Asymptomatic Idiopathic Belhassen Ventricular Tachycardia in a Neonate Detected Using ‘Smart Sock’ Wearable Smartphone-Enabled Cardiac Monitoring

ABDEFG 1 Ming-Lon Young
B 2 Leslie Flores

Corresponding Author: Ming-Lon Young, e-mail: Mingyoung@MHS.net
Conflict of interest: None declared

Patient: Male, baby-born
Final Diagnosis: Ventricular tachycardia
Symptoms: Palpitations
Medication: —
Clinical Procedure: —
Specialty: Pediatrics and Neonatology

Objective: Rare disease
Background: Wearable smartphone-enabled cardiac monitoring devices can aid the diagnosis of asymptomatic tachycardia in neonates and infants. This report is of a rare case of left posterior fascicular ventricular tachycardia of Belhassen type detected in a neonate by ‘smart sock’ cardiac monitoring.

Case Report: A premature baby boy at 37 weeks gestational age was discharged home after three days without complication, and was given ‘smart socks’ to wear. He was followed up daily for the management of hyperbilirubinemia, which was treated in the outpatient clinic with a phototherapy blanket. He was admitted to the emergency room (ER) at 6 days of age because his ‘smart socks’ identified a tachycardia of between 180–200 bpm. His parents reported no fever, cough, nasal congestion, or emesis. On examination in the ER, he was alert with no distress. An electrocardiogram (ECG) showed a sustained monomorphic and wide QRS tachycardia with a heart rate of 200 bpm, right bundle branch block (RBBB), and a superior axis that was compatible with a diagnosis of left posterior fascicular ventricular tachycardia of Belhassen type. The echocardiogram showed a structurally normal heart with normal cardiac function. His tachycardia spontaneously converted to normal sinus rhythm after four hours. He was discharged home three days later without further episodes of tachycardia. Cardiac monitoring using ‘smart socks’ continued at home, and no further arrhythmias were detected at one year of age.

Conclusions: The home use of smartphone-enabled technology to monitor the neonatal and infant cardiac heart rate can identify asymptomatic arrhythmias.

MeSH Keywords: Clinical Alarms • Infant, Newborn • Tachycardia, Ventricular

Full-text PDF: https://www.amjcaserep.com/abstract/index/idArt/921092
Background

Wearable smartphone-enabled cardiac monitoring devices can aid the diagnosis of asymptomatic tachycardia in neonates and infants and do not require a medical prescription. The Owlet® 'smart sock' (Owlet Baby Care, Liss, Hampshire, UK) uses pulse oximetry technology to track the heart rate and oxygen levels of infants and sends information on these measurements to the smartphone of the mother and father via its application (App) when the heart rate or oxygen levels vary from pre-set values. This 'smart sock' is currently not approved by the US Food and Drug Administration (FDA) as a diagnostic medical device. This report is of a rare case of left posterior fascicular ventricular tachycardia of Belhassen type detected in a neonate by 'smart sock' cardiac monitoring.

Case Report

A baby boy was born prematurely at 37 weeks gestational age (birth weight, 3,170 gm) by Cesarean section due to breech presentation and premature rupture of membranes. He was discharged home after three days without complication and was followed up daily in the office of his pediatrician for the management of hyperbilirubinemia, which was treated using a phototherapy blanket. His father had bought Owlet® smart socks (Owlet Baby Care, Liss, Hampshire, UK) which were used at home (Figure 1)

He was admitted to the emergency room (ER) at 6 days of age because his ‘smart socks’ identified a tachycardia of between 180–200 bpm. His parents reported no fever, cough, nasal congestion, or emesis. On examination in the ER, he was alert with no distress. His temperature was 97.8°F (36.6°C), pulse rate 198 bpm, respiration rate 42/min, blood pressure 69/42 mmHg, and his pulse oximetry was 100%. An electrocardiogram (ECG) showed a sustained monomorphic and wide QRS (0.11 sec) tachycardia with a heart rate of 200 bpm, right bundle branch block (RBBB), and a superior axis without a discernible P-wave (Figure 2A), which was compatible with a diagnosis of left posterior fascicular ventricular tachycardia (VT) of Belhassen type. The echocardiogram showed a structurally normal heart with a patent foramen ovale normal cardiac function.

He was breastfed and was latching on frequently, which indicated possible dehydration. Laboratory investigations showed a glucose level of 47 mg/dL, and a repeat glucose level of 36 mg/dL. He was given a bolus of intravenous dextrose 10% in water (D10W), which resulted in an improvement of the glucose value to 140 mg/dL. His total bilirubin was 16.8 mg/dL, his blood urea nitrogen (BUN) was 9 mg/dL, his serum creatinine was 0.28 mg/dL, and his sodium was slightly elevated at 148 mmol/L.

His tachycardia spontaneously converted to normal sinus rhythm after four hours (Figure 2B). He was started on propranolol 2 mg/kg/day (tid). Telemetry monitoring showed that he was in sinus rhythm with a heart rate that ranged between 7–130 bpm without any cardiac arrhythmia.
Because there was a concern that his mother’s breast milk was not sufficient and resulted in his hypoglycemia and hyperbilirubinemia, he was given formula milk as a supplement during his hospital stay, with 45 mL every three hours of a combination of breast milk and infant formula. The glucose and bilirubin levels returned to normal, and he was discharged home three days later. Propranolol was discontinued when he was one month of age. Cardiac monitoring using ‘smart socks’ continued at home, and no further arrhythmias were detected at one year of age.

**Discussion**

This report demonstrated the diagnostic role of the ‘smart sock’ wearable smartphone-enabled cardiac monitoring device in a newborn baby and identified an unusually high heart rate at six days old. Admission to hospital following tachycardia resulted in the diagnosis of the rare condition of left posterior fascicular ventricular tachycardia (VT) of Belhassen type before the neonate developed any cardiac symptom.

![Figure 2. A rare case of left posterior fascicular ventricular tachycardia of Belhassen type detected in a neonate by ‘smart sock’ cardiac monitoring. (A) The electrocardiogram (ECG) on arrival in the emergency room (ER) shows a wide QRS tachycardia, a heart rate of 200 bpm, a QRS interval of 0.11 seconds with right bundle branch block (RBBB). The QRS axis is 255 (superior axis), the QTc is 0.438, and there is no discernible P-wave. (B) The ECG following spontaneous cardioversion shows normal sinus rhythm, a heart rate of 137 bpm, PR interval 0.14 sec, a QRS interval of 0.07 seconds, a QRS axis of 130, and the QTc is 0.489 (a prolonged QTc).](image-url)
Belhassen VT is characterized by a wide QRS tachycardia with right bundle branch block (RBBB) with a superior axis, either with VA conduction or dissociation [1]. This type of tachycardia originates from the left posterior fascicle and occurs most commonly in children and young adults who have a structurally normal heart [2–4]. Belhassen VT rarely occurs in neonates or infants [2–4]. It is usually refractory to conventional antiarrhythmic therapy, such as beta-blockers, but is very sensitive to verapamil treatment. However, because the use of intravenous verapamil in infants can cause severe hypotension [5], the judicious use of verapamil at an intravenous dose of 0.05–0.1 mg/kg over at least 10 minutes is needed for cardioversion of acute tachycardia, with calcium available at the bedside [4].

In this case, VT spontaneously cardioverted in a few hours without any intervention. Although there was no initial reason to use the ‘smart sock’ in this case, had home-based neonatal heart rate monitoring not been done in this case, the episode of this rare form of VT in the neonate at six days old, would not have been detected. Although there was no recurrence of VT at one year of age, long term follow-up is recommended in this case.

Conclusions

This report is of a rare case of left posterior fascicular ventricular tachycardia of Belhassen type detected in a neonate by ‘smart sock’ cardiac monitoring. There are now several commercially available smartphone-enabled devices for real-time cardiac monitoring and oximetry in neonates, infants, and children. With increasing advances in wearable smartphone-enabled technology, the options are expanding rapidly. Home use of smartphone-enabled technology to monitor the heart rate in neonates and infants after hospital discharge can be useful in detecting abnormal cardiac arrhythmias, including those that are asymptomatic.

Conflict of interest

None.

References:

1. Belhassen B, Rotmensch HH, Laniado S: Response of recurrent sustained ventricular tachycardia to verapamil. Br Heart J, 1981; 46: 679–82
2. Dhala A, Lewis DA, Garland J, Pelech AN: Verapamil sensitive incessant ventricular tachycardia in the newborn. Pacing Clin Electrophysiol, 1996; 19(11 Pt 1): 1652–54
3. Ozer S, Allen S, Schaffer MS: Adenosine- and verapamil-sensitive ventricular tachycardia in the newborn. Pacing Clin Electrophysiol, 2001; 24(5): 898–901
4. Kehr J, Binfield A, Maxwell F et al: Fascicular tachycardia in infancy and the use of verapamil: a case series and literature review. Arch Dis Child, 2019; 104(8): 789–92
5. Epstein ML, Kiel EA, Victorica BE: Cardiac decompensation following verapamil therapy in infants with supraventricular tachycardia. Pediatrics, 1985; 75: 737–40