Multiple atrial thrombi in a neonate presenting with supraventricular tachycardia

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Introduction

We present a case of a neonate with multiple atrial thrombi, including a large pedunculated left atrial thrombus in the setting of supraventricular tachycardia (SVT). Neonatal SVT is common; however, atrial thrombus is a rare complication, with only 2 previously reported cases in the literature.[1,2] We discuss the management of intra-atrial thrombus in this setting.

Case report

A 21-day-old female term neonate presented to a regional hospital in New Zealand with a 2-day history of poor feeding and jaundice. Antenatal period was unremarkable, including no history of fetal tachycardia. At presentation, tachycardia was noted and a 12-lead electrocardiogram confirmed SVT at a rate of 240 beats per minute (Figure 1). Cold water immersions and adenosine boluses of up to 300 mcg/kg produced a transient response; however, SVT persisted. An intravenous amiodarone infusion was started and the baby was air-transferred to our pediatric intensive care unit. The rhythm was still SVT at a rate of 240 beats per minute on arrival; therefore, oral digoxin was added at 5 mcg/kg daily (half standard dose). A focused echocardiogram on arrival demonstrated severe biventricular dysfunction (ejection fraction 23%, fractional shortening 17%).

Eight hours after arrival, the rhythm reverted to sinus rhythm. There was no pre-excitation on the 12-lead electrocardiogram (Figure 1). A complete echocardiogram to reassess ventricular function and exclude structural heart disease was performed on day 3 of admission in the pediatric intensive care unit and revealed mobile hyperechoic masses in the right and left atria consistent with multiple thrombi (Figure 2). The heart was structurally normal other than a small atrial septal defect with left-to-right-flow. The largest thrombus on echocardiogram measured 6 × 12 mm and arose from the left atrial appendage. At least 2 smaller thrombi were seen in the left atrium, one deeper in the left atrial appendage measuring 5 × 3 mm and another on the roof of the left atrium adjacent to the right-sided pulmonary veins measuring 4 × 5 mm. A single thrombus was seen in the right atrium superiorly, measuring 4 × 7 mm. The systolic function had improved to moderate impairment by this stage (ejection fraction 38%, fractional shortening 24%), and clinically the infant was well, with no evidence of systemic embolization.

After careful consideration and literature review, a heparin infusion was commenced aiming for an activated partial thromboplastin time of between 60 and 80 seconds. A prothrombotic screen (including protein C, protein S, antithrombin assay, anticardiolipin antibodies, and factor V Leiden) was sent and was negative. The infant was closely observed with careful echocardiographic follow-up. A repeat echocardiogram on day 6 of admission demonstrated resolution of atrial thrombi and normal systolic function (ejection fraction 65%). There were no symptoms or clinical signs to suggest embolization of thrombi specifically. After 3 days the heparin infusion was changed to twice-daily subcutaneous enoxaparin with a plan to complete a 6-week course. A further brief episode of SVT recurred on day 8, prompting addition of oral propranolol to the treatment regimen. At discharge, the infant was on amiodarone, propranolol, and digoxin (digoxin levels within therapeutic range). She has made good clinical progress with no breakthrough SVT on therapy (including on 24-hour Holter monitor) and no thrombi seen on the most recent echocardiogram 2 months following presentation.

Discussion

Intra-atrial thrombus is uncommon in neonates with structurally normal hearts. When it does occur, it is most commonly secondary to central venous access and arises

KEYWORDS Neonates; Atrial thrombus; Supraventricular tachycardia; Echocardiogram; Heparin

ABBREVIATIONS SVT = supraventricular tachycardia

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KEY TEACHING POINTS

- Atrial thrombus is a rare complication of neonatal supraventricular tachycardia (SVT), which is a common neonatal arrhythmia.
- In cases of resistant or potentially long-standing neonatal SVT, echocardiography may reveal intracardiac thrombi.
- This case shows that atrial thrombi, even when very large, may be treated successfully with unfractionated heparin alone rather than with thrombolytic agents or a surgical approach.

within the right atrium.[3,4] This was not a feature of the history in our patient, who had a normal neonatal course with no requirement for central access lines. Unprovoked thrombus formation may be due to a primary thrombophilia; however, in neonates this is uncommon.[3]

Intra-atrial thrombus can be seen in adult patients with atrial arrhythmia, particularly atrial flutter and atrial fibrillation. The current guidelines from the American Heart Association recommend anticoagulation in atrial fibrillation or atrial flutter with hemodynamic instability where cardioversion is planned.[5] A recent paper by Schultz et al[6] concludes that patients with SVT do not have the same predisposing thrombogenic, endothelial, or inflammatory factors to promote or initiate thrombus formation as patients with atrial fibrillation.

Following the unexpected finding on echocardiogram of atrial thrombi in our case, various treatment options were considered. Thrombolysis was felt to present a higher chance of fragmentation and systemic embolization. In addition to

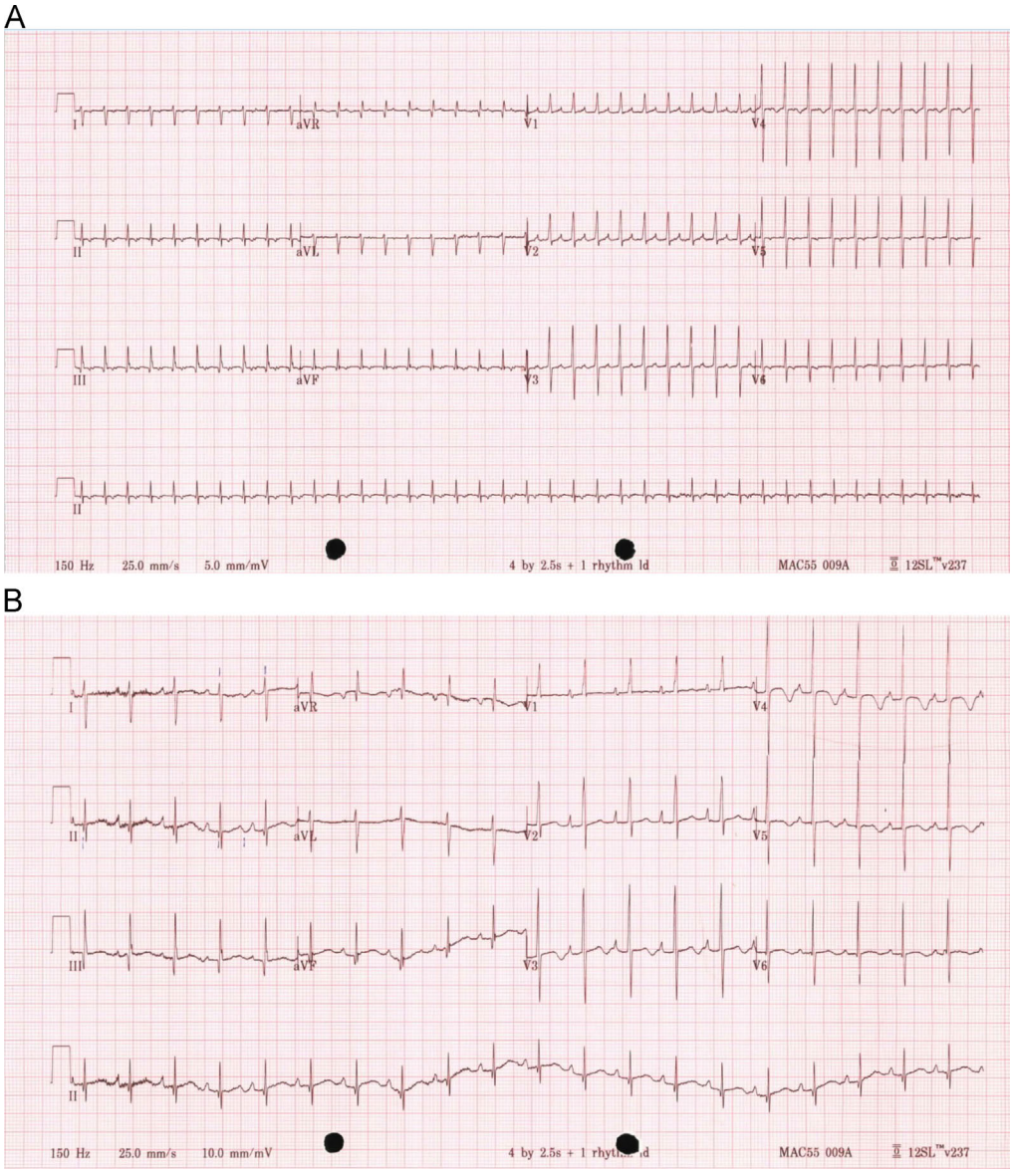

Figure 1 **A:** Electrocardiogram demonstrating supraventricular tachycardia at a rate of 234 beats per minute. There are retrograde P waves consistent with atrioventricular re-entrant tachycardia. **B:** A 12-lead electrocardiogram in sinus rhythm at a rate of 120 beats per minute with no evidence of pre-excitation.

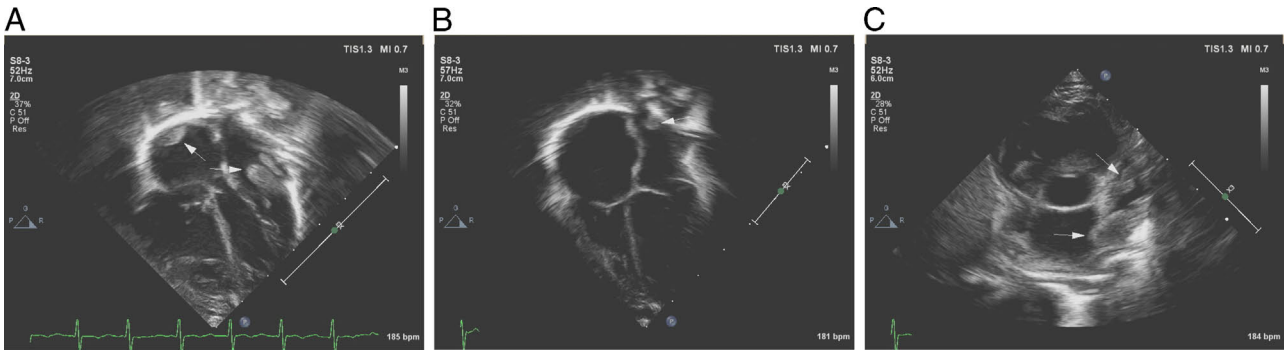

Figure 2 **A:** Apical 4-chamber view showing main thrombus arising from the left atrial appendage and isolated thrombus attached at the roof of the right atrium. **B:** Apical 4-chamber view showing small thrombus adjacent to the right pulmonary veins in the left atrium. **C:** Parasternal short-axis view showing main thrombus at the base of the left atrial appendage and separate thrombus deep in the left atrial appendage.

this, there is a paucity of data on the use of thrombolysis in neonates, with no therapeutic range for safe and effective use.[4] Surgical removal of the main thrombus was also considered, as the thrombus was large and had a concerning mobility; however, there were concerns at the invasiveness of this approach, with no guarantee of avoiding systemic embolization.

We found 2 previous case reports of neonatal SVT complicated by left atrial thrombus managed with low-molecular-weight heparin (enoxaparin) for initial treatment. The first report[1] combined enoxaparin with sotalol as an antiarrhythmic owing to the pre-excitation mechanism behind the initial SVT. Thrombus resolution was seen at 5 weeks, at which stage enoxaparin was discontinued. The more recent case report[2] also included aspirin and warfarin in addition to enoxaparin owing to low protein C and protein S levels on a thrombophilia screen. Thrombus resolution was noted on echocardiogram follow-up at 6 months. As described, our patient had a normal thrombophilia screen.

Resolution of thrombus in our patient was achieved with unfractionated heparin. The infusion rate was governed by the patient's activated partial thromboplastin time, aiming for 1.5–2 times the upper limits of normal. This is in keeping with current recommendations for use of antithrombotic agents in neonates and children.[7] Within 5 days, the thrombi had resolved on echocardiography. In keeping with the recommendations, we elected for a total 6-week course of therapy, changing to enoxaparin, for ease of administration (subcutaneous versus intravenous), and with less frequent monitoring with a less narrow therapeutic index.

Conclusion

We report a rare case of intra-atrial thrombi in an infant with resistant SVT that was successfully managed with intravenous heparin. Although thrombolysis and surgical intervention for a large pedunculated left atrial thrombus were considered, intravenous heparin achieved therapeutic success without complications and we recommend that this strategy be considered in similar circumstances.

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