Catheter ablation in infants and smaller children
Which energy source and how?

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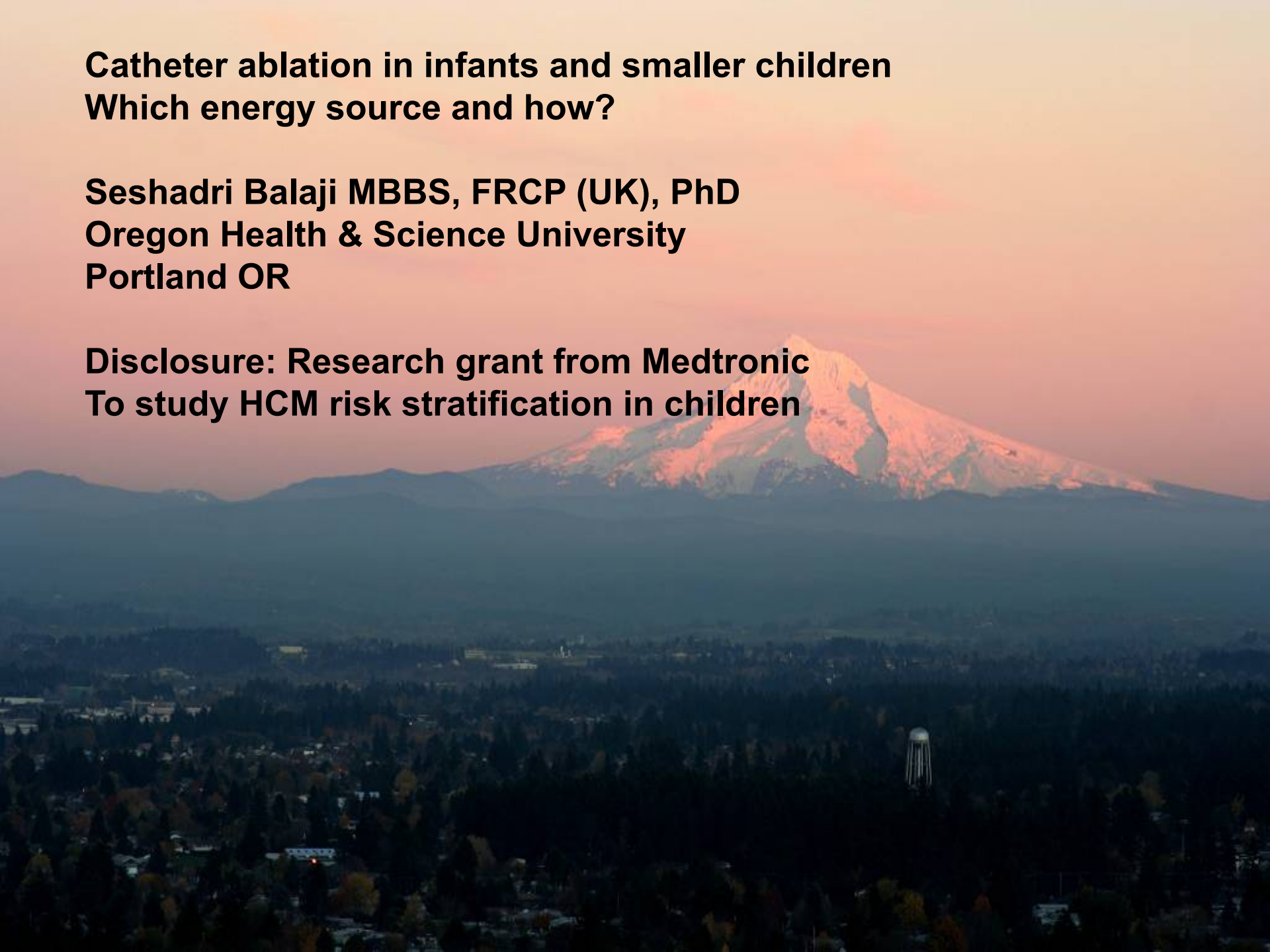
To study HCM risk stratification in children



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1992, 7 cases.

Radiofrequency Catheter Ablation of Incessant, Medically Resistant Supraventricular Tachycardia in Infants and Small Children

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Objectives. This study retrospectively evaluates initial experience with radiofrequency catheter ablation in a group of seven infants and small children with a history of incessant, medically resistant supraventricular tachycardia.

Methods. Before attempted catheter ablation, all patients had had unsuccessful conventional medical therapy (with digoxin or propranolol, or both) and, in addition, each continued to have daily episodes of supraventricular tachycardia while taking amiodarone or a class IC antiarrhythmic agent alone or in combination. The average patient age was 10 months (range 1 to 27) and the average patient weight was 6 kg (range 3 to 13). Electrophysiologic diagnosis included reentrant supraventricular tachycardia in six patients and atrial ectopic tachycardia in one patient.

Results. These seven patients underwent a total of nine catheter ablation procedures. The atrial approach to ablation was employed in eight of the nine procedures. Overall, radiofrequency catheter ablation was totally successful in five of the seven patients, partially successful in one patient and unsuccessful in the remaining patient. The combination of radiofrequency catheter ablation and surgical ablation was successful in controlling tachycardia in all patients; with at least 5 months of follow-up study, no patient has had a recurrence of supraventricular tachycardia or reappearance of a delta wave.

Conclusions. Surgical ablation of arrhythmogenic substrates in the pediatric age group, although rarely indicated, has been found in the past to be safe and effective. Our initial experience with radiofrequency catheter ablation in infants and small children demonstrates that this procedure is a promising nonpharmacologic therapeutic alternative to surgical ablation.

(J Am Coll Cardiol 1992;20:1405–10)

Case et al JACC 1992 (MUSC)

- 7 infants and children, 1-27 mo old, mean 10
- Weight 3-13 kg, mean 6.
- All SVT (1 EAT, 6 AP). 6/7 incessant, medically resistant. 3 had multiple APs.
- 6-7 Fr catheters.
- All but one anterograde approach.
- 9 procedures.
- 1 failed LFW. All others successful.
- Uncomplicated.
- 25-40 watts for 10-40 seconds, power-controlled

eds. Immunology of Heart and Lung Transplantation. London: Edward Arnold, *J* 1993;69(suppl):S3–S11.

Efficacy and Safety of Radiofrequency Ablation in Infants and Young Children <18 Months of Age

Christopher C. Erickson, MD, Edward P. Walsh, MD, John K. Triedman, MD, and J. Philip Saul, MD

Radiofrequency (RF) ablation has made a significant impact on the ability to treat arrhythmias in children.[1–3] The success rate has been comparable to the surgical approach, while postablation morbidity has been greatly reduced. However, rare cases of procedure-related mortality have been reported.[2,3] These reports, combined with the findings that most infants with supraventricular tachycardia (SVT) can be managed medically,[4] have led to a reluctance to perform catheter ablation in infants. However, some infants have recurrent and/or incessant tachycardia that is unresponsive to any medication.[1,5,6] Frequent or incessant tachycardic episodes may also lead to ventricular dysfunction and symptoms of congestive heart failure, particularly when associated with congenital heart disease. This report describes 10 infants and children aged <18 months who underwent RF ablation for treatment of medically refractory or unstable SVT, and 1 other patient who underwent elective ablation before having an atrial septal defect closure that may have prevented access to an accessory pathway (AP).

Of 185 patients undergoing RF ablation at Children's Hospital between March 1990 and March 1993, 11 were aged between 33 days and 16.6 months (median 10.4 months) (Table 1). Six of the 11 patients had tachycardia scheduled to have an atrial septal defect closed surgically. Two patients were offered elective ablation after they were 12 months of age and had no improvement with 2 and 3 medications, respectively. The arrhythmia diagnoses, associated structural heart defects, and prior drug therapy are listed in Table 1.

All procedures were performed with informed consent, and under either general anesthesia (n = 12) or sedation (n = 1). After systemic heparinization, 1 to 3 electrophysiology catheters were placed: a 5Fr bipolar, 3-mm electrode-tipped catheter (n = 2), or a 6Fr (n = 9) or 7Fr (n = 3) 4-mm electrode-tipped quadripolar steerable mapping/ablation catheter. An esophageal bipolar catheter was placed for atrial recording and pacing in 8 procedures. In 7 of 13 patients (54%), a single catheter (quadripolar, hexapolar, or decapolar) was used for His recording and right ventricular pacing.

Mapping of the AP or ectopic atrial focus was performed with the ablation catheter using an atrial approach to both right- and left-sided pathways in all patients, as described previously.[3] RF energy was applied for only 5 to 10 seconds if there was no evidence of success. If there was evidence of success by either intracardiac electrograms or the surface electrocardio-

Erickson 1994 (BCH)

- 11 children <17 mo (33 days to 16.6 mo, median 10)
- 16 APs, 1 EAT. 3 with multiple APs.
- 13 procedures
- Failed to ablate 1 pathway, all others ablated.
- 2 recurred.
- 1 died, small posterior MV leaflet tear, ? VT

Author	Energy	Cath	mode	misc
Case 1992	RF	6/7 Fr	Power 15-40	10-40 sec
Erickson 1994	RF	6/7 Fr	Power?	5-10 secs
Kantoch 2011	RF	5/6 Fr	Temp ?	
Blaufox 2001	RF	5/6/7 fr	Power/Temp	
An 2013	RF	6/7 fr	Temp	
Jiang 2016	RF	5/6 Fr	Temp	
Backhoff 2016	RF	5/6/7 Fr	Temp, 30 W	

Infants & small children

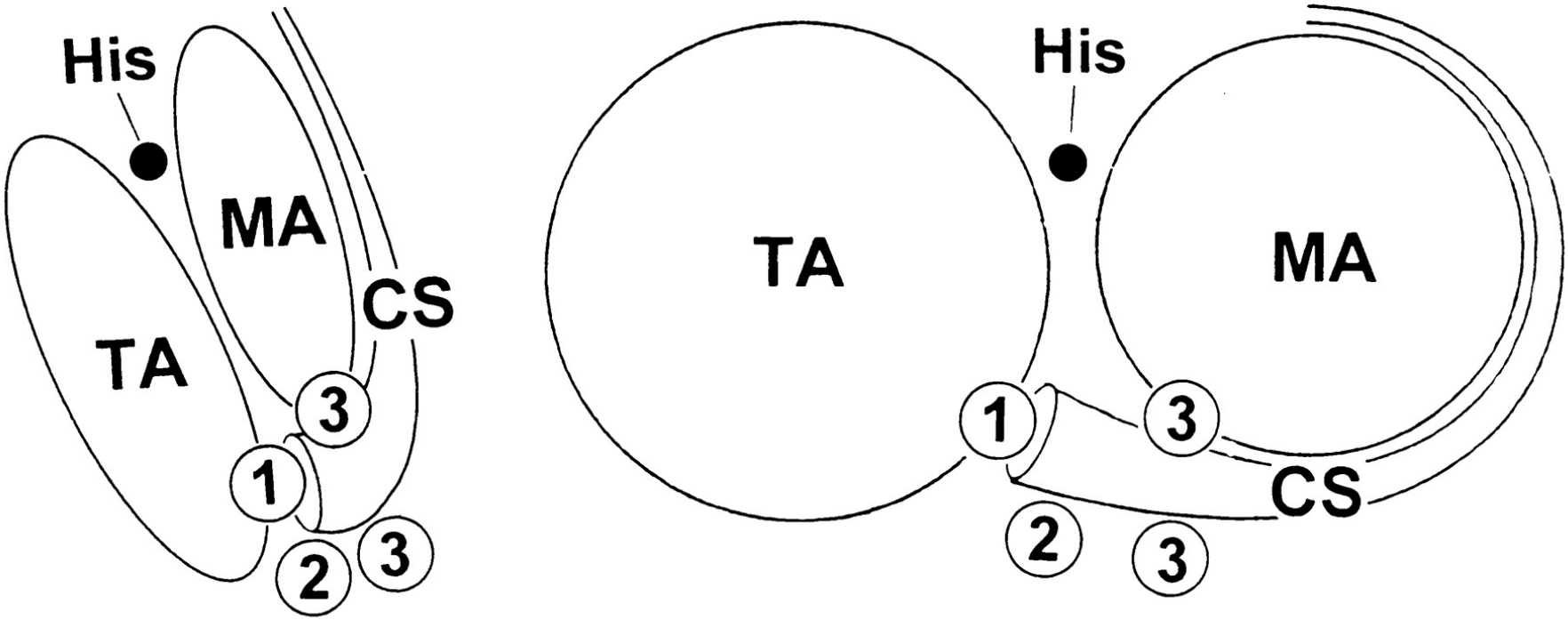
- Tend to be tough patients with multiple pathways, CHD etc.
- Higher risk of complications if <15 kg
  - Hemopericardium
  - Coronary artery injury
  - AV block if septal AP
  - Occlusion of femoral or iliac vein/artery
  - death

Infants

- Higher threshold for ablation
- Few reports of cryo in large series. Beware the stiff catheter.
- Most experience with RF
- Use anesthesia
- Use 5/6 Fr catheter
- Antegrade for left side (less experience with retrograde + potential for aortic valve damage)
- Short test lesions (5 seconds?) at low power (20 w?)

RAO

LAO



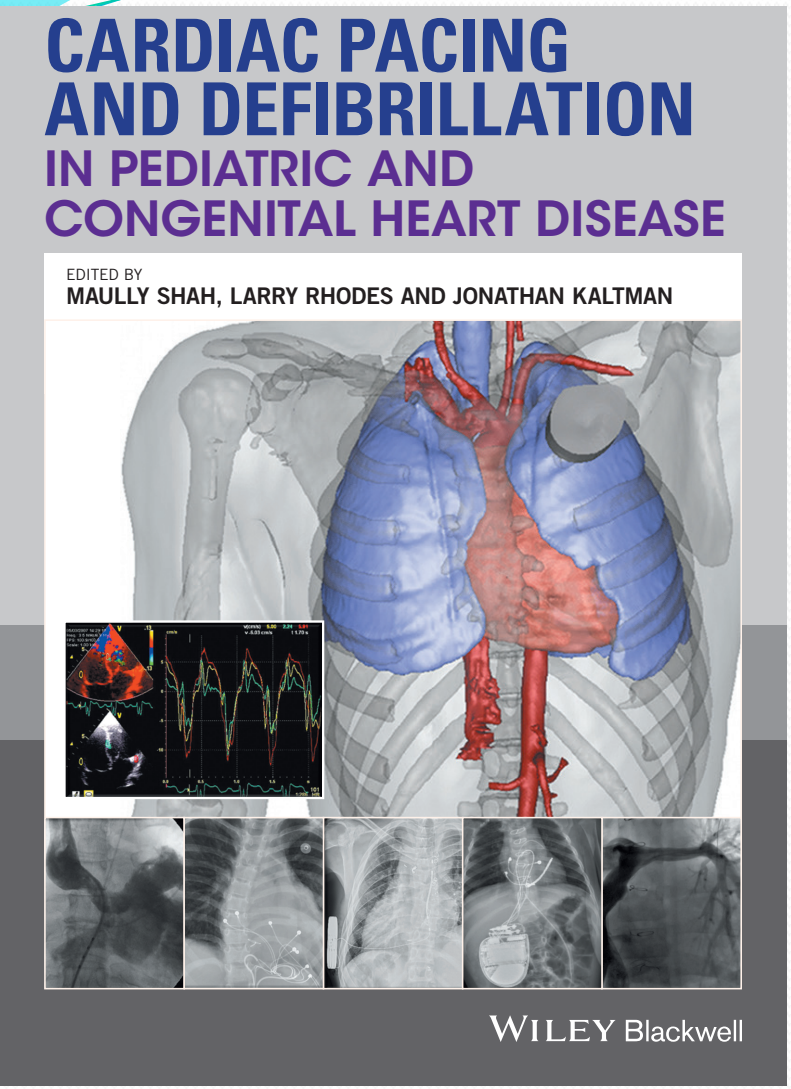
1. Coronary Sinus Ostium
2. Inferomedial Right Atrium
3. Left Posteroseptal Region

Cryo-ablation

- Safer for septal Aps
- Larger & Stiffer catheter
- Harder to manipulate

Conclusions

- Be cautious
- Use smallest catheter possible.
- RF with low power and short test lesions.
- Avoid doing septal pathways or use cryo with great caution during catheter manipulation.



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Thank You

Data

- Schaffer et al PES AJC 2000
- 10 deaths in 4651 cases in children
- 5 of 4092 normal heart
- 5 of 559 structural heart disease
- All left sided cases
- Smaller weight, more lesions, SHD associated with deaths.

Blaufox 2001 Ped Ablation Registry.

- RF in children <18 mo. compared to non-infants
- 137 children 152 procedures
- 5960 older kids 6610 procedures
- No difference in success or complication rates.
- Sub-analysis of <15 kg vs > 15 kg did show more complications in <15 kg.
- Also AV block higher if smaller with septal APs.

Kantoch 2011

- 34 <2 years with 42 procedures.
- Weight 2.6-12.3 kg, mean 7.4
- AVRT 19; EAT 6, AFL 1, VT 3, cJET 2.
- RF success 74%
- Major complications in 4: 1 AV block, 1 hemo-pericardium, 2 with femoral/iliac vein occlusion
- Major complications 10% vs 0.7% in older children

An et al PACE 2013 (Seoul)

- 95 procedures in children <10.
- Compared 0-4 yrs (n=24) to 5-9 years (n=71)
- Complications 2/24 vs 1/70 (statistically insignificant)
- 1 transient AVB in cJET
- 1 cardiac perforation
- 1 IVC injury.

Jiang et al PACE 2016

- 123 pts <3 yrs underwent EPs
- 109 had RFCA with 5 or 6 Fr catheters
- Acute success 95%
- Recurrence rate 7%
- No major complications.

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ORIGINAL ARTICLE

Radiofrequency Catheter Ablation of Accessory Atrioventricular Pathways in Infants and Toddlers ≤ 15 kg

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Abstract Accessory atrioventricular pathways (AP) are the most common substrate for paroxysmal supraventricular tachycardia in infants and small children. Up-to-date data on AP ablation in infants and small children are limited. The aim of the present study was to gain additional insight into

Keywords Accessory atrioventricular pathway · I
Radiofrequency catheter ablation

Abbreviations
AP Accessory atrioventricular

2016; 22 < 15 kg. longer, more complications (1 femoral vein & 1 artery Occlusion. 65 degrees celsius, 30 watts)