

Review of Indications for Pacemaker insertion in Cardiac Patients

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Abstract

Permanent pacemaker insertion is a recognised mode of therapy for cardiac arrhythmias. The procedure is carried out regularly at the Cardiac Catheterization Laboratory of Madras Medical Mission India. Certain conditions are expected as indications for this procedure. This study described the pattern of pacemaker insertions and the indications over a period of years.

This study was carried out in the Cardiac Electrophysiology department, of the Institute of Cardiovascular diseases, Madras Medical Mission, India. The study was retrospective using data of patients seen at cardiac interrogation between January to July of 2013 which were reviewed. 501 consecutive cases were chosen for analysis. A analysis was done using SPSS statistical software version 15.

The 501 patients had carried pacemaker for variable durations over the past two decades. They comprised 321 males and 180 females. Atrio-ventricular block (AVB) was the most common indication (298, 59.5%) followed by Sinus node dysfunction (74, 14.8%). Dual chamber pacemakers were most commonly utilized and the use of defibrillators and biventricular pacemakers increased over the years.

From this study we concluded that AVB disease and sinus node dysfunction were the major indications for permanent pacemaker insertion over two decades. Dual chamber pacemakers were most commonly utilized while utilization of defibrillators and biventricular pacemakers increased over the period of study.

Key-words: Review of indications, cardiac paced patients,

Introduction

The first permanent pacemaker was inserted in 1958 by Ake Senning, a thoracic surgeon at the Karolinska Hospital in Stockholm.¹ Over the years, the indications, techniques, affordability as well as type of cardiac pacemakers have evolved.² It is currently estimated that, worldwide, about 3 million persons are on cardiac pacemakers.³

Changing epidemiographic profile in the developing countries with increase in cardiovascular risk factors is also well documented.⁴ Lifestyle change has been especially rapid in many developing countries over the past two decades. The result is an upsurge in cardiovascular diseases.⁵⁻⁶ This supports ongoing research in cardiovascular disease pattern. Appreciation of current trends in cardiac diseases is of public health concern. It is expected that public policy makers as well as individuals adopt the benefit of such research into making choices that lead to better cardiac health outcomes.

We reviewed the demographic profile of patients seen at cardiac pacemaker interrogation at one of the largest tertiary care centres in South-east Asia, the indications for cardiac pacemaker insertion, and the changes in pattern of pacemaker use over the duration of study.

Methods:

We retrospectively studied records of consecutive ablations carried out between January to October 2009, and studied the follow up record over the years. In our study, we described the demographic characteristics of the patients treated by radio frequency ablation and the indication for the procedure. The study was carried out at the Cardiac Electrophysiology department, of the Institute of Cardiovascular diseases, Madras Medical Mission, India. The data was obtained from the records of the Cardiac Electrophysiology department.

The data obtained was analysed using SPSS statistical software version 15. Categorical data was compared using the Chi-square-test while continuous data was compared using T-test. Probability levels of less than 0.05 were considered significant.

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Results:

A total of 501 patients were interrogated with age range of 4-91 years (61.69 ± 16.60). Of these, 321 (64.1 %) were males. 370 (73.9%) had their implantation done at MMM. The duration following implantation varied from one week to 22.25 years, with a mean duration of 3.24 years (± 3.28). The distribution in years is shown in Table 1

Fifty-five different pacemaker models were used, comprising Adviza MRI 4, Guidant Contack Renewal 10, Guidant Insignia 14, Medtronic Consulta 10, Medtronic Adviza 34, Boston Scientific Altrua 18, Medtronic Syncra 8, Medtronic Sigma 72, St. Jude Accent 10, Medtronic kappa 6, Medtronic Sensia 57, Medtronic relia 45, Medtronic Maximo 23, Medtronic Virtuoso 1, Vitatron 3, InSync Medtronic 14, Medtronic Secura 5, BiotronikAxios 2, Medtronic Adapta 22, Intermedics 1, Medtronic Protecta 11,

Medtronic (brand unspecified) 9, St Jude ADXLR 3, Boston Scientific 10, Biotronic Evia 9, Guidant Vitality 2, St Jude ATLAS 6, St Jude Current 8, Medtronic Versa 1, Medtronic Enrhythm 2, Guidant Altrua 13, St Jude Identity 24, St Jude Quadra 1, Energen 1, St Jude Regency 8, BiotronicLumax 2, Boston Teligen 3, St Jude Fortify 1, Medtronic Ensura 1, St Jude frontier 1, Medtronic prevail 1, St Jude Zephyr 4, Pirouet Vitatron 1, Medtronic KSR 1, St Jude Anthem 5, Guidant Ventak Prizm 1, Medtronic Surescan 1, St Jude VeritySR 2, Medtronic Entrust 1, Cogins Guidant 1, Medtronic Consulta 5, Philos SLR 1, Medtronic Carelink 1, St Jude (unspecified) 1.

The distribution of devices implanted with the pacing modes are shown below in Table 2 while Table 3 shows the indications for pacemaker insertion.

The difference in indication over the duration of the study was not statistically significant ($p=0.041$).

Table 1: Distribution of patients in duration since implantation.

Duration	No.	%	Conventional pacemaker	AICD	CRT	CRT-D
			$(p=0.108)$			
2009-2013	326	65.1	229	49	35	15
2004-2008	126	25.1	105	7	12	3
1999-2003	36	7.2	31	4	0	1
1994-1998	8	1.6	8	0	0	0
1989-1993	2	.4	2	0	0	0
Total	501	100.0	375	60	47	19

AICD= Automatic implantable cardioverter-defibrillator

CRT=cardiac resynchronisation therapy,

CRT-D=cardiac resynchronisation therapy with defibrillator

Table 2: Devices implanted with distribution of pacing modes

Mode	Procedure				Total
	Conventional pacemaker	AICD	CRT	CRT-D	
VVI	83	36	2	0	121
DDD	174	13	35	10	232
VVIR	23	5	0	1	29
AAIR-DDDR	8	1	0	0	9
DDDR	78	4	10	8	100
AAI-DDD	3	1	0	0	4
AAIR	1	0	0	0	1
VDD	3	0	0	0	3
DDIR	1	0	0	0	1
DDI	1	0	0	0	1
Total	375(74.9%)	60 (12%)	47(9.4%)	19(3.8%)	501

AICD= Automatic implantable cardioverter-defibrillator CRT=cardiac resynchronisation therapy, CRT-D=cardiac resynchronisation therapy with defibrillator,

Table 3: Indications for Pacing over the duration of study

Indications	No.	%	2009-2013	2004-2008	1999-2003	1994-1998	1989-1993
AVN disease	279	55.7	183(55.8%)	68(53.5%)	23(63.9%)	4(50.0%)	1(50.0%)
Sinus node dysfunction	74	14.8	40(12.2%)	28(22.0%)	4(11.1%)	1(12.5%)	1(50.0%)
Tachyarrhythmias	47	9.4	36(11.0%)	7(5.5%)	4(11.1%)	0	0
AH	49	9.8	37(11.3%)	11(8.7%)	1(2.8%)	0	0
ACHD	17	3.4	8(2.4%)	6(4.7%)	1(5.6%)	1(12.5%)	0
Long QT syndrome	2	.2	1(0.3%)	1(0.8%)	0	0	0
Bifascicular block	10	2.0	5(1.5%)	2(1.6%)	1(2.8%)	2(25%)	0
Cardiomyopathy	9	1.8	8(2.4%)	1(0.8%)	0	0	0
HCS	1	.2	0	1(0.8%)	0	0	0
Undefined	15	3.0	10(3.0%)	3(2.4%)	1(2.8%)	0	0
Total	501	100.0	328	127	36	8	2

AH= abnormal hemodynamics, ACHD=Adult congenital heart disease,HCS=Hypersensitive carotid sinus

AVB was distributed as follows: degenerative complete heart block (CHB) 138 (46.3%), idiopathic CHB 44 (14.7%), postoperative CHB 35(11.7%), high grade AVB 20 (6.7%), post radiofrequency ablation CHB 15(5.0%), congenital CHB 10 (3.4%), symptomatic 2:1 AVB 9(3.0%), sick sinus syndrome (SSS) with CHB 3 (1.0%), intermittent CHB 9 (3.0%), intermittent CHB with 2:1 AVB 5(1.7%), intermittent CHB with Mobitz II AVB 3(1.0%) and Mobitz II AVB 2(0.7%). The following were each seen in 1 patient (0.3%): post radiofrequency ablation high degree AVB, Atrio-ventricular nodal(AVN) and infra-hisian disease, post radiofrequency ablation 2:1 AVB.

Among those with Sinus node dysfunction, 23 (31.1%) had documented tachy-brady syndrome (TBS), 10(13.5%) had sick sinus syndrome with AVN disease, 4(5.4%) had Atrial fibrillation(AF) with fast ventricular rate, 2(2.7%) for AF with low ventricular rate and 1 (1.4%) had dilated cardiomyopathy (DCM) and severe left ventricular dysfunction. 1 (1.4%) had associated CHB.

Of the 10 patients with bifascicular block, 5 had symptomatic trifascicular block, 2 had trifascicular block with intermittent CHB, while hisian and infra-hisian disease, Infrahisian disease, and combined AVN, His bundle and trifascicular block were each noted in a single patient.

Of the 49 patients with abnormal hemodynamics, DCM was present in 40, LBBB in 36 patients. 14 had associated severe ventricular dysfunction while CHB was present in one.

Among the 9 patients with cardiomyopathy 6 presented with ventricular tachycardia(VT), 2 has post operative CHB(post septalmyomectomy), while one presented with syncopal attacks.

Among the 18 patients with adult congenital heart(ACH) disease, 1 was paced following cardioversion for ventricular fibrillation while 17 presented with post-operative complications: CHB (15), 2:1 AVB (1) and bradycardia (1). The ACH diseases include ventricular septal defect/patent ductus

arteriosus 7, atrial septal defect 3, Transposition of great vessels 3, Tetralogy of Fallot 2, dextrocardia 1, double outlet right ventricle 1, VSD/pulmonary stenosis 1.

Forty-seven patients had tachyarrhythmias. 43 had recurrent or sustained VT while 1 had ventricular fibrillation, they were mostly resuscitated following cardiac arrest. Two had nonsustained VT while 1 had Atrial flutter with fast ventricular rate.

Of the 14 classed undefined 8 were resuscitated following cardiac arrest, 4 had presented with recurrent syncopal episodes and diagnosis was missing in 2.

Only 8 (1.6%) patients had received epicardial leads. Five patients had initial epicardial leads, with endocardial implantation following expiraion elective replacement interval (ERI) of epicardial pacemaker. two patient had dual epicardial leads, while one had a left ventricular epicardial lead. Three patients were on remote monitoring.

Discussion

There was no significant change in major indications for pacemaker insertion over the duration of study. AVB remained the most frequent indication, followed by sinus node dysfunction. The number of pacemakers inserted between 1989-1993 was too small for significant comparison. There was increased use of ICD and CRT in the most recent years. Among patients who were implanted between 1989-1998, none had received ICD or CRT. Dual chamber pacemakers were also by far the most commonly utilized, DDD and DDDR together accounting for 332 pacing modes out of 501. Medtronic models were more commonly used, comprising 331 of the 501 pacemakers.

The classification of indications used in this study followed the 2008 ACC/AHA/HRS 2008 Guidelines.⁷ This explains why acute myocardial infarction (AMI) is not used as an indication class. Most cases that followed AMI were included under AVN disease, of which a great percentage (37.99%)

were associated with coronary artery disease. The classification also explains the relatively low percentage with cardiomyopathies (1.8%) as many cases of dilated cardiomyopathies had ventricular dysfunction and were classed under abnormal hemodynamics. Some cardiomyopathies had also presented as tachyarrhythmias and were grouped as such. These highlight the imperfection of current classification criteria, complexities being created by use of pathological as well as electrophysiological entities as classification headings.

Conclusion

This study shows that had AVN disease and sinus node dysfunction remained the major indications for permanent pacemaker insertion over two decades. Dual chamber pacemakers were most commonly utilized and utilization of defibrillators and biventricular pacemakers increased over the years. The study is of economic importance to manufacturers, creates more awareness of interventional cardiology in developing countries and encourages continued development of manpower.

Limitations

The retrospective nature that made it difficult to fill up missing data and all indications for pacing do not fit neatly into current complex classifications.

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