Initial transaortic approach to induce a complete AV block in patients with recently implanted permanent pacing systems

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Summary

Objectives: The purpose of the study was to evaluate the feasibility and safety of the transaortic approach as an initial step to induce a complete atrioventricular (AV) block in patients with atrial tachyarrhythmias and recently implanted pacing systems.

Design and Methods: Seven patients with chronic or persistent atrial fibrillation received permanent pacing systems (DDD/DDDR was implanted in 3 patients, VVIR – in 3, bi-ventricular – in one patient). Because of a risk of lead dislodgement (up to 5.9 months after the implantation of a pacemaker), the transaortic approach to the AV junction was initially attempted.

Results: A complete AV block was successfully induced in all the patients with 1 to 8 radiofrequency energy applications and QRS complexes identical to those before the ablation procedure. No complications were reported. No restoration of AV conduction was observed during the follow-up period from 5 to 40 months, and an escape rhythm with a rate of >30 beats per minute was documented in 5/7 patients.

Conclusion: The transaortic approach is an effective and safe technique to induce an AV block in patients with recently implanted permanent pacing systems. This approach can be justified and particularly useful in patients with endocardial bi-ventricular pacing systems.

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Despite the evolution of curative ablation and surgery for various tachycardias, there is still a need to induce a complete atrioventricular (AV) block and to implant a permanent pacing system in some patients with drug-resistant atrial fibrillation. The induction of the AV block can be a challenge in a small proportion of patients. Two approaches to the AV conduction system can be used: the right atrial and transaortic. Although the right atrial approach is less traumatic and often successful, and is used as an initial approach, the transaortic approach has to be used in some patients if the right atrial approach is unsuccessful. It has been shown that the transaortic approach is effective after the crossover from the previously failed right atrial approach. The purpose of this study was to examine the effectiveness and safety of the transaortic approach as the first step to induce a complete AV block in patients with recently implanted (arbitrarily chosen time 6 months after implantation) permanent endocardial pacing systems. It was assumed that in these cases the right-sided approach can put a patient at a risk of dislodging the pacing leads, and the initial left-sided approach was justified although more traumatic and risky.

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Design and Methods

Seven patients with permanent pacing systems implanted because of chronic or persistent atrial fibrillation (AF) were included into the study.

These were 2 men and 5 women aged from 35 to 73 years. The clinical data of the patients are presented in Table 1. In all the patients with VVIR pacing systems, the indication for pacemaker implantation was chronic atrial fibrillation with alternating bradysystolic and tachysystolic episodes. Maximal drug therapy to control the heart rate was started after implantation. In patients with the implanted DDDR pacing systems, the indication for pacemaker implantation was the "brady-tachy" syndrome, in order to initiate effective antiarrhythmic therapy. This hybrid therapy was unsuccessful, and chronic AF with a poorly tolerated high heart rate had developed, so a decision to induce a complete AV block was made.

The procedure was performed after explaining the possible risks of the right-sided and left-sided approaches to the patients, and obtaining their written informed consent. The study conforms to the principles outlined in the Declaration of Helsinki. The right femoral artery approach was usually used, and a 7F introducer was put under local anesthesia with 1% lidocaine. In all the patients right coronary angiography with aortic cusp opacification was first performed in order to obtain anatomical landmarks. A 7F steerable ablation catheter (Marinr, Medtronic Inc., USA) was then introduced into the arterial system, and the site of recording the maximal His bundle potential was sought for below the aortic valve. Ablation was performed by applying radiofrequency (RF) energy with the preset catheter tip temperature of 60°C. The complete AV block, not just the slowing of the heart rate during AF by modifying AV conduction, was the end-point of ablation.

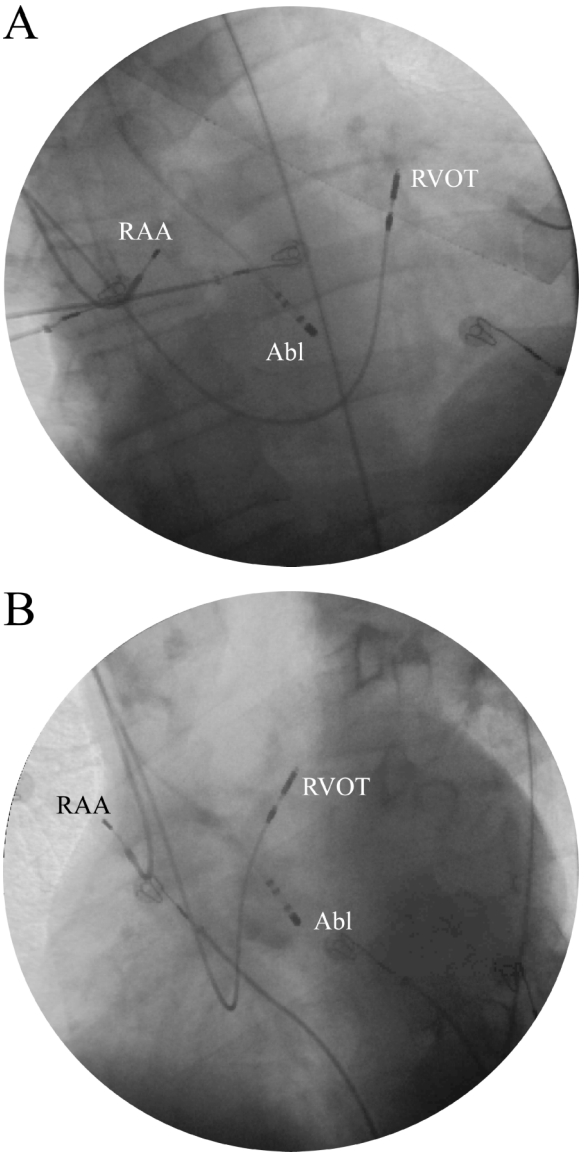

Figure 1. Anteroposterior (A) and left anterior oblique (B) fluoroscopic projections of electrode positions during the transaortic approach to induce a complete atrioventricular block. Permanent pacing electrodes in the right atrial appendage (RAA), right ventricular outflow tract (RVOT), and ablation electrode (Abl) positioned below the aortic valve are seen.

Results and Discussion

In all the patients, appreciable His bundle deflection was recorded and ablation was performed below the aortic valve (Figure 1). A complete AV block was successfully induced by applying 1 to 8 RF energy applications at the site of His bundle recording or near it (Figure 2). No ST-segment changes were seen during the ablation or after the procedure. The shape and width of spontaneous QRS complexes during the escape rhythm (when appreciable, Table 2) was identical to that at pre-ablation. The complete AV block persisted during the follow-up from 5 to 40 months. The rate of the escape rhythm during the follow-up was more than 30 beats per minute in 5/7 patients (Table 1).

The decision to induce a complete AV block in Patient 4 was made immediately after the implantation of a bi-ventricular pacing system because of chronic AF with a high heart rate uncontrolled by amiodarone and digoxin, and intrinsic AV conduction interfering with bi-ventricular pacing. The right-sided approach if attempted immediately after coronary sinus lead implantation would put a patient at risk of dislodging the electrode and significantly prolonging the duration of the entire procedure.

The catheter ablation of the AV junction using radiofrequency energy [1] has become a well established method to alleviate symptoms and to slow or stop the development of ventricular dysfunction due to the chronic high rate. In some patients, significant difficulties were encountered when performing this procedure. The left ventric-

Table 1.
Clinical characteristics of the patients

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
Age, gender	60, F	53, F	59, F	68, F	73, M	54, M	35, F
Concomitant heart disease	HHD	SSS	HHD	TCMP	SSS	HHD	HCMP
Type of pacemaker and lead implanted	DDD, P/P[1]	VVIR, P*	VVIR, P*	Bi-V, A*	DDDR, P/A*	VVIR, P*	DDD, A/A*
Time after implantation at ablation	5.9 months	4.6 months	5 days	1 hour	28 days	2.3 months	5.6 months

* A/P – pacing lead with active or passive fixation (atrium/ventricle); Bi-V – bi-ventricular; F – female; HCMP – hypertrophic cardiomyopathy; HHD – hypertensive heart disease; M – male; SSS – sick sinus syndrome; TCMP – tachycardiomyopathy.

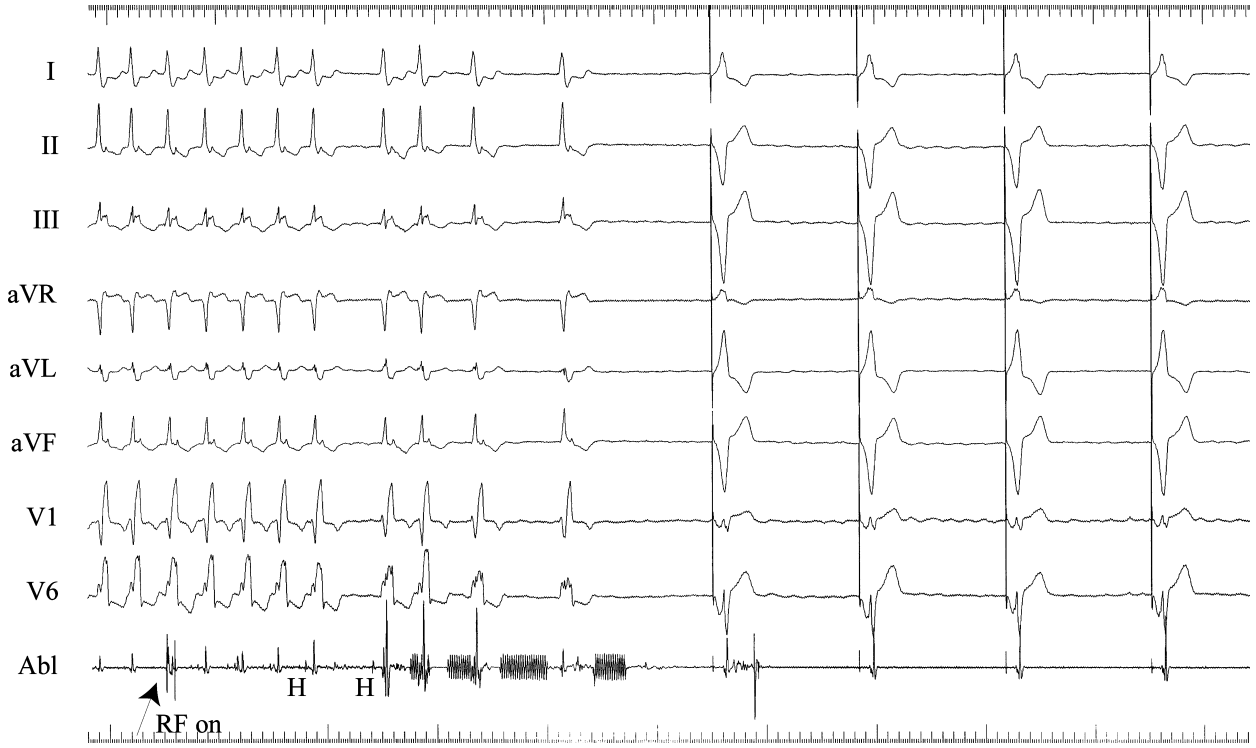

Figure 2. Surface ECG leads and tracing from the distal pair of ablation catheter electrodes during ablation. His bundle potential with an amplitude of 0.2–0.4 mV is seen before ablation. It took five seconds from the start of ablation (arrow, RF on) until the complete AV block and the start of ventricular pacing.

Table 2.
Data obtained during and after the ablation procedure

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
Amplitude of His bundle potential, mV	0.2	0.1	0.4	0.7	0.5	0.3	0.4
Number of RF energy applications	8	4	4	2	1	2	6
Rate of the escape rhythm after ablation, beats/min	<30	<30	40	<30	42	30	<30
Rate of the escape rhythm at follow-up, beats/min	<30	36	45	<30	35	32	40

RF – radiofrequency.

ular approach to the AV junction was suggested after right-sided ablation with both RF energy and DC shocks had failed [2]. Bipolar right-to-left ventricular configuration for ablation was also described after the right-sided unipolar approach had failed [3–5]. A randomised crossover from the right to the left approach, used during the same procedure after three right-sided RF energy applications had initially failed, showed that the left-sided approach was more successful [6]. In some cases, right and left ventricular approaches were unsuccessful, and the supravalvular aortic valve approach had to be used [7]. Predictors of a need of crossover to the left ventricular approach were determined (male gender and history of hypertension) [8].

The proximity of the AV conduction system to the left-sided endocardium could also be suggested from observations in some patients with AV nodal tachycardia. The ablation of the slow pathway was possible in them only from the left side [9]. This is in concordance with the demonstration of the left atrial inputs into the AV node [10] and suggests the proximity of the AV-conduction system to the left-sided endocardium. Inadvertent transient or a complete AV block during left-sided ablation of other arrhythmias was also described [11,12].

In previous studies the effectiveness of the left-sided approach has been examined only after initial right-sided ablation. In those cases, it could not be excluded that effects of both approaches could combine and fully interrupt the AV conduction. The present paper has shown that left-sided ablation alone may induce a complete AV block. The risk of the initially attempted left-sided approach (damage to the aortic valve or coronary arteries) can probably be overweighed by the risk of dislodgement of recently implanted permanent pacing leads, especially of the coronary sinus lead that can be extremely difficult to put in place.

Conclusion

Initial transaortic approach to induce a complete atrioventricular block is a successful and safe technique that can be justified in patients with recently implanted permanent pacing systems, especially with a recently implanted coronary sinus lead.

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