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Case Series

Impact of a respiratory syncytial virus outbreak in a tertiary care hospital neonatal intensive care unit

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ABSTRACT

Respiratory syncytial virus (RSV) is the major causes of respiratory tract infections during infancy, with high rates of hospitalization and mortality during the first year of life. RSV has been linked to recurrent wheezing and paediatric asthma. Infections are more severe in high-risk neonates, including those below six months of age, with prematurity, congenital heart diseases, neuromuscular disorders, or immune deficiencies. This prospective study was conducted at the out born NICU of Indira Gandhi institute of child health, a tertiary care centre in Bengaluru, between July 2018 and January 2019. Nasal turbinate samples were collected from 9 infants for RT-PCR testing irrespective of the mode of respiratory support. RSV-positive neonates were included for analysis. Of the 9 neonates, 7 (78%) were male and 2 (22%) females. Most were term babies (67%). All neonates were symptomatic with fever, cough, respiratory distress, and chest indrawing. Eight of nine required respiratory support. Of these, 4 required oxygen for 3 days, 2 for 4 days, 1 for 2 days, and 1 for 1 day. RT-PCR detected RSV type B in 8 cases and type A in 1 case. Chest X-rays showed haziness in 56%, patchy opacities in 33%, lung collapse in 11%. Bronchodilators were administered in 89% of cases; none received antiviral treatment and were discharged without mortality. RSV infection in neonates leads to significant respiratory morbidity requiring oxygen and ventilatory support. Despite clinical severity, favourable outcomes were observed. Early detection and supportive care remain critical in RSV management.

Keywords: Respiratory syncytial virus, Neonatal intensive care unit, Infant respiratory infections, RT-PCR diagnosis, Oxygen therapy in neonates

INTRODUCTION

Respiratory syncytial virus (RSV) is an enveloped virus with a single-stranded, negative-sense, non-segmented RNA genome. It is a member of the *Pneumoviridae* family, previously categorized under *Paramyxoviridae*.[1] Based on variations in surface glycoproteins, RSV is classified into two major antigenic groups: A and B. Infections caused by group A are more prevalent and tend to spread more rapidly.

RSV has a prevalence of 5.2 per 1,000 children, increasing to 26 per 1,000 in infants younger than one month. The first six months of life represent a high-risk period, with the most severe cases typically occurring during this time. Preterm infants are hospitalized at a rate three times higher than full-term infants.[3] Over 20% of RSV-related hospitalizations take place within the first two months of life, more than 50% occur by three months, and over 70% happen within the first six months.[1]

RSV is the leading cause of respiratory infections in infants and young children globally. It is the primary pathogen responsible for acute bronchiolitis and viral pneumonia.[1] Currently, RSV accounts for 45% to 90% of

bronchiolitis cases, 15% to 35% of pneumonia cases, and 6% to 8% of croup cases. It is also associated with conditions such as apnea and otitis media. Over half of all children contract RSV by the age of one, and by the time they are two years old, more than 80% have experienced at least one infection-many of whom are infected twice.

Certain groups, such as premature infants born before 35 weeks of gestation, children with chronic lung disease, and those with congenital heart defects, face a higher risk of severe illness and complications from RSV.[2] The virus is primarily spread through direct contact, as it can survive for several hours on surfaces and hands. RSV primarily targets ciliated epithelial cells in upper respiratory tract, small bronchioles and type I pneumocytes.

Due to the absence of an effective vaccine or specific antiviral therapy for RSV, the current strategy to prevent severe illness in high-risk infants is immunoprophylaxis with palivizumab.[4]

CASE SERIES

The study conducted at out born NICU at Indira Gandhi institute of child health, tertiary care center in Bengaluru. Seasonally characteristics of RSV in Bengaluru from June to February. This prospective study conducted among 9 infants between July 2018 and Jan 2019. Nasal turbinate samples were collected regardless of the mode of respiratory support diagnostic test were performed using a multiplex RT-PCR assay and qualitative results are provided; viral load results are unavailable.

Case definitions: only RSV positive babies admitted in NICU were considered in the study who come with the symptoms and signs of RSV. Infants were classified as symptomatic based on babies with signs of respiratory infections i. e. cough, rhinorrhea, fever, and who had escalation of respiratory and nutritional support. Asymtomatic infants who did not have clinical signs of respiratory infection. Control measures were taken to prevent viral spread among the other neonates admitted in NICU and during the study period there was no outbreak in NICU. In this case series we study incidence, characteristics, transmission, and outcomes of SARS-CoV-2 infection in neonates and also the association of other factors like season, demography type, O_2 requirement days on ventilator, CPAP, nasal O_2 by prongs clinical symptoms and signs, x-ray changes related to RSV infection among infants and treatment required.

DISCUSSION

This study was conducted between July 2018 to January 2019 among 9 neonates admitted to the out born NICU unit.

Table 1: Descriptive statistics of age of mothers.

Min	Max	Mean	SD	Median	IQR
20	21	26.33	3.354	26	4.5

In our study demography of mothers is as follows, the median age of the mother is (26 years) with history of fever was seen in 3 mothers (33%); with a positive family history of prodrome was seen in 7 (78%) cases. Antenatal steroids were given in 1 (11%) of cases; breast feeding was initiated within 1 hr in 4 (45%) of cases. There is no leak PV was seen in any of the mothers or mothers had history of GDM (Table 2).

Table 2: The clinical status of the mother.

Status	GDM	PIH	Leak PV	H/O fever in mother	Status	Antenatal steroids	Family H/O prodrome	H/O foetal distress	CIAB	Re-suscitation required	Breast feeding within 1 hour
Yes	0 (0)	1 (11.1)	0 (0)	3 (33)	Yes	1 (11.1)	7 (77.8)	1 (11.1)	9 (100)	1 (11.1)	4 (44.4)
No	9 (100)	8 (88.9)	9 (100)	6 (66.7)	No	8 (88.9)	2 (22.2)	8 (88.9)	0 (0)	8 (88.9)	5 (55.6)

Of the total 9 cases 7 (78%) males and 2 (22%) female babies, most of them are term babies 6 (67%), preterm 2 (22%) and extreme preterm 1 (11%) and the median birth weight is 2.6 kg (Figure 1).

All the enrolled cases are symptomatic with fever, cough, lethargy, chest indrawing, respiratory distress with median age of presentation of symptoms is 16 days. Of 9 cases, 8 cases required respiratory support i.e., either mechanical ventilation, CPAP or O_2 support (Figure 2 and 3). The mean days of mechanical ventilation required is 4 days and mean O_2 support required days are 3 days, mean duration of hospital stay is 17 days (Table 3).

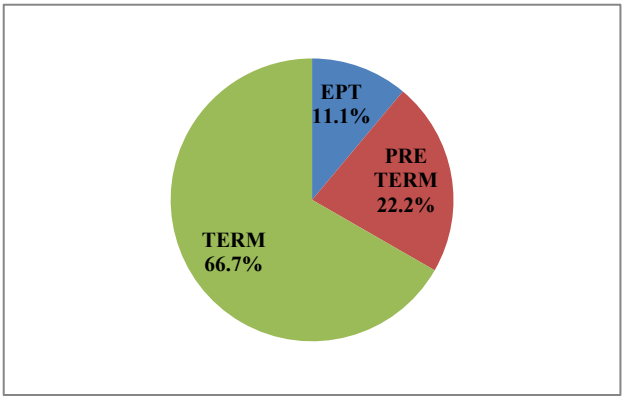

Figure 1: Percentage distribution of gestation.

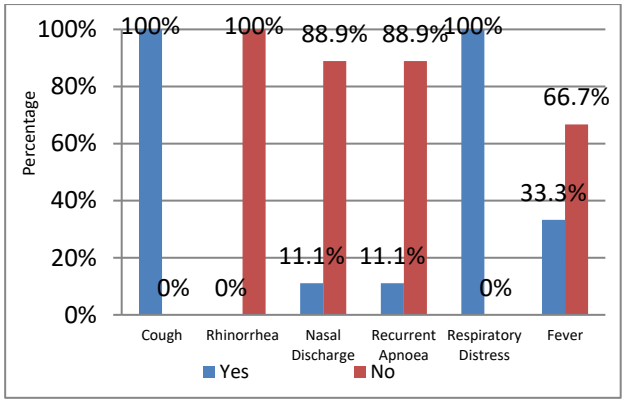

Figure 2: Percentage distribution of clinical features in newborns with RSV.

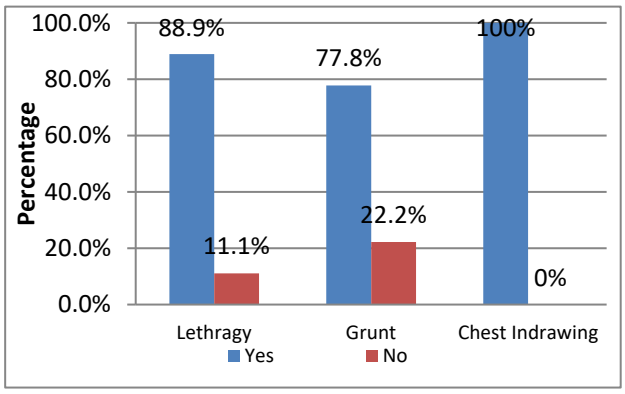

Figure 3: Percentage distribution of clinical signs in newborns with RSV.

Table 3: Descriptive statics of number of babies on oxygen.

O_2 (Days)	Number of babies	Percent (%)
1	1	12.5
2	1	12.5
3	4	50.0
4	2	25.0
Total	8	100.0

Table 4: Descriptive statics of babies of number of days on mechanical ventilation.

Number of days on mechanical ventilation	Number of babies	Percent (%)
1	1	16.7
2	2	33.3
4	2	33.3
9	1	16.7
Total	6	100.0

Table 5: Descriptive statistics of MV days.

Min	Max	Mean	SD	Median	IQR
1	9	3.67	2.875	3	3.5

Eight out of 9 babies were positive for RSV-B virus and only 1 baby is positive for RSV-A (Figure 4).

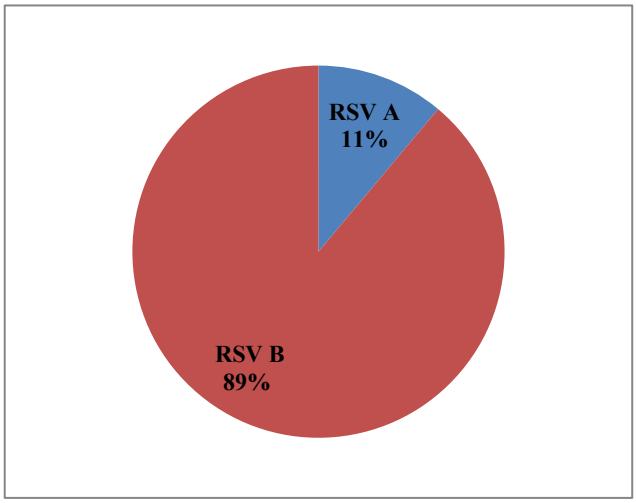

Figure 4: Percentage of RSV A and RSV B distribution among affected newborns.

Five babies showed haziness in x-ray, 3 with patch and 1 with lung collapse of the lung. Bronchodilators were used in 8 babies (89%). None received antiviral drugs (Figure 5).

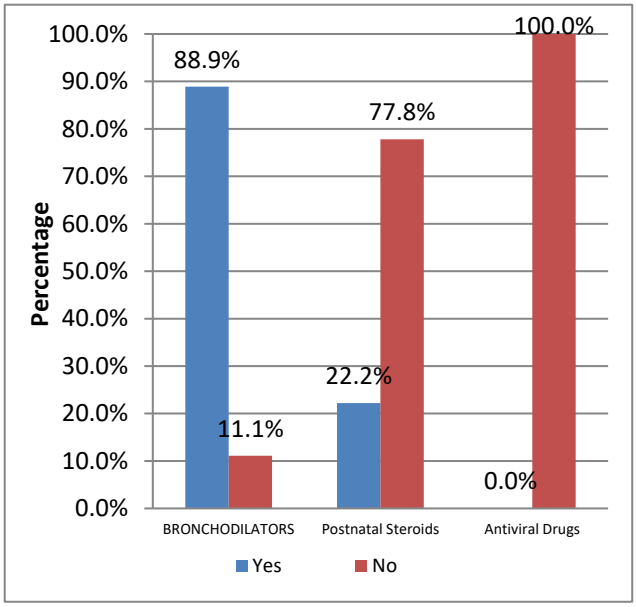

Figure 5: Percentage of newborns on bronchodilators, post-natal steroids and antiviral drugs.

DISCUSSION

In Bulgaria, for the seasons 2015/16, 2016/17, and 2017/18, RSV was identified in 44.5% of the infants with bronchiolitis and 25.1% of those with pneumonia.[7] During the season 2014-2015, serotype A dominated, while over the next three seasons RSV-B was dominant.[6,7] In our study, of the 9 cases, 8 cases required

respiratory support i.e., either mechanical ventilation, CPAP or O_2 support, about 88% developed bronchiolitis.

Among the 37 neonates admitted, 19 (48.7%) required mechanical ventilation, while the majority of others (n=28) required non-invasive ventilation for a median duration of 5 days.[8] A study by Goncalves et al in preterm and term infants, 5.4% were mechanically ventilated, 83.8% required oxygen support, and 37% needed respiratory support for median durations of 4, 3, and 4 days, respectively.[11] In our study The mean days of mechanical ventilation required is 4days and mean o2 support required days are 3 days.

A similar study from India described the clinical profile of 14 neonates, among whom 12 required respiratory support for a median (IQR) duration of 7 days.[3,12] However, this cohort was primarily comprised of preterm neonates who had been discharged from the NICU.[10] In our study mean duration of hospital stay is 17 days.

In a study by Alan et al the use of inhaled salbutamol (71.2%) was higher, whereas the use of inhaled steroids (6.8%) and systemic steroids (12.4%) was lesser.[11]

In another study, by Venkat et al of 37 neonates, 12 (30.8%), 5 (12.8%) and 10 (25%) infants received beta- 2 agonist nebulization, inhaled and systemic steroids, respectively.[8] In our study, inhaled bronchodilators were used in 8 babies (89%), systemic steroids were used in 22.2%.

Despite the use of palivizumab, ten patients included in this study presented with infection, six of them symptomatic and four asymptomatic. We believe that palivizumab did not prevent infection, probably because the infants were already in the incubation period of RSV.[12] In our study, none received antiviral drugs.

In spite of the unfavourable conditions all the babies were discharged with no deaths.

This study shows male predominance with more of term, normal birth weight with and most of the admitted cases are symptomatic with fever, cough, respiratory distress, grunt, chest indrawing, and most of them required O_2 requirement and all of them are positive for RSV type B virus except 1 baby positive for RSV type A. No deaths are seen and all the babies are discharged without any symptoms. The experience gained during this outbreak allows us to conclude that the creation of interdisciplinary teams is key in the control of epidemic outbreaks, as it leads to the quick and consistent implementation of preventive measures.[3]

The limitation of our study is the small sample size and RT-PCR was not repeated after 14 in the babies.

CONCLUSION

Diagnosis of viral infection is usually based on symptoms; investigations of all contacts is fundamental in NICU outbreak. To prevent contamination and to avoid to other neonates, RSV positive neonates were admitted in isolated sepsis room and avoid carriers to NICU we incorporated mask by the visitors as well as medical practitioners to NICU. Therefore, symptomatic and asymptomatic infants must be quickly identified and isolated to avoid viral spreading. Control measures of RSV such as use of face masks might be added when risk of respiratory particle spread is expected. To prevent contamination and to avoid carriers to NICU we have incorporated mask by the visitors to NICU. The present challenge to medical and infection control practitioners is to control RSV outbreaks. Early detection of cases, reinforcement of hand hygiene and contact precaution remains most important measures to control outbreaks. We believe and conclude that use of droplet precaution and hand hygiene were crucial in the control of outbreak.

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