

Trends In Permanent Pacemakers' Implantation: Where Do We Stand?

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Author's Contribution

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ABSTRACT

Objective: To determine the Trends In Permanent Pacemakers' Implantation: Where Do We Stand?

Methodology: The study was conducted at cardiology department The study was conducted in the cardiology department at Hayat Abad medical complex Peshawar from 2008 to 2017. In this study the retrospectively data was analyzed to see the trend in the rate of annual implantation of permanent pacemaker's and patient's demographics. Data for the study was extracted from the hospital records of cardiac devices implantation. All the information was recorded via study proforma. Analysis of the data was done by the SPSS version 20.

Results: Total 1670 procedure were analyzed retrospectively. Mean age of patients at the time of implantation was 60.47 ± 16.357 Std Deviation. Single chamber devices were 1030 and dual chambers pacemakers remained 535 in the study population. Complication rate remain 2.2% during the procedure. 62.8% devices were implanted on payment from patients and the rest 37.2% on donation from various resources. The trend of single and dual chamber devices remain constant in the study period. However dual chamber devices implantation ratio increased in 2017 due to donation of devices and government sponsorship scheme.

Conclusion: There is a significant increase in the implantation of cardiac devices, the trend closely follows the financial status of patients and the supply of devices from various donor agencies.

Keywords: Permanent Pacemakers' (PPM), cardiac implantable electronic devices (CIED), pacing mode.

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Introduction

Permanent Pacemakers' (PPM) implantation is an integral part of cardiology. There are clear guidelines for the type of permanent pacemakers' implantation. But due to various local, financial and technical constrains, the trends of implanting devices keep on changing according to local available facilities and expertise. We retrospectively reviewed cardiac implantable electronic devices (CIED) to define contemporary trends in PM implantation.

Low socioeconomic factors¹, sedentary life style, unhealthy food habits² and job oriented increased mental stress³ on one hand and the demographic shift toward an

older population⁴ has opened the door of a new epidemic in cardiac diseases all over the world.⁴ Coronary artery diseases are the leading cause of morbidity and mortality.⁵ Similarly new revolution in the management of congenital heart diseases increased the burden of adult population with congenital heart diseases.⁶ Together these are responsible for increasing the burden of implantation of cardiac electrical devices. These include devices both for diagnosis and management of different cardiac condition. Apart from other devices, there is an increasing trend in the implantation of permanent pacemakers⁷ (PPM) as an unavoidable procedure in cardiology to save life. Rates of permanent pacemaker (PPM) insertion increase with age, with an estimated 70–

80% of all PPMs being implanted in patients 65 years of age or older.⁸ There are worldwide increased in life expectancy and ageing, most evident in the developed countries⁹. This is associated with increased in the rates of PPM and other cardiac devices implantation in most countries around the world.¹⁰ Pacemaker technology has advanced from fixed-rate single-chamber pacemakers to dual-chamber pacemakers with pacing algorithms to enhance rate response and to minimize ventricular pacing.¹¹ Therefore, in most cardiac condition where PPM implantation is indicated dual chambers devices are class I indication. However The Medicare National Coverage Determination for permanent pacemaker, which emphasized single-chamber pacing, has not changed significantly since 1985 due to different reason at various places.¹² Similarly the rising incidence and declining mortality contribute to increasing rate of implantation, with the associated burden of replacement of devices in addition to initial insertions.¹³ Mostly the pacing leads are predominantly trans-venous, bipolar, and active fixation.¹⁴ However epicardial, unipolar leads are still in used. The past decades have seen trans-venous tine leads mostly and still in use in few centers.

Limited data exist regarding temporal trends in permanent pacemaker (PPM) and other CIEDS devices implantation for our population. We conducted a retrospective study to evaluate cardiac pacemaker implantation trends, contemporary medical practice and to emphasize on the disparity between international policies of devices implantation and the prevalent status of implantation at our region.

Methodology

It was an observational study. The study was conducted at Hayat Abad medical complex Peshawar from 2008 to 2017 after obtaining approval from the ethical committee of postgraduate medical institution Peshawar. A written informed consent was obtained from the patients after explaining the procedure to them. Non probability method was adopted for sample collection and WHO calculator was used for sample calculation. About 1670 patients who presented to our department for implantation of PPM were included in the study. Patients who presented for box change due to depletion of pulse generator were excluded from the study. Patient received dual chamber pacemakers or single chambers pacemakers on the basis of device indication, affordability of patients and the availability of devices from different donation sources tabulated in table II. All patients had base line

investigation including full blood counts (FBC), renal function test (RFTs), random blood sugar (RBS), and virology. Patients were brought nil by mouth to the catheterization laboratory. The data so collected was retrospectively analyzed for the trends of implantation of cardiac devices in our population. SPSS version 22 was used for calculation of frequency, mean, and mode. Mean + SD was calculated for quantitative variables like age of patients. Frequencies and Percentages was calculated for categorical variables like type of device and donor agency from where the devices were received for the patients.

Results

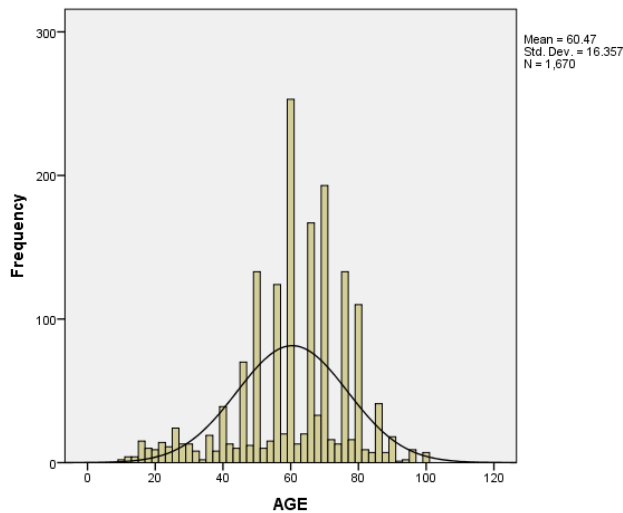
Total 1670 procedure were analyzed retrospectively. Male patients were 962 (57.6%) and female 708 (42.4%). Age of the patient ranged from 10 years to 100 years (age histogram figure I). Mean age of the cases of implantation was 60.47 ± 16.35 years. Single chamber devices were 1030 (61.7%) and dual chambers pacemakers remained 535 (32%) in the study population. Complication rate was 2.2% during the procedure. 62.8% devices were implanted on payment from patients and the rest 37.2% on donation from various resources including zakat/batulmal funds, sehat (health) card from government sponsor scheme, poor free from department of cardiology and from donation from other sources (table II). The trend of single and dual chamber devices implantation was not very much different during this whole period. However dual chamber devices implantation ratio increased in 2017 due to donation of devices and government sponsorship scheme on sehat card.

Table 1: Type of Devices Implanted During the Study Period

		DEVICE TYPE	
		Frequency	Percent
Valid	VVI/VVIR	1030	61.7
	DDD/DDDR	535	32.0
	AICD	49	2.9
	CRTP	45	2.7
	CRTD	10	.6
	REVEAL LOOP RECODER	1	.1
	Total	1670	100.0

Table II: Source of Payments For Implantation of Cardiac Devices

Economic Status		Frequency	Percent
Valid	Batul mal	8	.5
	Entitle	162	9.7
	Paid	1049	62.8
	Poor free	99	5.9
	Zakat	241	14.4
	Donation	53	3.2
	Social security	1	.1
	Sehat card	57	3.4
	Total	1670	100.0

**Figure 2: Age Histogram of Patients at Time of Procedure.**

Discussion

Like raising trend of permanent pacemaker's implantation in the rest of the world,¹⁵ pacemaker's implantation has increased enormously in our population. Despite advancement in Pacemaker technology from fixed-rate single-chamber pacemakers to dual-chamber pacemakers with pacing algorithms to enhance rate response and to minimize ventricular pacing¹⁶ and biventricular pacing¹⁷ and single and dual chambers AICDs/CRT-Ds¹⁸ to improve survival and functional class, the trends of device implantation has not changed significantly since 1985.¹⁶ Although DDD device use is increasing, whereas single-chamber ventricular pacemaker use is decreasing in most of the develop part of the world.¹² The costs associated with pacemaker implantation are also rising all around the world.¹² This cost and standard indication; there are disparities in the

use of dual-chamber pacing, based on the type of hospital and health insurance policies in different part of the world.¹²

In their report on the Pacemaker Selection in the Elderly (PASE) trial there was no specific quality-of-life benefit for patients undergoing dual-chamber pacing as compared with those undergoing single-chamber pacing.¹⁹ This conclusion is reached despite the fact that 26 percent of the patients assigned to the VVIR mode crossed over to the DDDR mode after symptoms of the pacemaker syndrome in the trial.¹⁹ But cost of the device is a big issue in most part of the world; where patient do not have any insurance. The cost of pacemaker systems was highly variable from country to country. Dual-chamber devices are more expensive. However a detailed analysis of the real long-term costs of pacing has shown, surprisingly, that single-chamber pacemakers are actually more costly than dual-chamber devices. Several retrospective and prospective studies have suggested that subsequent atrial fibrillation and congestive heart failure are much more common with prolonged single-chamber pacing than with dual-chamber pacing,²⁰ which not only increases the cost of management but leads to Co-morbidities and poly-pharmacy is a big issue in elderly population.²¹ The battery drain is greater with dual-chamber pacemakers than with single ventricular pacemakers. However, individual variations in pacemaker programming have made these differences more difficult to demonstrate.²² The incidences of complication reported by different researchers are differently. In some studies the rate of complications were more with dual chambers pacemakers²² while other reported the same rate of complication for single and dual chambers pacemakers.²³

The same raising trend was observed at our center in the last 10 years. The implantation was more in the 6th and 7th decade, however it was not respecting any age and the age limit at our center was from 10 years to 100 year. A few cases of children below 5 years were received and were referred to Pediatrics cardiology. The ratio of male population remains dominant for implantation of CEID. Mostly single chamber devices were implanted and the main reason was financial issue at the time of implantation. Most of the patient who were suitable candidates for dual chambers pacemaker received single chamber devices due to financial constrains as most of our population are not having any health insurance policies. The implantation of other CEID devices, apart from permanent pacemakers remained very low due to

the same affordability issue. Screwing lead was used in most cases though in very few cases in the early two years of the past decade, we used tine lead and occasionally it was seen in explantation procedures but was not used after 2014 in implantation of permanent pacemakers. About 92% patients were from our own country and 8% from other place particularly Afghanistan. The complication rate at our center was 2.2% and pneumothorax was one of the leading complications with 1% rate. For more than 62% of implantation the payment was provided by the patient. Possibly this was the reason for low implantation rate of dual chamber pacemakers in our study.

Conclusion

To sum up the implantation of pacemakers in our population increased in the past one decade. Mostly single chamber pacemakers were implanted irrespective of the indication for pacing. This disparity was due the financial restraint of the patients. Though there were indications mostly for dual chamber pacemakers. But there is a raising trend in the cost of dual chamber pacemaker's implantation. So government sponsorship scheme for poor population will decide the future trend of devices.

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