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Research Article

The Incidence of Respiratory Syncytial Virus (RSV) Bronchiolitis and Concomitant Urinary Tract Infection (UTI) in Young Infants

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ABSTRACT

Aim: Respiratory Syncytial Virus (RSV) is the leading cause of bronchiolitis in infants, resulting in frequent hospital admissions for this age group. Concurrent bacterial infections significantly increase the risk of complications and mortality. Previous studies have explored the association between RSV infection and Urinary Tract Infection (UTI), but the evidence has been limited and contradictory. This study aims to clarify the relationship between RSV and UTI, facilitating informed clinical decision-making and establishing the necessity for early intervention in this pediatric patient population.

Objective: To investigate the potential correlation between RSV infection and concurrent UTI among hospitalized infants aged less than one year to assist with informed clinical decision-making regarding optimal diagnostic and treatment approaches for pediatric patients diagnosed with RSV.

Methods: This single-site, retrospective, observational study was conducted by reviewing 166 pediatric patients diagnosed and admitted for bronchiolitis caused by RSV. Data was gathered from the Spartanburg Medical Center Pediatric Intensive Care Unit (PICU) and General Pediatrics Ward from October 1st, 2016, to December 16th, 2021. Inclusion criteria consisted of all patients less than one year of age admitted with a diagnosis of RSV during the defined study period. Exact Chi-Squared and Wilcoxon Rank Sum tests were used to compare the incidence of co-infection and associated risk factors.

Results: Based on the collected data, it was observed that among the 166 individuals included in the study, 3 (2 males and 1 female) had a positive urinalysis suggesting the presence of a co-existing urinary tract infection. Utilizing an exact 95% confidence interval, the estimated percentage of children with co-infection ranges from 0.37% to 5.19%. Statistical significance was not observed between co-infection and circumcision, fever, or prematurity. However, using a Type 1 error rate of 0.10, perihilar infiltrates (p=0.058) were associated with co-infection, and noninvasive ventilation approached statistical significance (p=0.101).

Conclusion: This study suggests no clinically significant rate of concomitant UTI in infants diagnosed with RSV bronchiolitis. The result of this study suggests avoiding the routine collection of urine studies in all patients under one year old who are admitted for RSV bronchiolitis. Workup for these infants should remain individualized, and UTI diagnosis should be pursued only when there is high clinical suspicion for co-infection. Additional research involving multiple sites and a larger sample size would be beneficial to further strengthen these conclusions.

Keywords: Respiratory syncytial virus; Bronchiolitis; Urinary tract infection; Infants; Paramyxovirus

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INTRODUCTION

Respiratory Syncytial Virus (RSV) is a paramyxovirus that frequently infects young infants, and which can manifest as a variety of clinical syndromes, including bronchiolitis, pneumonia, upper respiratory tract infections, and asthma exacerbations [1,2]. Although it is well established that RSV is a significant cause of hospitalizations for respiratory illness in pediatric populations, and notably is the leading cause of bronchiolitis in young infants, significant confusion exists regarding the prevalence of concomitant bacterial urinary tract infection in this population. Previous studies have attempted to elucidate the relationship between RSV and UTI, but the evidence to date has been limited and contradictory [3-8]. Whether or not a correlation does exist, and the mechanism and risk factors associated with increased risk of bacterial co-infection in RSV-positive infants, remains elusive [4].

Accurate initial identification and diagnosis of UTI is warranted since young infants, especially those<1 year old, are at increased risk for renal scarring and concomitant widespread bacteremia if the diagnosis and initiation of treatment for an active urinary tract infection are ineffective or delayed [9-11]. While treatment protocols for RSV bronchiolitis are well-established [12], significant variability exists regarding the workup for RSV-positive infants and whether this workup should include urine studies to rule out co-infection.

By identifying pediatric patients admitted for management of RSV with concomitant UTI and analyzing patient demographics, past medical history, and symptom severity, this study aims to identify consistent predictors of UTI in patients at higher risk for more significant disease morbidity. These predictors, if present, could help clinicians limit illness severity and improve patient outcomes through knowledgeable surveillance and identification of concomitant infections.

MATERIALS AND METHODS

This retrospective observational study was conducted at a single center by reviewing the medical records of pediatric patients who were admitted to the general pediatrics unit or Pediatric Intensive Care Unit (PICU) at Spartanburg Medical Center. The study period spanned from October 1st, 2016, to December 16th, 2021.

The inclusion criteria for this study encompassed patients under one year of age who were admitted with a diagnosis of respiratory syncytial virus during the defined study period. Patients older than one year at the time of RSV infection diagnosis were excluded from the study. Patient identification and selection were facilitated using EPIC SlicerDicer™ software.

The patients identified with respiratory syncytial virus and admitted with acute bronchiolitis were categorized into three cohorts based on their RSV PCR and urine culture results: (1) positive RSV PCR with no urine culture, (2) positive RSV PCR with negative urine culture, and (3) positive RSV PCR with positive urine culture indicating a bacterial infection. The data collection process involved capturing various data points, including the etiology of viral infection, presence of concomitant bacterial infection, demographics (age, race, gender, zip code, siblings), exposure risks (daycare attendance, sick contacts), the month of exposure, prior medical history (prematurity, circumcision status, immunodeficiency, prior surgery, congenital malformations, congenital heart disease), admission location (General Pediatrics or PICU), length of stay, clinical presentation, clinical management (medications, oxygen delivery), complications during hospitalization, and patient outcomes (discharge home, transfer to a higher level of care, death). The identification and management of patients were facilitated using SAS 9.4 software (SAS Institute Inc., Cary, NC).

RESULTS

Out of 269 patients admitted for RSV bronchiolitis during the study period, 166 met inclusion criteria and their medical records were examined in depth. Study subject age, gender and race are delineated in Table 1.

Table 1: Patient demographics

Variable	All (N=166)	Negative/ Non-collected (N=163)	Positive (N=3)	P-value
Gender				
Male	66 (39.8%)	64 (97.0%)	2 (3.0%)	0.56
Female	100 (60.2%)	99 (99.0%)	1 (1.0%)	-
Race				
White	124 (74.7%)	122 (98.4%)	2 (1.6%)	1
Black	35 (21.1%)	34 (97.1%)	1 (2.9%)	-
Other	7 (4.2%)	7 (100%)	0 (0%)	-
Age				
0-28 days	19 (11.5%)	19 (100%)	0 (0%)	
29-56 days	37 (22.3%)	36 (97.3%)	1 (2.7%)	
57 days -1year	110 (66.2%)	108 (98.2%)	2 (1.8%)	

Upon reviewing the charts, it was found that only 3 (2 males and 1 female) of the 166 infants had a positive test indicating

the presence of a co-existing urinary tract infection as shown in Figure 1.

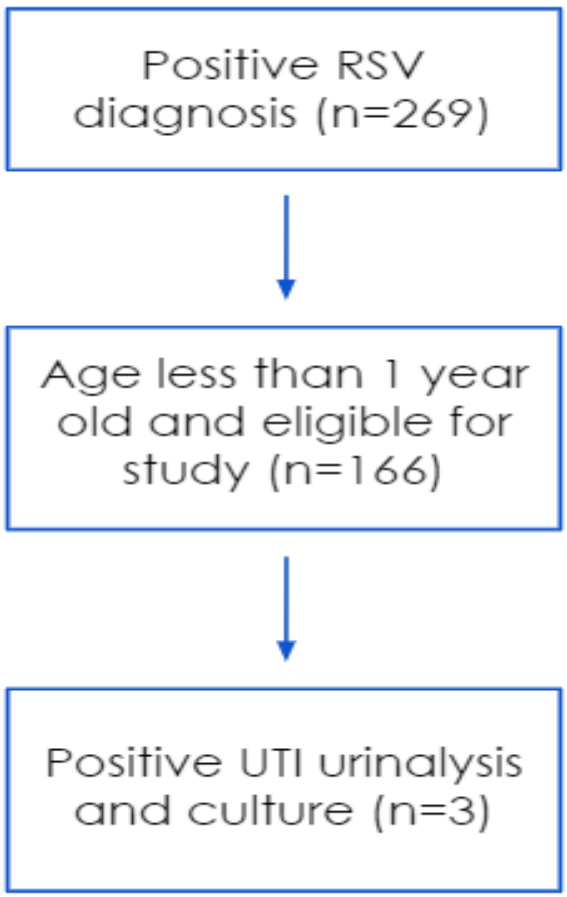

Figure 1: Patient flow.

An exact 95% Confidence Interval estimated the actual percentage of children with co-infection to be between 0.37%-5.19%. Factors for co-infection were tested with an exact Chi-Square approach with a Type I error rate of 0.10 as shown in Figure 2.

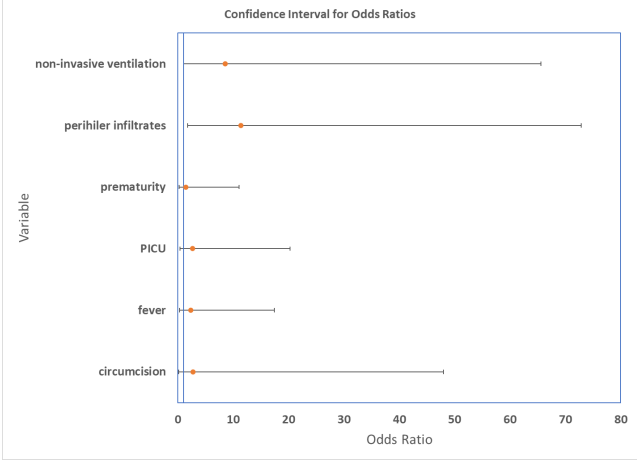

Figure 2: Factors associated with UTI co-infection.

We utilized an increased Type 1 error rate due to the rarity of co-infection. Statistically significant associations were not observed between bacterial co-infection and circumcision (males only p=1.0), fever (p=0.605), PICU admission (p=0.580), or prematurity (p=1.0). However, using a Type 1 error rate of 0.10, perihilar infiltrates (p=0.058) were associated with co-infection, and noninvasive ventilation approached statistical significance (p=0.101). Wilcoxon Rank Sum tests were used to compare the length of stay (p=0.325) and days with fever (p=0.581) between children with UTI co-infection *vs*. no co-infection. The graph displays means ± standard deviations for each outcome by UTI status in days mentioned in Figure 3.

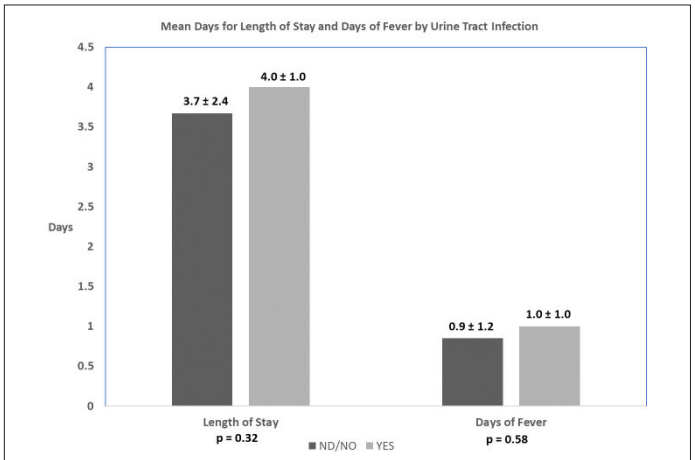

Figure 3: Length of stay and days with fever in children with UTI co-infection versus no UTI co-infection.

DISCUSSION

The goal of the study was to use qualitative data to determine whether a correlation exists between the diagnosis of bronchiolitis from RSV and concomitant Urinary tract infection (UTI) of a bacterial origin in infants. Previous efforts to determine a direct relationship between RSV and concomitant infection UTI among infants reveal conflicting data and an inability to provide robust evidence [2]. Variables studied included patient demographics, age, gender, circumcision, birth weight, past medical history, and the presence of co-infections, the goal of this analysis being to identify patients at higher risk for disease presentation.

Data analysis shows that UTI was a relatively rare event among the patients in our study. Most patients did not receive urine studies during their admission. Furthermore, the data suggest that the rate of successful treatment and discharge home for these patients did not differ significantly from those who did receive urine studies. We acknowledge that one significant limitation of this study is the lack of an RSV-negative control group. This prohibits us from determining whether a statistically significant difference exists between UTI incidence in RSV-positive patients and the general pediatric population, we are limited to reporting the basic

rate of UTI among our study participants. This is still relevant but less meaningful than if there had been a control group for objective comparison. Another limitation is the limited number of urinalyses ordered on pediatric patients admitted with RSV infection. Routine urinalysis for these patients is not part of the standard workup at the hospital where this study was conducted, and most patients were not screened for UTI upon admission. It is difficult to argue that our sample size of UTI-positive patients (n=3) is large enough to draw meaningful conclusions about the risk factors for UTI in RSV bronchiolitis.

Future research should involve a large-scale analysis of RSV patients from multiple hospitals to increase the sample size for this group. However, despite the limitations, this study provides a valuable perspective regarding concurrent UTI and RSV infection.

CONCLUSION

The statistical analysis conducted in this single-site, retrospective, observational study did not reveal a clinically significant concomitant Urinary Tract Infection (UTI) rate in infants diagnosed with RSV bronchiolitis. Furthermore, despite considering various patient factors such as congenital malformation, circumcision status, prematurity, and fever, none of these factors demonstrated statistical significance in influencing the incidence of concomitant UTI, except for the presence of perihilar infiltrates on chest x-ray. This suggests that these factors have limited predictive value in a clinical setting.

Based on the findings, we recommend against routine urinalysis and urine culture for all children below one year old diagnosed with RSV. Instead, the workup for RSV-positive infants should be individualized, and the diagnosis of UTI should be pursued when there is a high clinical suspicion of co-infection. However, it is essential to note that these recommendations are based on the specific context of this study and may need further validation in future research. Therefore, future studies are warranted to confirm these findings and provide guidance for treatment guidelines in this patient population.

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