INSTRUCTIVE CASE

Infant with poor growth after cardiac surgery: Do not miss the rhythm!

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Case Report

A 6-month-old infant was evaluated for poor growth after cardiac surgery.

The baby was born by spontaneous vaginal delivery at 39 weeks of gestation after an uncomplicated pregnancy. His history was relevant for diagnosing a perimembranous ventricular septal defect (VSD), with a diameter of 7.5 mm and a significant left-to-right shunting, which required cardiac surgery at 4 months of age by a direct autologous pericardium patch closure under cardiopulmonary bypass. The postoperative course was complicated by a temporary complete atrioventricular (AV) block, followed by a spontaneous resumption of the normal AV conduction, with a post-surgical incomplete right bundle branch block (RBBB) and a heart rate of 129 bpm (Fig. 1). In the following days, cardiac monitoring showed AV dissociation with accelerated ventricular rhythm alternating with sinus rhythm with first-degree AV block. Therefore, corticosteroid therapy was set upon the suspicion of postoperative myocardial oedema and inflammation, which could cause the above-mentioned electrical disturbances.[1] The final cardiac monitoring reported a stable resumption of the normal AV conduction, so the infant was discharged after 11 days of hospitalisation.

At the age of 6 months, the paediatrician referred the child again for poor growth (5.56 kg, <3rd percentile) and limited milk intake, both through bottle and breastfeeding, without evidence of feeding difficulties, such as polypnea and sweating. Physical examination at admission was remarkable for a heart rate of 90 bpm at cardiac auscultation. Therefore, an electrocardiogram (ECG) was performed (Fig. 2).

Due to the poor growth and ECG abnormalities, the patient was implanted with a dual-chamber epicardial pacemaker at 7 months. At the following check-ups, the child was vigorous and began to feed more than in the previous months. Growth gain resumed (Fig. 3).

Key Points

1. The correction of ventricular septal defect located close to the cardiac conduction system has a risk of atrioventricular conduction block.
2. Heart rate should be monitored in these patients.
3. Failure to thrive in the postoperative course may be secondary to advanced atrioventricular block.

Discussion

The ECG in Figure 2a shows a ventricular rate of 77 bpm, which was abnormal for a 6-month-old baby, with the average range between 3 and 6 months of age being 120–159 (10th–90th percentile).[2] The QRS complex was broad, with the typical morphology of an incomplete RBBB. An accurate analysis of the trace proved a 2:1 AV block, with P waves merged with the end of the T wave (Fig. 2b, red arrows).

VSD is the most common cause of murmur in a well-appearing child in a nursery, while in a critical baby in the neonatal intensive care unit patent ductus arteriosus is the most frequent cause.[3] Infants with moderate to large VSDs usually experience symptoms between 4 and 8 weeks of age, concurrent with decreasing pulmonary vascular resistance. As systemic vascular resistance is higher than pulmonary vascular resistance, the direction of shunting across VSDs is typically left-to-right, and it results in an intensified flow of blood to the lungs, determining an increased breathing work and caloric demands. The raised blood flow to the lungs also decreases systemic flow, further compromising the growth failure.[4] In addition, due to an imbalance between total energy expenditure and energy intake, the infants reveal growth retardation.[5] Besides, feeding is the most strenuous activity in the early months of life, and infants with large VSD tire during suction, contributing to poor growth.

Surgical repair complications are rare, but there is a risk of rhythm abnormalities due to the proximity of some defects to the cardiac conduction system. VSD location is essential in predicting the AV block risk: the closer the defect is to the AV node, the greater the risk of postoperative AV block. The chance of iatrogenic permanent heart block requiring pacemaker is 0.8%, while the incidence of transient heart block is 4.9%.[6] Instead, the incidence of postoperative RBBB is still 30–40%, with a risk of right ventricle overload, dysfunction and increased mortality, especially in patients with heart failure.[7] Thus, in selected cases, 24-h Holter monitoring could be a valid test for detecting intermittent forms of AV block.

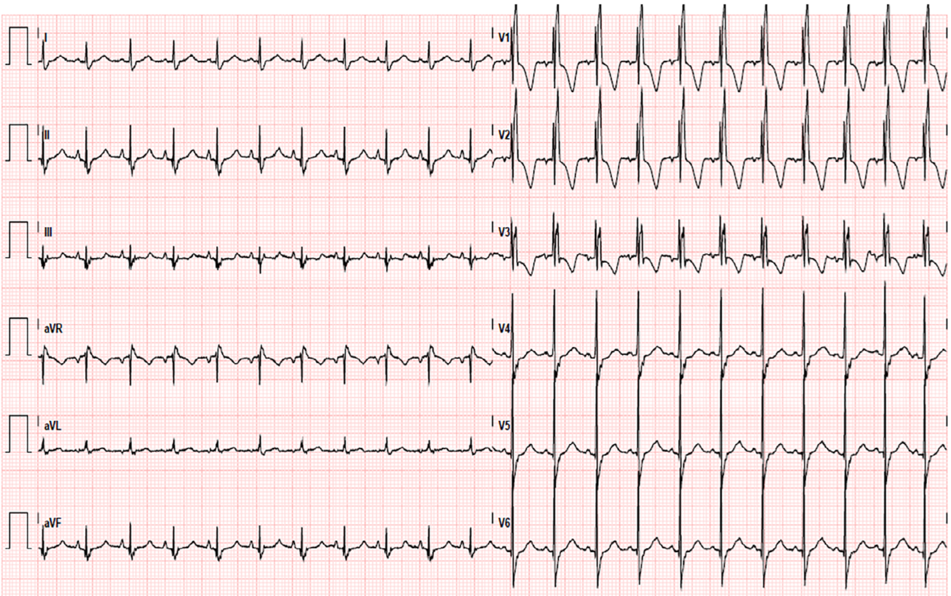

Fig. 1 A 12-lead electrocardiogram after surgical closure of ventricular septal defect. It shows normal atrioventricular conduction, with a ventricular rate of 129 bpm and an incomplete right bundle branch block.

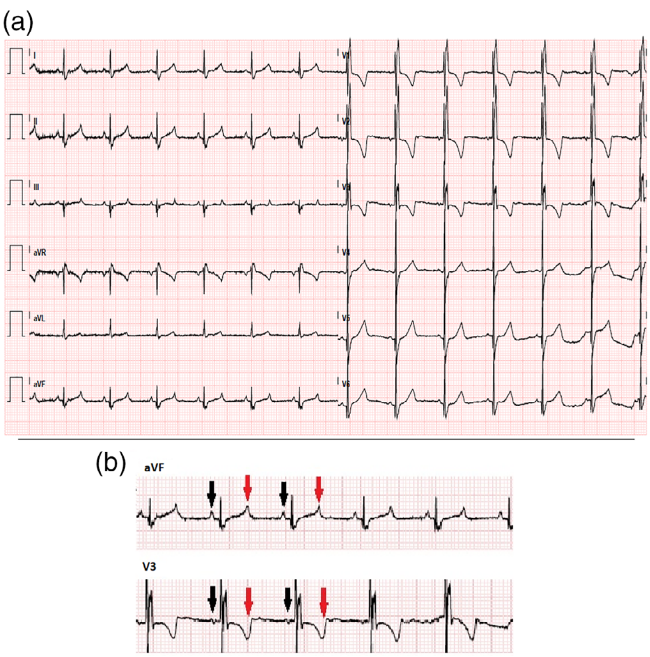

Fig. 2 (a) A 12-lead electrocardiogram from a 6-month-old infant post ventricular septal defect closure shows an unexpected bradycardia (rate 77 bpm) which at first review looks like sinus rhythm. (b) Upon accurate analysis, it is a 2:1 atrioventricular (AV) block: red arrows show non-conducted P waves superimposed to T waves, while black arrows indicate P waves with normal AV conduction.

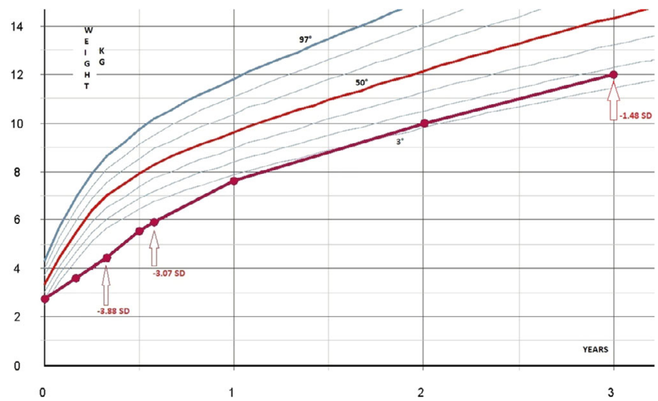

Fig. 3 Weight curve. The first arrow indicates ventricular septal defect closure, while the second one the pacemaker implantation. With the restoration of chronotropic competence, the child started to thrive, with his weight over the third percentile of a 3-year old.[8]

Physicians should be aware that an AV block following surgical VSD correction can cause persistent bradycardia, impairing the child's capacity to rise heart frequency while feeding, thus causing poor feeding and stunted growth. In congenital complete AV block, a form associated with anti-Ro/SS-A and anti-LA/SS-B antibodies in maternal serum, symptoms resulting from AV block can be subtle and include poor growth and sleep disturbances at night, such as terror and bedwetting, especially in young children.[9] From this perspective, detecting an unusually low heart rate should not be overlooked.

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Fractured Season by Declan Scharkie, Hayden Alcorn & Cooper Gourla (age 8) from Operation Art 2021