

Asymptomatic Bradycardia in a Neonate: A Rare Manifestation of Respiratory Syncytial Virus Infection with Literature Review

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Abstract: Respiratory syncytial virus (RSV) is a leading cause of pulmonary infections and is associated with significant morbidity and mortality in infants and children under the age of 2 years. Although RSV infection most commonly affects the respiratory system, it has increasingly been linked to cardiovascular manifestations such as conduction abnormalities. Such complications are exceedingly rare in neonates, especially in the absence of clinical signs of infection. Herein, we present the case of a 3-day-old full-term neonate who presented to the emergency department owing to maternal concern of yellowish discoloration of the skin. During assessment, he exhibited multiple episodes of isolated bradycardia necessitating admission to the intensive care unit for further investigation and monitoring. After an extensive work up for bradycardia, he was found to be RSV positive via nasopharyngeal polymerase chain reaction (PCR). He remained hemodynamically stable with resolution of bradycardia episodes after 4 days. This case highlights the importance of recognizing RSV as a potential cause of arrhythmia in newborns, even in the absence of respiratory symptoms and underscores the need for further studies on the cardiovascular effects of RSV.

Keywords: cardiac involvement, conduction abnormalities, electrocardiography, respiratory infection

Introduction

Respiratory syncytial virus (RSV) is a unique pathogen belonging to the *Paramyxoviridae* family. It is highly prevalent among children, particularly those under 2 years of age.¹ It is also associated with significant morbidity and mortality in newborns, especially those younger than 6 months of age.² Although primarily recognized for its respiratory effects, RSV has increasingly been linked to cardiovascular events, which are considered the most common extrapulmonary manifestations.^{3,4} Cardiac arrhythmias, including supraventricular tachyarrhythmia, bradyarrhythmia, and heart block, have been reported in patients hospitalized with RSV infection.⁵ However, such complications are exceedingly rare in neonates, especially in the absence of obvious clinical signs of infection.⁴

Here, we present the case of a 3-day-old, full-term neonate who presented with asymptomatic bradycardia, subsequently identified as being associated with RSV infection. This case highlights the importance of recognizing RSV as a potential cause of arrhythmia in newborns, even in the absence of respiratory symptoms. It also underscores the need for further research into the cardiovascular effects of RSV.

Case Presentation

A term male neonate was born to a G8 P5 A2 mother via an uncomplicated vaginal delivery at 40+1 weeks of gestation, with a birth weight of 2.9 kg. He was discharged home with his mother in good condition 24 h after birth. The antenatal history was unremarkable, apart from diet-controlled gestational diabetes. The mother was healthy with no history of chronic medical

illnesses, fever, infection, or substance use during pregnancy, and was not on any regular medications aside from multi-vitamins and iron. The family history was unremarkable for autoimmune diseases such as systemic lupus.

At 3 days of age, he was brought to our emergency department owing to his mother's concern over increasing yellowish discoloration of his skin and eyes and a slight decrease in oral intake. He was otherwise active and alert, with no history of fever, cough, nasal congestion, apnea, vomiting, or changes in voiding or stooling habits. There was no clear history of sick contacts.

During the emergency department assessment, the patient exhibited multiple episodes of isolated bradycardia, with heart rates dropping to 70 beats/min (bpm) while awake. On physical examination, he appeared well, with mild scleral icterus and no signs of respiratory distress. Cardiovascular examination revealed good capillary refill time (<2s), strong femoral pulses, and normal heart sounds without murmurs. The results of the remainder of his systemic examination were unremarkable.

Electrocardiography (ECG) revealed sinus bradycardia with a heart rate of 80 bpm, PR interval of 80 milliseconds (ms) and no evidence of atrioventricular block or other conduction irregularities (Figure 1A). The results of laboratory investigations, including complete blood counts; serum electrolyte analysis; blood gas analysis; lactic acid, ammonia, and inflammatory marker levels; thyroid function tests; and cerebrospinal fluid, blood, and urine cultures were normal. The patient's bilirubin level was below the threshold for phototherapy and liver function was normal. An urgent cardiology consultation and echocardiogram revealed normal ventricular function with no structural abnormalities (Figure 2). Further imaging included cranial ultrasound which revealed no intraventricular hemorrhage.

The patient was admitted to the pediatric intensive care unit for cardiorespiratory monitoring and started on antibiotics for 48 h pending culture results. During admission, he remained hemodynamically stable, with a heart rate ranging from 70 to 120 bpm. His self-limited bradycardia episodes continued with no associated desaturation or hemodynamic instability.

Having ruled out the common causes of bradycardia in a neonate, such as hypothyroidism, electrolyte imbalance, sepsis, intraventricular hemorrhage and maternal medication exposure, viral testing was performed, confirming RSV positivity via nasopharyngeal polymerase chain reaction (PCR). ECG monitoring showed persistent asymptomatic sinus bradycardia episodes until day 3 of admission without progression to more serious conduction disorders or need for intervention. Repeat ECG on day 4 revealed a normal sinus rhythm with a heart rate of 136 bpm and PR interval of 80ms (Figure 1B). The patient was discharged on day 5 and returned for Holter monitor placement the following day. At the outpatient cardiology follow-up at 1 month of age, the Holter monitor readings were reviewed: the average heart rate was 140 bpm with a predominantly sinus rhythm and no further concerns.

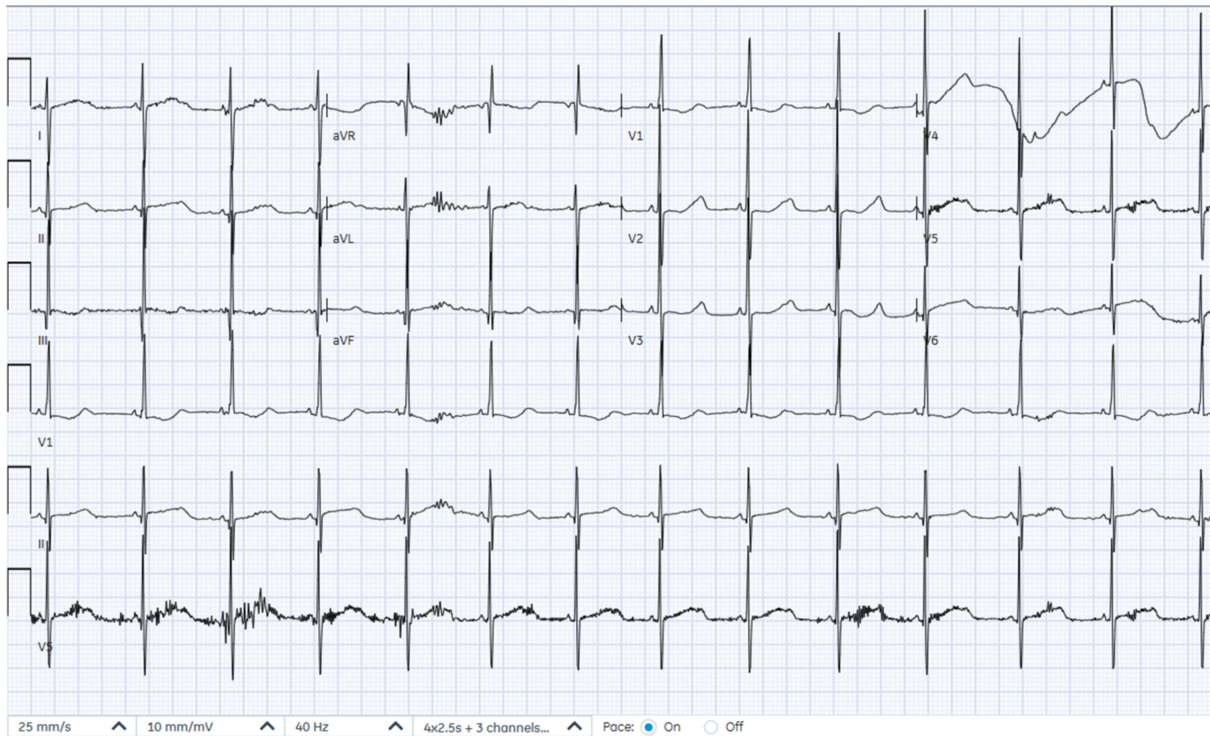
Discussion

RSV is a well-known cause of bronchiolitis and lower respiratory tract infection in young children, with severe cases primarily occurring within the first year of life.¹ However, there is growing recognition of the virus's ability to induce extrapulmonary complications, particularly cardiac manifestations.² These manifestations include myocarditis, heart failure, complete heart block, and arrhythmias such as supraventricular tachycardia, ventricular tachycardia, and bradyarrhythmia.^{3,6,7}

The pathogenesis of cardiac involvement in RSV infection is not yet fully understood. Proposed mechanisms include autoimmune inflammatory response due to the release of pro-inflammatory cytokine interleukin-1 and interleukin-6, and suppression of interferon gamma. This in turn leads to recruitment of cytotoxic T-cells, causing further myocardial cell death, inflammation, fibrosis and myocardial dysfunction. Another proposed mechanism is direct invasion of the virus to myocardium and cardiac conduction pathways leading to arrhythmia and myocarditis.^{4-6,8}

RSV infection presents with varying degrees of severity based on respiratory symptoms, ranging from mild bronchiolitis to severe respiratory disease requiring invasive ventilation and intensive care.⁶ To the best of our knowledge, all RSV-associated arrhythmias reported previously occurred during the acute phase of infection and were accompanied by respiratory symptoms.^{4,6} Esposito et al found a significant incidence of temporary sinoatrial block in patients admitted with RSV-positive bronchiolitis, particularly in those with higher viral loads.⁴ Most reported cases showed complete regression of arrhythmia. However, Oulego-Eroz et al described four cases of

A



B

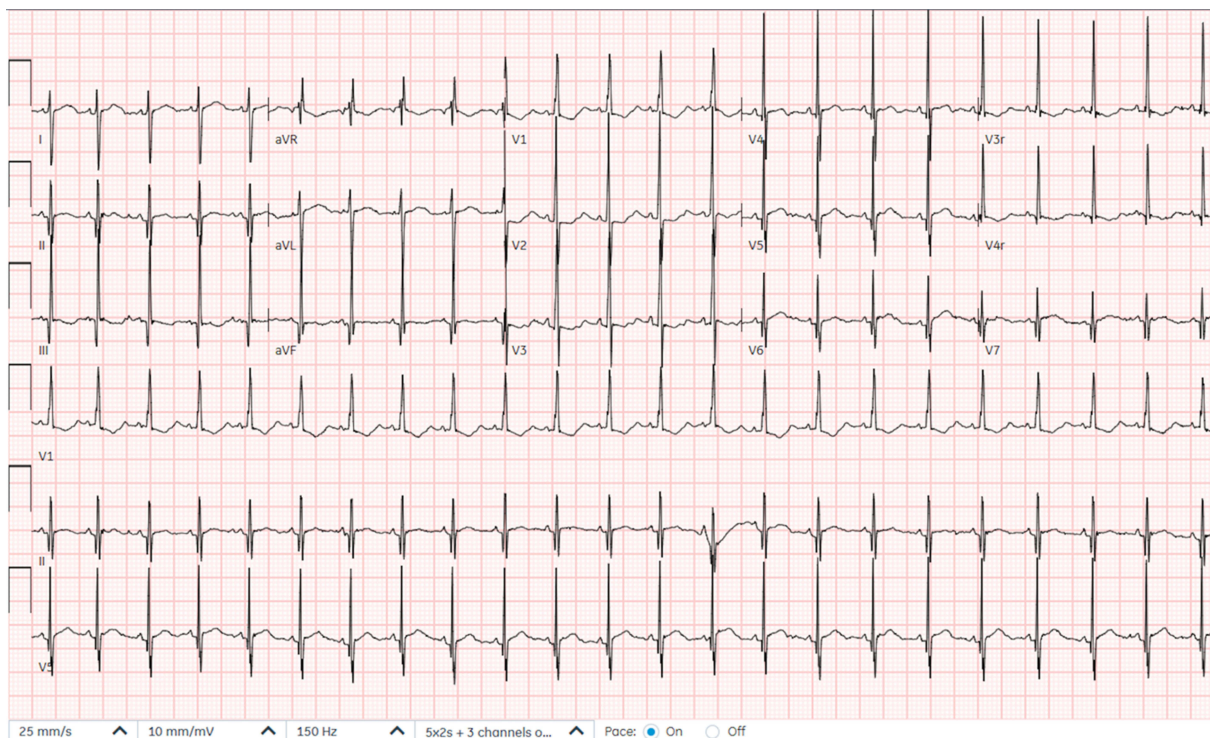


Figure 1 (A) Electrocardiography (ECG) shows sinus bradycardia with a heart rate of 80 beats per minute and PR interval of 80 milliseconds, with no acute ischemic changes or heart block upon presentation to the emergency department at 3 days of age. (B) ECG on day 4 of admission shows resolution of the sinus bradycardia with normal sinus rhythm, heart rate of 136 beats per minute and PR interval of 80 milliseconds, consistent with clinical improvement.

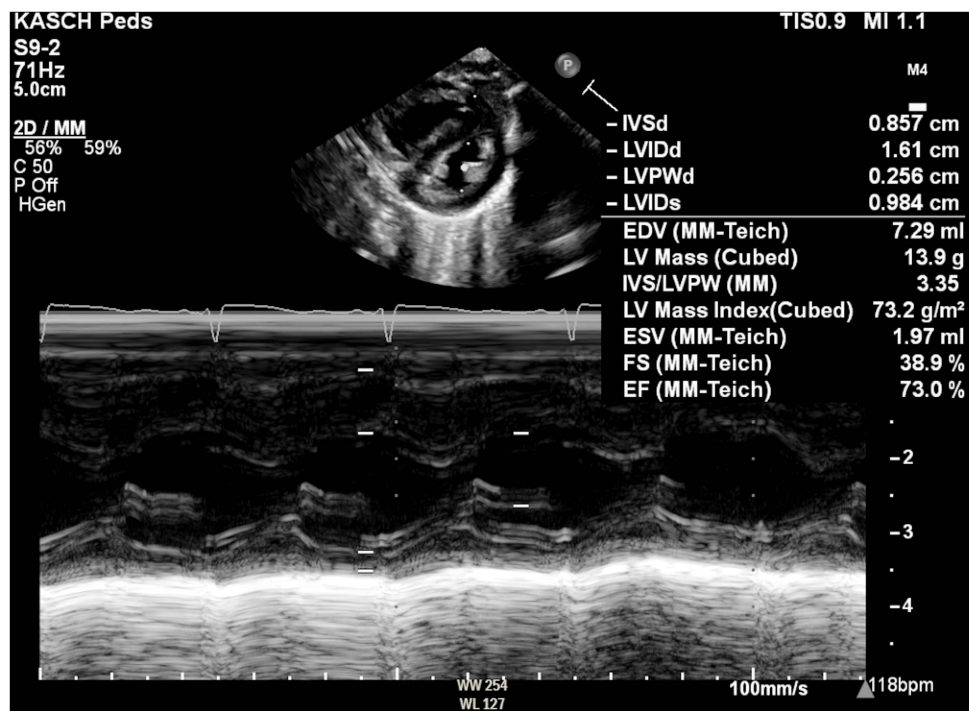


Figure 2 M-mode echocardiography showing normal left ventricular function.
Abbreviations: IVSd, interventricular septum in diastole; LVIDd and LVIDs, left ventricular internal diameter in diastole and systole; LVPWd, left ventricular posterior wall in diastole; EDV, estimated diastolic volume; LV mass, left ventricular mass; IVS, intraventricular septum; LVPW, left ventricular posterior wall; ESV, estimated systolic volume; FS, fractional shortening; EF, ejection fraction.

permanent complete heart block, some of which required considerable intervention and pacemaker placement.^{3,5,6} To better understand the association between respiratory syncytial virus (RSV) infection and cardiac arrhythmias in neonates, we conducted a literature search on PubMed using the following search strategy: *infant, newborn* [MeSH Terms] AND *respiratory syncytial virus infections* [MeSH Terms] AND (*arrhythmias, cardiac* [MeSH Terms] OR *bradycardia* [MeSH Terms]). The search was limited to articles published in English. A total of 8 articles were included, all of which portray respiratory symptoms along with conduction abnormalities attributed to RSV infection. Table 1 summarizes the pertinent literature on RSV-associated bradyarrhythmia in infants.

Table 1 Literature Review of RSV-Related Bradycardia in Infants

	Reference	Results
1	Forster J, Schmacher RF. Clinical picture presented by premature neonates infected with respiratory syncytial virus. <i>Eur J Pediatr.</i> 1995;154:901–905. ⁹	This study examined the clinical presentation of RSV infection in 79 premature neonates over a 3-year period in a neonatal intensive care unit. RSV was detected in 41.6% of cases; bradycardia (74%) was the most frequent symptom, followed by apnea (64%), cyanosis (53%), and hypercapnia (36%). Bradycardia was more common in neonates with lower gestational ages.
2	Huang M, Bigos D, Levine M. Ventricular arrhythmia associated with respiratory syncytial viral infection. <i>Pediatr Cardiol.</i> 1998;19:498–500. ⁷	Case report: A 7-week-old late preterm infant presented with respiratory symptoms and bradycardia. RSV was detected via nasopharyngeal wash. The patient developed SVT and was treated with lidocaine, esmolol, propranolol, amiodarone infusion, and dexamethasone for suspected myocarditis. The patient was discharged on amiodarone until 6 months of age.

(Continued)

Table 1 (Continued).

	Reference	Results
3	Olesh CA and Bullock AM. Bradyarrhythmia and supraventricular tachycardia in a neonate with RSV. <i>J Pediatr Child Health</i> . 1998;34:191–201. ¹⁰	Case report: A 2-week-old infant admitted with RSV-positive bronchiolitis developed frequent episodes of non-sustained SVT and sinus bradycardia with nodal escape. No treatment was required. The SVT was resolved by 6 months of age.
4	Esposito S, Salice P, Bosis S, et al. Altered cardiac rhythm in infants with bronchiolitis and respiratory syncytial virus infection. <i>BMC Infect Dis</i> . 2010;10:305. ⁴	Prospective study. Sixty-nine healthy infants (aged 1–12 months) hospitalized with bronchiolitis underwent 24 h Holter ECG monitoring and echocardiography. Sinoatrial blocks were identified in 26 of 34 patients with positive RSV (76.5%), in only 1 of 35 patients with negative RSV (2.9%) ($p < 0.0001$), and correlated with higher RSV viral load ($\geq 100,000$ copies/mL) ($p < 0.0001$). Follow-up Holter ECG after 28 ± 3 days showed complete resolution of the arrhythmia.
5	Menahem S. Respiratory syncytial virus infection and complete heart block in a child. <i>Cardiol Young</i> . 2010;20:103–104. ¹¹	Brief report. A 3-year-old child with an intercurrent viral infection and a history of RSV infection at 3 months of age was found to have bradycardia and complete heart block. The patient was managed with pacemaker insertion.
6	Haddad W, Agoudemous M, Basnet S. Prolonged sinoatrial block in an infant with respiratory syncytial viral bronchiolitis. <i>Pediatr Cardiol</i> . 2012;33:1203–1205. ⁶	Case report. A 3-month-old boy admitted with RSV bronchiolitis developed bradycardia, and ECG confirmed sinoatrial block. The condition resolved without intervention.
7	Karatza AA, Kiaffas M, Rammos S. Complete heart block complicating the acute phase of respiratory syncytial viral bronchiolitis. <i>Pediatr Pulmonol</i> . 2017;52:E61–E63. ¹²	Case report. A 10-month-old infant presented with viral respiratory symptoms and RSV-positive nasopharyngeal swabs. Bradycardia and complete heart block were identified. The patient received intravenous immunoglobulins for suspected myocarditis and an isoproterenol infusion. The condition persisted after discharge but required no further management.
8	Oulego-Erroz I, de Castro-Vecino P, Ocaña-Alcober C, Gutiérrez-Marqués S, Martínez-Badás JP, Centeno-Jiménez M. Complete atrioventricular block associated with respiratory syncytial virus: Presentation of a case and a literature review. <i>An Pediatr. (Engl Ed)</i> . 2021;(94):417–419. ³	Scientific letter. A 1-month-old child with RSV-associated bronchiolitis developed bradycardia and complete heart block. The patient was treated with isoproterenol infusion and intravenous immunoglobulins for suspected myocarditis. Atrioventricular conduction recovered by 3 months of age.

Abbreviations: ECG, electrocardiography; RSV, respiratory syncytial virus; SVT, supraventricular tachycardia.

In our case, the occurrence of multiple episodes of bradycardia lasting for 4 days without respiratory distress or other systemic symptoms represented an atypical presentation of RSV infection with bradycardia.⁶ The absence of respiratory symptoms despite RSV positivity suggests that the primary effect of the virus in this patient may have been cardiac. The atypical viral response in neonates compared with those in older infants and children may reflect the underdeveloped immune system in neonates.⁸ These observations align with reports of RSV's ability to induce cardiac-specific pathology independently of severe pulmonary involvement.^{4,12} Limitations to this report include absence of viral load quantification and serotyping which could help understand the correlation between RSV infection and cardiac involvement. Another limitation is the inability to confirm direct invasion of the virus to myocardial tissue, due to the invasive nature of endomyocardial biopsy.

From a clinical perspective, this case underscores the importance of considering RSV infection as a differential diagnosis in neonates presenting with unexplained arrhythmia, particularly during peak RSV seasons, while also raising significant questions about potential long-term consequences. Routine viral testing and ECG monitoring may be warranted in such cases to identify the underlying viral etiologies and assess the risk of conduction abnormalities. Additionally, the absence of respiratory symptoms should not preclude investigation for RSV in neonates with unexplained cardiac manifestations.

Conclusion

This case highlights a rare and atypical presentation of RSV infection in a 3-day-old full-term neonate with persistent asymptomatic bradycardia. It underscores the unexpected potential of RSV to cause isolated cardiac events, such as conduction disturbances, even in the absence of major respiratory symptoms. Given the rarity of this presentation, clinicians must consider RSV infection in neonates with unexplained arrhythmia, particularly during peak infection periods, when subtle signs indicating RSV as an underlying cause are observed. Early identification and close monitoring are crucial, because cardiac complications of RSV, though rare, can lead to significant morbidity.² This case contributes significantly to the growing understanding of the diverse clinical manifestations of RSV and highlights the need for further research into its mechanisms, long-term effects, and optimal management strategies for RSV-related cardiac complications.

Abbreviations

RSV, respiratory syncytial virus; PCR, polymerase chain reaction; Bpm, beats per minute; ECG, electrocardiography; ms, Milliseconds.

Ethics Approval and Informed Consent

IRB approval was obtained by the ethics committee of King Abdullah International Medical Research Center (KAIMRC). IRB approval No. 00000106825.

Consent for Publication

Written consent for publication was obtained from parents.

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Disclosure

The authors report no conflicts of interest in this work.

References

1. Jasti JR, Chaudhry HS, Chaudhary SS, Jasti NR. A rare association: Non-ST Elevation Myocardial Infarction (NSTEMI) secondary to Respiratory Syncytial Virus (RSV) infection. *Cureus*. 2023;15:e47518. doi:10.7759/cureus.47518
2. Shi T, McAllister DA, O'Brien KL, et al. Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in young children in 2015: a systematic review and modelling study. *Lancet*. 2017;390:946–958. doi:10.1016/S0140-6736(17)30938-8
3. Oulego-Erroz I, de Castro-Vecino P, Ocaña-Alcober C, Gutiérrez-Marqués S, Martínez-Badás JP, Centeno-Jiménez M. Complete atrioventricular block associated with respiratory syncytial virus: presentation of a case and a literature review. *An Pediatr*. 2021;94:417–419. doi:10.1016/j.anpedi.2020.06.009
4. Esposito S, Salice P, Bosis S, et al. Altered cardiac rhythm in infants with bronchiolitis and respiratory syncytial virus infection. *BMC Infect Dis*. 2010;10:305. doi:10.1186/1471-2334-10-305
5. Playfor SD, Khader A. Arrhythmias associated with respiratory syncytial virus infection. *Paediatr Anaesth*. 2005;15:1016–1018. doi:10.1111/j.1460-9592.2005.01580.x
6. Haddad W, Agoudamous M, Basnet S. Prolonged sinoatrial block in an infant with respiratory syncytial viral bronchiolitis. *Pediatr Cardiol*. 2012;33:1203–1205. doi:10.1007/s00246-012-0250-7
7. Huang M, Bigos D, Levine M. Ventricular arrhythmia associated with respiratory syncytial viral infection. *Pediatr Cardiol*. 1998;19:498–500. doi:10.1007/s002469900369
8. Legg JP, Hussain IR, Warner JA, Johnston SL, Warner JO. Type 1 and type 2 cytokine imbalance in acute respiratory syncytial virus bronchiolitis. *Am J Respir Crit Care Med*. 2003;168:633–639. doi:10.1164/rccm.200210-1148OC
9. Forster J, Schumacher RF. The clinical picture presented by premature neonates infected with the respiratory syncytial virus. *Eur J Pediatr*. 1995;154(11):901–905. doi:10.1007/BF01957502
10. Olesch CA, Bullock AM. Bradyarrhythmia and supraventricular tachycardia in a neonate with RSV. *J Paediatr Child Health*. 1998;34:199–201. doi:10.1046/j.1440-1754.1998.00182.x
11. Menahem S. Respiratory syncytial virus and complete heart block in a child. *Cardiol Young*. 2010;20(1):103–104. doi:10.1017/S1047951109990102
12. Karatza AA, Kiaffas M, Rammos S. Complete heart block complicating the acute phase of respiratory syncytial virus bronchiolitis. *Pediatr Pulmonol*. 2017;52:E61–E63. doi:10.1002/ppul.23714

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