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Standard Atrial Epicardial Wire Placement Leads to Improved Atrial Signal Identification and Pacemaker Sensing

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Introduction

Atrial epicardial wires are known to yield dampened atrial signals and lose capture, thus complicating diagnosis and treatment of atrial arrhythmias

The locations of atrial wires may impact pacing and sensing capabilities

There are no pediatric prospective studies examining ideal placement of atrial epicardial wires

Methods

Prospective multicenter pilot study comparing atrial amplitudes, pacing sensitivities and thresholds from atrial epicardial wires placed at test sites:

- (A) right-sided interatrial groove
- (B) Bachmann's Bundle

Versus the surgeon's standard locations (control sites S1 & S2) [*Figure 1*]

Atrial amplitudes were measured by obtaining atrial ECG using the AtriAmp [*Figure 2*]

Pacing sensitivities and thresholds were evaluated via temporary pacemaker

Dr. Von Bergen is a co-founder of Atrility and inventor of the AtriAmp

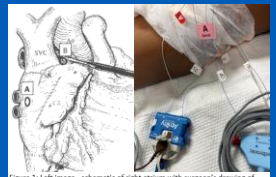

Figure 1: Left image - schematic of right atrium with surgeon's drawing of atriotomy and four atrial epicardial wire locations. Right image - labeled atrial epicardial wires. A = right-sided interatrial groove, B = Bachmann's Bundle, S1 and S2 = surgeon's standard locations.

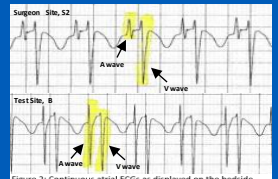

Figure 2: Continuous atrial ECGs as displayed on the bedside monitor using the AtriAmp. (Top) Surgeon Site S2 – atrial wave = 9 mV, ventricular wave = 27 mV. (Bottom) Bachmann's Bundle – atrial wave = 30 mV, ventricular wave = 29 mV.

Table. Comparison across different atrial wire locations

	Combined (N=29)		CMH (N=7)		UW (N=22)	
	Mean (SD)	P value	Mean (SD)	P value	Mean (SD)	P value
Atrial amplitude		**<0.001**		**0.009**		**0.006**
Wire A	9.9 (5.5)		14.7 (7.6)		8.3 (3.5)	
Wire B	12.5 (8.1)		19.3 (12.4)		10.2 (4.6)	
Wire C	7.2 (3.3)		7.9 (2.0)		7.0 (3.7)	
Wire D	6.6 (2.9)		8.0 (3.2)		6.1 (2.7)	
A/V ratio		0.093		**0.016**		0.599
Wire A	0.6 (0.3)		0.8 (0.5)		0.5 (0.2)	
Wire B	0.7 (0.4)		0.9 (0.6)		0.5 (0.3)	
Wire C	0.5 (0.7)		0.3 (0.1)		0.5 (0.8)	
Wire D	0.4 (0.3)		0.4 (0.3)		0.4 (0.2)	
Atrial sensing		**<0.001**		0.107		**<0.001**
A (-) B (+)	1.8 (1.4)		3.3 (2.6)		1.5 (0.8)	
B (-) A (+)	1.7 (1.2)		2.8 (2.1)		1.5 (0.7)	
C (-) D (+)	1.0 (0.5)		1.3 (0.4)		1.0 (0.5)	
D (-) C (+)	1.0 (0.6)		1.3 (0.5)		0.9 (0.6)	
Atrial threshold		0.142		0.261		0.163
A (-) to B (+)	1.8 (1.3)		0.7 (0.8)		2.1 (1.2)	
B (-) to A (+)	1.8 (1.1)		0.6 (0.9)		2.0 (1.0)	
C (-) to D (+)	2.4 (2.4)		0.8 (0.4)		2.9 (2.6)	
D (-) to C (+)	2.2 (2.5)		1.3 (1.3)		2.5 (2.8)	

Wire A = right-sided interatrial groove. Wire B = Bachmann's Bundle. Wires S1 and S2 = surgeon's standard locations. (-) and (+) denote negative and positive ports of the temporary pacemaker, respectively. ANOVA test was used to calculate mean and SD between groups with p-value <0.05 taken as significant.

Results

No demographic differences between hospitals

Combined mean patients' characteristics at time of surgery:

- Age 3.2 yr ± 3.6
- Weight 14.6 kg ± 12.4
- CPB 111.8 min ± 51.1

Within hospitals and combined, atrial amplitudes were greater at test sites compared to control sites

Combined, atrial sensing was greater at test sites compared to control sites

Phrenic nerve capture was common during test pacing at site A (n=14/29)

Discussion

Standard atrial wire placement improves atrial signal amplitude and pacemaker sensing

Atrial wire position near the right superior pulmonary vein may cause phrenic stimulation

Conclusion

Standard atrial wire placement should be considered to improve post-operate cardiac care

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