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ORIGINAL ARTICLE

Variation in Pediatric Post-Ablation Care: A Survey of the Pediatric and Congenital Electrophysiology Society (PACES)

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Abstract Although catheter ablation is a standard treatment for pediatric arrhythmias, there are no consensus guidelines for follow-up care. This study describes the variation in post-ablation practices identified through a survey of the pediatric and congenital electrophysiology society (PACES). Pediatric and congenital electrophysiology society members were invited to participate in an online survey of post-ablation practices in September 2014. Survey questions targeted routine post-ablation practices for three common arrhythmia substrates: atrioventricular nodal reentry tachycardia, concealed accessory pathways (AP), and manifest APs. Significant practice variation was defined as <90% concordance among respondents. There were 70 respondents from 67 centers, 29 (41%) in practice for <10 years. Uniform practices included aspirin after left side ablation by 65 (93%), immediate post-procedure ECG by 63 (90%), and performance of outpatient follow-up in 69 (99%) including ECG in 97–100% depending on substrate. The majority, 57 (81%), have standardized follow-up independent of substrate. Post-procedural observation is highly variable, with 25 (36%) discharging patients on the day of ablation, 22 (33%) observing patients in hospital overnight, and 21 (30%) basing hospitalization on pre-defined criteria. Immediate post-procedure echo is performed after all ablations in only 16 (23%). Discharge from outpatient care occurs at a median time of 12 months for each arrhythmia substrate. Common post-ablation practices are evident among pediatric electrophysiologists. However, they report significant variation in post-procedure monitoring practices and testing. The rationale for these variances, and their impact on costs and outcomes, should be defined.

Keywords Pediatrics · Cryoablation · Radiofrequency ablation · Post-ablation care · Variation

Abbreviations

AP	Accessory pathway
AVRT	Atrioventricular tachycardia
AVNRT	Atrioventricular nodal reentry tachycardia
PACES	Pediatric and congenital electrophysiology society

Introduction

Since the introduction of pediatric catheter ablation in the early 1990s, success rates have increased and complication rates have decreased [1–9]. Ablation has become a standard treatment for various types of arrhythmias in children including atrioventricular nodal reentry tachycardia (AVNRT) and atrioventricular reentrant tachycardia (AVRT). Despite the widespread use of ablation, and internationally developed guidelines defining its therapeutic role, there is no agreed upon standard of care for post-ablation monitoring and management of pediatric patients [10].

The recently published guidelines for ablation in children and patients with congenital heart disease addressed some aspects of post-procedure care such as discharge on the same day for an uncomplicated procedure as long as factors such as age, potential complications, and the travel

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distance home are taken into consideration [10]. The document acknowledges differences in post-procedure management and testing, yet does not provide specific recommendations on these issues. The purpose of this study was to describe variation in typical post-ablation care among the members of the Pediatric and Congenital Electrophysiology Society (PACES).

Methods

PACES is an international organization of over 300 electrophysiology practitioners including physicians and allied professionals who work closely with the Heart Rhythm Society and other international cardiology organizations to promote quality pediatric and congenital electrophysiology care. PACES is the recognized leader for guidelines related to pediatric electrophysiology practice. All PACES providers were invited via email in September 2014 to participate in an online survey (www.surveymonkey.com) of questions focusing on their standard post-ablation practices for procedures without complications. Participation in this survey was voluntary. Question format was multiple choices with an option for free-text narrative answers. The survey queried standard patient management practices at the respondents center, both immediately following ablation and at long-term (≤2 years) follow-up. Standard post-ablation practices for three common arrhythmia substrates—AVNRT, concealed accessory pathway, and manifest accessory pathway—were queried separately in the survey. The survey did not address post-ablation care after more complex ablations such as ventricular tachycardia, complex atrial tachycardias, or patients with congenital heart disease. For purposes of the study, significant practice variation was defined as less than 90% concordance among the respondents. Institutional review board approval was not obtained because this was a survey of practitioners and not of human subjects.

Results

Of the 184 interventional electrophysiologists in PACES, 70 (38%) responded from 67 centers. Three centers had more than one respondent, with each respondent having a different individual practice. There were 14 (20%) respondents from outside the United States and 32 (41%) in practice for less than 10 years. The majority of centers, 49 (73%), had standard follow-up for all pediatric electrophysiologists in the practice, whereas follow-up at the remaining centers varied among the different pediatric electrophysiologists in the group. Most, 57 (81%), had a single standardized follow-up regardless of substrate.

Immediate Post-Ablation Practices

All respondents recommended that their patients lie supine after ablation: for <4 h in 10 (14%), for 4 h in 36 (51%), and for 6 h in 23 (33%). One center required supine position for 12 h post-ablation. Of the 70 respondents, 25 (36%) routinely discharged all patients home on the same day of procedure and 23 (33%) routinely hospitalized their patient's overnight. The other 21 (30%) respondents based time of discharge on pre-defined factors including age, length of procedure, and need for transseptal puncture (Fig. 1). One had no pre-defined routine for discharge. Aspirin was prescribed to all patients after ablation by 48 (69%), to only those patients who underwent left-sided ablation by 18 (26%), to only those who had radiofrequency ablation by 2 (3%), and not prescribed routinely by 2 (3%). The most common duration of aspirin treatment was 1–3 months post-ablation by 97% of respondents.

Immediate Post-Ablation Testing

ECGs immediately post-ablation (prior to discharge) were routinely ordered for all patients by 63 (90%) respondents and only for certain patients (ventricular pre-excitation) by 3 (4%) respondents. ECGs were not part of routine post-procedure testing for 4 (6%). Holter monitoring was performed by 18 (25%). Post-procedure echocardiograms for all patients were routine for 16 (23%) and performed only for patients who underwent transseptal puncture in another 13 (19%). The remainder, 41 (58%), did not routinely perform post-procedure echocardiograms.

Post-Ablation Follow-Up and Long-Term Testing

Follow-up within 1 week in clinic or by telephone was provided by 26 (37%) and the majority of respondents, 69 (99%), followed all patients long term with one respondent following only those with a manifest accessory pathway. The median time to first follow-up after ablation and the time of discharge from cardiology clinic was the same for all arrhythmia substrates (Table 1). Figures 2, 3, and 4

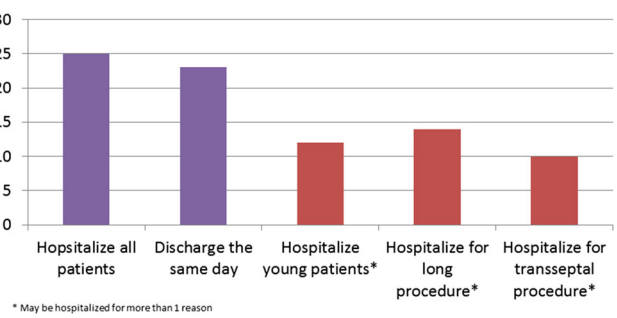

Fig. 1 Post-ablation observation practices

Table 1 Outpatient follow-up

	AVNRT	Concealed AP	Manifest AP
Time to first follow-up (days)	42 (28–56)	42 (28–56)	42 (28–56)
Number of follow-up visits in first 2 years	1.8 (1–2)	1.9 (1–2)	2 (1–3)
Time at outpatient discharge (months)	12 (6–12)	12 (6–12)	12 (12–12)

Data listed as median (IQR)

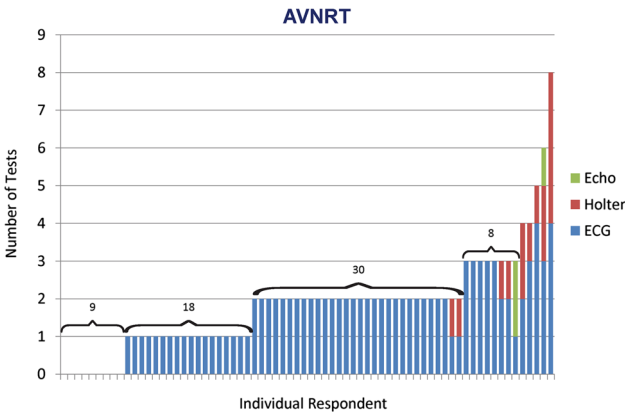

Fig. 2 Testing obtained in follow-up: total tests by respondent in first 2 years after ablation for AVNRT

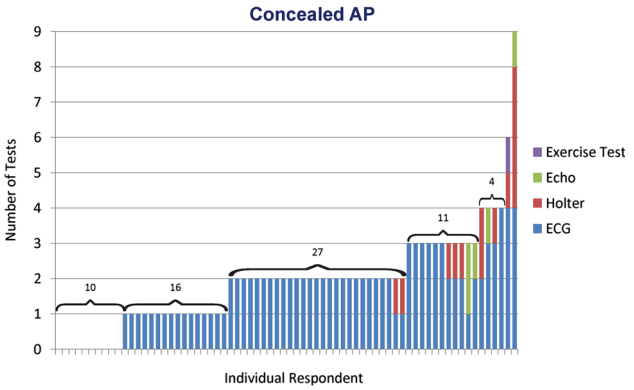

Fig. 3 Testing optional in follow-up: total tests by respondent in first 2 years after ablation for concealed AP

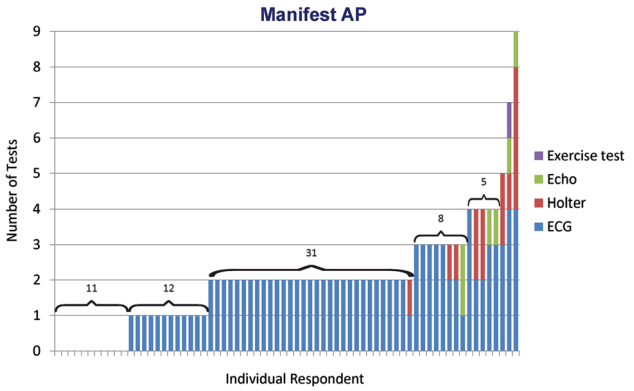

Fig. 4 Testing optional in follow-up: total tests by respondent in first 2 years after ablation for manifest AP

display the number and types of tests obtained at each individual center based on arrhythmia substrate. There were no differences in the number of tests ordered based on provider's years in practice (Fig. 5).

Discussion

This study found significant variation in the standard post-ablation care practices across different pediatric EP centers. There are some common practices among the centers including ECG immediately following the procedure and aspirin use after ablation to prevent thrombus; however, other practices varied widely—such as echocardiogram and Holter monitoring immediately following the procedure. Despite recently developed, internationally agreed upon guidelines on appropriate use of and performance of catheter ablation in pediatrics, standard post-ablation care practices appear to lack consensus as evidenced by both the absence of guidance and the variation identified in this study. Clearly, different arrhythmia substrates could reasonably have different follow-up standards. However, the study identifies wide variation between centers even among similar substrates. This likely reflects a lack of evidence available to agree upon practice standards.

There is currently a national focus on practice standardization as medical care continues to increase in

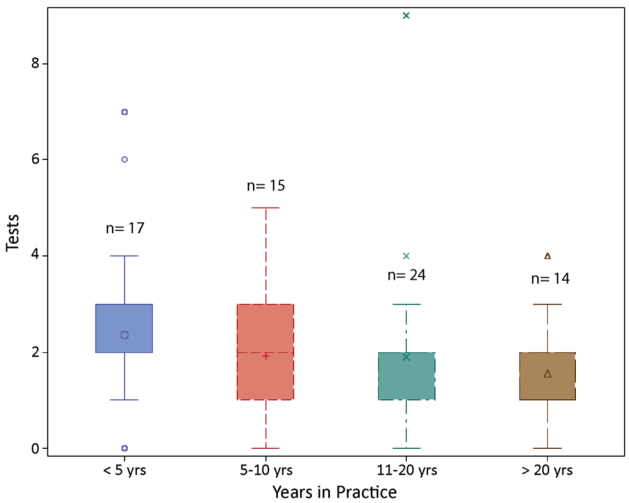

Fig. 5 Tests ordered by years in practices (all substrates combined)

complexity and cost. The positive effects of decreasing practice variation have been highlighted nationally [11–13]. Although post-ablation care may be a small part of the overall health care costs for an individual center, the cumulative effect of multiple centers using standardized procedures would contribute to quality improvement and lead to decreased costs. Efforts should be dedicated to examining current practices with the goal of reducing variation.

Outcomes from the Prospective Assessment after Pediatric Cardiac Ablation (PAPCA) found only 5 thrombotic events in 2761 ablations (0.18%) [14]. A large retrospective study of adult patients undergoing AVNRT, accessory pathway, or atrioventricular node ablation found that the use of post-procedure anticoagulation did not result in a decrease of complications including stroke or emboli post-ablation [15]. Despite this evidence, nearly all survey respondents use aspirin post-procedure, especially when left-sided ablation is performed. While echocardiograms are ordered routinely by nearly half of the respondents for at least those patients having transseptal puncture, a recent single center study of 335 transseptal procedures in pediatric and congenital ablation patients showed a low risk (0.3%) of complications [16]. Notably, missing a rare pericardial effusion could be life-threatening and post-ablation echo in these situations may be warranted despite the low risk. The use of routine echocardiography either early or late post-procedure to assess for valve injury was shown to have low yield with only a 0.12% of injury with radiofrequency ablation [17]. Holter monitoring is routine for one-fourth of the respondents. Data from the University of Michigan Congenital Heart Center did not, however, support the use of routine Holter monitoring due to low risk of detectable arrhythmia or heart block post-ablation, although it remained useful for patients with ventricular pre-excitation to document recurrence [18].

Nearly all respondents recommend long-term follow-up. In patients with AVNRT or a concealed accessory pathway, the goal of the follow-up visit is to assess for symptoms that may indicate recurrence or assess for possible complications following ablation (e.g., vascular injury or late heart block). Late heart block is a potential complication and is reported in up to 0.4–1.5% of patients up to 5 years post radiofrequency ablation in one large adult study; it is more common after AVNRT ablation compared to accessory pathway ablation [19]. In one pediatric study, late high-grade second-degree block requiring a pacemaker occurred 2 years post radiofrequency ablation of AVNRT. None of these patients had heart block noted during the procedure. Patients developing late heart block typically had associated symptoms, [19, 20] making asymptomatic diagnosis by surveillance ECG unlikely. Heart block has not been reported in any patient following cryoablation even up to 8 years post-procedure [21]. An alternative to a clinic visit may be a telemedicine encounter or a scheduled phone call to assess for symptoms. This change would decrease health care costs and time spent by the patient, family, and provider. A follow-up ECG is advisable in patients with a manifest accessory pathway or in patients with higher risk of late heart block.

In 1996 and 1997, the North American Society of Pacing and Electrophysiology (NASPE; currently the Heart Rhythm Society) Pediatric Committee surveyed the NASPE members (unpublished data) with regard to institutional practice patterns during and after ablation. In 1996 and 1997, 46 and 72%, respectively, kept all of their patients overnight in the hospital, compared to 33% in the current study. Anticoagulation use after ablation has decreased as well. In the 1996, 100% of pediatric electrophysiologists prescribed anticoagulation (including warfarin, aspirin, or Persantin) for patients after both right- and left-sided ablation. The following year, the use of anticoagulation decreased to 91% of patients after left-sided ablation and 61% after right-sided ablation. Currently, 69% prescribe aspirin to all patients and 28% only to those patients after a left-sided procedure. Anticoagulation treatment duration for both the earlier and current surveys remains unchanged. A general comparison of the relevant data in the early surveys and the current study suggests that the pediatric electrophysiology community has become less rigorous in post-procedure testing and routine hospitalization. Also notable is that the post-ablation practices have become less uniform nationally with more variation in practice in the current era.

This study was limited by its survey methodology. Importantly, it was designed to identify only the standard practice of the practitioner, and not to reflect actual practice. It is possible that the perceived standard for each respondent differs from the reality of their practice. A study collecting the specific clinical data of each center's follow-up practice would identify this bias, but was not the intention of this study. The results still give good insight into areas of variation in post-ablation care and are evidence for the lack of evidence in establishing standards, since well-known evidence supporting specific practices would be clearly identifiable even in this type of survey. There may be unavoidable practice differences between international centers simply due to resource availability, which was not identified by this study.

Conclusions

Certain aspects of post-ablation care are common among pediatric electrophysiologists, while there is significant variation in post-ablation monitoring and testing practices.

These variations likely reflect both individual practice patterns and a general lack of evidence to determine best practice. The rationale for post-ablation care should be analyzed and modified based on the cumulative experience of the PACES organization. A collaborative commitment to the standardization of post-ablation care could be a small example of how patient care may be optimized on a national level.

Compliance with Ethical Standards

Conflict of interest None of the authors who contributed to this manuscript have potential conflict of interest to disclose.

Informed Consent Informed consent was not obtained as this was a voluntary survey study of healthcare providers.

Research Involving Human and Animal Participants No human participants or animals were used for this study.

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