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Long-Term Follow-Up After Radiofrequency Catheter Ablation of Accessory Atrioventricular Pathways in Children

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ABSTRACT

OBJECTIVES The purpose of this study was to evaluate long-term safety and efficacy of catheter ablation of accessory atrioventricular pathways (AP) in a pediatric cohort.

BACKGROUND Radiofrequency catheter ablation of accessory AP is the recommended treatment for patients with atrioventricular re-entrant tachycardia. Data on long-term results ≥1 year after AP ablation in pediatric patients is sparse.

METHODS A total of 296 patients <18 years of age who had undergone radiofrequency-AP ablation between October 2002 and June 2015 were included into the study. Follow-up was >1 year in all patients. Median age at ablation had been 11.6 years, and median follow-up was 5.6 years. Recurrence of AP conduction after ablation was defined as documentation of pre-excitation, supraventricular tachycardia attributable to AP, or proof of AP conduction during repeat electrophysiological study.

RESULTS AP ablation succeeded in 268 of 296 individuals (91%). After successful ablation, recurrence of AP conduction was observed in 29 of 268 individuals (10.8%). Of those 29, 23 (79%) had AP recurrence within the first year after ablation, whereas 13 (45%) had recurrence of AP conduction already within the first month. Six patients had late recurrence of AP conduction >1 year post-ablation. Procedural success and freedom from AP conduction after a single ablation procedure was 86% at 1 month, 83% at 1 year, and 81% at 5 years after ablation.

CONCLUSIONS After radiofrequency ablation of AP in children, recurrence of AP conduction occurred in 23 subjects (8% of the study cohort) within the first year after ablation. Late recurrences >1 year after ablation were noticed in 6 children (2% of the study group), highlighting the need for longer follow-up >1 year. Results of the present study on late AP recurrence should be taken into account whenever families are counselled for pediatric AP ablation.
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Catheter ablation of accessory atrioventricular pathways (AP) is the recommended treatment for children and adolescents with atrioventricular re-entrant tachycardia (AVRT) as well as for those with asymptomatic pre-excitation in case of short AP anterograde refractory periods (1,2). Data on efficacy and safety of pediatric catheter ablation using radiofrequency (RF) was reported more than 20 years ago by the North American Pediatric Electrophysiology Society multicenter registry (3-6). Recent analysis of pediatric cohorts including up to 600 patients have demonstrated improved success and low complication rates by use of state of the art techniques such as 3-dimensional

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mapping and navigation systems (7,8) and the availability of cryogenic energy as an alternative energy source (2). However, almost all studies on catheter ablation in children have reported on procedural success and on follow-up after successful ablation separately (5,8). Moreover, data focusing on follow-up after catheter ablation is mainly limited to the first year following ablation (5,7,8). At the present time, there is a lack of data on long-term efficacy in terms of a combined endpoint including primary success and recurrence, which is of paramount concern for families when considering pediatric catheter ablation.

To date, no systematic data is available on long-term fate of children undergoing RF ablation of AP. We therefore analyzed follow-up data of all children who had undergone RF ablation of AP during the last decade at our tertiary pediatric electrophysiology (EP) center.

Special attention was paid to occurrence and timing of reappearance of AP conduction, impact of procedural data, and AP localization, as well as long-term safety concerning development of secondary arrhythmias.

SEE PAGE 456

METHODS

PATIENTS. All children and adolescents <18 years of age, who were scheduled for RF catheter ablation of AP between October 1, 2002, and July 31, 2015, at our institution were included in this study. A total of 296 subjects were identified. Procedural data and primary success rates as well as acute complications have recently been published (9). Patients who underwent AP ablation with cryogenic energy or with RF and cryogenic energy combined were excluded from this analysis. Data from patients after initially successful AP ablation were separately assessed from those with ablation failure in order to avoid bias by including follow-up data of repeat procedures.

Recurrence >1 year after ablation was defined as late recurrence. Congenital heart defects (CHD) were considered exclusively in case of structural abnormalities relevant for catheter ablation. Patients with repaired CHD and normal intracardiac anatomy (i.e., patients after surgical or catheter-guided closure of atrial or ventricular septal defects, closure of arterial ductus, status post balloon valvuloplasty of aortic/pulmonic stenosis) were not considered to have CHD relevant to this study.

The study was approved by the institutional review board and fully complies with the Declaration of Helsinki. Informed consent was obtained from the patients and/or their parents/legal guardians, respectively.

ABLATION PROTOCOL. The institutional approach for EP study and RF ablation has been described before (9). In general, a total of 3 diagnostic EP catheters were placed within the coronary sinus, at the His bundle, and within the apex of the right ventricle. In selected patients with a body weight <15 kg, the number of catheters was reduced by recording His bundle signals from the proximal electrodes of a decapolar electrode catheter and using the distal electrodes of the same catheter for right ventricular pacing and recording. In selected patients, a transesophageal probe served as reference for left atrial activation. In all patients, catheter navigation and endocardial mapping were guided by 3-dimensional nonfluoroscopic catheter navigation systems (LocaLisa, Medtronic EP Systems, Minneapolis, Minnesota; EnSite NavX, St. Jude Medical, St. Paul, Minnesota). Mapping and ablation was performed with a standard 5-F (body weight ≤25 kg) or a standard 7-F (body weight >25 kg) nonirrigated catheter with a 4-mm tip. For access to the left atrium, a transfemoral, transseptal approach was used in all patients. In the case of overt pre-excitation, unipolar signals from the tip of the ablation catheter were used in addition to bipolar signals to aid localization of the AP. In patients with concealed AP, AP mapping was performed by right ventricular pacing or during orthodromic AVRT. In patients with body weight >25 kg, RF ablation was performed in a temperature-controlled mode with the generator output set to 30 to 50 W and a target temperature of 65°C. In patients with body weight ≤25 kg, maximum generator power output was 30 W with a target temperature of 65°C. If AP conduction remained present after 15 s of ablation, energy delivery was stopped and mapping was continued. If AP conduction was interrupted within 15 s of RF energy application, energy application was continued for a total of 30 s at this spot. Primary procedural endpoint was interruption of retrograde and (in case of overt pre-excitation) anterograde AP conduction during ablation. Additional "insurance applications" were not applied in small children (i.e., body weight <15 kg), in patients with AP in close anatomical proximity to the normal conduction system, and in patients with posteroseptal AP in close proximity to the left circumflex coronary artery. In the remaining patients, 1 to 2 "insurance applications" were applied at the discretion of the operator with the same RF generator settings for 30 s. Procedures were concluded

ABBREVIATIONS AND ACRONYMS

AP = atrioventricular pathway
AVRT = atrioventricular re-entrant tachycardia
CHD = congenital heart defects
ECG = electrocardiogram
EP = electrophysiology
IQR = interquartile range
RF = radiofrequency
SVT = supraventricular tachycardia