Antiarrhythmic Effect of Atrial Pacing

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Summary

Atrial pacing is an efficient, cost-effective mode of pacing in patients with the sick-sinus-node disease and preserved atrioventricular conduction. The current study investigates the antiarrhythmic effect of atrial pacing in this subset of patients. Eighty-nine patients underwent atrial pacemaker implantation (28 of them received rate-responsive pacemaker) at our center between 1982-1998. A total of 75 patients were followed-up for 64 (1 - 192) months. No complete or second degree permanent AV block developed in any patient. Chronic atrial fibrillation developed more frequently in the group of patients with AAI pacemaker (5 out of 47 patients with AAI pacing versus 1 out of 28 patients with AAI,R pacing). In the group of patients with dominantly sinus bradycardia, 41 of 43 patients were in stable sinus rhythm and 2 patients required cardioversion, whereas in the group of patients with the tachycardia-bradycardia syndrome 22 of 32 patients required cardioversion ($p < 0.01$) and chronic atrial fibrillation developed in 6 of 32 patients. In conclusion, atrial pacing is effective in the prevention of atrial fibrillation in patients with sick sinus syndrome. Development of AV block is rare when patients are properly selected.

Key Words

atrial pacing, rate-responsive pacemaker, arrhythmia prevention

Introduction

Patients with sick sinus syndrome comprise approximately 40-50% of all patients receiving permanent pacemakers. In such patients, VVI pacing is suitable to prevent serious symptoms like syncope, but has no beneficiary effect on survival [1]. VVI pacing promotes atrial fibrillation, thus thromboembolic complications, and congestive heart failure [2]. Pacemaker syndrome may occur in up to 70% of patients with VVI pacemaker [3].

Atrial or atrioventricular sequential pacing has a favorable effect on the clinical course of sick sinus syndrome. Atrial pacing preserves AV synchrony, prevents pacemaker syndrome as well as atrial fibrillation, thus reduces the number of thromboembolic complications [4][5]. Atrial pacing also has economic advantage over dual chamber pacing. The aim of the current study was to evaluate the antiarrhythmic effect of atrial pacing.

Patients and Methods

Between 1982 - 1998, 2282 patient underwent pacemaker implantation at our center. Atrial pacing was employed in 89 (3.9%) patients, 28 of them received atrial rate responsive (AAIR) pacemaker. The patient population consisted of 39 males, 50 females, age range was 41 - 87 years, mean age was 49.6 years. Criteria for atrial pacing were AV conduction time < 0.24 s, no history of AV block, no AV block on Holter monitoring, no AV block during carotid massage neither at rest nor during rapid atrial pacing, Wenkebach point > 130 min^{-1}, left atrium < 50 mm and ejection fraction >40% by echocardiography performed before pacemaker implantation.

Unipolar passive fixation atrial J electrodes were used in all cases. Postoperative check-up included postero-anterior and lateral chest X-ray and Holter monitoring. Follow-up conducted in every 3 - 6 months included evaluation of spontaneous atrial activity and pace-

maker dependency by interrupting pacemaker activity. Atrioventricular conduction was evaluated by incremental atrial pacing up to 110 - 140 min^{-1} frequency depending on the type of the pulse generator. Patients with rate-responsive pacemakers were evaluated also by exercise test and Holter monitoring. Patients with dominantly sinus bradycardia (43 patients) received no antiarrhythmic medication. Patients with tachycardia-bradycardia syndrome (32 patients) received antiarrhythmic therapy for maintenance of sinus rhythm (propafenon was used in 9 patients, amiodaron in 13 patients, chinidin in 5 patients) and these patients were also on chronic anticoagulant treatment.

Results

Three patients out of 89 were lost for follow-up and 9 patients died (5 patients due to non-cardiac causes, 1 patient due to congestive heart failure and 3 patients due to cerebral embolism despite chronic anticoagulant treatment). The pacing mode was switched to VVI pacing in 2 patients due to repeated atrial lead dislodgment. Thus, a total of 75 patients were followed-up for 64 (1 - 192) months. No complete or second degree permanent AV block developed in any patient. Temporary II to I type or complete AV block with narrow QRS escape rhythm was noted in 4 patients, all of them on antiarrhythmic medication due to tachycardia-bradycardia syndrome. Reduction of the dose of antiarrhythmic drug therapy abolished the AV conduction disturbance. High rate atrial pacing resulted in II to I type AV block in another 4 patients, but AV conduction disturbance was not evident at the 70 min^{-1} AAI pacing employed in those patients. Among the 28 patients who underwent AAIR pacemaker implantation, signs of AAIR pacemaker syndrome was revealed by Holter monitoring in 3 patients: increase in heart rate was accompanied by increase in AV conduction time (instead of decrease in AV conduction time) producing symptoms during exercise [6]. The symptoms of AAIR syndrome could be abolished by decreasing the rate of heart rate increase in these patients.

Among the 75 patients followed, stable sinus rhythm was observed in 47 patients and chronic atrial fibrillation developed in 6 patients. Chronic atrial fibrillation developed more frequently in the group of patients with AAI pacemaker (5 out of 47 patients with AAI pacing versus 1 out of 28 patients with AAIR pacing), but statistical comparison could not be performed due to the low number of events. Successful electrical cardioversion was performed in 22 patients: 11 patients required cardioversion in one, 6 patients in 2, 4 patients in 3 and one patient in 4 occasions. In the group of patients with dominantly sinus bradycardia, 41 of 43 patients were in stable sinus rhythm and 2 patients required cardioversion, whereas in the group of patients with the tachycardia-bradycardia syndrome significantly more, 22 of 32 patients required cardioversion ($p < 0.01$) and chronic atrial fibrillation developed in 6 of 32 patients.

Discussion

Pacemaker is the choice of treatment for patients with symptomatic sick sinus syndrome. VVI pacing is considered unsatisfactory or even risky for the treatment of sick sinus syndrome [7]. In VVI acing mode, pacemaker syndrome may develop frequently [3], and may produce even more symptoms than the sick sinus

	AAI	VVI
AV synchrony	+	-
retrograde conduction	-	+
PM syndrome	-	+
atrial fibrillation	rare	frequent
throboembolic events	rare	frequent
lead problems	more (?)	less
price	same	same
ECG interpretation	less simple	simple

Table 1. Comparison of AAI vs. VVI pacing modes.

	AAI	DDD
implantation time	short	long
complications	less	more
ventricular activation	normal	abnormal
PMT	no	possible
ECG interpretation	easy	difficult
price	cheaper	expensive

Table 2. Comparison of AAI vs. DDD pacing modes.

syndrome itself. The hemodynamic advantages of atrial pacing are well known [8], and there is increasing evidence for the antiarrhythmic effect of atrial pacing [4][5][9]. We also have reported a favorable antiarrhythmic effect of atrial pacing [10]. Atrial (AAI) and ventricular (VVI) pacing modes are compared in Table 1.

Dual chamber pacing is as effective in the treatment of sick sinus syndrome as atrial pacing, but dual chamber pacing is considerably more expensive. Dual chamber (DDD) and atrial (AAI) pacing is compared in Table 2.

The use of atrial pacing was limited in the past partly due to frequent lead complications (up to 20 - 30% complications in the 70's) [11]. With technical development, the number of lead dislodgment complications reportedly decreased to 4.5 - 18% [12]. We have experienced lead dislodgment in 2 of 89 patients (2.2%) with atrial lead. We had to switch the pacing mode to VVI pacing in those 2 patients.

The main reasons against atrial pacing is the potential development of AV block requiring mode switching. Reports on non-selected patients showed a considerable incidence of AV block among patients with sick sinus syndrome. However, the meta-analysis of these studies demonstrated a reasonable low risk of AV conduction disturbance (0.6% per year) [13]. No permanent AV block was observed in our series, and 4 patients presented with temporary II to I or III degree AV block due to antiarrhythmic treatment. Modification in antiarrhythmic drug therapy eliminated AV block in all cases. Development of AV block may be prevented by proper patient selection.

VVI pacing does not alter the clinical course of atrial fibrillation in patients with sick sinus syndrome [14]. Some retrospective [4][7] and recently published prospective study [5] demonstrated a favorable antiarrhythmic effect of atrial pacing. Development of atrial fibrillation was significantly less common in AAI pacing mode than in VVI pacing mode. In our series, chronic atrial fibrillation developed in 6 of 75 patients (8%). Sinus rhythm was successfully restored in 22 patients with one or more electric cardioversion, while sinus rhythm was spontaneously maintained in 47 patients. Altogether, sinus rhythm was maintained in 92% of the patients in our series by atrial pacing or atrial pacing and antiarrhythmic medication.

Atrial pacing is still an underused mode of pacing [15]. Atrial pacing is effective in the prevention of atrial fibrillation in patients with sick sinus syndrome. Development of AV block is rare when patients are properly selected, and it has undoubtedly the most favorable cost/benefit ratio.

References

[1] Shaw DB, Holman RR, Gowers Ji. Survival in sinoatrial disorder (sick sinus syndrome). Br Med J. 1980; 280: 139-141.

[2] Sutton R. Pacing in atrial arrhythmias. PACE. 1990; 13 (II): 1823-1827.

[3] Heldman P, Mulvihil D, Messenger J, et al. True incidence of pacemaker syndrome. (abstract) PACE. 1990; 13: 526.

[4] Rosenquist M, Brandt J, Schuller H. Long-term pacing in sinus node disease: Effects of stimulation mode on cardiovascular morbidity and mortality. Am Heart J. 1988; 116: 16-22.

[5] Andersen RH, Thuesen L, Bagger JP, et al. Prospective randomised trial of atrial versus ventricular pacing in sick sinus syndrome. Lancet. 1994; 344: 1523-1528.

[6] Bõhm Á, Lehoczky D, Pintér A, Préda I. Detection of AAI, R pacemaker syndrome by Holter monitoring: A case report. Annals of Noninvasive Electrocardiology. 1998; 3: 284-286.

[7] Camm JA, Katritsis D. Ventricular pacing for sick sinus syndrome - A risky business? PACE 1990; 13: 361-369.

[8] Hass JM, Strait GB. Pacemaker induced cardiovascular failure: haemodynamic and angiographic observations. Am J Cardiol. 1974; 33: 259-299.

[9] Witte J. Pacing within the Atrium Prevents Supraventricular Tachycardias. Prog Biomed Res. 1998; 3: 85-90.

[10] Bõhm Á, Pintér A, Székely Á, Préda I. Clinical Observations with Long-term Atrial Pacing. PACE. 1998; 21 (II): 246-249.

[11] Hill PE. Complications of permanent transvenous cardiac pacing: A long-term follow-up study. Ann Int Med. 1979; 90: 24-29.

[12] Markewitz A, Wenke K, Weinhold C. Reliability of atrial screw-in leads. PACE. 1988; 11 (II): 1777-1783.

[13] Rosenquist M, Obel IWP. Atrial pacing and the risk for AV block: Is there a time for change attitude. PACE 1989; 12: 97-101.

[14] Sutton R, Kenny RA. The natural history of sick sinus syndrome. PACE. 1986; 9 (II): 1110-1114.

[15] Ryden L. Atrial inhibited pacing - An underused mode of cardiac stimulation. PACE. 1988; 11: 1375-1379.