

Original Article

Is routine echocardiography valuable after uncomplicated catheter ablation in children?

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Abstract We determined the clinical value of routine transthoracic echocardiography performed after catheter ablation of supraventricular tachyarrhythmias in children. Between April 1996 and December 2003, 253 children, of whom 135 male, with the overall group having a median age of 9, ranging from 0.1 to 19 years, underwent 280 uncomplicated radiofrequency catheter ablation procedures for supraventricular tachyarrhythmias at three institutions. In every child, transthoracic Doppler echocardiography was performed before and after the procedure. The pre-ablation transthoracic echocardiograms were normal in all, and this was one of the criteria for inclusion. The post-ablation echocardiogram showed a disorder in four asymptomatic patients. In one patient, with focal atrial tachycardia, ablated via a retrograde aortic approach, there was mild aortic valvar insufficiency. This had resolved 6 months later. Pericardial effusions developed in 3 other children. In 2 the effusions resolved spontaneously but 1 patient required pericardial drainage. This same patient also developed clinically asymptomatic mild aortic insufficiency, which resolved spontaneously within 6 months. Routine echocardiography after uncomplicated catheter ablation procedures is of clinical value, and is especially indicated when a retrograde aortic approach has been used.

Keywords: Catheter ablation; echocardiography; children; complications

RADIOFREQUENCY CATHETER ABLATION HAS BEEN performed in children for over 13 years, with good rates of success and few complications.^{1–3} Apart from the well documented complications relating to permanent atrioventricular block, cardiac perforation, or thromboembolism, potential minor complications include pericardial effusion and valvar damage, which may be asymptomatic and can be detected by echocardiography. In a study in adults, Pires et al.⁴ concluded that routine post-procedural echocardiography was of limited clinical value. There is no report, however, on the role of routine echocardiography after ablation procedures in children.

Procedures and results

Between April 1996 and December 2003, 253 children (135 of whom were male) with a structurally normal heart underwent 280 catheter ablation procedures for supraventricular tachyarrhythmia at one of three institutions. Their median age was 9 years, with a range from 0.1 to 19 years. In every child, a transthoracic echocardiogram with Doppler interrogation was performed before and after the procedure. The following echocardiographic indexes were documented in all patients:

- whether the heart was structurally normal
- inflow and outflow velocities through all the cardiac valves
- the presence or absence of valvar insufficiency
- global ventricular function assessed by M-mode measurement of left ventricular fractional shortening

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Table 1. Arrhythmic substrates.

Diagnosis	n
Atrioventricular nodal re-entrant tachycardia	65
Wolff–Parkinson–White syndrome (manifest ventricular pre-excitation)	77
Concealed accessory pathway	98
Non-automatic focal atrial tachycardia	5
Persistent junctional reciprocating tachycardia	4
Sinus nodal re-entry	1
Junctional ectopic tachycardia	3

- the presence or absence of regional abnormalities of wall motion assessed in short and long axis views and
- the presence or absence of pericardial effusion.

All patients included in this study were children who had undergone an uncomplicated ablative procedure. We excluded children with pre-existing congenital cardiac disease and those with complex arrhythmic substrates such as scar-related re-entry, atrial flutter, and ventricular tachycardias. The arrhythmic substrates are shown in Table 1.

Also excluded were 3 patients with evidence of pre-existing aortic or mitral valvar insufficiency, or dilated cardiomyopathy.

Post-ablation echocardiography

The echocardiograms following 276 of 280 ablation procedures were considered to be normal. In 4 asymptomatic patients, the echocardiogram demonstrated a new finding.

In one patient, aged 15, mild aortic valvar insufficiency had developed after an ablation procedure for focal left atrial tachycardia. In this patient, the approach was via the femoral artery, crossing both aortic and mitral valves retrogradely. The insufficiency resolved spontaneously 6 months later. In 3 other children, we discovered asymptomatic pericardial effusions. In two of those, an 11-year-old who had undergone successful ablation of a concealed left-sided accessory pathway via a trans-septal approach, and a 16-year-old who had had a successful modification of the slow atrioventricular nodal pathway, the pericardial effusion resolved spontaneously. The third patient, 9 years of age, in whom a left-sided accessory pathway was ablated via a femoral arterial approach, an hemorrhagic pericardial effusion of moderate size was present, which required drainage. This same 9-year-old child also developed a clinically asymptomatic mild aortic valvar insufficiency, which had resolved spontaneously within 6 months.

Discussion

Our study shows that routine post-ablation echocardiography may occasionally detect problems in otherwise asymptomatic patients. The mechanisms of post-ablation pericardial effusion are unclear. Trauma that results from catheter manipulation, or transmural lesions following application of radiofrequency energy, could induce either a traumatic pericardial effusion or inflammation of the visceral pericardium. Due to the small size of catheters used in electrophysiologic studies in children, minor perforations may go unnoticed during the procedure. Damage to the valvar apparatus secondary to catheter trauma is well recognized.^{5,6} We only noted two instances of possible injury to the aortic valve. Previous reports suggest this complication occurs in about 1% of patients having ablation on the left side of the heart via a retrograde femoral arterial.⁵ Manipulation, as well as prolonged placement of a catheter across the valvar leaflets, may stretch or compress the leaflets with consequent damage. Pires et al.,⁴ however, could not find a clear relationship between the valvar injury and technique of ablation. In their study, 9 patients had aortic regurgitation of new onset after ablation when, in fact, 8 of the 9 did not have catheter manipulation across the aortic valve during the ablation procedure.⁴ This suggests that trauma to the aortic valve may not be the only explanation for the observed aortic insufficiency after catheter ablation.

A limitation of this study is that the majority of data were obtained retrospectively. The echocardiograms were performed and interpreted by different echocardiographers at three separate institutions.

An important issue in current management is that, in many patients, catheter ablation is now performed as a day-case procedure. In one of the institutions participating in this study, patients with uncomplicated procedures are discharged on the same day. Our experience demonstrates that routine echocardiography is valuable in children with structurally normal hearts undergoing catheter ablation for re-entrant atrioventricular tachyarrhythmias. The occurrence of effusions appears to be a random event, unrelated to the approach used.

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