FIGURE 1. Representative computed tomographic images. A and B, Mural thrombus is evident along the wall of the aneurysm. C, Transitions are evident between the sinotubular junction of normal caliber and the descending aorta with interposed aneurysmal neo-aorta.

heart syndrome, with 98% of patients demonstrating a neo-aortic dilation with a z score greater than 2 at a median of 9.2 years of follow-up.⁵ The etiology of neo-aortic aneurysm formation may involve myxoid degeneration as opposed to atherosclerosis³; however, it is unclear whether any contributing factors exist (eg, hypertension, hyperlipidemia, smoking status, pregnancy) and whether medical therapy can mitigate them.

Given that the rate of aneurysmal growth of the neo-aorta appears unpredictable and smaller aneurysms may be asymptomatic, it is difficult to determine when a routine surveillance program should be initiated, although it is clear that routine lifetime surveillance is needed for these patients. Routine, long-term surveillance of late survivors of Norwood reconstructions may also shed light on the

true incidence and natural history of neo-aortic aneurysm formation in this population.

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Mapping-guided total excision of the sinoatrial node for inappropriate sinus tachycardia

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Inappropriate sinus tachycardia (IST) is a syndrome characterized by symptomatic sinus tachycardia at rest and with

minimal physical activity. Pharmacologic treatment is often ineffective, and endocardial or epicardial sinus node ablation has proved effective in only a small number of patients with high rates of recurrence.¹ This report is the first to describe a surgical excision of the total sinoatrial node (SAN) guided by epicardial and endocardial intraoperative mapping as a definitive treatment for a patient with highly symptomatic IST.

CLINICAL SUMMARY

A 44-year-old male patient with IST and severe symptoms of fatigue, palpitations and dizziness did not have improvement in symptoms and decrease in heart rate

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FIGURE 1. Epicardial mapping. A, Bipolar atrial epicardial electrograms localized the earliest right atrial activation (red arrow) and identified the sinoatrial node area preexcision. B, Similarly, electrograms localized retrograde atrial activation (red arrow) after excision of the total sinoatrial node area. HR, Heart rate; ECG II, electrocardiographic lead II.

despite various drug strategies. In addition, multiple percutaneous endocardial radiofrequency catheter ablations failed to decrease heart rate and to improve symptoms. Because of the severity of his symptoms, the patient was highly motivated to undergo a definitive treatment. An electrophysiologically guided excision of the total SAN with atrial pacemaker implantation was therefore considered the best therapeutic option.

After exposure of the heart by sternotomy and opening of the pericardium, the earliest atrial activation was located at the lateral aspect of the right atrium and superior vena cava junction, as measured with a 6-pole Josephson catheter (Biotronik, Berlin, Germany). Cardiopulmonary bypass with bicaval venous cannulation was instituted, and on normothermic full extracorporeal circulation the right atrium was opened and epicardial and endocardial electrophysiologic mapping of the sinus node area was performed on beating heart. The total electrophysiologically indicated SAN area was identified and excised from the medial side of the right atrial appendage to the lateral side of the right atrium under the level of the crista terminalis and cranially to the junction of the superior vena cava.

The total resected tissue of the atrial wall had a size of 5×3 cm, with a tissue thickness of 5 mm. After excision, no further sinus node activity was detected, and right atrial electrophysiologic mapping showed simultaneous atrial and ventricular activity with a narrow QRS complex (retrograde activation from the atrioventricular node; Figure 1). Reconstruction of the right atrium was performed with an autologous pericardial patch, sutured over a 25-mL saline solution-filled balloon catheter placed inside the right atrium to obtain a sufficient sizing (Figure 2). Temporary epicardial pacemaker leads were placed on the right atrium and at the right ventricle.

After the operation, the electrocardiogram showed a nodal escape rhythm with a frequency of 60 beats/min. During exercise testing 1 week after surgery, the patient was considered chronotropically incompetent as expected, with a rise in heart rate from 69 beats/min to 84 beats/min at a maximum exercise level of 60 W. As preoperatively planned, a 1-lead endocardial atrial pacemaker implantation was performed. Exercise testing after pacemaker implantation showed a rise in heart rate from 64 beats/min to 135 beats/minute at a maximum exercise level of 80 W.

FIGURE 2. Endocardial mapping of the earliest atrial activation areas (A) and reconstruction of the right atrium after sinus node excision (B). P, Pericardium; ICV, inferior caval vein cannula; B, endoballoon for geometric reconstruction.

At 1-year follow-up, the patient had relief of symptoms without tachycardia recurrence.

DISCUSSION

IST is a rare but disabling disorder with an abnormal fast heart rate at rest that is extremely increased on adrenergic stimulation.¹ Exercise training and anti-arrhythmic drugs are considered the first therapeutic option. Drug treatment often fails, and extensive radiofrequency catheter ablation similarly gives only temporarily success.¹ Surgical therapy may be recommended when all other options have failed. Nevertheless, even surgical modification of the SAN by excision or ablation has only been partially effective,^{2,3} probably because the electrophysiologically defined SAN is larger than the anatomically defined SAN.⁴ This is the first report to describe a surgical excision of the total SAN guided by epicardial and endocardial intraoperative mapping. No recurrence of tachycardia occurred, probably

because the region of the electrophysiologically guided excised SAN in our patient was fairly larger than the anatomically defined SAN.⁴ Although the procedure is maximally invasive, total electrophysiologically guided excision of the sinus node area may be a definitive therapeutic option for patients with IST that is highly symptomatic and fails to respond to pharmacologic and ablation therapy.

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