

# EPICARDIAL PACING; TIME RELATED EFFICACY OF ELECTRODES FOLLOWING CARDIAC SURGERY

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**ABSTRACT...** Placement of epicardial wires on the right atrial and right ventricle surfaces is a routine practice in cardiac surgery. These pacing electrodes are used for invasive pacing of the myocardium for a variety of emergent and elective conditions postoperatively. There is uncertainty in actual practice about the optimum time for their removal, and practice varies widely between different institutions. **Objectives:** To determine the time related efficacy of these pacing electrodes after cardiac surgery, to find out the optimum time of their removal. **Period:** July 2008 to October 2008. **Patients & Methods:** 47 patients those underwent coronary artery bypass surgery were prospectively enrolled and evaluated with standard 12 lead ECG and ventricle pacing threshold immediately after surgery and on the 5<sup>th</sup> postoperative day. The patients were divided into two subgroups according to their left ventricle ejection fraction ( $\geq 40\%$  verses  $< 40\%$ ). **Results:** There was significant difference in the effective pacing threshold in group 1 and 2 on immediate post operative period and on day 5. ( $P = 0.002$  and  $P = 0.02$  respectively) The sensing threshold immediately after operation and on 5<sup>th</sup> post operative day also differed significantly ( $P = 0.009$  in group 1 and  $0.02$  in group 2) The effective VVI\* pacing was lost in 17 patients (40.5%) on the 5<sup>th</sup> post operative day and comparison of effective pacing threshold in the two groups showed no significant difference during the same period of time ( $P = NS$ ). \*Ventriculo-ventricular inhibition. **Conclusions:** The epicardial pacing wires have little usefulness after the fifth postoperative day and should be removed by this time. In addition postoperative pacing threshold was not affected by the decreased left ventricular function.

**Key words:** Cardiac Surgery, Epicardial Pacing, Left ventricular Function, Efficacy.

## INTRODUCTION

Placement of epicardial wires on the right atrial and right ventricle surfaces is a routine practice in cardiac surgery<sup>1</sup>. Pacing option is used when the intrinsic impulse is weak and the native impulses are not conducted or the heart rate is too slow to maintain adequate output. These electrodes are remained in place during the first few post operative days. There is uncertainty in actual practice about the optimum time for their removal, and practice

varies widely between different institutions<sup>2,3</sup>. Few studies have evaluated the duration of usefulness of these electrodes after cardiac surgery.

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The purpose of this study is to determine the time related efficacy of these pacing electrodes after cardiac surgery and to find out the optimum time of their removal.

### PATIENTS AND METHODS

During the period from July 2008 to October 2008, 47 patients those underwent coronary artery bypass surgery were prospectively enrolled and evaluated with standard 12 lead ECG and ventricle pacing threshold immediately after surgery and on the 5<sup>th</sup> postoperative day. The patients were divided into two subgroups according to the left ventricle ejection fraction ( $\geq 40\%$  verses  $< 40\%$ ) as assessed on their preoperative echocardiogram and during coronary angiography.

Inclusion criteria considered all patients undergoing elective coronary artery bypass grafting with sinus rhythm. Patients on anti arrhythmic drugs preoperatively, with post operative atrial fibrillation or flutter, no pacing wire insertion or had permanent pacemaker were excluded from study.

The patients were operated on standard cardiopulmonary bypass with aortic cross clamp and ante grade blood cardioplegia. The pacing wires were inserted with an attached curved needle and fixing the electrode in the myocardium of the right ventricle. Some coiling of the wire was made at its distal end to secure the electrode from its accidental slipping. The wires exit the chest on the left side and fixed on the skin. The pacing wires were removed by simple continuous traction before sending the patient home. The patient was in his own intrinsic rhythm before performing the test. Initially the output was set at 5mA. the sensitivity was set at 2mA. The rate was adjusted at 10 beats per minutes over the intrinsic heart rate. The stimulus thresholds were determined by gently decreasing the output voltage while watching monitor until capture was lost and the voltage up till capture was seen again. The sensitivity was determined by slow decrease in the sensitivity by turning the number up. When there was pacing spikes in competition with intrinsic rhythms then the sensibility was set at half the threshold.

### STATISTICAL ANALYSIS

For numerical values student's t-test, paired t-test and for nominal values Chi-square test is Used.

### RESULTS

The clinical variables of the two groups analyzed are shown in table-I. There was a significant difference in calculated left ventricular ejection fraction in group 1,  $49.2 \pm 5$  as compared with  $25.8 \pm 7$  in group 2. ( $p=0.01$ ) while the others clinical characteristics showed no significant difference.

	Group 1 (n=26)	Group 2 (n=21)
Age	53.8 $\pm$ 8.0	54.4 $\pm$ 6.4
Male	17(65.4%)	15(71.4%)
Female	9(34.6%)	6(28.6%)
<b>Angina</b>		
Stable	12(46.2%)	8(38.1%)
Unstable	14(53.8%)	13(61.9%)
<b>CCS Class</b>		
111	10(38.5%)	7(33.3%)
IV	16(61.5%)	14(66.7%)
Previous MI	17(65.4%)	15(71.4%)
Smoker	16(61.5%)	13(61.9%)
CRF	03(11.5%)	02(09.5%)
COPD	04(15.4%)	03(14.3%)
<i>CRF, chronic renal failure. COPD, chronic obstructive pulmonary disease.</i>		

The operative data is given in table II. The post operative recovery was event less in majority of the patients. Five patients got post operative atrial fibrillation and were excluded from the study. The patients remained on ventilator for  $4.75 \pm 2$  hours before extubation. An average

stay in intensive care unit was  $2.5 \pm 0.5$  days before the patient was shifted to surgical ward.

Table-II. Operative Data.	
Average number of bypass grafts	3.5
Left internal mammary artery	76%
Average bypass time (minutes)	$135 \pm 19.5$
Average X clamp time (minutes)	$55.4 \pm 11.7$

The post operative time related comparison of the effective pacing threshold in group 1 and 2 is shown in table III. There was significant difference in the effective pacing threshold in group 1 and 2 on immediately post operative period and on day 5. ( $P=0.002$  and  $P=0.02$  respectively).

	Day 0	Day 5	P value
Group 1 (n=23)	$1.5 \pm 0.2$ mV	$3.3 \pm 0.5$ mV	0.002
Group 2 (n=19)	$1.8 \pm 0.3$ mV	$3.6 \pm 0.7$ mV	0.02
<i>mV= millivolts</i>			

The sensing threshold immediately after operation and on 5<sup>th</sup> post operative day was also differed significantly ( $P=0.009$  in group 1 and  $P=0.02$  in group 2) Table-IV .

	Day 0	Day 5	P value
Group 1 (n=23)	$7.0 \pm 0.4$ mV	$4.8 \pm 0.75$ mV	0.009
Group 2 (n=19)	$8.4 \pm 1.2$ mV	$5.2 \pm 0.5$ mV	0.02

The effective VVI pacing was lost in 17 patients (40.5%) on the 5<sup>th</sup> post operative day. The comparison of effective pacing in the two groups showed no significant difference on 5<sup>th</sup> post operative day.

## DISCUSSION

Temporary invasive pacing of the myocardium is used for a variety of emergent and elective conditions<sup>4</sup>. Pacing electrodes are routinely inserted during certain cardiac surgical procedures such as bypass grafting and valve repair or replacement. Another common indication for insertion of a temporary pacemaker is recent myocardial infarction. Although treatment with  $\beta$ -blocking agents is considered an important intervention after recent myocardial infarction, the agents slow the heart rate markedly. In addition, serious brady arrhythmias often occur in patients with recent myocardial infarction even without drug therapy. These low heart rates interfere with successful recovery. Temporary pacing after myocardial infarction can be a lifesaving intervention, allowing patients to enjoy the benefits of  $\beta$ -blocker therapy while simultaneously maintaining an adequate heart rate and cardiac output<sup>5</sup>. Approximately 9% of the patients undergoing CABG require post operative pacing for transient high grade atrioventricular block or sinus bradycardia, although that incidence is probably higher in patients with reduced ventricular function<sup>6</sup>. Morin and colleagues<sup>7</sup> advised temporary pacing wires in all patients undergoing open heart surgery.

In actual clinical practice the timing for the removal of epicardial pacing varies widely. We studied to find out the most suitable time for removal of epicardial pacing wires post operatively and evaluated the effect of decreased left ventricular function on their efficacy.

We prospectively evaluated ventricular pacing threshold to determine if these electrodes are useful for a period of more than five days after cardiac surgery. In our study there was a significant decline in the usefulness of the pacing wires on the day one compared with day five in terms of increasing threshold for pacing and decreasing in sensitivity threshold. These findings are similar with other studies<sup>2,6</sup>. Moreover the post operative pacing and sensitivity thresholds did not differ significantly in respect of left ventricular ejection fraction. We conclude that the epicardial pacing wires have little usefulness after the fifth postoperative day and should be removed by this

time. In addition postoperative pacing threshold was not affected by the decreased left ventricular function.

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