Research Article

THE EFFECT OF SINGLE CHAMBER RIGHT VENTRICULAR PACING ON THE CLINICAL PROFILES, QRS MORPHOLOGY AND QRS DURATION

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ABSTRACT

To assess the impact of single chamber right ventricular pacing on the clinical profiles, QRS morphology and QRS duration on electrocardiogram. This prospective study was conducted to evaluate clinical profile, QRS morphology and QRS duration of patients are having a atrioventricular disease, undergoing single chamber pacemaker implantation between November 2017 to January 2019 at UNMICRC, Ahmedabad, Gujarat. All patients were followed up biannually. At each follow-up visit clinical features were assessed, and pacemaker interrogation, electrocardiography was done. Results: Out of 135 patients, 98 patients completed 12 months follow -up and were included in final analysis. Mean age was 65.92 ± 9.64 years with 60.2% male. Most common comorbidity was hypertension (49.5%) followed by diabetes mellitus type II (24.5%), coronary artery disease (9.2%), hypothyroidism (4.1%) and cerebro vascular accident (2.0%). The Commonest indication for pacemaker was complete heart block (85.7%) followed by high degree Atrioventricular (AV) block (14.3%). 35.7% and 40.8% patients had presyncope and syncope. About 16.3% and 7.1% patients had New York Heart Failure Association (NYHA 2) and (NYHA 3) grade dyspnea. In the present study, baseline QRS was 155.63 ± 15.70 ms which increased to 164.79 ± 10.69 ms at 12 month follow- up (p = 0.0001). All except 4 patients had Left Bundle Branch Block (LBBB) on baseline of electrocardiogram ECG. The QRS duration increases over one year follow- up. The patients remain asymptomatic for heart failure and arrhythmias on follow-up.

Keywords: COVID-19, QRS, ECG, ventricular, heart disease, pacemaker.

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INTRODUCTIION

Sick sinus syndrome and complete heart block are the most common causes of cardiac syncope, which can easily be correctable by a pacemaker. Furman S et al. illustrated that trans-venous endocardial cardiac pacing with a pacemaker electrode placed in the right ventricle (RV) apex was a lifesaving technique [1]. Trans venous cardiac pacing became life saving device for the management of life-threatening symptomatic heart block. RV apical pacing is traditionally used for ventricular pacing because of its stable position and reliable pacing. [2, 3.]

Placement of pacing lead in RV apex produces iatrogenic block in Left Bundle Branch (LBBB) which can produce an abnormal late activation of the lateral wall of the LV. This electrical dyssynchrony can induce differential muscle strain, and fiber shortening which can lead to increase work load and oxygen demand. This mechanical dyssynchrony can alter cardiac hemodynamics and cause ventricular remodeling due to neuro-hormonal and electrophysiological changes. This electrical and mechanical dyssynchrony can lead to systolic dysfunction, and diastolic dysfunction of LV [4-6]. These effects are more clinically related to pacing-dependent patients with preexisting LV dysfunction the time of pacemaker insertion.[7- 8.]

Aims- To evaluate the clinical, electrocardiographic, and echocardiographic
Changes of single chamber right ventricular pacing at 1 year of prospective follow- up[9]

Objective- To assess effect of single chamber right ventricular pacing on clinical profile, QRS morphology, and QRS duration on electrocardiogram.[10]

MATERIAL AND METHOD

This prospective study was undertaken to evaluate clinical profile, LV function, QRS morphology, and

QRS duration of patients having a atrioventricular disease, undergoing single chamber pacemaker implantation between November 2017 to January 2019 at UNMICRC, Ahmedabad, Gujarat. Informed consent was taken from every patient prior to the conducting of the study. Ethical clearance was obtained from the Institutional ethical committee.

Inclusion criteria

1. All patients with atrioventricular block undergoing single chamber pacemaker implantation at UNMICRC between 2017 to 2019.
2. All patients willing to undergo regular evaluation and regular echo screening.

Exclusion criteria

1. Structural heart disease (including ,valvular, congenital, ischemic heart disease)
2. RV pacing on follow- up less than 90 %
3. Patients who are not willing to give informed consent.
4. Patients who are not willing for echo screening

METHODS

The clinical evaluation of the patients requiring permanent pacing was done as per the standard guidelines, and institute protocol. After pacemaker implantation patients data was collected immediately post pacemaker implantation and then at 15 days, 6 months, and after one year of follow-up.

Clinical Profile

Complaints on follow- up were noted and effort tolerance using NYHA score was evaluated.

Electrocardiography

Twelve lead ECGs were digitally recorded using Mac commercial system. Maximum value from among all leads, averaged over three consecutive beats was considered as the QRS duration. .

Follow -up

All patients were followed-up biannually. At each follow up visit clinical features were assessed, and pacemaker interrogation, electro cardiography, and echo cardiography were done.

RESULTS

Total 135 patients were registered in the study. All patients had successfully undergone fluoroscopic guided single chamber pacemaker (VVI) implantation without any procedural complication with more than 90 % RV pacing and had right ventricular apical lead placement.

Out of 135 patients, 98 patients completed 12 months follow-up was included in final analysis, while 37 patients were excluded from study. 6 patients died during a follow-up (2 patients died due to known bronchogenic carcinoma, while in 4 patients cause of death was unknown). Remaining patients had either <90% ventricular pacing on follow up, incomplete data or had coronary artery disease related to MI and LV dysfunction on follow up and were eliminated from the study. Baselines characteristics of study population are shown below Age group wise distribution has been shown in table 1.

Table 1: Age wise distribution of patients

| Age group	No of cases	Percentage (%)
31 to 40	1	1.0
41 to 50	5	5.1
51 to 60	26	26.5
61 to 70	37	37.8
71 to 80	23	23.5
81 to 90	6	6.1
Total	98	100.0
Mean $\pm$ SD	65.92 ± 9.64	

Figure 1: Age wise distribution of patients
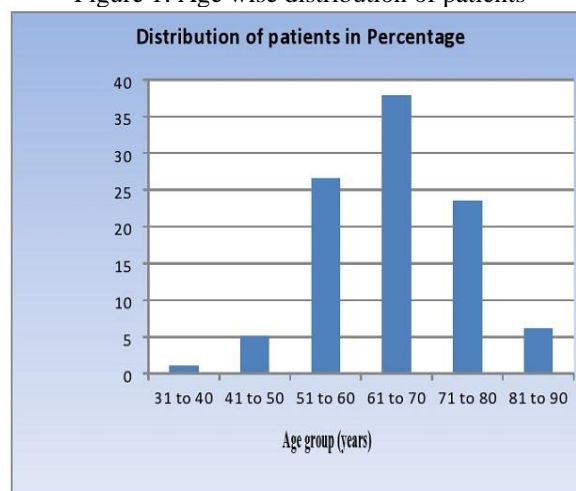
Mean age of patients was 65.92 ± 9.64 years. Majority of patients were in 7th (37, 37.8%) and 6th decade (26, 26.5%).

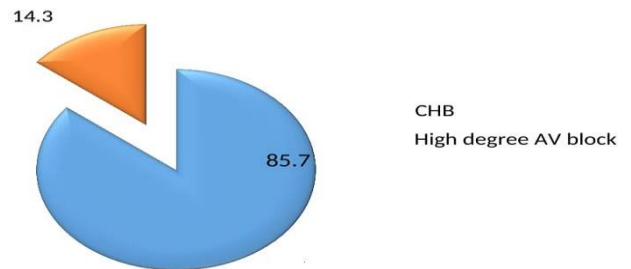Table 2: Gender wise distribution of patients

Gender	No of cases	Percentage (%)
Male	59	60.2
Female	39	39.8

Figure 2: Gender wise distribution of patients
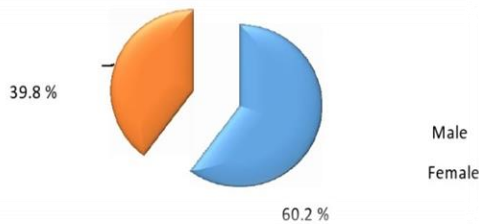
Out of 98 patients, 59 patients (60.2%) were male
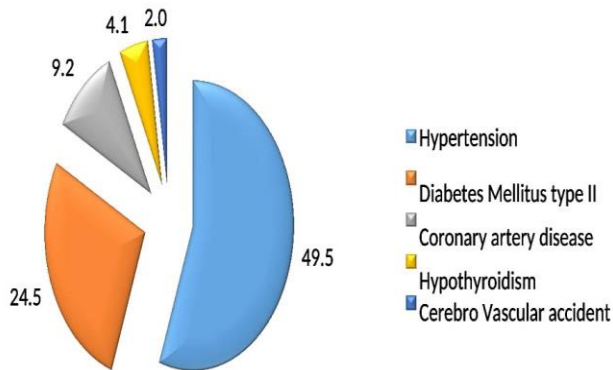
Table 3: Distribution of patients according to comorbid condition

Comorbidity	No of cases	Percentage (%)
Hypertension	48	49.5
Diabetes Mellitus type II	24	24.5
Coronary artery disease	9	9.2
Hypothyroidism	4	4.1
Cerebro Vascular accident	2	2.0

Figure 3: Distribution of patients according to comorbid condition

Out of 98 patients, half of patients (48, 49.5%) had hypertension. Other commonest comorbidities were diabetes mellitus type II (24, 24.5%), coronary artery disease (9, 9.2%), hypothyroidism (4, 4.1%) and cerebro vascular accident (2, 2.0%).

Table 4: Distribution of patients according to diagnosis

Diagnosis	No of cases	Percentage (%)
Complete heart block	84	85.7
High degree AV block	14	14.3

Figure 4: Distribution of patients according to diagnosis

Most common indication for pacemaker was complete heart block (84, 85.7%) followed by high degree AV block (14, 14.3%).

Table 5: Comparison of symptom at 12 months follow-up

Symptom		Baseline	12 month	p value
Pre syncope		35 (35.7%)	0 (0.0%)	< 0.0001
Syncope		40 (40.8%)	0 (0.0%)	< 0.0001
Dyspnea	NYHA 1	75 (76.5%)	98 (100.0%)	< 0.0001
	NYHA 2	16 (16.3%)	0 (0.0%)	
	NYHA 3	7 (7.1%)	0 (0.0%)	

Figure 5: Comparison of symptom at 12 months follow-up
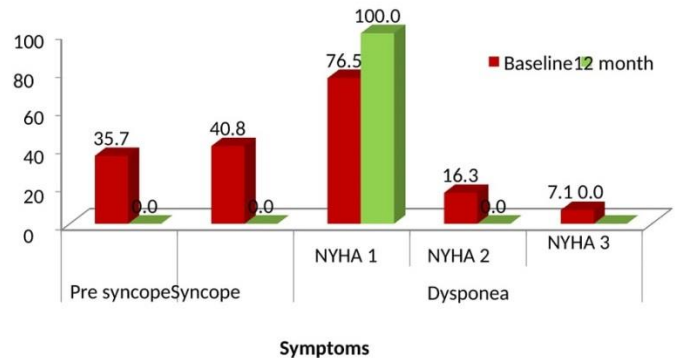
Initially 35 (35.7%) and 40 (40.8%) patients had presyncope and syncope. About 16 (16.3%) and 7 patients (7.1%) had NYHA 2 and NYHA 3 grade dyspnea. After 12 months, no one had any symptoms.

Table 6: Change in variable during different follow-up time

Variable	Baseline	6 months	12 months	p value
QRS (ms)	155.63 ± 15.70	158.91 ± 11.28	164.79 ± 10.69	0.0001

Table 7: p value of variable for comparison during different time point

Variable	Time point of follow up	p value
QRS	Baseline v/s 6 month	0.07
	Baseline v/s 12 month	0.0001
	6 month v/s 12 month	0.0001

Figure 6: Change in QRS during different follow up time
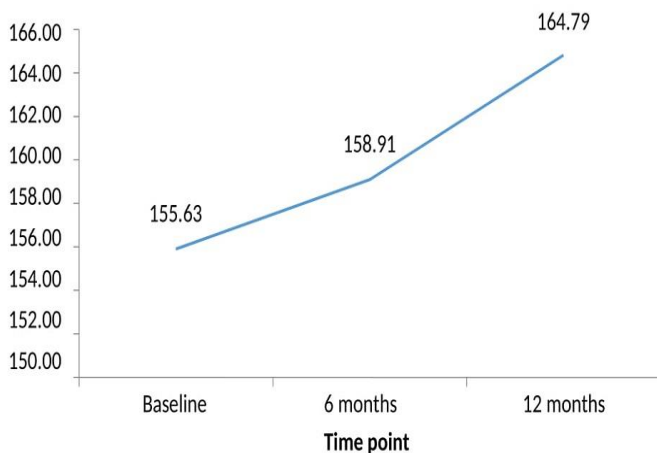
Baseline QRS was 155.63 ± 15.70 ms which was significantly increased to 164.79 ± 10.69 ms at 12 month follow up (p = 0.0001). All except 4 patients had LBBB on baseline ECG. Four patients had RBBB pattern in pacing

DISCUSSIONS

In our prospective study out of 135 patients, 98 patients completed 12 months follow-up and were included in final analysis. Mean age was 65.92 ± 9.64 years with 60.2% male. Most common comorbid condition was hypertension (49.5%) followed by diabetes mellitus type II (24.5%), coronary artery disease (9.2%), hypothyroidism (4.1%) and cerebro vascular accident (2.0%). Most common indication for pacemaker was complete heart block (85.7%) followed by high degree AV block (14.3%).

Sharma G et al. 9 included 48 patients who completed 12months of follow up. Mean age of the patients was 56.21 ± 12.04 years with 58.33% male patients. Most common associated disease was hypertension (47.9%), CHD (14.6%), diabetes (12.5%), valvular heart disease (4.2%). Complete heart block was the commonest indication for pacing (91.66%) followed by sick sinus syndrome (8.33%).

Silva RT et al. 10 evaluated 75 patients with pacemaker implantation. Mean age of the group was 70.9 ± 14 which was higher than our study group. Proportion of male (22.6%) was also lower than our study group. The most frequent heart diseases in their study were Chagas heart disease (33%) and hypertensive heart disease (32%). Mean LVEF before PM insertion was 72%, and LVEDD was 46 mm. Sixty-nine patients (92%) were belongs to NYHA functional class I or II; six patients were in class III and no patient was in class IV.

In our present study, 35.7% and 40.8% patients had presyncope and syncope. About 16.3% and 7.1% patients had NYHA 2 and NYHA 3 grade dyspnea. In our study paced QRS duration was far less than that in other studies suggesting possibly RV apical and septal placement of the lead. This observation could be explained by various factors. Right ventricular pacing

induced adverse left ventricular remodeling with normal baseline left ventricle function may be manifest after a long period. Our study had follow-up of 12 months only as compared to other clinical studies. In our study, population was relatively young as compared to western studies, which could also have affected the outcomes.

Zhang XH et al. 11 prospectively analyzed the prevalence and clinical predictors for the development of new-onset HF after long-term RV apical pacing in patients with acquired atrioventricular (AV) block in 304 patients who required permanent pacing. The RV apical pacing was associated with HF in 26% of patients . The prolonged QRS duration and the presence of coronary artery diseases independently associated with new-onset HF. Heart Failure after RV apical pacing was increases the cardiovascular mortality.

In the present study, baseline QRS was 155.63 ± 15.70 ms which increased to 164.79 ± 10.69 ms at 12 month follow up (p = 0.0001). In most of the western studies, paced QRS duration was more than 180 msec. In the present study, proportion of patients with QRS > 150 ms (64.2%) was higher than QRS < 150 ms (35.7%).

LIMITATIONS

This study was a single center non-randomized observational study involving small study group with a relatively short follow-up duration. We did not systematically assess and analyze echocardiographic parameters of LV dyssynchrony and structural remodeling. Manual measurement of QRS duration and LVEF measurements at different times are vulnerable to inter and intra observer variability.

SUMMARY AND CONCLUSION

In the present study, 98 patients with implantation of pacemaker who completed 12 months follow- up were enrolled.
- ➢ Mean age was 65.92 ± 9.64 years with 60.2% male.
- ➢ More prevalent comorbid condition was hypertension (49.5%) followed by diabetes mellitus type II (24.5%), coronary artery disease (9.2%),

hypothyroidism (4.1%) and cerebrovascular accident (2.0%).

➢ Most common indication for pacemaker was complete heart block (85.7%) followed by high degree AV block (14.3%).

➢ No patients had developed congestive heart failure or atrial fibrillation at 12 months of follow-up.

➢ Paced QRS had a significantly increased at 12 months of follow-up.

Our is a prospective study of 98 patients without any structural heart disease, who were implanted with single chamber pacemaker with RV apical pacing and having pacing of more than 90%, over a one year follow- up period. The patients remain asymptomatic for heart failure and arrhythmias on follow-up. The QRS duration increases over one- year follow -up.

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