

Accelerated Idioventricular Rhythm in a Child With Status Asthmaticus

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Acute asthma exacerbations occur relatively frequently in children. We present the case of a 4-year-old boy who was admitted to our hospital in status asthmaticus and found to have a wide complex rhythm while being treated with inhaled albuterol and intravenous methylprednisolone. This rhythm was diagnosed as accelerated idioventricular rhythm (AIVR), which carries a benign prognosis. It resolved as the medications used to treat his asthma exacerbation were weaned. There was no ventricular ectopy seen on a 24-hour Holter monitor performed 3 months after his hospitalization, suggesting that the AIVR was related to the medications the patient was receiving at the time. This case suggests that albuterol may be a risk factor for the development of AIVR and highlights the importance of recognizing this rhythm to avoid unnecessary and potentially harmful therapies.

abstract

Accelerated idioventricular rhythm (AIVR) is an arrhythmia consisting of ≥ 3 consecutive ventricular beats with gradual onset and termination. It is common in neonates, is typically asymptomatic, requires no specific therapy, and carries a benign prognosis. AIVR has been described in children with use of halothane and propranolol.^{1,2} Although albuterol and methylprednisolone have been found to cause ventricular ectopy, typically in the form of premature ventricular complexes (PVCs),^{3–5} to our knowledge they have not been reported to cause AIVR.

CASE REPORT

A 4-year-old boy with a history of asthma and 1 previous admission for an asthma exacerbation presented to the emergency department with 2 days of increased work of breathing. He had been treated with intermittent inhaled albuterol since the start of his illness. In the emergency department he received intravenous (IV) methylprednisolone, intramuscular epinephrine, 3 hours of continuous inhaled albuterol, and a mixture of

inhaled helium and oxygen. Because of continued tachypnea and limited air entry on physical examination, he was admitted to the PICU for further management of status asthmaticus. Further medical management consisted of IV aminophylline, IV terbutaline, IV methylprednisolone, inhaled albuterol, and inhaled ipratropium. The patient also received bilevel positive airway pressure.

On the day after his admission, the patient was incidentally noted to have multiple runs of nonsustained wide complex rhythm (each 5–15 beats) while receiving inhaled albuterol. His active medications included inhaled albuterol, IV methylprednisolone, and inhaled ipratropium. Telemetry showed a wide complex ventricular rhythm with ventriculoatrial (VA) dissociation consistent with AIVR (Fig 1). The ventricular rhythm was faster than, but within 10% of, the patient's preceding sinus rate. There was left bundle branch morphology with an inferior axis suggesting probable origin in the right ventricular outflow tract. The initial or final wide complex beat was often preceded by

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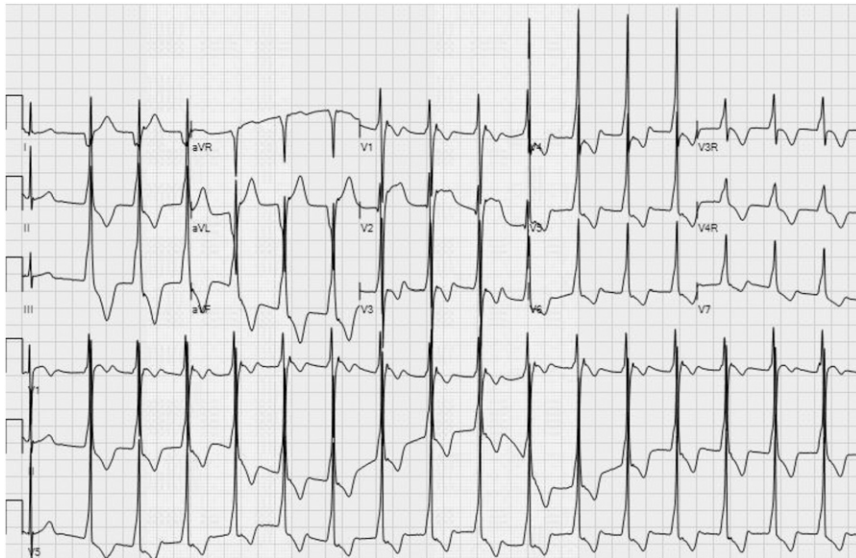


FIGURE 1
Electrocardiogram showing AIVR. There is 1 sinus beat followed by a wide complex, ventricular rhythm with left bundle branch block morphology consistent with AIVR.

a P wave and a short PR interval, suggesting a fusion beat, which is narrow relative to a purely ventricular beat (Fig 2). The patient was asymptomatic without hemodynamic compromise. Electrolyte levels were normal. An echocardiogram revealed normal intracardiac anatomy and normal biventricular function. A diagnosis of ventricular tachycardia (VT) was also

considered, but the characteristics and asymptomatic nature of the arrhythmia were more suggestive of AIVR. The arrhythmia was unlikely to have been supraventricular tachycardia owing to its VA dissociation. Dosing of inhaled albuterol was transitioned from continuous to intermittent, and IV methylprednisolone was transitioned to oral prednisolone. The patient

tolerated these medication changes well, and the arrhythmia resolved during the course of the hospitalization. The patient was discharged from the hospital 4 days after his admission. Three months after the patient's hospitalization, he was well without cardiovascular symptoms. A 24-hour Holter monitor recording was normal without ventricular ectopy.

DISCUSSION

AIVR is thought to be caused by enhanced automaticity of the ventricular myocardium and may be exacerbated by autonomic imbalance. It is most often seen in adults after myocardial infarction, in the setting of digitalis toxicity, and in neonates within the first few hours of life. It has been observed in patients both with and without congenital heart disease.^{6,7} It has been reported to occur in children with the use of volatile anesthetic agents and propranolol, which may slow the sinus rate and allow an automatic ventricular rhythm to overcome it.

Active medications at the time of our patient's arrhythmia were inhaled albuterol, IV methylprednisolone, and

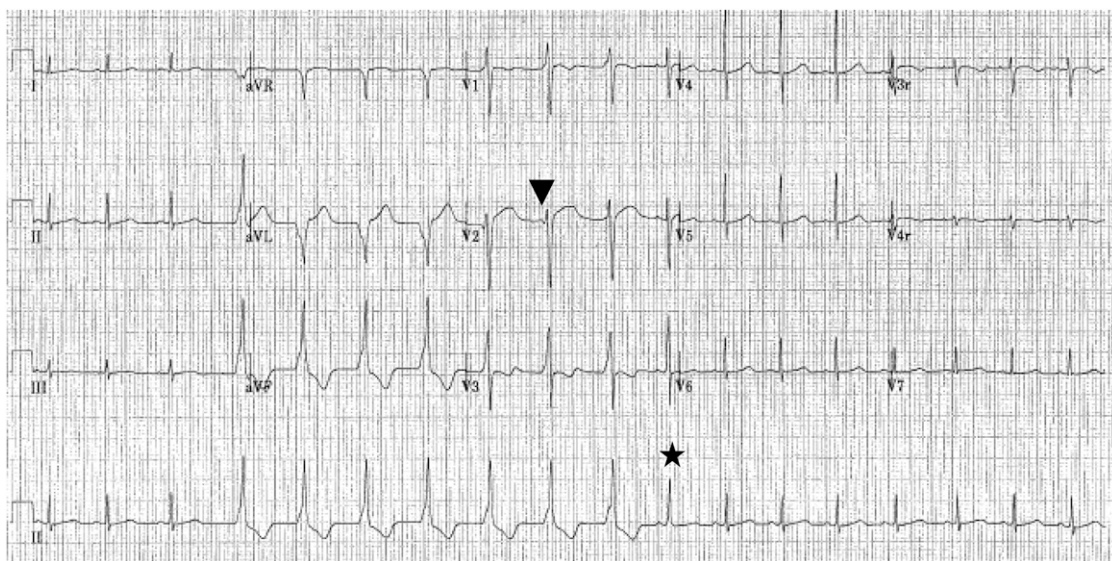


FIGURE 2
Electrocardiogram showing AIVR. There is a wide complex, ventricular rhythm. A P wave, demonstrating VA dissociation, is marked with a triangle. The preceding sinus rate is 100 beats per minute, whereas the AIVR rate is 105 beats per minute. A fusion beat is marked with a star.

inhaled ipratropium. Albuterol is a β_2 -agonist that is commonly used in the pediatric population. There have been reports of albuterol causing PVCs and VT.^{3,4} Salbutamol, another β_2 -agonist, has been shown to have electrophysiologic effects in adult subjects.⁸ It shortens sinus cycle length and sinus node recovery time, enhances atrioventricular nodal conduction, and decreases refractoriness of atrioventricular nodal and myocardial tissue. This alteration in the refractory period of cardiac muscle may make the heart more susceptible to rhythm disturbances.

High-dose methylprednisolone has been suggested to cause an increased frequency of PVCs, and there is a report of VT occurring in an adult patient with multiple sclerosis after high-dose methylprednisolone.⁵ To our knowledge, ipratropium has not been shown to cause arrhythmias. Given the known effects of β_2 -agonists on cardiac tissues, it is possible that our patient's AIVR was related to continuous albuterol administration, but we cannot rule out the possibility that it was caused by methylprednisolone.

The differential diagnosis for AIVR includes VT. To help distinguish AIVR from VT in children, 9 criteria have been proposed.⁹ These include chance discovery, absence of symptoms, absence of hemodynamic effects, sinus isochronicity, heart rate ≤ 120 beats per minute, conversion to sinus rhythm with exercise, occurrence of the arrhythmia in

short bursts, no effective drug treatment, and presence of left bundle branch morphology. Our patient met at least 7 of these 9 criteria. We did not perform a formal exercise test, and we did not attempt drug treatment.

This report highlights the importance of considering a diagnosis of AIVR in a well-appearing pediatric patient with a wide complex rhythm in the setting of an acute asthma exacerbation. It is important for pediatric providers to have a higher index of suspicion for AIVR in certain settings. Albuterol is used relatively frequently to treat acute asthma exacerbations in the pediatric population, and considering a relationship between AIVR and albuterol may help providers to make the correct diagnosis. It may, in turn, help to avoid unnecessary and potentially harmful therapies.

ABBREVIATIONS

AIVR: accelerated idioventricular rhythm
IV: intravenous
PVC: premature ventricular complex
VA: ventriculoatrial
VT: ventricular tachycardia

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