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Clinical Significance of Cardiac Permanent Pacemaker Mode Option in Patients with Complete Atrioventricular Block

Atriyoventriküler Tam Bloklu Hastalarda Kalıcı Kalp Pili Mod Seçiminin Klinik Önemi

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Abstract

Objective: We assessed the impact of pacing mode on long-term clinical outcomes in cases with the complete atrioventricular block (CAB).

Method: We retrospectively analyzed 161 patients with CAB, who undergone a cardiac permanent pacemaker. Of the patients involved in the physiologic pacing (PP) group, 95 patients were with the VDD pacing mode and 14 patients were with the DDD pacing mode. In the ventricular pacing (VP) group, with the VVI pacing mode, there were 52 patients.

Results: The average age of the patients was 66±13 years and the average follow-up duration was 40.2±22.6 months. Atrial fibrillation (AF) was observed to be significantly more common in the VP group than in the PP group (p=0.007). However, the occurrence of stroke was similar between the two groups (p=0.753). Newly developed congestive heart failure (CHF) was seen more commonly in the VP group (p=0.015). When we evaluated the patients with and without CHF before pacemaker placement, the number of patients with CHF was reduced in the PP group (p=0.039) and insignificantly increased in the VP group (p=0.219).

Conclusion: We conclude that in patients with CAB, the use of PP, compared to VP, may decrease the rate of AF and CHF in the long-term.

Keywords: Artificial cardiac pacing, atrial fibrillation, atrioventricular block, heart failure, stroke

Öz

Amaç: Atriyoventriküler (AV) tam bloklu hastalarda kalıcı pacemaker mod seçiminin uzun dönem klinik sonuçları incelendi.

Yöntem: AV tam blok nedeni ile kalıcı pacemaker takılan toplam 161 hasta retrospektif olarak incelendi. Fizyolojik pacemaker (FP) grubu altında incelenen hastaların 95'inde VDD, 14'ünde DDD modu bulunmaktaydı. Ventriküler pacemaker (VP) grubu içinde incelenen 52 hastada VVI modu mevcuttu.

Bulgular: Ortalama yaş 66±13 yıl ve ortalama takip süresi 40,2±22,6 ay idi. Takip süresinde, VP grubunda, FP grubu ile karşılaştırıldığında daha fazla oranda atriyal fibrilasyon (AF) saptandı (p=0,007). İnme gelişimi açısından iki grup arasında bir fark bulunmadı (p=0,753). Pacemaker takılmadan önce konjestif kalp yetersizliği (KKY) bulunmayan hastalar incelendiğinde, takip süresi esnasında VP grubunda daha fazla oranda KKY gelişimi tespit edildi (p=0,015). Başlangıçta KKY bulunan ve bulunmayan hastalar birlikte incelendiğinde, takip süresi sonunda FP'li grupta KKY bulunan hastaların sayısı azalırken (p=0,039), VP'li grupta istatistiksel olarak anlamlı olmayan düzeyde bir artma saptandı (p=0,219).

Sonuç: AV tam bloklu hastalarda FP kullanımı, VP kullanımı ile karşılaştırıldığında, uzun dönemde AF ve KKY gelişimini azaltabilir.

Anahtar kelimeler: Atriyal fibrilasyon, atriyoventriküler blok, inme, kalp yetersizliği, yapay kalp pili

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Introduction

Physiologic pacing (PP) possibly provides a clinical benefit compared to ventricular pacing (VP) in the treatment of the complete atrioventricular block (CAB). Non-randomized studies suggest that PP is associated with a lesser incidence of stroke, atrial fibrillation (AF), heart failure than in the VP, and mortality decreases in patients with heart failure (1-8). Mortality rates were found similar between two groups in a recent retrospective study (9). The small randomized studies comparing PP to VP have demonstrated that mortality, the incidence of AF, and stroke are high in VP (10,11). For mortality and heart failure, the randomized studies with more patients established no significant differences between the PP and VP groups (12-14). For AF, only the Canadian Trial of Physiologic Pacing (CTOPP) found a risk reduction in the PP group (12), and for stroke, only the United Kingdom Pacing and Cardiovascular Events (UKPACE) trial found risk increase in the fixed-rate VP group (13).

Materials and Methods

All patients who received a cardiac permanent pacemaker (CPP) for CAB at our institution before June 2015 were reviewed. Patients with permanent AF, missing or inadequate records, follow-up period shorter than 6 months, and younger age group (<20 years) were excluded from the study.

The study group consisted of 161 patients (57% females), 68% with PP and 32% with VP. The mean age was 66±13 years and the mean follow-up period was 40.2±22.6 months. The follow-up visits occurred 1, 3, and 6 months after pacemaker implantation, and there were yearly visits thereafter. The patient's clinical condition, ambulatory ECG recordings, and 12-lead ECG records were analyzed. Stroke, AF, signs and symptoms of CHF before and after pacemaker implantation were evaluated. Hemorrhagic stroke and transient ischemic attack were not included in the stroke group. Patients with paroxysmal, persistent and permanent AF during the follow-up period were involved in the AF group.

Statistical Analysis

The results are specified as mean ± standard deviation. Statistical tests included chi-square analysis with the Yates' correction, Fisher's Exact test or McNemar test where pertinent, and Student's t-test. A p-value <0.05 was assessed as significant. All statistical studies were performed using SPSS for Windows, Version 9.0 (SPSS Inc., Chicago, IL, USA).

Results

No statistically significant difference was found compared to baseline characteristics between the treatment groups (Table 1).

As shown in Table 2, AF developed significantly more frequently in patients assigned to the VP group than in the PP group (34.6 vs 14.7%, p=0.007), and no significant difference existed among the patient groups concerning stroke (1.9% in VP vs 2.7% in PP group, p=0.753).

There were five patients with a history of CHF in the VP group and 13 patients in the PP group. We excluded these patients from analysis when we compared the newly developed CHF between the groups. This study demonstrates that the newly developed CHF in the group of VP is significantly more common than among those with PP (10.6% vs 1%, p=0.015, Table 3). Also, when we examined all patients with or without CHF before implantation of the pacemaker, CHF frequency was decreased significantly in

Table 1. Comparison of baseline characteristics and pharmacological agents according to pacing modes

			VP n=52	PP n=109	p
Age (year)			68±11	65±14	0.300
Follow-up (month)			44.4±24.4	38.2±21.5	0.100
Male (%)			46.1	42.2	0.762
History (%)					
	CAD		21.2	19.3	0.945
	Stroke		3.8	1.8	0.595
	PAF		3.8	4.6	1.000
	CHF		9.6	11.9	0.793
	Cardiac surgery				
		Valve	7.7	5.5	0.728
		CABG	5.8	6.4	1.000
Antiarrhythmic drugs (%)			26.9	37.6	0.246
Anticoagulant drugs (%)			13.5	11	0.849

CAD: Coronary artery disease, CHF: Congestive heart failure, PAF: Paroxysmal atrial fibrillation, PP: Physiologic pacing, VP: Ventricular pacing

Table 2. Event rates for atrial fibrillation and ischemic stroke

	VP (n=52)	PP (n=109)	p
Atrial fibrillation	18 (34.6%)	16 (14.7%)	0.007
Ischemic stroke	1 (1.9%)	3 (2.7%)	0.753

PP: Physiologic pacing, VP: Ventricular pacing

the PP group (p=0.039), and insignificantly increased in the VP group (p=0.219) during the study period (Table 4).

Discussion

This study aimed to assess if the pacing mode, whether PP or VP, contributed to the clinical benefit in the patients with CAB and implanted CPP. The retrospective studies showed mortality decrease in patients with heart failure, and improved clinical outcomes with respect to AF, stroke, and heart failure with PP. The small randomized studies have shown that the mortality, incidence of AF, and stroke were higher in the VP group. The randomized studies with more patients have failed to reveal a marked benefit for PP in terms of reduction of mortality and heart failure. AF risk was significantly lower in the PP group only in the CTOPP trial, and stroke risk was significantly higher in the fixed-rate VP group only in the UKPACE trial.

PP is believed to have an advantage over VP in that it mimics cardiac physiology more similarly by preserving atrioventricular synchrony and domination of sinus node (15-17), increases cardiac output which in turn may reduce heart failure, AF and stroke. PP improved left ventricular functions and hemodynamics, especially in patients with heart failure (18-23). VP may induce AF through changes in the atrial structure resulting from asynchronous ventricular contraction (19).

Our results showed a high incidence of AF in the VP group like that found in the CTOPP trial. Also, we found a high incidence of CHF in the VP group. This may be because of the loss of AV synchronization and decreased contribution of the atrium to ventricular filling. We found no significant difference concerning stroke between the two groups.

Table 3. Newly developed congestive heart failure

	VP (n=47)	PP (n=96)	p
New onset of CHF	5 (10.6%)	1 (1%)	0.015

CHF: Congestive heart failure, PP: Physiologic pacing, VP: Ventricular pacing

Table 4. The number of the patients with CHF before pacemaker implantation and at the end of follow-up period

	Before pacemaker implantation (CHF)	End of follow-up period (CHF)	p
VP (n=52)	5 (9.6%)	9 (17.3%)	0.219
PP (n=109)	13 (11.9%)	6 (5.5%)	0.039

CHF: Congestive heart failure, PP: Physiologic pacing, VP: Ventricular pacing

Study Limitations

The major limitations of our study are the small sampling size, retrospective design, although statistically insignificant, some baseline differences between the study groups.

Conclusion

We concluded that the PP compared to VP might reduce the incidence of AF and CHF. More randomized studies must be done for the selection of the best pacing mode in the patients with CAB.

Ethics

Ethics Committee Approval: The study protocol was approved by the local ethics committee of our institution (2020.09.1.05.122).

Informed Consent: Written informed consent was obtained.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: C.Ç., O.İ., Design: C.Ç., O.İ., Data Collection or Processing: C.Ç., O.İ., Analysis or Interpretation: O.İ., K.G., E.O., S.Ö., Literature Search: O.İ., K.G., E.O., S.Ö., Writing: O.İ., K.G., S.Ö.

Conflict of Interest: No conflict of interest was declared by the authors.

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