

Original Research Article

Clinical profiles of patients undergoing permanent pacemaker implantation in a tertiary care hospital in India

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ABSTRACT

Background: Despite an increase in the number of permanent pacemaker implantations in India over the last few decades, there are no systematic nationwide database recording the rate of implantation of permanent pacemaker, clinical conditions or types of pacemakers used for PPM implantation in India.

Methods: A total of 5341 patients, admitted in the department of cardiology, Institute of Post Graduate Medical Education and Research, West Bengal, India from April, 2019 to August 2023 and received a permanent pacemaker were included in the study. Objective of the study was to provide information about the clinical profile and indications of patients receiving permanent pacemaker implantation (PPI).

Results: Most (67%) of the recipients among the study population were males. The mean (\pm SD) age of patients in the present cohort was 63.59 ± 11.82 years. The most frequent type of pacemaker used in this institution was VVIR (86.2%). The mean impedance for DDDR type pacemakers was 599.7 ± 109.19 (range =416-1074) for ventricle and 915.9 ± 116.2 (range =525-1240) for the atrium, while the threshold of DDDR type was 0.5 ± 0.3 (range =0.1 -3) for ventricles and 0.3 ± 0.2 (range =0.1-1.3) for the atrium. For VVIR type of pacemakers, the impedance for ventricles was 918.5 ± 131.1 (range =120-1620), while the threshold for ventricle was 0.3 ± 0.2 (range =0.1-2.2). The commonest indication of pacemakers were AV blocks (69%), of which the commonest was complete heart block (59.7%).

Conclusions: In conclusion, male population were implanted with a higher number of pacemakers than females. No difference in age was noted among males and females in terms of the age of implantation. Use of single chamber VVIR types were higher than the dual chamber due to the pattern of government supply of pacemakers. Most common indication for pacemaker implantation was degenerative complete heart block.

Keywords: Atrioventricular block, Permanent pacemaker implantation

INTRODUCTION

Permanent pacemaker implantation is the mainstay of treatment or prophylaxis in the management of symptomatic brady-arrhythmias caused by electrophysiological dysfunctions like sinus node disease, atrioventricular (AV) node disease.¹ There has been an increase in the number of pacemaker implantations throughout the world, including India.² The 11th world survey of cardiac pacemaker and implantable devices, conducted in 2009, reported that approximately 20,000 PPMs were implanted annually in India.³

Although several studies on the clinical profile of the patients undergoing pacemaker implantation are available in Western literature, there are not many studies from this part of the world.⁴ Not surprisingly, there are no systematic nationwide database recording the rate of implantation of PPM, clinical conditions or types of pacemakers used for PPM implantation in India.⁵ The present study was undertaken to provide information about the clinical profile and indications for permanent pacemaker implantation (PPI) in a tertiary care hospital in India.

METHODS

This was an institutional based observational study. The present study was conducted in the department of cardiology, Institute of Post Graduate Medical Education and Research, West Bengal, India. Data of the patients were retrieved from the registry of cardiac catheterization lab retrospectively who were received permanent pacemaker between the study period from April, 2019 to August 2023. Patients, who received a permanent pacemaker based on the ACC/AHA/HRS guidelines for device-based therapy of cardiac rhythm abnormalities for brady-arrhythmias.⁵ Patients with other CIEDs were excluded from the study. 5341 patients who had received permanent pacemaker were included in the study. Routinely collected data on age, sex, indication for pacing and type of pacemaker implanted were recorded on electronic spread sheet (Microsoft Excel, Redmond) and statistical analysis was done using the SPSS Version 20 software (SPSS INC, Chicago, III). Continuous variables were presented as mean±standard deviation, while categorical variables were presented as proportions

or percentages. Ethical permission was obtained from the Institution Ethics committee.

RESULTS

A total of 5341 pacemaker were implanted in the above maintained period. Most (67%) of the recipients of permanent pacemakers among the study population were males. The most frequent type of pacemaker used in this institution was VVIR (86.2%) (Table 1).

Table 1: Table showing the distribution of study population based on sex and type of pacing (n=5341).

Variables	Level	Frequency	Percentage
Sex	Male	3578	67
	Female	1763	33
Type of pacing	DDDR	737	13.8
	VVIR	4604	86.2
Total		5341	100.0

Table 2: Age distribution of the study population (n=1781).

Age	Mean±SD	Minimum	Maximum	Chi square/t-test	P value
Male	64.56±11.34	17	96	4.956	0.000*
Female	61.63 ±12.53	14	90		
Total	63.59±11.82	14	96		

Table 3: Mean and standard deviation of pacing impedance and threshold voltages based on the type of pacing.

Type of pacing	DDDR (n=738)	VVIR (n=4604)	Total (n=5341)
Impedance of ventricle	599.7±109.1	918.5±131.1	874.7±168.9
Impedance of atrium	915.9±116.2		
Threshold of ventricle	0.5±0.3	0.3±0.2	0.3±0.2
Threshold of atrium	0.3±0.2		

Table 4: Indications of PPM in the study population (n=1781).

Indications	Levels	Total n (%)
AV blocks	1 degree AV block	5 (0.1)
	2:1 AV block	454 (8.5)
	3:1 AV block	32 (0.6)
	4:1AV block	5 (0.1)
	CHB	3190 (59.7)
	Total	3686 (69)
AF with severe bradycardia		16 (0.3)
Bundle branch block	LBBB	326 (6.1)
	RBBB	123 (2.3)
	BFB	502 (9.4)
	Tri-fascicular block	42 (0.8)
	Total	993 (18.6)
Junctional bradycardia		11 (0.2)
Carotid sinus hypersensitivity		5 (0.1)
Sick sinus syndrome		630 (11.8)
Total		5341 (100)

The mean (\pm SD) age of patients in the present cohort was 63.59 ± 11.82 years. The minimum age of patients was 14 years (female patient) while the highest age was 96 years (male patient). While in males the mean (\pm SD) age was 64.56 ± 11.34 years, in females the mean (\pm SD) age was 61.63 ± 12.53 years. The difference in the ages were statistically significant (Table 2).

The mean impedance for DDDR type pacemakers was 599.7 ± 109.19 (range =416-1074) for ventricle and 915.9 ± 116.2 (range =525-1240) for the atrium, while the threshold of DDDR type was 0.5 ± 0.3 (range =0.1-3) for ventricles and 0.3 ± 0.2 (range =0.1-1.3) for the atrium. For VVIR type of pacemakers, the impedance for ventricles was 918.5 ± 131.1 (range =120-1620), while the threshold for ventricle was 0.3 ± 0.2 (range =0.1-2.2) (Table 3).

The commonest indication of pacemakers were AV blocks (69%), of which the commonest was complete heart block (59.7%). The second most common group were the bundle branch group with 18.6% of patients. In the bundle branch block group, the commonest cause was left bundle branch block (LBBB) at 6.1%. Sick sinus syndrome was the cause of PPM in 11.8% of the patients. (Table 4).

DISCUSSION

There has been a gradual increase in the implantation of pacemakers since it was first introduced in 1958.¹ With increases in the number of insertions, there has also been an expansion of the indications for pacemaker insertions. To cater to the different needs, the pacemakers have undergone structural changes with several additional and improved features for better management of illnesses and compliance.

The dual chamber pacemakers are more physiological. However, prohibitive costs, self-financing for dual chamber pacemakers in contrast to government supply single chamber types, and lack of expert manpower, makes the single chamber pacemakers the more widely inserted pacemakers in India.² Since the present study was conducted in a government institution in West Bengal, the choice of pacemakers was to a large extent limited by the types of pacemakers supplied by the government; which in most cases were the VVIR type. Pacemaker choices reflect the underlying economic issues in healthcare and lack of health insurance in developing countries, like India.²

The mean age of patients in the present cohort was 63.59 ± 11.82 years. In their study, Jain et al reported the mean age of study group as 64.71 ± 14.75 years, similar to the present study, while Kumar et al reported a mean age of 60.1 years in their study.^{4,5} The youngest patient was only 4 years old in their study compared to the minimum age of 14 years seen in the present study.⁵ In another study from Maharashtra, Desmukh also reported a similar

mean age of the study population.⁸ Our study found a statistically significant lower age of pacemaker insertion in females. This is also in contrast to the findings of the 11th world survey where males underwent pacemaker implantation at a lower age than females.³

Most (67%) of the recipients of pacemakers among the study population were males, similar to the study from a single tertiary care institution in Karnataka, where male (56.8% compared to females at 43.2%).⁵ A study from a single academic centre in Greece reported 54% males among their study population.² The 11th world survey for cardiac devices also reported a predominantly higher male population at 68%.³

The commonest indication of PPM in most studies, from India was complete heart block, with varying prevalence between 68 to 80%.³⁻⁵ Sick sinus syndrome was the cause of PPM in only a small percentage of cases (8-16%).^{2,4,5} It has been suggested that in India, most permanent pacemaker insertions are reserved for life threatening events like AV blocks and not for the sick sinus syndrome, that do not decrease life expectancy.^{4,5,10} Studies from other developing countries like Nepal also reported similar observations.^{3,4} In contrast, in the USA, Brady et al, found that the commonest indications for pacing were A-V block (52%) and sick sinus syndrome (48%).⁵ The Netherland Pacemaker registry showed sick sinus syndrome as the commonest indication (42.3%) for pacemaker implantation, followed by heart block (38.9%) while the Swedish pacemaker registry reported atrioventricular conduction disorders (38%) as the commonest cause followed by sick sinus syndrome (34%).^{3,4}

The study was a single centre study and may not be representative of pacemaker insertions at other centres, given the various types of treatment centres throughout the country. Being a retrospective study, the study is subjected to all limitations of such studies. Also, the data analysed was over a very short period of time and larger studies involving several years will give a more accurate picture. No data on the co-morbidity of the patients were noted on the records during the year, which could have added valuable information.

CONCLUSION

In conclusion, male population were implanted with a higher number of pacemakers than females. No difference in age was noted among males and females in terms of the age of implantation. Use of single chamber VVIR types were higher than the dual chamber due to the pattern of government supply of pacemakers. Most common indication for pacemaker implantation was degenerative complete heart block.

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