Section: Cardiology

Original Research Article

STUDY OF PREVALENCE AND CHARACTERISATION OF CAD IN PATIENTS REQUIRING PERMANENT PACEMAKER IMPLANTATION FOR SYMPTOMATIC BRADYARRYTHMIA AND ITS IMPACT ON MANAGEMENT STRATEGY

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Abstract

Background: This study was conducted to assess the prevalence and characterization of CAD in high risk patients requiring pacemaker implantation for symptomatic bradyarrhythmias. **Materials and Methods:** This study included 45 patients with symptomatic sinus node dysfunction or atrioventricular block, who were at high risk of CAD or had previously documented atherosclerotic cardiovascular disease (ASCVD). Coronary angiography was performed on same day of pacemaker implantation. CAD was defined as the presence of any degree of narrowing in at least one major coronary artery. Significant CAD was defined as more than 50% diameter stenosis. CAD was categorized as single vessel disease (SVD), double vessel disease (DVD), or triple vessel disease (TVD). **Result:** Out of 45 patients (mean age 64.6 years), 44% had CAD. 29 % had non obstructive CAD and 16 % had significant CAD. In Abnormal CAG 13 patients (28.8%) had single vessel disease (SVD), 6 patients (13.3%) had double vessel disease (DVD) and 1 patient (2.2%) had triple vessel disease (TVD). Presence of CAD significantly correlated with Diabetes Mellitus (p = 0.01). **Conclusion:** Angiographic CAD is observed in a substantial proportion of patients with symptomatic bradyarrhythmias and risk factors for CAD. Patients with normal CAG underwent PPI alone (55.5%), patients with <50% and more than 50 and less than 70% stenosis underwent PPI with OMT (38%) and patients with >70% stenosis underwent PPI along with PCI (4.5%). The patient with Triple vessel disease underwent PPI and referred for CABG (2%).

INTRODUCTION

Bradyarrhythmia is a common clinical occurrence and comprise of a variety of rhythm disorders including sinus node dysfunction (SND) and atrioventricular (AV) conduction blocks.[1,2] These disorders can result from various intrinsic and extrinsic conditions causing damage to the conduction system. Furthermore, bradycardia can be a normal physiologic response under certain circumstances (during sleep, healthy athletes). Clinical presentation of bradyarrhythmias ranges from asymp-tomatic electrocardiographic (ECG) findings to a broad array of symptoms which may be typical (syncope, near syncope) or atypical (dyspnea, angina, dizziness, fatigue, lethargy).[2] Symptoms can be either permanent or intermittent and unpredictable. Many individuals with conduction system disorder are asymptomatic and never seek medical attention.[3,4]

The prevalence of coronary artery disease (CAD) in chronic conduction disorders has been reported to be 15–70%, depending on patient's characteristics and the diagnostic modality used to detect CAD.[5–8] Although dobutamine stress echocardiography (sensitivity – 88%, specificity – 92%) and exercise thallium-201 myocardial SPECT (sensitivity – 94%, specificity – 31%) have been used to diagnose CAD in patients with transvenous pacemakers, coronary angiography remains the 'gold standard' for confirming diagnosis[8] Beyond its possible causative role, the presence of CAD makes the prognosis of

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conduction disorder worse.[9,10] Moreover, since patients with symptomatic complete heart block or sick sinus node dysfunction may not develop angina owing to their low heart rate, the underlying CAD may remain undiagnosed or underdiagnosed, which in turn may have serious implications on their clinical outcomes despite treatment of bradycardia with permanent pacemaker implantation. This study was conducted with an aim of assessing the prevalence and characterization of CAD in high risk patients requiring permanent pacemaker implantation for symp-tomatic bradyarrhythmias and its impact on management. To the best of our knowledge, there is very limited data of such nature available among Indian population. We believe that it is important and useful to have such data for formulating appropriate method of care in such patients.

MATERIALS AND METHODS

This hospital based prospective observational study, was conducted in the Department of Cardiology, Government Rajaji Hospital, Madurai for a period of 1 year. All consecutive patients requiring permanent pace-maker implantation for symptomatic sinus node dysfunction or Atrio Ventricular blocks who fulfilled the eligibility criteria were enrolled. All consenting patients >18 years of age with symptomatic sinus node dysfunction / AV conduction disorders; Patients deemed to be at high risk for CAD or previously documented ASCVD; Patients with two or more than two conventional risk factors including hypertension; type-2 diabetes mellitus; history of angina; smoking; dyslipidemia; positive family history of CAD; Previous history of ASCVD, including CAD (documented on angiography), stroke, transient ischemic attack (TIA), peripheral vascular disease (PVD), , percutaneous coronary intervention (PCI), coronary artery bypass grafting (CABG) were included in the study.

Patients with Acute illness including acute coronary syndrome (ACS), myocarditis, infective endocarditis or sepsis; History of chronic diseases known to cause conduction disturbances like connective tissue disorders, infiltrative disorders, muscle dystrophies or systemic malignancies; Intake of drugs known to cause bradyarrhythmias like digoxin, beta blockers, calcium channel blockers or anti-arrhythmic medications; Presence of severe anemia, coagulopathy, end stage renal disease (ESRD) , dyselectrolemia or thyroid disorders; Patients with congenital heart disease (including congenital heart block), valvular heart disease or cardiomyopathy; History of allergy to contrast agents were excluded from the study.

A detailed history including presenting symptoms, past history, family history of CAD or conduction disorders, history of atherosclerotic risk factors and drug history was taken from all patients. Complete physical examination including cardio- vascular examination was then performed. Base line investigations including electrocardiogram (ECG), complete blood count, kidney function tests, liver function tests, serum electrolytes, lipid profile, fasting blood sugar, thyroid profile, coagulation profile were obtained. Echocardiography to rule out significant structural heart disease or cardiomyopathies and to assess left ventricular function was also done in all the cases. Risk calculation was done according to the Framingham coronary heart disease risk score and only patients having high risk (10 year CHD risk _20%) were included in the study. Pacemaker implantation, coronary angiography (CAG) was performed via trans-radial or trans-femoral approach. The angiograms were assessed by two independent interventional cardiologists who were blinded to the clinical details of the patients.

Coronary artery disease was defined as the presence of any degree of narrowing in at least one major coronary arteries [left anterior descending (LAD), left circumflex (LCx), right coronary artery (RCA)] or their branches. Significant CAD was defined as >50% diameter stenosis in any of these vessels, while <50% diameter stenosis was labelled as non-significant CAD. CAD was categorized as single vessel disease (SVD), double vessel disease (DVD), or triple vessel disease (TVD) according to number of major branches with atherosclerotic involvement. We also studied the correlations of various clinical and demographic variables with the presence or absence of CAD in these patients.

Statistical analysis was performed by SPSS software package (version 22.0, SPSS Inc, Chicago, Illinois, USA). All continuous variables were expressed as mean and SD, and categorical variables were reported as frequency and percentages. Group comparisons were performed with Student t-test or crosstabs. The Chi-square test or Fisher exact test was used for categorical variables. A p-value of <0.05 was considered statistically significant.

RESULTS

During the study period of 1 year, a total of 45 patients with symptomatic bradyarrhythmias requiring permanent pacemaker implantation and at high risk of CAD or previously documented ASCVD were enrolled in the study. The mean age of our patients was 61.6 years with patients ranging from 27 to 81 years. Majority of the patients belonged to 61-70 years' age group (35. 5%).Out of 45 patients, 22 were males and 23 were females. Complete heart block was present in 17 patients, 28 patients had sinus node dysfunction. Out of 45 patients, 20 (44.4%) were documented to have abnormal CAG (coronary angiography) while 25 had normal CAG. Association between age group and coronary angiographic findings was found to be statistically significant (p value <0.05) while the association between gender and coronary angiographic findings was not statistically significant. Of all the patients, majority (38%) were diagnosed to have Complete Heart Block

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–Suprahisian type. Among all the factors, association between Diabetes and coronary angiographic findings was found to be statistically significant (p value-0.01). In terms of the number of vessels involved, 13 patients (28.8%) had single vessel disease (SVD), 6 patients (13.3%) had double vessel disease (DVD) and 1 patient (2.2%) had triple vessel disease (TVD). Among all patients with single vessel disease, nearly half of the patients had significant involvement (>50 % stenosis) while among double vessel disease patients more than half had significant involvement. One patient with Triple Vessel Disease had significant involvement. Among all patients with single vessel disease, majority had Left Anterior Descending (LAD) involved similarly in double vessel disease patient's majority had LAD and Right Coronary Artery (RCA). In triple vessel disease, the only patient had all three arteries (LAD, LCX, RCA) significantly involved.

With respect to clinical symptoms, majority presented with syncope. Among the risk factors for CAD, large group of patients presented with Hypertension followed by Diabetes and Smoking. The statistical association between Diabetes and CAD was found to be significant. Among patients with abnormal CAG, 26.7% patients had minimal and 18% patients had significant stenosis.

Of all the patients, all patients were undergoing PPI irrespective of CAG, patients with normal CAG underwent PPI alone (55.5%), patients with <50% and 50-70% stenosis underwent PPI with OMT (38%) and patients with >70% stenosis underwent PPI along with PCI (4.5%). The patient with Triple vessel disease underwent PPI and was referred for CABG (2%).

Table 1: Association between age group and Gender with Coronary Angiography findings.

Age group	Coronary Angiographic findings			P value
	Normal	Abnormal	Total	
<40	1 (4%)	0 (0%)	1 (2.2%)	0.04 (fischer exact test)
41-50	6 (24%)	1 (5%)	7 (15.6%)	
51-60	6 (24%)	6 (30%)	12 (26.6%)	
61-70	7 (28%)	9 (45%)	16 (35.6%)	
>71	5 (20%)	4 (20%)	9 (20%)	
Gender				
Male	9 (36%)	13 (65%)	22 (49%)	0.06 (chi square test)
Female	16 (64%)	7 (35%)	23 (51%)	

Table 2: Association between ECG Diagnosis and ECHO picture with Coronary angiographic findings.

ECG diagnosis	Coronary Angiographic findings n (%)		Total n (%)	p value
	Normal	Abnormal		
AVblock-20	0	1(5%)	1(2.2%)	0.8
Sinus node dysfunction	7 (28%)	4 (20%)	11 (24.4%)	
Complete Heart Block-Suprahisian	9 (36%)	8 (40%)	17 (37.8%)	
Complete Heart Block-Infrahisian	9 (36%)	7 (35%)	16 (35.6%)	
ECHO findings				
Hypokinesia	4 (16%)	7 (35%)	11 (24.4%)	0.1
No Regional Wall Motion Abnormality with concentric LVH	5 (20%)	4 (20%)	9 (20%)	
No Regional Wall Motion Abnormality	16 (64%)	9 (45%)	25 (55.6%)	

Table 3: Association between Clinical profile and Coronary angiographic findings.

Symptoms	Coronary Angiographic findings		Total	P value
	Normal	Abnormal		
Chest pain	7	6	13	0.88
Dyspnea	9	9	18	0.5
Syncope	16	7	23	0.06
Palpitations	8	8	16	0.6
Co-morbid illnesses				
Hypertension	17	15	32	0.6
Diabetes Mellitus	6	12	18	0.01
Smoking	8	10	18	0.2

Table 4: Distribution of lesions among patients based on number of vessels involved.

Disease	Vessel involved	Number of patients	Significance
Single Vessel Disease	Left Anterior Descending (LAD)	12	Significant: 4 Non-significant: 8
	Right Coronary Artery (RCA)	1	Non-significant
Double Vessel Disease	LCX and RCA	1	Significant

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	LAD and RCA	5	Significant: 2 Non-significant: 3
Triple Vessel Disease	LAD,LCX and RCA	1	significant

Table 5: Distribution of patients based on severity of stenosis.

	Number of patients
Normal	25 (55.5%)
Minimal	12 (26.7%)
Significant	8 (17.8%)
Total	45 (100%)

Table 6: Severity of Coronary Artery Disease and their outcomes

CAG findings	Number of patients	Outcome
Normal CAG	25	PPI (55.5%)
<50 % stenosis	12	PPI and OMT (37.8%)
50-70% stenosis	5	
>70% stenosis	2	PPI and PCI (4.5%)
>70% stenosis Triple Vessel Disease	1	PPI and CABG (2.2%)

DISCUSSION

Our study showed Angiographic CAD was observed in nearly half (44%) of the patients requiring permanent pacemaker implantation for symptomatic bradyarrhythmias and risk factors for CAD, and nearly one third (40%) had significant CAD (>50% stensosis).

Most of the patients belonged to the 61-70 years' age group. The number of female participants was slightly more than male participants while most studies used only male participants. Bruek et al,[7] performed coronary angiography non selectively in 507 patients with symptomatic bradyarrhythmias and found incident CAD in 71% of these patients and Alai et al study showed CAD at 45% similar to our study (45%).

Jayaram et al,[11] showed 12% involved of LAD while our study showed 40% involvement of LAD. Similar to Alai et al study, majority of our study participants presented with syncope as the symptom.

Of all the patients, patients with normal CAG underwent PPI alone (55.5%), No patients were deferred from PPI and CAG did not affect the planned pacepamaker implantation procedure, patients with <50% and 50-70% stenosis underwent PPI with OMT (38%) and patients with >70% stenosis underwent PPI along with PCI (4.5%). The patient with Triple vessel disease underwent PPI and referred for CABG (2%). Many studies didn't report the modality of treatment for such patients.[12]

CONCLUSION

Angiographic CAD is observed in a substantial proportion of patients with symptomatic bradyarrhythmias and risk factors for CAD. It could be argued that these patients should undergo a coronary work-up before pacemaker implantation. Diagnosis and appropriate management of concomitant CAD is likely to improve the long term prognosis of these patients, over and above the benefits derived from pacing. 6.

Limitations

The present study had some important limitations.

This was a single center study with a small sample size, and there was no control group. Therefore, extrapolation of these results to general population requires further validation from larger prospective multi-center studies.

Patients who were admitted only for permanent pacemaker implantation were included in the study. The association of CAD with asymptomatic and less severe conduction disturbances needs to be studied further.

Long term follows up needs to be done to quantify the prognostic benefit derived from revascularization in this patient group.

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