studies from China, the United Arab Emirates, and Iraq [4, 23, 24]. Sex-related variations in respiratory anatomy and physiology, as well as innate immune responses, may contribute to differences in susceptibility and severity of respiratory viral infections between males and females [25, 26]. However, these mechanisms were not investigated in the present study.

Bottle feeding was the most common feeding type among infants with severe bronchiolitis in the present study. Breastfeeding has been associated with a lower risk of lower respiratory tract infections during infancy, with exclusive breastfeeding showing a protective dose-response relationship in a prospective birth cohort study [27]. Similarly, a systematic review by Mineva *et al.*, reported that lack of breastfeeding in infants younger than 1 year was associated with an increased risk of severe respiratory syncytial virus (RSV)-associated acute lower respiratory tract infections and hospitalization [17]. These findings support the potential role of breastfeeding in reducing the risk and severity of respiratory infections during infancy.

Approximately half of the infants with severe bronchiolitis in the present study were underweight. Recent evidence suggests that weight status may influence the clinical course of bronchiolitis. Tamir *et al.* reported that low body weight infants hospitalized with RSV bronchiolitis had higher rates of intensive care unit admission and longer hospital stays than normal-weight infants [28]. These findings suggest that inadequate weight status may be associated with a more severe clinical course of bronchiolitis.

We next examined whether age, sex, feeding type, and weight status were associated with pneumonia among infants with severe bronchiolitis. In the present study, age group was not significantly associated with pneumonia among infants with severe bronchiolitis. A similar finding was reported by Kobińska *et al.* in hospitalized children with laboratory-confirmed RSV infection, in whom age was associated with pneumonia in univariate analysis but was no longer significant after adjustment for other factors [29]. The similar age distribution between the pneumonia and non-pneumonia groups in our cohort further suggests that age alone may have limited value in distinguishing infants with severe bronchiolitis who also have pneumonia from those without pneumonia.

Our study did not show a significant association between sex and pneumonia among infants with severe bronchiolitis. This finding is consistent with a recent study of hospitalized children with laboratory-confirmed RSV infection, which also found no significant association between sex and pneumonia in either univariate or multivariable analysis [29]. Although male infants accounted for a greater proportion of severe bronchiolitis cases in our cohort, the similar distribution of males and females between the pneumonia and non-pneumonia groups suggests that sex alone may not distinguish infants with severe bronchiolitis who also have pneumonia from those without pneumonia.

The current study found no significant association between feeding type and pneumonia among infants with severe bronchiolitis. This finding is consistent with a recent study of hospitalized children with laboratory-confirmed RSV infection, in which feeding method was not significantly associated with pneumonia after adjustment for other factors [29]. The lack of a significant association in our cohort suggests that feeding type alone may not distinguish infants with severe bronchiolitis who also have pneumonia from those without pneumonia. Differences in study populations, feeding categories, and viral etiology may partly explain variations in findings across studies.

The current study found no significant association between weight status and pneumonia among infants with severe bronchiolitis. Although low body weight infants accounted for a higher proportion of the pneumonia group than the non-pneumonia group, this difference was not statistically significant. A recent study of hospitalized infants with RSV

bronchiolitis found that low body weight infants had a more severe clinical course, including higher rates of pediatric intensive care unit admission and longer hospital stays [28]. However, these outcomes reflect bronchiolitis severity rather than the presence of pneumonia; therefore, the findings cannot be directly compared with our results. Further studies are needed to determine whether weight status is associated with pneumonia among infants with severe bronchiolitis.

However, there are certain limitations in this study that need to be taken into account. The first limitation of this study is that it has been conducted in one hospital and there has been a moderately sized sample of infants in this study. Second, we diagnosed bronchiolitis clinically without laboratory confirmation of the causative virus. Therefore, we cannot determine whether particular viruses, such as RSV and rhinovirus, were more frequently linked to pneumonia in our study. Third, we diagnosed pneumonia based on clinical examination and CXR findings without laboratory testing to identify the specific cause. Additionally, although our study evaluated a limited number of demographic and clinical characteristics, it did not include other factors such as socioeconomic status, household density, maternal education, or maternal health during pregnancy. These factors may influence pneumonia occurrence and should be considered in future research. Finally, as this was a cross-sectional study, our findings show associations between the studied factors and pneumonia but cannot establish cause-and-effect relationships.

5 CONCLUSIONS

Pneumonia was found in 40.9% of infants hospitalized with severe bronchiolitis in our study. Most infants were younger than 6 months, and males were more frequently represented. However, we found no significant association between pneumonia and age, sex, feeding type, or weight status. These findings suggest that pneumonia can occur relatively frequently among infants hospitalized with severe bronchiolitis, regardless of the demographic and clinical characteristics examined in this study. Further studies with larger samples and data from more than one hospital, along with identification of the viral causes, may provide a better understanding of pneumonia among infants with severe bronchiolitis.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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Diagnostics through the University of Utah and receives royalties through the University of Utah related to the FilmArray System; has received research support from BioFire Diagnostics for investigator-initiated research and has acted as a paid advisor to BioFire Diagnostics; and has acted as a paid advisor to Merck Sharp and Dohme LLC. Dr Pavia has acted as a paid consultant to Glaxo Smithkline and Sanofi. The other authors have no conflicts of interest to disclose.

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