CASE REPORT

Cardioversion of a supraventricular tachycardia (SVT) in a 7-year-old using a postural modification of the Valsalva manoeuvre

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SUMMARY

A boy aged 7 years presented with his parents to the emergency department (ED). He had a known diagnosis of paroxysmal supraventricular tachycardia (SVT) and was under the care of paediatricians. He had been suffering episodes of palpitations and chest pain for over a year and had been prescribed atenolol 25 mg ON, though the side effects meant he had not taken it for a month prior to presentation. He had 2 previous confirmed episodes of SVT, one that reverted with Valsalva manoeuvres, and the other with intravenous adenosine. In the ED, an ECG was recorded showing SVT at 180 bpm. Aside from his tachycardia, he was haemodynamically stable. The postural modification of the Valsalva technique was performed within 5 min of arrival, with reversion to sinus rhythm occurring during the leg-lift phase on the first attempt. After 30 min of observation, the child remained stable and was discharged home.

BACKGROUND

Supraventricular tachycardia (SVT) is an infrequent but important presentation to the emergency department (ED) representing 6.5/10 000 cases in the paediatric ED, and often requires the use of intravenous adenosine to restore normal sinus rhythm.¹ A recent randomised controlled study in adults (the REVERT trial) has shown a postural modification to the standard Valsalva technique to be successful in cardioverting SVT back to sinus rhythm in 43% of cases compared with 17% in those undergoing a standard technique.² This technique has not been previously documented as being used in children, and potentially represents a superior alternative to standard Valsalva manoeuvres, as well as reducing the likelihood of a patient requiring intravenous adenosine.

CASE PRESENTATION

A boy aged 7 years presented to the ED with dizziness and breathlessness. Prior to this attendance, he had had two ECG confirmed episodes of SVT; one which reverted with vagal manoeuvres, and one requiring the use of intravenous adenosine. His first episode occurred when he was 5 years. His parents also described multiple episodes where the child became symptomatic, but the symptoms dissipated (often with vagal manoeuvres) before arriving at hospital. They tended to be precipitated by strenuous exercise. His paediatrician had prescribed atenolol 25 mg ON, but the patient and parents believed this was responsible for episodes of chest

pain he was experiencing, hence he had not taken it in over a month.

Other than SVT, he had no significant medical history and was on no other medication. He had no family history of note, lived with his family and was developing normally.

On the day of presentation, he had suddenly felt dizzy and slightly short of breath while at football training. He rested for 2.5 hours and tried vagal manoeuvres (such as blowing on a balloon and having ice poured down his back) but after no success, his parents brought him to the ED.

INVESTIGATIONS

At triage, he was found to have a regular pulse of 180 bpm, a blood pressure of 110/70, oxygen saturations of 100% on air and a respiratory rate of 16. An ECG was performed which showed SVT (figure 1).

TREATMENT

He was moved to the resuscitation area of the ED, attached to a cardiac monitor and positioned at 45°. Besides him were his mother, father and younger sister. He was calm and comfortable, and talking in full sentences. The method for doing a postural modification of the Valsalva manoeuvre was explained and verbal consent from both parents was obtained. The patient performed a 5 s practice blow into the tubing connected to the sphygmomanometer to ensure he could achieve 40 mm Hg pressure required.

The procedure was then performed as described in the REVERT study:² the patient blew into tubing connected to a sphygmomanometer successfully achieving the target pressure of 40 mm Hg for 15 s. At the end of the Valsalva manoeuvre, the patient lied supine with legs raised. This position was held for a further 15 s. The patient then returned to the semirecumbent position.

During the phase when the legs were elevated, the child cardioverted to normal sinus rhythm. The change in rhythm was seen in real time on the cardiac monitor; for half a second preceding the reversion to normal sinus rhythm, there was a pause in observed electrical activity.

Within 1 min of completing the modified Valsalva manoeuvre, his dizziness sensation had fully subsided. He was observed in the department for a further 30 min, and confirmed to have remained in a normal sinus rhythm prior to discharge (figure 2).

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Figure 1 Initial ECG demonstrating supraventricular tachycardia at 188 bpm.

Figure 2 ECG prior to discharge demonstrating normal sinus rhythm.

OUTCOME AND FOLLOW-UP

He initially continued to have episodes of palpitations once a week but all had subsided with either time or standard vagal manoeuvres.

He attended a paediatric clinic at 3 months where atenolol was restarted. He and his parents were advised that the atenolol was unlikely to be related to his chest pain episodes. An echocardiogram and a 48-hour Holter monitoring test were ordered.

Since the recommencement of atenolol, he reported occasional exercise-associated chest pains but no palpitations or documented episodes of SVT. His echocardiogram showed a structurally and functionally normal heart. His 48-hour Holter while demonstrating no episodes of SVT did identify intermittent delta waves, suggesting a diagnosis of Wolff-Parkinson-White syndrome. He is awaiting formal cardiac follow-up with a view to consider ablation and a further Holter monitoring test in view of his recurrent chest pains.

DISCUSSION

SVT is the most common arrhythmia in childhood occurring in 0.1–0.4% of healthy children.³ Epidemiological data are sparse, with the median ages at presentation reported in separate studies at 3.1, 8.8 and 9 years.^{1 4 5} It most commonly presents to the ED in the form of palpitations, but can have a variety of presenting symptoms. It is caused in most cases by a cardiac accessory electrical pathway either through the AV node (AVNRT) or a wider circuit through the atrioventricular musculature. The majority of children with SVT have structurally normal hearts.⁶

Common practice is to try vagal manoeuvres in a haemodynamically stable child and progress to intravenous adenosine if these measures fail.⁷ Evidence, however, is scarce for the efficacy of vagal manoeuvres in paediatric SVT. One study showed 74% of cases having vagal manoeuvres documented, but 64% of the same caseload receiving adenosine, suggesting a maximum vagal success rate of 10%.¹ The available literature suggests up to 89% of cases are ultimately treated using adenosine.⁵ Vagal manoeuvres are considered superior to intravenous adenosine as cannulation in children can be time-consuming, distressing and costly,⁸ and intravenous adenosine has in rare instances been reported to precipitate serious arrhythmias.^{9 10}

The modified Valsalva manoeuvre (described in the Treatment section of this report) aims to increase the relaxation phase venous return and vagal stimulation of the standard manoeuvre. In adults, the REVERT trial demonstrated a 43% success rate of SVT cardioversion using the modified Valsalva technique compared with 17% with the standard Valsalva manoeuvre.² This case report is the first to demonstrate its use in children.

The technique does have potential limitations in the paediatric population. It requires that the patient is capable of blowing at 40 mm Hg for 15 s, and that they cooperate with the instructions, passive rapid reclining and leg elevation that the procedure requires. By its nature, it would therefore be unsuitable for infants and preschool children. However, the technique can easily be applied, as demonstrated, to children of school age.

It is possible that a standard Valsalva might have worked in this case as previously. However, the patient and parents had tried various vagal manoeuvres at home without success and there is now good evidence of modified Valsalva manoeuvre efficacy in adults.

A randomised study is required to formally assess the efficacy of the modified Valsalva technique in the paediatric population, but should now be considered as part of the management strategy in children.

Learning points

- ▶ This is the first recorded use of the modified Valsalva technique on a child presenting with supraventricular tachycardia.
- ▶ Evidence suggests current practice enjoys little success with standard vagal manoeuvres, with up to 89% requiring adenosine.
- ▶ A randomised trial is required to evaluate the efficacy and safety of the modified Valsalva technique in children.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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