Natural History of Symptomatic Sinus Node Disease After Permanent Ventricular Pacing

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Abstract

- **Background-** Patients with symptomatic sinus node disease require a permanent pacemaker to relieve symptoms. This study was conducted retrospectively in patients who had received a ventricular pacemaker for sick sinus syndrome and was designed to analyze the incidence of complications and long-term survival in sinus node disease treated with ventricular pacing.
- **Patients and Methods-** Eighty-two adult patients between the ages of 20 and 90 years old with symptomatic sinus node disease who received a permanent ventricular pacemaker between 1979 and 1996 at our department were followed to determine the natural history of the disease. 31 had coronary artery disease, 26 had hypertension, 7 had rheumatic valvular heart disease, and diabetes and mitral valve prolapse were present in 7 and 2 patients, respectively. The etiology was unknown in 9 patients.
- **Results-** 3 patients had died during this period because of congestive heart failure and ischemic heart disease. There was a distinct trend toward poor survival in those with congestive heart failure and old age.
- Conclusion- The long-term prognosis of symptomatic sinus node disease after permanent ventricular pacing depends on: 1) etiology of underlying heart disease, 2) ventricular function prior to implant, and 3) specific arrhythmias. (Iranian Heart Journal. 2002; 2(4)&3(1): 39-43)

Keywords: sinus node disease < permanent pacemaker implantation < natural history

C inus node disease is manifested by Deither intermittent or persistent severe sinus bradycardia, sinoatrial block or sinus arrest.^{1,3,4} In its symptomatic stage, patients may have pre-syncope or syncope, due to supraventricular palpitation arrhythmias or congestive heart failure.^{2,5,6} Sinus node disease may be associated with coronary artery disease, valvular or congenital heart disease or cardiomyopathy, but many patients have apparent etiology.⁷ This report no history describes the natural of symptomatic patients with sinus node

disease who received a ventricular pacemaker at our department.

Methods

All adult patients who received their initial permanent pacemaker implantation for symptomatic sinus node disease at our department between March 1979 and February 1996 comprised the subjects of this report. All patients had received a ventricular demand pacemaker (VVI mode), which was the routine modality during that period. Diagnosis of sick sinus

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syndrome was made on clinical and grounds^{1,3,8} electrocardiographic and supplemented by electrophysiologic testing in some patients. Selected variables history, from the clinical course, electrocardiograms and Holter monitoring and follow up information were derived from patients' medical records. All patients were assessed at intervals of 6-12 months in the outpatient clinic.

The etiology of the underlying heart disease in each patient was classified according to clinical data at the time of initial pacemaker implantation. During the time of the study patients were paced from the ventricle at rates of 70-75 beats/min. It is interesting to note that the time period between the beginning of symptoms and admission for evaluation and pacemaker implant varied from one day to 12 years.

Results

Between 1979 and 1996, 82 adult patients received permanent ventricular pacemakers for treatment of sinus node disease. There were 51 men and 31 women. They ranged in age from 20-95 years with a mean of 57.7 ± 17.5 . The percentages of patients in each decade are shown in Table I.

 Table 1. Incidence of sinus node disease in each decade

Age	No. of patients	(%)
3 rd decade	4	4.8
4 th decade	8	9.6
5 th decade	12	14.5
6 th decade	13	15.6
7 th decade	22	26.5
8 th decade	14	16
9 th decade	9	10.1

The major underlying heart diseases are summarized in Table II.

 Table II. Characteristics of the patients with sinus

 node disease

Underlying disease	No.	(%)	
CAD	31	37.34	
Hypertension	26	31.3	
Rheumatic	7	8.4	
Diabetes	7	8.4	
MVP	2	2.4	
Unknown	9	10.8	
Surgical	1	1.2	

CAD indicates coronary artery disease; MVP, mitral value prolapse

In this study, 2 patients had history of sinus node disease in their first degree relatives, which may denote familial basis of this disease. Other causes of heart disease were COPD in 4 (4.8%), asthma in 2 (2.4%), cor pulmonale in one (1.2%), hypothyroidism in one (1.2%) and ankylosing spondylitis in one case (1.2%). 16 patients had varying degrees of atrioventricular block and 8 patients had bundle branch block.

The mean follow up period was 45 months (range 8-204 months). The most common clinical presentation of patients was dizziness, and other symptoms were dyspnea, syncope, chest pain, presyncope, fatique, blurred vision, nausea and convulsions. The frequency of these symptoms is presented in Table III.

noue disease				
Symptom	No.	(%)		
Dizziness	56	67.5		
Dyspnea	37	44.6		
Syncope	26	31.3		
Chest pain	20	24		
Presyncope	18	21.7		
Lassitude	16	19.2		
Fatigue	6	7.2		
Blurred vision	4	4.8		
Nausea	4	4.8		
Convulsion	1	1.2		

Table III. Symptom status of the patients with sinus node disease

Status of patients before pacemaker implantation

Eighteen patients (21.7%) had cardiomegaly, sixteen patients (20%) had AV block. Ten patients (12%) had atrial fibrillation and 7 patients (8.4%) had congestive heart failure before implant.

Course following pacemaker implantation

Survey of cardiac complications after pacemaker implant shows increase of the incidence of these disorders.

Complication	After implant		Before implant	
	No	(%)	No	(%)
Cardiomegaly	33	39.75	18	21.7
Atrial fibrillation	25	30.11	10	12
AV block	16	20	16	20
CHF	9	10.8	7	8.4
Persistent atrial flutter	3	3.6	-	-
Pacemaker malfunction	7	8.4	-	-
Systemic emboli	4	4.8	-	-
Death	3	3.61	-	-
Pocket infection	1	1.2	-	-

Table IV. Long-term characteristics of the patients with sinus node disease following ventricular pacemaker implantation

CHF indicates congestive heart failure

As shown in Table IV and in comparison to pre-implant status. The prevalence of cardiomegaly, atrial fibrillation, and congestive heart failure increased to 39.75%, 30.1% and 10.8%, respectively, which shows considerable increase in these complications.

4 patients developed new systemic emboli, 7 patients developed pacemaker malfunction mostly due to lead displacement, one patient developed pocket infection. Two of the patients died because of congestive heart failure and one due to coronary artery disease.

Discussion

The natural history of symptomatic sinus disease without pacemaker node implantation is not known and there is a wide variation in the fate of patients after pacemaker implants. In some reports,^{3,6,10,11} death was reported to be infrequent following pacemaker implant. In another study,^{12,13} there has been significant mortality, especially within the first 2 years after pacemaker insertion that can be attributed to different patient selection, severity of underlying disease, and age.^{14,19} Mortality is highest in ischemic heart disease and also in congestive heart failure.²⁰ As in our patients, of particular interest is the high rate of conversion of supraventricular arrhythmias to atrial fibrillation during the follow up period.^{13,20,23,24} It is rare for sinus bradycardia or sinoatrial arrest to

progress to atrial fibrillation.²⁵ It is apparent that the development of chronic atrial fibrillation is a common late development in patients with sinus node disease 23,25 with a yearly rate of development of 10% in VVI mode. The incidence of atrial fibrillation is high in patients older than 70 years old.^{15,20} Incidence of AF with VVI pacemaker has been reported to be three times higher than with dual chamber pacemaker,²⁰ or atrial Asynchronous and pacing. atrial ventricular contraction, especially during persistent retrograde ventriculoatrial conduction has been proposed as a likely cause of the increased incidence of development of AF when VVI pacing is used. Atrial contraction against closed atrioventricular valves causes atrial enlargement and stretching that, in turn, may serve as a substrate that incites and supports chronic atrial fibrillation. ^{26,28,29} The most common disorder with sinus node disease in our series has been atrioventricular (AV) block,¹³ which denotes diffuse conduction system disease^{15,16} and can be a marker of chronicity of disease or left ventricular dysfunction due to coronary artery disease and hypertension. The yearly incidence of AV block is reported as 2.5% up to 4.5%.¹⁵ If there is intraventricular conduction defect as monofascicular, or bifascicular, progression to complete heart block can reach 25%.^{16,17,18} Progression of ventricular dysfunction with cardiomegaly, worsening of ventricular arrhythmias and a significant risk of cerebral emboli appear common in this patient population and contribute to morbidity and mortality.^{22,23} The results of this study ^{20,30} suggest that long-term survival following ventricular pacemaker implantation in symptomatic sinus node disease correlated with a number of variables, including: 1- the etiology of the underlying heart disease, 3-associated congestive heart 2- age, failure and the specific arrhythmias prior to implant. It appears that the young patient with only sinus bradycardia and

sinoatrial exit block has the best prognosis ^{14,30} and those who are old with cardiomyopathy or ischemic heart disease have the worst prognosis after ventricular pacemaker implant. ³¹

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