

Reversible hypertension associated with complete heart block in a 6-year-old boy

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ABSTRACT

We herein report a case of a 6-year-old boy with hypertension and complete heart block with a unique outcome. The patient was treated with an epicardial pacemaker followed by complete and sustained resolution of his hypertension with no further need for the previously prescribed antihypertensive medication.

Keywords: Complete heart block, pacemaker, pediatric hypertension

INTRODUCTION

Hypertension and bradycardia is quite rare but serious combination in pediatric population. Rapid identification of etiology and effective management are very crucial. Detecting the source of hypertension can be challenging specially in young children and the challenge doubles with an associated bradycardia specially with absence of neurological signs.

CASE REPORT

Presentation

A previously healthy 6-year-old boy is transferred to the pediatric ward from an outside facility with findings of hypertension and bradycardia that were incidentally discovered during evaluation for abdominal pain associated with cough, congestion, frontal headache, and decreased appetite for 1 week. He had been started on prednisolone for a presumed diagnosis of wheezing-associated respiratory illness 4 days prior, but this was discontinued after 48 h when the patient was found to be hypertensive. His family denies the use of over-the-counter decongestant medications.

The patient was born full term with a cesarean section due to the previous two C-sections. His perinatal course

was notable for transient tachypnea of newborn that was complicated with left small pneumothorax that spontaneously resolved. He had multiple surgeries for correction of bilateral club feet. His family feels that he sleeps more than usual for other kids in his age group. On reviewing his medical chart, his last normal heart rate (HR) and blood pressure (BP) were recorded when he was 3 years and 9 months old, and he has been mildly hypertensive with low HR since the age of 4.5 years. Family history was positive of the father with primary hypertension starting from the age of 29. His mother's uncle died at the age of 26 with heart attack, and his mother's great grandfather died suddenly at the age of 35 years. There is no known family history of renal disease or thyroid abnormalities. The patient does not have known allergies and is not currently on any daily medications.

On initial physical examination, the boy is alert, oriented, and not in pain or distress. His temperature is 97.5°F, HR is 54 beats/min, respiratory rate is 24 breaths/min, BP is 160/91 (99% – Stage 2 hypertension), and oxygen saturation is 99% on room air. Height is 1.13 m (8.7%), weight is 19.5 kg (14.5%), and body mass index is 15.3 kg/m² (44.5%). He has Grade 2/6

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ejection systolic murmur at the left lower sternal border with normal heart sounds. He has normal looking feet with a full range of movement but with bilateral scars. He does not have dysmorphic features, and his chest, abdominal, and neurological examination is completely normal.

Patient course

On admission, the initial concern was that bradycardia and hypertension in the setting of headache might represent increased intracranial pressure. His headache resolved without intervention, and his neurological examination was reassuring. His HR and BP during his course did not vary significantly. HR stayed between 47–63/min, systolic BP 136–160 mmHg, and diastolic BP 75–97 mmHg. Initial workup showed normal complete blood count, electrolytes, kidney functions, and urinalysis.

His electrocardiogram (ECG) [Figure 1] showed normal sinus rhythm with complete heart block as indicated by complete dissociation between P-waves and QRS complexes and junctional escape rhythm. Left axis deviation was also noticed. Echocardiography was negative for congenital heart disease and demonstrated normal ventricular function. There was, however, increased left ventricular (LV) mass with mild LV hypertrophy (LVH).

Lyme titers were within normal limits. The patient was also investigated for common causes of secondary hypertension. His thyroid-stimulating hormone was 3.44 uIU/mL and T4 was 11.3 ug/dL excluding hypothyroidism. Plasma renin activity was 5.18 ng/mL/h, which was within normal limits. His renal ultrasound was normal as well as his renal duplex that showed no evidence of hemodynamically significant stenosis bilaterally. Both renal veins were visualized and patent.

Given the fact that the patient had mild LVH suggesting secondary organ changes from hypertension, an angiotensin-converting enzyme (ACE) inhibitor was

initiated. The patient was observed for 4 h after the first dose for any signs of hypotension or medication intolerance. He was then discharged home with diagnoses of likely congenital complete heart block and primary hypertension. He had scheduled follow-up with our pediatric cardiology facility.

The patient was followed as an outpatient with successful control of his hypertension. He demonstrated normal exercise tolerance and denied any cardiac complaints related to his bradycardia. A routine Holter monitor placed 15 months after his initial presentation showed several episodes of ventricular couplets, triplets, and a limited run of ventricular escape rhythm which was a new finding. He was referred to cardiac surgery for the placement of an epicardial pacemaker [Figure 2]. He tolerated the procedure well, and his baseline HRs reflected appropriate atrial sensing. Over the next several weeks, his hypertension resolved and his ACE inhibitor was discontinued. Over a 1-year follow-up, he has been asymptomatic with no recurrence of his hypertension.

DISCUSSION

Primary hypertension in children and adolescents has been found to contribute to premature atherosclerosis and the early development of cardiovascular disease. It was found that in the period from 2013 to 2016, elevated BP or hypertension was diagnosed in around one in seven American youths.^[1] The increased rates of obesity incidence have added to the importance of early detection and management of pediatric hypertension.

Primary hypertension is more prevalent in adolescents, whereas secondary hypertension is more prevalent in children <15 years old, with renal, endocrine, and renovascular disorders being the most common etiologies.^[2]

Cardiac etiologies are less frequent to cause pediatric secondary hypertension, with coarctation of the aorta as the main causative and well-established disorder. Our case shows another possible cause for

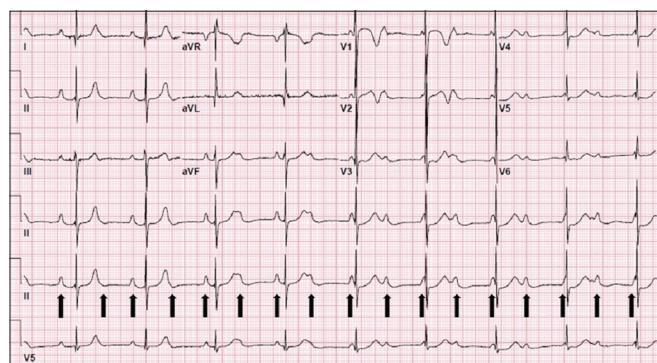


Figure 1: Electrocardiogram showing complete heart block with dissociation between atrial and ventricular beats. Black arrows show P-waves which are sometimes buried in QRS and T-waves and has a different rate than QRS rate

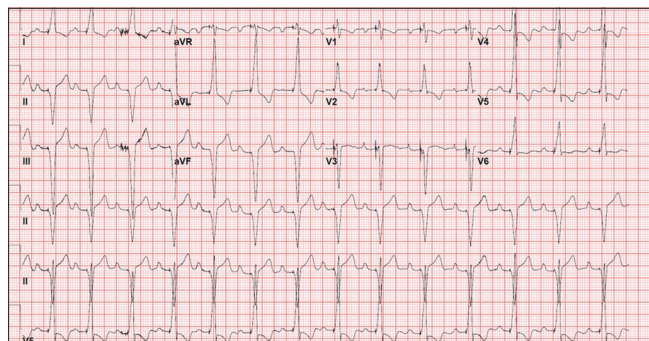


Figure 2: Electrocardiogram showing atrial-sensed ventricular-paced rhythm with prolonged atrioventricular conduction and left bundle branch block

pediatric hypertension, given the fact that the patient's hypertension was not proved to have secondary cause after the exclusion of most of renal parenchymal, renovascular, and endocrine causes. His hypertension dramatically improved after pacing with no more need for the antihypertensive medication that he needed for 15 months before his pacemaker insertion.

Hypertension can cause reflex bradycardia through baroreceptors. The medical literature since 1950 has evidence – yet commonly underreported – that severe bradycardia, especially due to heart block in adults, can result in hypertension.^[3,4] Different hypotheses were suggested to explain the causative role of bradycardia for hypertension. Bradycardia-induced impaired cerebral and/or renal blood flow has a decisive part in the pathogenesis of hypertension in old age.^[5,6] More recently, high LV filling pressures through prolonged diastole due to bradycardia have been found to cause greater ventricular stretch and increased force of contraction, resulting in substantially elevated systolic and pulse pressure, while maintaining normal or even low diastolic pressure.^[7,8] Multiple adult case reports showed that pacing alone can reverse severe hypertension.^[7,8] Hypertension treatment with a pacemaker-based device for adults with a requirement for a pacemaker appears safe and effective.^[9] To the best of our knowledge, this is the first case report to show this reversible hypertension after cardiac pacing in the pediatric population.

Differential diagnosis

Hypertension associated with bradycardia can both complicate conditions with high intracranial pressure as a part of Cushing's triad. Both together also can complicate severe cases of hypothyroidism and systemic lupus and as a complication for certain medications such as phenylephrine and oxymetazoline due to their sympathomimetic properties that can lead to severe hypertension and reflex bradycardia.

Treatment/management

For stable childhood complete heart block, disorders that cause reversible heart block such as Lyme disease, myocardial ischemia, increased vagal tone, hypothyroidism, hyperkalemia, and drugs that depress atrioventricular (AV) conduction should be identified and treated.

Frequent monitoring with transthoracic echocardiography and 24-h Holter ECG should be applied. Permanent pacemaker implantation is indicated in symptomatic, nonreversible AV node disorder. Asymptomatic high-degree AV blocks are other possible indications for pacing, especially with high-risk conditions such as prolonged QTc interval, wide QRS escape rhythm, complex ventricular ectopy, and/or ventricular dysfunction.^[10]

Lessons for the clinician

- Pediatric hypertension is increasingly seen as a cause for long-term morbidity. It can be primary more in adolescents, but still, the great majority of children <15 years old are affected by secondary type that its cause needs to be rapidly identified and treated
- Cardiac disorders are generally rare to cause secondary hypertension, but even more rare disorders such as complete heart block need not to be missed on initial ECG that should be done for all cases of pediatric hypertension to evaluate for possible end-organ cardiac damage. Complete heart block can be identified by complete dissociation between P-waves and QRS complexes
- Disorders that cause increased intracranial pressure should be urgently excluded in pediatric cases with hypertension associated with bradycardia. Other differential diagnoses include profound hypothyroidism, systemic lupus erythematosus, complete heart block, and sympathomimetic medications
- Pacemaker therapy has been demonstrated as an effective treatment for refractory hypertension in adult patients
- Stable childhood heart block asymptomatic patients need to be closely monitored with Holter monitor and echocardiography to early identify cases which need permanent pacing after exclusion of reversible disorders.

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Conflicts of interest

There are no conflicts of interest.

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