The utility and safety of temporary pacing wires in postoperative patients with congenital heart disease

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Arrhythmias constitute a common complication after cardiovascular surgery (CVS) in pediatric patients.¹⁻³ Pacing wires are helpful in the differentiation and treatment of supraventricular, ventricular, and sinus tachycardia. The purpose of this study was to determine (1) whether pacing wires are useful in the diagnosis and treatment of early postoperative arrhythmias, (2) whether any factors exist to predict patients who benefit from their placement, and (3) the complications associated with their placement, use, or removal.

Clinical Summary

A single-center, institutional review board–approved, prospective observational study was performed. Inclusion criteria were as follows: patient age of less than 18 years and CVS between September 2000 and March 2003. Exclusion criteria were a patent ductus arteriosus ligation or coarctation of the aorta repair because wires were not placed. Data collected included cardiopulmonary bypass (CPB) and aortic crossclamp (AXC) times, pacing wire placement and location, use of pacing wires, and complications. Before chest tube removal and transfer from the intensive care unit, wires were removed by a pediatric cardiology fellow.

The Student test and χ analysis, along with simple and multiple logistic regression analysis, were used to make comparisons.

A total of 209 patients met the inclusion criteria: 170 (81%) having pacing wires, 159 (93.5%) having atrial and ventricular wires, 10 (5.9%) having ventricular wires, and 1 having atrial pacing wires. Wires were used in 59 (35%) patients: 33 for diagnostic purposes, 11 for therapeutic purposes, and 15 for both purposes.

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Comparisons between group 1, those with pacing wires, and group 2, those without pacing wires, found a significant difference in CPB time (123.8 vs 46.1 minutes) and AXC time (59.5 vs 18.5 minutes,) $P < .0001$.

Splitting group 1 into those who used their pacing wires (group 1A) versus those who did not (group 1B), direct relationships were found between longer AXC time (81.4 vs 47.9 minutes, $P < .0001$) and CPB time (151.3 vs 109.1 minutes, $P < .0006$). Further analysis of group 1A, dividing it into those who used the wires for therapeutic, diagnostic, or both therapeutic and diagnostic purposes versus group 1B found that both AXC and CPB times increased (Table 1).

For every 10-minute increase in AXC time, the odds of therapeutic use of the pacing wires increased by 27% (95% confidence interval [CI], 16%–40%). For each 10-minute increase in CPB, the odds of therapeutic use of the pacing wires increases by 13% (95% CI, 7%–20%). When AXC and CPB times were entered into the

TABLE 1. Comparisons between groups

	AXC	CPB	Mg	Ca
Pacing wires (n = 170), no pacing wires (n = 59)				
Group 1	59.5	123.8	1.5	4.78
Group 2	18.5	46.1	1.62	4.62
P value	<.0001	<.0001	.004	NS
Use: group 1 patients				
Group 1A (used; n = 59), Group 1B (unused; n = 112)				
Group 1A	81.4	151.3	1.49	4.81
Group 1B	47.9	109.1	1.51	4.77
P value	<.0001	.0006	NS	NS
Therapeutic (n = 28), diagnostic (n = 48), both (n = 17)				
Therapeutic	98.3	164.8	1.53	4.98
Group 1B/diagnostic	51.5	115.6	1.5	4.76
P value	<.0001	.0007	NS	NS
Diagnostic	86	159	1.47	4.83
Group 1B/therapeutic	48.6	109.7	1.51	4.77
P value	<.0001	.0003	NS	NS
Therapeutic	98.3	164.8	1.53	4.91
Diagnostic	65.7	139	1.46	4.74
P value	.0213	NS	NS	NS

Aortic crossclamp and cardiopulmonary bypass times are measured in minutes. Magnesium levels are measured in mg/dL, and ionized calcium levels are measured in mg %. AXC, Aortic crossclamp; CPB, cardiopulmonary bypass; Mg, magnesium; Ca, calcium; NS, not significant.

model simultaneously, only AXC time was an important predictor of therapeutic use of pacing wires.

In our group of patients, no complications related to the placement, use, or removal of wires was noted. The 95% CI around the estimate of complication rate is 0% to 1.2%. None of the patients in whom wires were not placed experienced an arrhythmia. The surgeons were able to predict with 100% accuracy the patients not requiring pacing wires but only 26% (59/170) of those patients who would.

Discussion

This study found the incidence of use of pacing wires to be equal to 26% for post-CVS pediatric patients. Of those operations in which pacing wires were placed, the percentage of use increased to 35%, with more than half (56%) for diagnostic purposes.

When analysis was performed to evaluate the need for pacing wires (diagnostic, therapeutic, or both), 2 predictors fell out: length of AXC and CPB time. When the group of patients with pacing wires was further analyzed, therapeutic and diagnostic versus all other, significantly longer AXC and CPB times were noted as predictors. When comparisons were made between pacing wires used for therapeutic and diagnostic purposes, the only difference was in the AXC time (98.3 vs 65.7 minutes).

Although this study does not determine patients who require pacing wires, it does provide some guidelines. Patients whose

AXC times, CPB times, or both are longer might benefit from placing pacing wires at the time of CVS. With each 10-minute increase in AXC or CPB time, a significant increase, 27% and 13%, occurred in the therapeutic use of pacing wires. These findings, longer AXC and CPB times, might simply be variables of the surgical complexity of the case. Despite anecdotal reports of complications associated with pacing wires, no complications were noted with the placement, use, or removal in this study.

Patients with longer CPB and AXC times associated with more complicated surgical procedures have a significantly higher chance of requiring pacing wires for their postoperative management. In addition, their placement, use, and removal appear to be safe.

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Hybrid approach as a bridging procedure to biventricular repair for aortic hypoplasia with ventricular septal defect in a 1720-g premature infant

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Hypoplastic left heart syndrome varies from mitroaortic atresia and a diminutive left ventricle to milder forms of mitroaortic stenosis with a reasonable-sized left ventricle.

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Clinical Summary

A female infant with fetal diagnosis of aortic atresia was born at 34 weeks of gestation weighing 1620 g. At birth, echocardiography was carried out, showing a double-outlet right ventricle with great vessels side to side and aorta on the right and a large subpulmonary ventricular septal defect. The aorta was extremely hypoplastic, with a minimal antegrade blood flow. The aortic arch was also hypoplastic and filled with retrograde blood flow from the ductus. The left ventricle and mitral valve were in normal values. Prostaglandin E₁ infusion was started.

When she was 25 days old, weighing 1720 g, a median sternotomy was performed. First, pulmonary artery branches were banded at their origin (polytetrafluoroethylene bands,* diameter of 2.8 mm). Next, two self-expandable stents (6 × 12/6 × 18 mm) were placed through the main pulmonary artery puncture to cover

*Gore-Tex band, registered trademark of W. L. Gore & Associates, Inc, Newark, Del.