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Original Article

Radiofrequency catheter ablation of left-sided accessory pathways via retrograde aortic approach in children

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ABSTRACT

Background: We aimed to analyze the results of retrograde aortic radiofrequency catheter ablation of left-sided accessory pathways in children.
Methods: Between January 2010 and September 2014, 25 children who underwent left-sided accessory pathway ablation with a retrograde aortic approach were evaluated retrospectively.
Results: The mean age of the patients was 11.09 ± 3.71 years. Seventeen patients were male (68%). The mean procedure and fluoroscopy times were 71.54 ± 21.05 min and 31.42 ± 19.57 min, respectively. Radiofrequency energy was delivered with 41.38 ± 15.32 W at 52.38 ± 5.45 °C. Sixteen patients (64%) presented with manifest preexcitation and, 9 had concealed accessory pathways. The location of accessory pathway was left lateral in 16 patients, posteroseptal in 5, left anterolateral in 2, and left posterolateral and left posterior in the remaining 2. The acute success rate was 96%. The patients were followed for a mean of 16.68 ± 18.01 months. There were 2 recurrences. No major complications were observed in the periprocedural period. One patient had groin hematoma, another one had transient severe headache and vomiting. Trivial mitral regurgitation was noted in a patient, which remained the same throughout follow-up. None of the patients developed new aortic regurgitation, pericardial effusion, or thrombi at the site of ablation.
Conclusions: The retrograde aortic approach can be safely employed with a high success rate for ablation of left-sided accessory pathways in children.

1. Introduction

Radiofrequency (RF) catheter ablation is an established method of therapy for symptomatic supraventricular tachycardia (SVT). It has gained widespread acceptance for the treatment of accessory pathways in pediatric SVTs [1]. Accessory pathways are distributed unevenly along the right and left atrioventricular valve annuli. The left-sided accessory pathways are most common and may be accessed by using the transseptal approach or the retrograde aortic approach, or less commonly, from within the coronary sinus. Each approach has proven to be successful, but has a unique set of risks [2].

The aim of the present study was to analyze the data of retrograde aortic RF catheter ablation of left-sided accessory pathways in children.

2. Materials and methods

Our institutional ethical committee approved this clinical study. All consecutive patients with left-sided accessory pathways treated with RF through a retrograde aortic approach were analyzed. The following peri-interventional parameters were noted: procedure time (measured from the first femoral puncture to removal of all sheaths), fluoroscopy time, total duration of RF application, maximum power of RF energy and maximum temperature attained during RF application.

2.1. Electrophysiologic study procedure and ablation technique

The antiarrhythmic drugs were discontinued for 5 half lives before the electrophysiologic study (EPS). After obtaining written informed consent from the parents, all patients underwent EPS

Abbreviations: AP, accessory pathway; AVNRT, atrioventricular nodal reentrant tachycardia; AVRT, atrioventricular reentrant tachycardia; CS, coronary sinus; EPS, electrophysiologic study; RF, radiofrequency; SD, standard deviation; SVT, supraventricular tachycardia; WPW, Wolff–Parkinson–White.

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followed by the ablation procedure in a conscious sedation state. Midazolam, propofol, and ketamin were used for anesthesia as needed.

A 6- or 7-F decapolar catheter was positioned inside the coronary sinus. Other diagnostic catheters (usually 5-F quadripolar) were placed in the right ventricular apex, high right atrium, or bundle of His region. The baseline measurements of conduction and refractoriness were performed in sinus rhythm. The PR, QRS, QT, AH, and HV intervals, basal cycle length, and atrioventricular and ventriculoatrial Wenckebach cycle lengths were measured. Programmed atrial and ventricular stimulations were made in an attempt to initiate the atrioventricular reentrant tachycardia (AVRT), to locate the earliest atrial activation site. In case of preexcitation, the position of the accessory pathway was delineated by assessing the site with the earliest ventricular activation during sinus or paced atrial beat rhythm.

2.2. Retrograde approach

After preliminary mapping, when the presence of a left-sided accessory pathway with the absence of patent foramen ovale was confirmed, a 7-Fr sheath was placed into the right femoral artery. At this point, all patients underwent full heparinization with 100–150 units/kg. A 7-Fr, single curve, tip-deflecting bipolar catheter (Medtronic RF Marinr 110 cm to 2.3 mm) with an electrode size of 4 mm and deflectable tip length of 40–60 mm was inserted through the sheath, advanced to the aorta, and prolapsed through the aortic valve, making a large "J" loop. The catheter was then placed at a site that had the shortest interval between local atrial and ventricular electrograms (during sinus rhythm in the presence of manifest preexcitation) or at the site of earliest retrograde activation (during orthodromic reciprocating tachycardia or ventricular pacing in the presence of concealed accessory pathway). A 5-Fr single curve, 4 mm tip-deflecting bipolar catheter (Medtronic RF Marinr 110 cm to 2.3 mm) was used through a 5-Fr sheath only for the youngest of our patients, who was 4 years old. The transseptal approach was not utilized in any of these patients, simultaneously or in a separate session.

Fig. 2 shows the placement of coronary sinus and ablation catheters in the right and left anterior oblique positions under fluoroscopy. The RF energy was delivered with a maximum power of 50 W for 10–60 s at the target site until a temperature of 50–60 °C was reached at the catheter tip. The RF energy was given for at least 120 s, when the accessory pathway conduction was abolished. If a sudden increase in impedance occurred during energy application, energy delivery was automatically discontinued.

2.3. Post procedural follow-up

All patients were monitored in the hospital for rhythm and other electrocardiogram (ECG) abnormalities like ST level and T wave changes, suggesting myocardial ischemia. They were also observed for complications like groin hematomas and loss of peripheral pulses. An ECG and echocardiogram were performed before discharge. Mitral/aortic regurgitation, pericardial effusion, and left ventricular systolic functions were specifically monitored. The patients were discharged on aspirin (5 mg/kg/day), which they took for the next 3 months. All patients were seen within 1 week and 4–6 weeks after the procedure; they paid regular biannual visits to the outpatient clinics thereafter, unless they had recurrence of symptoms.

2.4. Statistics

The variables were analyzed by using SPSS 15.0 for Windows (SPSS Inc., 1989–2006). Continuous variables are presented as mean ± standard deviation. In case of non-Gaussian distribution, median and quartile values are given. Categorical variables are expressed as number and percentage. *P*-values of < 0.05 were accepted as statistically significant.

3. Results

Between January 2010 and September 2014, 59 children underwent accessory pathway ablation, of which 25 (42.4%) had their left-sided accessory pathways accessed via the retrograde aortic approach. The other 34 patients underwent right-sided accessory pathway ablation. The mean age of the patients during the intervention was 11.09 ± 3.71 years (quartiles: 7.96, 12.25, 14.0 years). Our youngest patient was a 17-kg, 105-cm, 4-year-old boy. Seventeen patients (68%) were male, and 8 (32%), female. The mean body weight and height were 49.56 ± 24.92 kg (quartiles 35.5, 46.8, 54.5 kg) and 148.48 ± 18.34 cm (quartiles 135.5, 149.0, 161.0 cm), respectively.

The mean procedure time was 71.54 ± 21.05 min (quartiles 60.0, 70.0, 80.0 min); the fluoroscopy time was 31.42 ± 19.57 min (quartiles 18.73, 26.0, 39.15 min). The RF energy was delivered with 41.38 ± 15.33 W (quartiles 34.75, 47.0, 50.0 W) at 52.38 ± 5.45 °C (quartiles 47.0, 51.50, 57.75 °C) for a total of 5.16 ± 3.14 min (quartiles 3.0, 4.2, 6.4 min). The procedural details are given in Table 1. Sixteen patients (64%) presented with manifest preexcitation on ECG; the remaining 9 patients had only retrograde conduction from the accessory pathway (concealed pathway). Clinical tachycardia was induced in 15 patients (60%), either spontaneously or with atrial/ventricular stimulation. In 3 patients, atrial fibrillation was induced during programmed stimulation along with the reentrant SVT. One of these patients had corrected transposition of the great arteries.

Four patients had accompanying dual AV node physiology, however, atrioventricular nodal reentrant tachycardia (AVNRT) was not induced in the cath-lab, and none of these patients presented with tachycardia (AVRT or AVNRT) after successful ablation of the accessory pathway. Another patient, however, had slow pathway modification for AVNRT before the current retrograde approach. During the initial EPS of this patient, the only inducible tachycardia was AVNRT, which was successfully eliminated with slow pathway modification. However, SVT recurred about a year after the procedure. The second EPS identified the left-sided accessory pathway, which was successfully ablated with a retrograde approach.

The location of the accessory pathway was left lateral in 16 patients, posteroseptal in 5, left anterolateral in 2, and left posterolateral and left posterior in the remaining 2 (Fig. 1). Our

Table 1
Details of the Catheter Ablation Procedure.

	Mean ± standard deviation	Quartiles (25, 50, 75)
Age at ablation (years)	11.09 ± 3.71	(7.96, 12.25, 14.00)
Sex (female/male)	8/17 (%32/%68)	
Body weight (kg)	49.56 ± 24.92	(33.50, 46.80, 54.50)
Procedure time (min)	71.54 ± 21.05	(60.00, 70.00, 80.00)
Fluoroscopy time (min)	31.42 ± 19.57	(18.73, 26.00, 39.50)
Local temperature (°C)	52.38 ± 5.45	(47.00, 51.50, 57.75)
Duration of RF application (min)	5.16 ± 3.14	(3.00, 4.20, 6.40)
Follow-up (months)	16.88 ± 18.01	(6.00, 6.00, 19.50)