Incidence and Predictors of Permanent Pacemaker Implantation after Valve Surgery – A Single Center Experience

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Introduction

- Approximately 2.2 % of patients undergoing cardiac surgery require permanent pacemaker implantation (PPMI) postoperatively. Patients who undergo valve surgery have higher incidence of PPMI (3-8%) as compared to the patients who undergo coronary artery bypass grafting (<1%).
- Identifying the patients who are at the high risk for post-operative PPMI is important to reduce the morbidity related to the post-operative conduction abnormalities and reducing the length of hospital stay.
- Several predictors of post-operative PPM implantations have been studied and observed. A risk score proposed by Koplan, et al. accounted for preoperative conduction, age, prior valve surgery, and surgery type. However, reliability of risk factors for PPM implantation have been inconsistent across various studies.
- Our research sought to determine the predictors which accounted for the increased risk of PPMI in valve replacement surgery.

Objectives

To identify the incidence and predictors of permanent pacemaker implantation in patients who undergo valve surgery.

Methods

- We performed a retrospective chart review of 197 consecutive patients who underwent valve replacement surgery at Lehigh Valley Health Network, an 880 bed academic community hospital in Allentown, PA up until June 2010.
- Inclusion criteria consisted of 197 consecutive valve replacement surgery patients, who received PPM within 30 days post valve surgery. Nineteen patients had PPMI. The 178 remaining patients served as controls.
- Risk factors, predictors and clinical outcomes were recorded for each patient. A statistical analysis was performed using chi-square, fisher's exact test, t-test, and logistic regression.
- Reasons for exclusion included patients with an indication for pacemaker implantation before the valve surgery, patients who died within 1 week of surgery and patients who underwent postoperative ICD implantation who did not have indication for the permanent pacing (i.e. Newer-generation ICDs are also equipped with a demand pacing system and are a combination of an ICD and a pacemaker – so they do not have true pacemaker indication).

Table 1. Demographic Characteristics

Variables	No Pacemaker (n=178)	PPMI (n=19)	p-value
Female Gender	74 (41.6%)	7 (36.8%)	.690*
Smoking History	64 (36.0)	3 (15.8)	.124*
Coronary Artery Disease	80 (44.9)	6 (31.6)	.264*
Diabetes Mellitus	45 (25.3)	6 (31.6)	.585†
H/O of CVA	20 (11.2)	0	.227†
Hypertension	136 (76.4)	15 (78.9)	1.0†
Hyperlipidemia	112 (62.9)	7 (36.8)	.027*

* Chi-Square test
† Fisher's Exact test

Table 2. Important Predictive Variables

Variables	No Pacemaker (n=178)	PPMI (n=19)	p-value
Beta Blocker	81 (45.5)	6 (31.6)	.245*
Ca Blocker	40 (22.5)	4 (21.1)	1.0†
Dig	9 (5.1)	2 (10.5)	.287 †
Antiarrhythmic	8 (4.5)	1 (5.3)	1.0†
Infective Endocarditis	8 (4.5)	0	1.0†
Redo Surgery	9 (5.1)	1 (5.3)	1.0†
Valve Repair	16 (9.0)	4 (21.1)	.109†
Valve + CABG	63 (35.4)	6 (31.6)	.740†
Valve + Aorta	26 (14.6)	2 (10.5)	1.0†
Re-Op same Hosp	9 (5.1)	0	.604†
RBBB - PRE	18 (10.2) n=177	7 (36.8)	.004†
LBBB - PRE	12 (6.8) n=177	2 (10.5)	.631†
Fascicular Block - PRE	11 (6.2) n=177	1 (5.3)	1.0†
IntraV Conduct Delay PRE	10 (5.6) n=177	0	.602†
Leaflet Calcification	73 (42.0) n=174	10 (52.6)	.372*
Emergent Procedure	3 (1.7)	1 (5.3)	1 (5.3)
Elective Procedure	174 (97.8)	18 (94.7)	.401†

* Chi-Square test
† Fisher's Exact test

Table 3. Clinical Outcomes

	No Pacemaker (n=178)	PPMI (n=19)	p-value
Periop MI	0	0	--
Periop Stroke	8 (4.5)	0	1.0†
Periop Death	3 (1.7)	0	1.0†

† Fisher's Exact test

Results

- Baseline Demographics including age, sex, CAD, DM and HTN were similar between the two groups (Table 1). 9.6% of Post valvular surgery patients underwent PPMI. Incidence of PPMI for aortic, mitral and multivalvular surgery was 8.3%, 17.6% and 15.4% respectively.
- Mean surgery to PPMI duration was 5.4 days.
- Presence of pre-operative right bundle branch block significantly increased the incidence of PPMI (P=.004). Being on rate control and anti-arrhythmic medications, other conduction abnormalities, degree of valvular stenosis and regurgitation, leaflet calcification, endocarditis, surgery type and prior valve surgery did not significantly increase the incidence of PPMI. (Table 2)
- Indications for PPMI were complete heart block (26.3%), persistent junctional rhythm (21.1%), sinus node dysfunction (31.6%) and atrial fibrillation with slow ventricular response (5.3%).
- Cardiac outcomes such as peri-operative MI, death and stroke were not significantly different between the two groups. (Table 3)

Conclusions

- Patient going for valvular surgery are at an increased risk for developing post-operative conduction system abnormalities requiring permanent pacing. Multiple valvular and mitral valve surgeries pose the greatest risk.
- Pre-operative conduction disease, specifically the presence of right bundle branch block, was associated with an increased risk of need for PPMI.
- Identifying the patients who are at the high risk for post-operative PPMI may be helpful in reducing the morbidity related to the post-operative conduction abnormalities and reducing the length of hospital stay. A larger study is needed to determine significance for other variables.

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