Characteristics of Decremental Accessory Pathways in Children

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Background—Although retrograde decremental accessory pathways (DAPs) are thought to typically present as permanent junctional reciprocating tachycardia (permanent junctional reciprocating tachycardia), they may also be diagnosed unexpectedly during electrophysiology study. We aimed to compare the clinical and electrophysiological characteristics of patients with DAPs to an age-matched cohort with nondecremental accessory pathways.

Methods and Results—We retrospectively studied pediatric patients (<21 years of age) with retrograde DAPs and an age-matched control population with nondecremental accessory pathways who underwent electrophysiology study between 2005 and 2014. Decrement was defined as rate-dependent prolongation of the local ventriculo-atrial time by >30 ms. Twenty-six patients with DAPs were compared with 73 controls (mean age at electrophysiology study 9.8±5.7 and 10.3±5.2 years, respectively [P=nonsignificant]). Compared with controls, patients with DAPs had more frequent syncope (5/26 [19%] versus 3/73 [4%; P=0.02) and ventricular dysfunction (6/26 [23%] versus 4/73 [6%; P=0.04). Only 11 (42%) DAP patients manifested clinical permanent junctional reciprocating tachycardia, and these patients had more syncope (5/11 [45%] versus 0/15 [0%; P<0.01), slower orthodromic reciprocating tachycardia (176±44 beats per minute versus 229±51 beats per minute; P=0.001), and longer ventriculo-atrial times (mean maximum ventriculo-atrial times of 283±116 ms versus 208±42 ms; P=0.02) compared with those with DAPs without clinical permanent junctional reciprocating tachycardia. DAPs and controls had similar rates of acute ablation success (23/26 [89%] versus 67/73 [92%]; P=nonsignificant) and recurrences (1/23 [4%] versus 2/67 [3%; P=nonsignificant).

Conclusions—The majority of pediatric patients with DAPs do not present with clinical permanent junctional reciprocating tachycardia. DAPs are associated with more severe symptoms, but ablation outcomes are similar to those of age-matched controls. (Circ Arrhythm Electrophysiol. 2016;9:e004190. DOI: 10.1161/CIRCEP.116.004190.)

Key Words: accessory pathways • catheter ablation • electrophysiology • outcome • pediatric • supraventricular tachycardia

Accessory pathways typically demonstrate rate-independent conduction and are, thus, nondecremental. However, a subset of accessory pathways exhibits decremental conduction with rate-dependent prolongation of conduction similar to the atrioventricular (AV) node. The proportion of pathways that demonstrate this property in children is unknown, although adult studies have found that 7% of all accessory pathways and 7% to 9% of accessory pathways associated with Wolff–Parkinson–White syndrome are decremental.1–3 These decremental accessory pathways (DAPs) are typically thought to present clinically as permanent junctional reciprocating tachycardia (PJRT) in children. However, some accessory pathways unexpectedly exhibit decremental properties that are recognized during electrophysiology study (EPS) without previous clinical findings to suggest PJRT. Although PJRT has been described in both children and adults, these other variants of DAPs have only been studied in adults.1–8

Our objective was to compare the clinical presentation, electrophysiological properties, and ablation outcomes in pediatric patients with retrograde DAPs to those with retrograde nondecremental accessory pathways.

Methods

Inclusion and Exclusion Criteria
We retrospectively reviewed all patients 0 to 21 years of age with retrograde DAPs who underwent EPS between 2005 and 2014 at the Children’s Hospital Los Angeles. Patients with both concealed DAPs and those with bidirectional conduction with a decremental retrograde limb were included. Patients with DAPs exhibiting only antegrade conduction (including atriofascicular fibers) were excluded.

A control group consisted of patients who underwent EPS during the same time period but were found to have nondecremental accessory pathways. Controls were matched for age at the time of the EPS and accessory pathway directionality: cases with concealed DAPs were matched with controls with concealed nondecremental pathways, whereas cases with bidirectional accessory pathways were age-matched with controls with bidirectional accessory pathways. Although we initially aimed to identify a 3:1 age-matched control group, we accepted a ratio of 2:1 when sufficient age-matched patients were not available. Patients with multiple pathway recurrences were included when at least one of the pathways met criteria...
WHAT IS KNOWN

- Decremental accessory pathways (DAPs) are typically thought to present with frequent or even incessant tachycardia.
- DAPs are considered rare and unclear whether it has less successful catheter ablation outcomes than typical accessory pathways.

WHAT THE STUDY ADDS

- DAPs were found in ≤10% of patients with concealed accessory pathways, but less than half of these DAP patients presented with clinical permanent junctional reciprocating tachycardia.
- Patients with DAPs had more severe clinical presentations, including syncope and ventricular dysfunction, compared with those with nondecremental accessory pathways.
- DAPs may be found at any location across the atrioventricular groove, not just at posteroseptal locations, and have similar catheter ablation outcomes compared with nondecremental accessory pathways.

for decremental retrograde conduction. For patients who also required a second EPS during the 2005 to 2014 period, only the first EPS was included.

Data Collection

Clinical presentation, including age at diagnosis, age at onset of symptoms, presenting symptoms, orthodromic atrio-ventricular tachycardia (ORT) rate, emergency room visits, presence of ventricular dysfunc tion at any point in their care, and medication management prior to EPS were recorded. Furthermore, the medical record was queried to determine whether the patient was suspected of having clinical PJRT (defined in definitions section below) based on the evaluation of the pediatric electrophysiologist before the EPS. EPS data were reviewed to identify the location and electrophysiological properties of the accessory pathways and the electrophysiological properties of the AV node. This included measurements of the ventriculo-atrial (VA) conduction times during ventricular pacing and ORT. Ablation modality, outcome, and associated complications were recorded.

Definitions

Decrement was defined as rate-dependent prolongation of the local VA conduction time by >30 ms during ventricular extrastimulus or rapid ventricular pacing.2 Minimum VA time was defined as the shortest VA time through the accessory pathway measured during ORT, ventricular extrastimulus, or rapid ventricular pacing. Maximum VA time was defined as the longest VA time measured during ORT, ventricular extrastimulus, or rapid ventricular pacing. Absolute decrement was the difference between the minimum and maximum VA times. Differentiation of retrograde DAP conduction from retrograde AV node conduction was made based on either (1) eccentric atrial activation, with decrement occurring at the site of shortest VA time, (2) variable VA conduction times during ORT echo beats or more sustained ORT, or (3) disappearance or clear change in VA conduction after successful elimination of the DAP.

Clinical criteria for PJRT were frequent or incessant supraventricular tachycardia (SVT) with a 1:1 AV relationship, negative P waves in the inferior leads, long RP intervals, and lack of preexcitation during tachycardia.3 Because this study sought to determine the relevance of a suspected clinical PJRT diagnosis made prior to the EPS, precise definitions (such as RP>RR) were not retrospectively included. Acute ablation success was defined as elimination of accessory pathway conduction during the EPS. If both radiofrequency and cryoablation were used in a case, the ablation type was recorded as the successful ablation modality. Recurrence was defined as return of accessory pathway conduction during the follow-up period. Although the post-EPS follow up was generally left to the discretion of the referring cardiologist, recurrences were communicated to the electrophysiologist and documented in a database. Long-term success was defined as an acutely successful procedure and lack of recurrence during the follow-up period. Major procedural complications were defined as permanent complete heart block, vascular or cardiac damage leading to a need for intervention, or death. Minor procedural complications were defined as any complication not meeting criteria as a major complication.

Data Analysis

Clinical presentation, electrophysiological properties, and ablation outcomes of patients with DAPs were compared with those of the age-matched control group with nondecremental accessory pathways. In addition, the DAP group was divided based on whether the patients had been diagnosed with clinical PJRT prior to the EPS. A subanalysis was performed to compare the clinical presentation, accessory pathway electrophysiological characteristics, and outcomes between the clinical PJRT and nonclinical PJRT groups. Continuous variables were reported as mean±standard deviation for normally distributed variables and median (interquartile range) for non-normally distributed variables; categorical variables were reported as frequency (percent). Conditional logistic regression was used for univariate comparisons of children with and without DAPs. Subgroup analysis was performed to compare clinical PJRT to nonclinical PJRT with Wilcoxon rank-sum for continuous variables and χ² for categorical data (or Fisher’s exact if cell count <5). Subgroup analyses were also performed to compare DAPs by location (right versus left and septal versus nonseptal) again with Wilcoxon rank-sum for continuous variables and χ² for categorical data (or Fisher’s exact if cell count <5). Statistical significance was set at 5% level with 2-sided tests. Analyses were performed with STATA/IC 13.1 (StataCorp, College Station, TX) and JMP 11.2 (SAS Institute, Cary, NC). This study was approved by the Institutional Review Board at the Children’s Hospital Los Angeles, and informed consent was deemed unnecessary because of the nature of the study.

Results

Patient Characteristics

Of the 248 EPSs for concealed accessory pathways during the study period, 24 (9.7%) patients had concealed DAPs. In addition, 2 patients had bidirectional pathways with a decremental retrograde limb, which represented 0.6% (2/337) of the total number of patients who had EPS for bidirectional pathways during the study period. Each DAP case had 3:1 age-matched controls, except 5 cases (ages 23 days, 24 days, 3.2 years, 3.4 years, and 3.8 years) who had 2:1 age-matched controls. Thus, a total of 26 DAP patients and 73 controls were included, and catheter ablation was performed in all of these procedures. Table 1 shows demographic and clinical presentation data. By design, the ages of DAP patients and controls at the time of EPS were similar (mean age 9.8±5.7 years and 10.3±5.2 years, respectively [P=nonsignificant (NS)]). The ages of DAP patients and controls were also similar at symptom onset (mean age 6.1±5.7 years and 7±5.1 years, respectively [P=NS]). However, the mean age at the time of EPS was significantly younger for DAP cases compared with the total group of 248 concealed accessory pathway cases (9.8±5.7 years and 13.4±2.8 years,
respectively \( P<0.01 \)). The majority of patients in both the DAP and the control groups reported palpitations associated with SVT. However, patients with DAPs were more likely than controls to have a history of syncope (5/26 [19%] versus 3/73 [4%]; \( P=0.02 \)). Although heart failure symptoms were rare for both groups (12% for DAPs and 4% for controls; \( P=\text{NS} \)), ventricular systolic dysfunction by echocardiography was more common in patients with DAPs compared with controls (6/26 [23%] versus 4/73 [6%]; \( P=0.04 \)). The clinical SVT rate was 200±46 in the DAP patients and 232±37 (\( P=0.07 \)) in controls.

Patients with DAPs were more likely to be treated with an antiarrhythmic medication prior to the EPS (18/26 [69%] versus 33/73 [45%]; \( P=0.046 \)). Beta-blockers were the most frequently used antiarrhythmic medication in both groups. Other antiarrhythmic medications (flecainide, digoxin, amiodarone, and calcium channel blockers) were used with similar frequencies between the DAP and control groups (Table 2). Two of the 26 DAP patients (8%) and 6 of the 73 controls (8%) had undergone a previous mapping and ablation procedure either at a different institution or prior to 2005.

### Electrophysiological Characteristics

The majority of patients in both groups had concealed accessory pathways. Only 2 of 26 (8%) DAP patients had bidirectional accessory pathway conduction (6 of 73 [8%] matched controls). Table 3 shows the electrophysiological characteristics during EPS of the DAPs compared with controls. ORT was incessant in 3 of 26 (12%) DAP patients and induced in all the other DAP patients. Both groups had similar accessory pathway effective refractory periods during extrastimulus testing and cycle lengths at which the accessory pathway blocked during rapid ventricular pacing. A similar proportion of cases and controls had multiple accessory pathways present. Figure 1 shows accessory pathway locations for cases and controls. DAPs were more likely to be right-sided as compared with left-sided (18/26 [69%] versus 23/73 [32%]; \( P<0.01 \)) and septal as compared with nonseptal (17/26 [65%] versus 14/73 [19%]; \( P<0.01 \)). There was no statistically significant difference between the minimum VA time, maximum VA time, or absolute decrement in the patients with septal DAPs compared with nonseptal DAPs or in the patients with right-sided DAPs compared with left-sided DAPs.
Outcomes
Radiofrequency ablation was the predominant ablation modality. Cryoablation was used in a single (4%) DAP patient (who ultimately had a successful radiofrequency ablation) and 7 of 73 controls (10%). Table 4 shows the ablation outcomes with a mean follow-up of 5±3.4 years for DAP patients and 4.9±2.7 years for controls (P=NS). DAP patients and their age-matched controls had similar rates of acute ablation success (23/26 [89%] versus 67/73 [92%], respectively; P=NS), recurrence rates (1/23 [4%] versus 2/67 [3%], respectively; P=NS), and long-term success (22/26 [85%] versus 65/73 [89%]; P=NS). All 3 of the DAP patients who did not have acutely successful initial ablation procedures each had a second procedure with successful ablation of the DAP.

There were no major procedural complications. One minor complication occurred: a 24-day-old male with a left posterior DAP had a possible small perforation in the mitral valve after radiofrequency ablation (a transseptal approach had been used). Mitral regurgitation was mild 1 day after the EPS and had improved on his most recent clinic visit. No intervention was required.

Comparison of DAPs With and Without Clinical PJRT
A total of 11 (4%) patients with a concealed accessory pathway had a clinical diagnosis of PJRT. Thus, of the 26 patients with DAPs, only 11 (42%) had clinical PJRT prior to the EPS, whereas the other 17 (58%) were not suspected to have a DAP prior to the EPS. Table 5 shows a comparison of the patients with DAPs with and without a clinical diagnosis of PJRT. The age of presentation was similar in both the clinical PJRT and nonclinical PJRT groups, as was the age at time of EPS. However, those with DAPs who presented with clinical PJRT had more syncope (5/11 [45%] versus 0/17 [0%]; P<0.01) and slower clinical SVT (176±44 beats per minute versus 229±31 beats per minute; P<0.01). There was no statistically significant difference in heart failure symptoms, ventricular dysfunction, history of emergency department visit, or antiarrhythmic medication use in the PJRT versus non-PJRT groups. Beta-blockers were the most commonly used medication for both groups, followed by flecainide, digoxin, amiodarone, and diltiazem (P=NS).

Table 3. Electrophysiological Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Decremental Accessory Pathways (n=26)</th>
<th>Controls (n=73)</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP retrograde ERP*</td>
<td>260 (250, 280) ms</td>
<td>270 (250, 303) ms</td>
<td>0.99</td>
<td>0.97–1.01</td>
<td>0.32</td>
</tr>
<tr>
<td>AP retrograde block*</td>
<td>300 (300, 360) ms</td>
<td>300 (290, 300) ms</td>
<td>1.01</td>
<td>0.99–1.02</td>
<td>0.07</td>
</tr>
<tr>
<td>Right-sided</td>
<td>18 (69%)</td>
<td>23 (32%)</td>
<td>4.11</td>
<td>1.64–10.32</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Septal</td>
<td>17 (65%)</td>
<td>14 (19%)</td>
<td>6.47</td>
<td>2.34–17.89</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Multiple accessory pathways present</td>
<td>2 (8%)</td>
<td>4 (6%)</td>
<td>1.4</td>
<td>0.25–7.66</td>
<td>0.70</td>
</tr>
</tbody>
</table>

*Median (interquartile range).

AP indicates accessory pathway; CI, confidence interval; ERP, effective refractory period.

Figure 1. Comparison of accessory pathway locations for decremental and nondecremental accessory pathways. Percentages reflect number at each location in comparison to the entire group of DAPs or controls. DAP indicates decremental accessory pathways; L, left; and R, right.
All DAPs in clinical PJRT patients had retrograde-only conduction, whereas 2 DAPs without clinical PJRT had bidirectional conduction (13%; \( P = \text{NS} \)). In the 18 DAP patients with VA times available, accessory pathway retrograde effective refractory period and rapid pacing cycle length at retrograde block were similar between the clinical PJRT and nonclinical PJRT groups. Figure 2 displays DAP VA times with and without clinical PJRT. These are shown as scatter plots and box and whiskers representing mean and standard deviation, respectively. DAPs associated with clinical PJRT had longer minimum VA times (180\( \pm \)89 ms versus 97\( \pm \)35 ms; \( P < 0.01 \)) and maximum VA times (mean 283\( \pm \)116 ms versus 208\( \pm \)42 ms; \( P = 0.02 \)); however, the absolute decrement was not significantly different between the 2 groups (117\( \pm \)88 ms versus 114\( \pm \)57 ms; \( P = \text{NS} \)). During ORT, the VA times were longer in the PJRT group than in the nonclinical PJRT group (267\( \pm \)106 versus 129\( \pm \)54 ms; \( P < 0.01 \)). Accordingly, the surface RP interval was greater than the PR interval during ORT (orthodromic atrio-ventricular reciprocating tachycardia) in the EPS in 7 of 11 clinical PJRT patients (64%) compared with only 4 of 15 nonclinical PJRT patients (27%), but this difference did not reach statistical significance. Acute success, recurrences, and long-term success rates were similar in the clinical and nonclinical PJRT groups.

### Discussion

DAPs are typically thought to be associated with clinical PJRT.\(^5,6\) In our study of a pediatric population, however, less than half (42%) of DAP patients exhibited clinical PJRT, while the majority was considered to have typical SVT prior to the EPS. Although unexpected decremental properties have been seen anecdotally, the finding that less than half of our DAPs were clinically anticipated was surprising. In an adult cohort, however, Chen et al described 759 patients with accessory pathway–mediated tachyarrhythmias, of which 74 (10%) had decremental pathways (5 antegrade, 64 retrograde, and 5 bidirectional). Of these decremental pathways, only 9 (12%) had a clinical pattern consistent with PJRT.\(^2\) These findings suggest that a significant proportion of decremental pathways have properties that do not result in the significant arrhythmia burden that is typically associated with clinical PJRT. A total of 10% of our concealed accessory pathways exhibited decremental conduction, which is relatively high, but consistent with the decremental pathway rate for accessory pathways (antegrade and retrograde) described by Chen et al.\(^3\). When considered with the fact that less than half of these had clinical PJRT, this suggests that although DAPs are not uncommon, clinically evident PJRT remains relatively rare.

Our data identified that the retrograde conduction properties of the accessory pathway may partly determine the likelihood that a DAP patient may have clinical PJRT. Although longer minimum and maximum VA times were seen in our PJRT patients compared with the non-PJRT DAPs, the

### Table 4. Ablation Type and Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Decremental Accessory Pathways (n=26)</th>
<th>Controls (n=73)</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiofrequency ablation</td>
<td>26 (100%)</td>
<td>65 (89%)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Cryoablation</td>
<td>0 (0%)</td>
<td>7 (10%)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Acute ablation success</td>
<td>23 (89%)</td>
<td>67 (92%)</td>
<td>0.73</td>
<td>0.18–2.94</td>
<td>0.66</td>
</tr>
<tr>
<td>Recurrence</td>
<td>1 (4%)</td>
<td>2 (3%)</td>
<td>1.5</td>
<td>0.14–16.54</td>
<td>0.74</td>
</tr>
<tr>
<td>Long-term success</td>
<td>22 (85%)</td>
<td>65 (89%)</td>
<td>0.71</td>
<td>0.21–2.38</td>
<td>0.59</td>
</tr>
<tr>
<td>Complications</td>
<td>1 (4%)</td>
<td>0 (0%)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

CI indicates confidence interval; and NA, not applicable.

### Table 5. Comparison of Decremental Accessory Pathways With and Without Clinical PJRT

<table>
<thead>
<tr>
<th></th>
<th>Clinical PJRT (n=11)</th>
<th>Nonclinical PJRT (n=15)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex, female</td>
<td>6 (55%)</td>
<td>6 (40%)</td>
<td>0.69</td>
</tr>
<tr>
<td>Age at symptom onset*</td>
<td>5.8(\pm)5.8 y</td>
<td>6.3(\pm)5.8 y</td>
<td>0.83</td>
</tr>
<tr>
<td>Prenatal SVT3 (27%)</td>
<td>3 (27%)</td>
<td>0 (0%)</td>
<td>0.06</td>
</tr>
<tr>
<td>Palpitations</td>
<td>7 (64%)</td>
<td>13 (87%)</td>
<td>0.35</td>
</tr>
<tr>
<td>Syncope</td>
<td>5 (45%)</td>
<td>0 (0%)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Clinical SVT rate*</td>
<td>176(\pm)44 beats per minute</td>
<td>229(\pm)31 beats per minute</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Heart failure symptoms</td>
<td>1 (9%)</td>
<td>2 (13%)</td>
<td>1.00</td>
</tr>
<tr>
<td>Ventricular dysfunction</td>
<td>4 (36%)</td>
<td>2 (13%)</td>
<td>0.35</td>
</tr>
<tr>
<td>Antiarrhythmic therapy</td>
<td>8 (73%)</td>
<td>10 (67%)</td>
<td>1.00</td>
</tr>
<tr>
<td>Age at time of EP study*</td>
<td>9.1(\pm)6.5 y</td>
<td>10.3(\pm)5.3 y</td>
<td>0.61</td>
</tr>
<tr>
<td>AP retrograde ERP†</td>
<td>285 (260, 310) ms</td>
<td>250 (250, 270) ms</td>
<td>0.14</td>
</tr>
<tr>
<td>AP retrograde block†</td>
<td>305 (300, 435) ms</td>
<td>313 (275, 355) ms</td>
<td>0.31</td>
</tr>
<tr>
<td>Minimum VA time*</td>
<td>180(\pm)89 ms</td>
<td>97(\pm)35 ms</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Maximum VA time*</td>
<td>283(\pm)116 ms</td>
<td>208(\pm)42 ms</td>
<td>0.02</td>
</tr>
<tr>
<td>Absolute VA decrement*</td>
<td>117(\pm)88 ms</td>
<td>114(\pm)57 ms</td>
<td>0.91</td>
</tr>
<tr>
<td>Right-sided</td>
<td>10 (91%)</td>
<td>8 (53%)</td>
<td>0.08</td>
</tr>
<tr>
<td>Septal</td>
<td>8 (73%)</td>
<td>8 (53%)</td>
<td>0.43</td>
</tr>
<tr>
<td>Acute success</td>
<td>9 (82%)</td>
<td>14 (93%)</td>
<td>0.56</td>
</tr>
<tr>
<td>Recurrence</td>
<td>0 (0%)</td>
<td>1 (7%)</td>
<td>1.00</td>
</tr>
<tr>
<td>Long-term success</td>
<td>9 (82%)</td>
<td>13 (87%)</td>
<td>1.00</td>
</tr>
</tbody>
</table>

AP indicates accessory pathway; EP, electrophysiology; ERP, effective refractory period; PJRT, permanent junctional reciprocating tachycardia; SVT, supraventricular tachycardia; and VA, ventriculo-atrial.

*Mean (+SD).
†Median (interquartile range).
absolute decrement was not statistically differently in the 2
groups. Therefore, the finding most consistent with clinical
PJRT seems to be inherently longer VA times, while extent of
absolute decrement is less relevant.

When decremental pathways are encountered during a case, there may be some apprehension regarding ablation outcomes because of anecdotal experience. Ablation procedures in patients with DAPs may be more difficult.
because of mapping relatively prolonged VA times (versus electrogams with very short VA times at locations of ablation success). In addition, the 3-dimensional posteroseptal space, which is the perceived location of most DAPs, may be more difficult to thoroughly map. Finally, there are concerns regarding the ability to more easily injure a DAP during catheter mapping with this mechanical block, resulting in lower long-term success rates. Despite these concerns, ablation outcomes in our study were not statistically different between DAPs and controls with 89% versus 92% acute success rates, respectively. This is consistent with a multicenter cohort study by Kang et al, which described a 90% success rate for pediatric PJRT ablations. Recurrence rates were also relatively low in our study, resulting in long-term ablation success rates of 85% for DAPs and 89% for controls. These findings suggest that despite perceptions regarding difficulty in ablation of DAPs or PJRT, outcomes are comparable to other accessory pathway ablations in an experienced pediatric EP laboratory.

An additional finding of our study is the high frequency of syncope (19%) in patients with DAPs. Syncope only occurred in the DAP patients with clinical PJRT, however, with nearly half of the PJRT patients having syncope compared with none of the nonclinical PJRT DAP patients (and 4% of controls). Although one study of 49 adults with PJRT described no syncope in their cohort, another study of pediatric and adult patients with PJRT reported syncope in 4 of 21 (19%) patients. These 4 syncopal patients were the oldest patients in their study (20–83 years of age), whereas patients without syncope were all younger (3–19 years of age) at the time of EPS. The mechanism for frequent syncope in our children with PJRT is not clear, particularly because only one patient with syncope also had ventricular dysfunction. It is possible that syncope could be related to abrupt pauses or a slow escape rate immediately after spontaneous cessation of chronic ORT (as opposed to decremental conduction in itself because DAP patients without PJRT did not exhibit syncope).

In addition to variation in clinical presentations and electrophysiological properties, the locations of the DAPs were also more variable than expected. While 91% of clinical PJRT cases were right-sided, only 53% of DAP cases without PJRT were right-sided (compared with 32% of controls). The tendency toward the posteroseptal location of PJRT-related accessory pathways is consistent with prior literature, suggesting that most PJRT pathways are in the right posteroseptal region. Even if left posteroseptal accessory pathways are considered anatomically similar, the remaining large number of nonposteroseptal DAPs without PJRT (47%) were somewhat unexpected and suggest an anatomic difference between those pathways capable of manifesting clinical PJRT versus those with merely decremental properties. Previous reports have proposed 2 mechanisms for decremental conduction across an accessory pathway: (1) the accessory pathway is an AV node–like structure based on its proximity to the AV node, and (2) accessory pathways in PJRT have a tortuous course on pathological examination and, therefore, result in longer conduction properties. Our finding that many DAPs are not located near the AV node (almost a third of all decremental pathways in our study were left-sided) suggests that proximity to the AV node is not a prerequisite to decremental conduction. In addition, DAPs that were septal and, thus, closer to the AV node had no more decrement than those that were further away from the AV node in our study. Whether there are specific properties of posteroseptal pathways that allow clinical PJRT (beyond just decremental conduction), however, remains unanswered.

**Limitations**

The inherent limitations of a retrospective design apply to this study in addition to limitations related to small patient cohorts, particularly for those with suspected PJRT. Specifically, there was a significant difference between the proportion of patients who had ventricular dysfunction by echo between the DAP group and controls, but no significant difference between the proportion of patients with heart failure symptoms between these 2 groups. It is possible that this inconsistency is because of underpowering in a relatively small cohort. A specific set of criteria was not defined by the referring pediatric electrophysiologist when assigning a patient a suspected PJRT diagnosis. As a result, there may be DAP patients not described as having PJRT who may have been considered to have PJRT if structured criteria had been used. Although antiarrhythmic medication use was described in this study, the effectiveness of the antiarrhythmic medications was not evaluated.

In a subgroup of patients, cycle lengths had been collected as upper limits for conduction block and effective refractory period (eg, <300 ms) and were converted to absolute numbers for purposes of our calculations. For these variables, medians were reported instead of means to partially account for this bias. In addition, detailed VA times (including maximum and minimum VA times) from intracardiac electrograms were not available for all DAP patients. The inherent differences in the autonomic state between clinical SVT compared with induced ORT during an EPS may influence AV nodal and possibly VA conduction intervals. Finally, communication between referring physicians and our center often determined our awareness of recurrences. Thus, it is possible that patients who moved out of the geographic area or had changed cardiologists (particularly to adult care) may have had recurrences that were underreported in our study.

**Conclusion**

DAPs are present in nearly 10% of pediatric patients with concealed accessory pathways. The majority of DAPs, however, do not present with clinical PJRT. While DAPs resulting in clinical PJRT are associated with more severe symptoms, including syncope and ventricular dysfunction, the presence of a decremental pathway may otherwise not be anticipated prior to the EPS. Catheter ablation outcomes in DAPs are similar to those in age-matched controls with nondecremental pathways.

**Disclosures**

None.
References


Characteristics of Decremental Accessory Pathways in Children
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