Prevention of Atrial Fibrillation with Biatrial Pacing - Therapeutic Efficacy

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Summary

Fifteen patients with atrial fibrillation/flutter resistant to drug therapy were treated with AAT biatrial pacing with one lead implanted in the high right atrium and one in the coronary sinus. The patients showed improved subjective findings and reduced recurrence, and it was possible to reduce medication. The results were significantly better for paroxysmal fibrillation/flutter than for persistent fibrillation.

Key Words

Interatrial conduction time (IACT), biatrial pacing, right-atrial pacing

Introduction

The role of intra- and interatrial conduction disturbances in the generation and recurrence of atrial tachyarrhythmias (e.g., atrial flutter and fibrillation) was discovered in the early 90s [1-3]. Patients with such conduction disturbances exhibit atrial tachyarrhythmias to an elevated degree. The occurrence of reentry is promoted by the delayed atrial conduction. In addition, the late activation of the left ventricle can cause the left atrium and ventricle to contract simultaneously (pacemaker syndrome).

Since 1994, multifocal pacing modes providing for resynchronization of the two atria have generated therapeutic possibilities for patients. Daubert was the first to present the idea of using biatrial pacing to treat intraatrial conduction disturbances [4]. Saksena proposed a bifocal right-atrial pacing configuration [5]. In the studies conducted on both pacing concepts, the results were very promising for future therapy [2-3][6-9]. Additionally, these studies demonstrated the feasibility and safety of biatrial pacing.

This study assesses the therapeutic success of resynchronization of both atria through AAT-pacing with two leads, one in the high right atrium and one in the coronary sinus.

Materials and Methods

15 patients (11 male, 4 female, aged 66.6 ± 4.97 years) with atrial fibrillation/flutter that was resistant to drug therapy (Table 1) received pacemakers that offered the possibility of biatrial pacing (Figure 1). The patients with persistent atrial fibrillation were cardioverted at least once. The patients with paroxysmal atrial fibrillation had an average of 0.59 ± 0.22 documented episodes per month. All patients had a lengthened P-wave of no less than 120 ms, with an average P-wave duration of 135 ± 15.28 ms (min. 120 ms; max. 160 ms). This was determined through surface- and esophageal ECG. Two failed attempts at drug therapy, with failure anticipated for amiodarone, were also a prerequisite for inclusion in the study. For reasons of compatibility, Cordarex could only be administered in 30% of the patients included in the study.

Three patients with normal AV conduction were implanted with a DDD pacemaker (Logos, BIOTRONIK), a standard right-atrial (RA) lead (Y60BP), and a coronary sinus (CS) lead (Corox BP, BIOTRONIK). The CS-lead was connected to the pacemaker's ventricular connection, and the pacemaker was programmed to DDD. This system offers the possibility of programming an AV-time of 0 ms. Due to disrupted conduction, the other 12 patients received

Figure 1. Biatrial lead configuration: PA view. The two rings of the CS lead permit for left atrial pacing and sensing. An electrically inactive distal silicon screw is of use for fixation the lead.

dual-chamber systems that were expanded into a three-chamber system via a Y-connector. The Y-Connector (BIOTRONIK, Osypka) splits the bipolar atrial channel into two unipolar channels. The RA lead (Y60BP, BIOTRONIK) is cathodic and the CS-lead (Corox BP, BIOTRONIK) is anodic. With a standard right-ventricular (RV) lead (SX60BP, BIOTRONIK), the pacemaker runs in DDTA-mode. The following systems were implemented: Chorum (2), Brio DR (2), Talent DR (5) (all ELA Medical) and Logos (3) (BIOTRONIK). All leads for biatrial pacing were positioned in the coronary sinus.

For all patients, the intrinsic, RA-stimulated, and biatrial-stimulated interatrial conduction times were determined by means of the esophageal ECG. Along with intra- and postoperative examinations, P/R-waves (right-atrial, biatrial, ventricular) and thresholds (right-atrial, biatrial, ventricular) were examined at fixed follow-up intervals (4 weeks, 3 months, 6 months).

In addition, the patients' subjective complaints were surveyed both preoperatively and at 4 and 12 weeks after implantation. The medication was also recorded preoperatively; it was changed at the discharge or 4 weeks after implantation. In order to assist in postoperative documentation of atrial fibrillation, the Mode Switching function of the pacemaker was activated and the appropriate trends were interrogated at each follow-up.

	N	%
parox. AF	6	40.0
persist. AF	5	33.3
parox. Afl	4	26.7
total	15	100.0

Table 1. Distribution of patients with atrial fibrillation.

Results

The systems were implanted successfully in all patients. Intraoperative measurements could be performed. Postoperatively the CS-lead dislocated in two persons and another patient exhibited microinstability that could not be remedied. All three CS-leads had to be explanted. All further results were taken from an average follow-up interval of 2.8 ± 1.9 months (min. 1, max. 6).

In Figures 2 and 3, the P-wave amplitudes and thresholds are shown for the individual follow-up examinations. The results show that the P-wave amplitudes for right-atrial and biatrial pacing do not show large variations. For biatrial pacing, the average postoperative amplitude of 2.1 ± 1.76 mV increased by a statistically insignificant degree to 2.33 ± 1.57 mV after three months. After six months, the value lowered by a statistically insignificant degree. The thresholds in the coronary sinus increased from 1.71 ± 0.47 V (intraoperative) to a three-month follow-up value of 1.83 ± 0.47 V.

The results of IACT measurement are summarized in Table 2. While the average IACT increased from 85.4 ± 18.87 ms to 132.9 ± 44.34 ms for purely right-atrial pacing, biatrial pacing led to a clear shortening of the IACT to 47.7 ± 22.2 ms.

In the independent observation of patients with persistent atrial fibrillation, the average measured P-wave duration was 140 ± 20 ms longer than that of patients with paroxysmal fibrillation/flutter (130.7 ± 12.4 ms). Additionally, a longer IACT (145 ± 60.6 ms) was shown for right-atrial pacing in patients with persistent fibrillation than for patients with paroxysmal fibrillation/flutter (127.1 ± 46.8 ms).

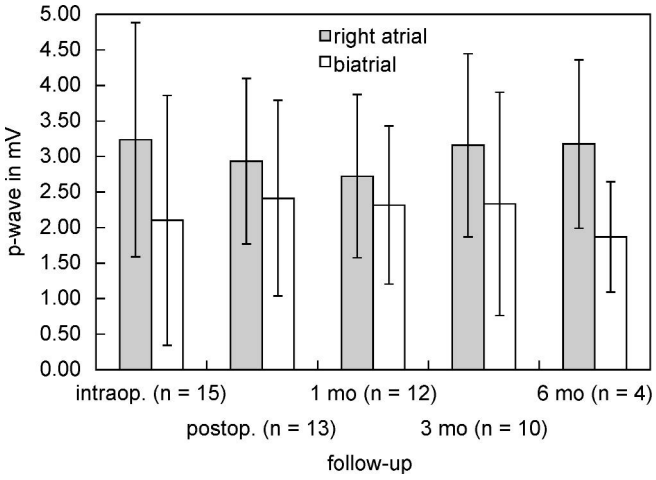

Figure 2. Mean P-wave amplitudes.

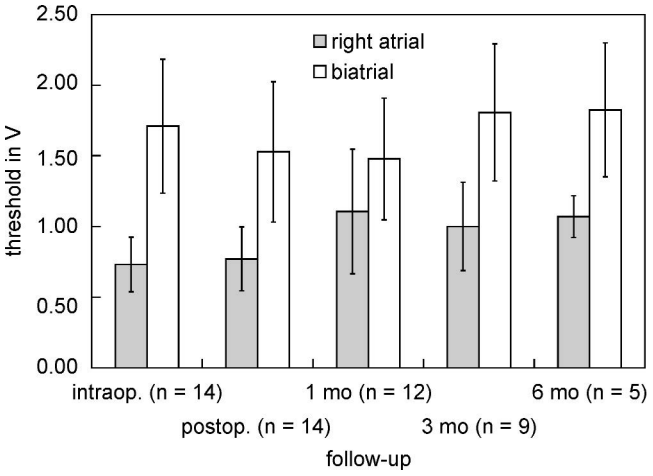

Figure 3. Mean threshold in the right atrium and the coronary sinus.

The analysis of pacemaker memory for atrial tachyarrhythmias showed that only three of 12 patients experienced a recurrence. Two of the patients with persistent fibrillation each experienced 3 recurrences. Since the last cardioversion, they showed no recurrence for 5 months. The other patient had 1 event of recurrence after 4 weeks, but has shown no recurrence since that time. For the patients who had CS-leads explanted, atrial arrhythmias could also be detected. All other patients were free from atrial arrhythmias after implantation.

Due to the biatrial pacing, the medication could be significantly reduced. Preoperatively, the patients received an average of 2.2 antiarrhythmic drugs. With biatrial pacing, the medication was reduced by 45% in average to 1.2 antiarrhythmic drugs per patient; the medication could not be reduced considerably in patients with persistent fibrillation. Thus following can be concluded:

- Class I antiarrhythmic drugs could be reduced by 80%.
- The administration of ß-blockers was increased by 43%; it is to be noted here that in 80% of all cases the ß-blockers were administered due to coronary heart disease or hypertonia.
- The administration of Class III and IV medication was also significantly reduced: by 71% and 57%, respectively.

The general experiences of the patients were surveyed pre- and postoperatively in a three-step scale (good-middle-bad) (n = 12) (Figure 4). All patients felt significantly better with biatrial pacing and reduction in medication than before the operation. Eight patients reported that their condition had improved by 1 step and 4 patients reported an improvement of two steps.

Discussion and Conclusions

The clinical experiences with biatrial pacing show effective prevention of recurrence in patients with atrial fibrillation and flutter that is resistant to drug therapy. From the small number of patients, it can be concluded that the therapeutic effect for patients with persistent fibrillation is not very large compared to the effect for patients with paroxysmal fibrillation. From the results regarding P-wave duration, it can be observed that patients with longer P-waves tended more often toward persistent fibrillation than toward paroxysmal fibrillation. If one also considers the longer IACT during right-atrial pacing, it seems likely that interatrial conduction disturbances also play a role here. The extreme reduction in medication with a simultaneous reduction in recurrence is very desirable,

	Mean	St.dev.
p-wave	135.00	15.28
IACT (intr.)	85.38	18.87
IACT (RA)	132.92	44.34
IACT (BiA)	47.73	22.20

Table 2. Interatrial conduction times.

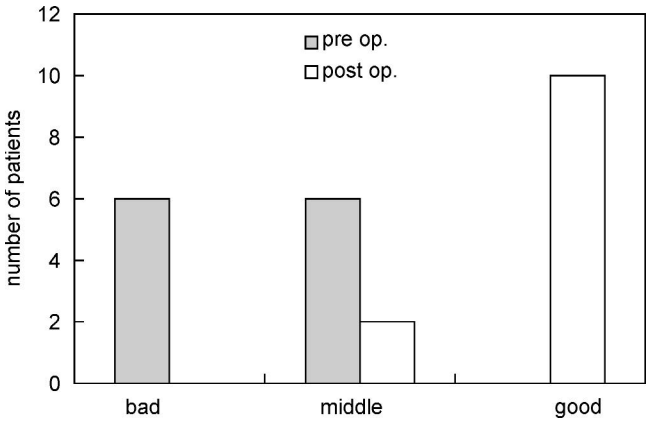

Figure 4. The patients' subjective complaints.

and leads to a noticeable subjective improvement in quality of life. In order to be able to derive statistically valid statements, more patients must be involved. It is still unresolved whether biatrial pacing gives rise to hemodynamic benefits. These questions should be answered in a future study.

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