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Original Research Article

Characteristics, indications and complications in patients undergoing permanent pacemaker implantation: a single centre study

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ABSTRACT

Background: To determine the demographic details, indications, type of pacemakers and complications in patients undergoing the permanent pacemaker implantation.
Methods: This was a single-center, retrospective study conducted in at a tertiary-care center in India. The records of 200 patients who had undergone implantation of permanent pacemakers in the period of May 2016 to April 2018 were reviewed.
Results: Total 200 patients with mean age of 67 years were paced. Of these 120 (60%) were males. The mean duration of hospital stay was 6.5 days. Sinus node disease (105 patients, 52.5%) was the most common indication for permanent pacemaker insertion. Single chamber (VVIR) pacing mode (125 patients, 62.5%) was found to be the most common pacing mode used for pacemaker insertion. Among the 200 patients complications were observed in 8 patients (4%). Of these 8 patients, pneumothorax (4 patients, 2%) was found to be the most common complication for permanent pacemaker implantation followed by local site infection (1 patient, 0.5%). Only 1 patient (0.5%) died during the observation period of the study.
Conclusions: Geriatric population with male predominance have observed to commonly undergo permanent pacemaker implantation. Sinus node disease in the elderly patients is the most common indication for cardiac pacing followed by atrioventricular block. Single chamber (VVIR) pacing mode is commonly used followed by dual chamber (DDDR) due to economic reasons in India. Pacemaker implantation is a relatively safe procedure with a low complication rate.

Keywords: Atrioventricular block, Left bundle branch block, Pacemaker, Pneumothorax, Sepsis, Sinus node disease

INTRODUCTION

Pacemakers or artificial pacemakers (PMs) are small electronic medical devices, which use the electric impulses delivered by the electrodes that sense intrinsic heart rhythm and provide electric stimulation when indicated. The purpose of cardiac pacing is to maintain adequate heart rate. The pacemaker can either be temporary or permanent.[1,2] Temporary PMs are used to treat short-term heart rhythms and permanent PMs are used to control long-term heart rhythms. The number of permanent pacemaker insertions has been steadily increasing worldwide over the years.[1,3-6] For instance, UK reports a 10-year average annual growth rate of 4.7% in permanent pacemaker implantation.[1]

The incidence of permanent pacemaker implantation increases with age.[4] The median age of implantation as reported in various studies conducted globally ranges from 64 to 77 years with a male predominance; and the percentage of male patients ranging from 53.5 to 60%.[7,8,4,9,10]

Majority of the patients undergoing permanent pacemaker implantation belong to the geriatric age group.[9] Hence, bradyarrhythmias requiring permanent pacemaker implantation form an important cause of geriatric morbidity. The guidelines outlining the indications for permanent pacemaker implantation are available from the American Heart Association and the European Society of Cardiology.[11,12]

The most common indications for a permanent pacemaker insertion are atrio-ventricular (AV) block and sick sinus syndrome with AV block responsible for 45-80% of pacemaker implantations in various studies.[9,10]

Permanent pacemaker implantation is a minimally invasive procedure with a generally low complication rate mostly between 4-6.1%.[1,13,14] Complications are categorized into early and late. The rate of acute complications is 4-5% and late complications are 2.7%.[13] The most common complications include pneumothorax (1-3%) and lead dislodgement.[15-17] Mortality occurs rarely (0.08-1.1%).[1]

This study was conducted to review the demographic characteristics, indications, type of pacemakers and complications in patients undergoing permanent pacemaker implantation at a tertiary-care center in India.

METHODS

This was a single-center, retrospective study conducted at a tertiary-care center in India. The records of 200 patients who had been implanted with permanent pacemakers in the inclusive period of May 2016 to April 2018 were reviewed.

The permanent pacemaker insertion was performed in the cardiac catheter laboratory by a team comprising of a consultant cardiologist, a cardiac technician, a cardiac nurse and a radiographer.

Antibiotics were given post-operatively through intravenous route (Inj teicoplanin 400mg IV once daily) for 4 days followed by oral antibiotics (Tab cefuroxime axetil 500mg and Tab linezolid 600mg) for one week. The patients were also prescribed with oral anti-inflammatory agents and analgesics.

The procedure was performed under local anaesthesia. The left subclavian vein route was used for pacemaker insertion in most of the patients but one of the consultants used the right subclavian vein in 4 patients when vascular access through the left Subclavian route was found difficult. The patients were advised limb immobilisation for 24hours post-operatively.

Chest radiography was usually performed on the third post-operative day and pacemaker was checked prior to discharge from the hospital. Subsequent follow up was on outpatient department (OPD) basis.

RESULTS

Total 200 patients with an age range of 39–95 years were paced. Of these**,** 120 (60%) were males (age range 52–95 years). The mean duration of hospital stay was 6.5 days post-pacemaker implantation with a range of 3-15 days.

Indications

Table 1 shows the indications for pacemaker implantation with involvement of associated blocks. Sinus node disease was the most common (105 patients; 52.5%) indication for permanent pacemaker insertion followed by AV block (95 patients; 47.5%).

Of the 95 patients who had AV block, 61 patients (30.5%) were associated with complete heart block, 21 patients (10.5%) had trifascicular block, 5 patients (2.5%) had left bundle branch block (LBBB), 4 patients (2%) had bifascicular block and 4 patients (2%) had 2:1 block. Among the 200 patients, 39 patients (19.5%) had temporary pacemaker implantation.

Table 1: Baseline demographic details of all the patients.

Characteristics	Patients, (N=200)
Age, (mean (range), years)	67 (39-95)
Male, n (%)	120 (60%)
Indications	
Sinus node disease, n (%)	105 (52.5%)
AV block, n (%)	95 (47.5%)
Complete heart block, n (%)	61 (30.5%)
Trifascicular block, n (%)	21 (10.5%)
Left bundle branch block, n (%)	5 (2.5%)
Bifascicular block, n (%)	4 (2%)
2:1 AV block, n (%)	4 (2%)
Temporary pacemaker implantation	39 (19.5%)
Modes of pacing used	
VVIR pacing, n (%)	125 (62.5%)
DDDR pacing, n (%)	57 (28.5%)
VVI pacing, n (%)	17 (8.5%)
VDDR pacing, n (%)	1 (0.5%)
Hospital stay, (mean (range), days)	6.5 (3-15)

AV block: atrioventricular block

Modes of pacing

The VVIR was found to be the most commonly used mode of pacemaker among the study population accounting for 125 patients (62.5%), followed by DDDR pacing mode in 57 patients (28.5%), VVI and VDDR pacing modes were used in 17 patients (80.5%) and 1 patient (0.5%) respectively. The modes of pacemaker used for pacing are demonstrated in Table 1.

Complications

Among the 200 patients complications were observed in 8 patients and the overall complication rate was found to be 4%. Of these 8 patients, 4 patients (2%) had pneumothorax and had to undergo chest tube insertion subsequently. One patient (0.5%) had local site infection after 7 months of pacemaker insertion for which the pacemaker was removed from the original site in the left subclavian fossa and had to be reimplanted in the right subclavian fossa under the cover of antibiotics. One patient (0.5%) had sepsis possibly secondary to pulmonary infection for which he received antibiotics and inotropic support and recovered subsequently. One patient (0.5%) had lead displacement and had to undergo repositioning of the lead on the 3rd post-permanent pacemaker implantation day.

Only 1 patient (0.5%) died during the observation period of the study. The patient was in a state of encephalopathy prior to the insertion of the pacemaker and remained in altered sensorium in the post-operative period. He remained violent in the recovery ward and died suddenly on the same day in the night possibly due to lead dislodgement and subsequent cardiac arrest. Complications in pacemaker implantation of all the patients are shown in Table 2.

Table 2: Complications in pacemaker implantations of all the patients.

Complications	Patients, (N=200)
Pneumothorax, n (%)	4 (2%)
Local site infection, n (%)	1 (0.5%)
Sepsis, n (%)	1 (0.5%)
Lead displacement, n (%)	1 (0.5%)
Death, n (%)	1 (0.5%)
Total, n (%)	8 (4%)

DISCUSSION

This study was conducted to review the demographic details, indications, type of pacemakers and complications in patients undergoing permanent pacemaker implantation. In this report the mean age of pacemaker implantation in the study population was 67 years. This implies that pacemaker implantation is primarily required in the geriatric age group which is similar to the age distribution in the UK.[18] Permanent pacemaker implantation remains the only effective treatment for symptomatic bradycardia.[9] This is in accordance with the reports published worldwide and reiterates that bradyarrhythmias requiring permanent pacemaker implantation constitute an important cause of geriatric morbidity.[8,9,19] This report also revealed male predominance (60% of the study patients were males) amongst the patients requiring permanent pacemakers. This is comparable to age distribution reported worldwide.[1,10]

In USA, sinus node disease is the primary indication for pacemaker implantation in over 50% of patients.[20] Elderly patients with sick sinus syndrome or AV block are treated with pacemaker implantation.[21] The most common indication for permanent pacing in this study was sinus node disease (52.5%) followed by AV block (47.5%). This is in contrast to earlier reports that indicate AV block to be the more common indication for pacemaker insertion. This difference can possibly be explained by the more widespread availability of 24hr Holter recording as compared to previous years that has improved the pick-up rate of sinus node disease in the general population. In this report it showed that complete heart block (30.5%) was the most common indication for AV block and it was comparable to that reported in the earlier studies.[7,9,10]

Harrigan RA et al, showed that temporary cardiac pacemaker is a life-saving procedure in the emergency department as it can definitely control the heart rate and provide adequate cardiac output in selected circumstances.[22] Among the 200 patients, 19.5% had temporary pacemaker implantation at the time of presentation in the emergency department prior to permanent pacemaker implantation. This indicates that permanent pacemakers are implanted for survival in a large number of patients in India and not just for the improvement of quality of life as is the trend in western countries.

The single chamber VVIR is the more common pacing mode (62.5%) as compared to dual chamber DDDR pacing mode (28.5%). This is similar to the data obtained from earlier reports from developing countries.[10,23-26] This is in contrast to the trend observed in developed nations and reflects the underlying economic issues in healthcare and lack of health insurance in developing countries. This further implies that permanent pacemakers are implanted mainly when they are essential for survival rather than for an improved quality of life as is prevalent in the general population in India.

In this report subclavian route was used in most of the patients which remains the most widely employed route for pacemaker implantation.[27,28] Permanent pacemaker implantation is a relatively safe procedure as indicated by the low complication rate of 4% in this study. This rate is similar to the rates reported worldwide.[5,13,14] Iatrogenic pneumothorax requiring chest tube insertion was the most common complication in the post-operative period (2%) which was comparable to the rates prevalent worldwide.[3,13-15] Lead displacement, local site infection and sepsis were other complications noted in the post-operative period, each having a rate of 0.5%. Only 1 death occurred in the study population (0.5%). This suggests that mortality occurs rarely due to permanent pacemaker implantation (0.08-1.1%).[5] The mean duration of the hospital stay was 6.5 days, implying that permanent pacemaker implantation has a low peri-operative and post-operative morbidity.

CONCLUSION

The results of the present study concluded that it was evident that geriatric population constitutes the major bulk of permanent pacemaker implantation with male predominance (60%). Sinus node disease and AV block are the two most common indications of pacemaker implantation. VVIR pacing mode is the most common pacing mode used in India due to economic reasons. Temporary pacemaker insertions are often required prior to permanent pacemaker implantation at the time of presentation in the emergency department for immediate survival of patients. Pacemaker implantation is a relatively safe procedure with a low complication rate, low peri-operative and post-operative morbidity and mortality.

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