Incidence of Atrial Flutter and Atrial Fibrillation in Patients With Implanted Physiological Pacemakers

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Atrial flutter (AF) is a troublesome arrhythmia for patients with an implanted pacemaker. Although it has recently become possible to eliminate AF by radiofrequency catheter ablation (RF-CA), the incidence of AF before and after pacemaker implantation has not been clarified. The present study was conducted with 123 consecutive patients (69.3±11.6 (SD) years old) implanted with pacemakers, excluding patients who had chronic atrial fibrillation (AFib) when the pacemaker was implanted; 69 patients with atrioventricular (AV) block and 54 patients with sick sinus syndrome (including 29 patients with bradycardia–tachycardia syndrome). All patients were implanted with physiological pacemakers. The follow-up period was 4.7±1.9 years. In 11 of the 123 patients (8.9%), AF was observed before pacemaker implantation and the incidence was significantly higher in patients with sick sinus syndrome than in those with AV block (16.7 vs. 2.9%, p<0.01). Nine of the 29 patients with bradycardia–tachycardia syndrome (31%) had AF. After physiological pacemaker implantation, AF recurred in 9 of the 11 patients, and AF was newly observed in 1 patient. Thus, 10 of the 123 patients (8.1%) had AF after physiological pacemaker implantation. Recurrence of AF was not suppressed by physiological pacing. Thirty of the 123 patients had AFib before implantation of a pacemaker and its occurrence was reduced by physiological pacing (from 24.4% to 12.2%, p<0.05). The incidence of AFib in patients with AF was significantly higher than in those without AF (90.0 vs. 5.3%, p<0.001). In conclusion, the recurrence of AF is not prevented by physiological pacing and is closely related to the occurrence of AFib. RF-CA should be considered in patients who have AF before pacemaker implantation. (Jpn Circ J 2000; 64: 505–509)

Key Words: Atrial fibrillation; Atrial flutter; Atrioventricular block; Physiological pacemaker; Sick sinus syndrome

Atrial fibrillation (AFib) is the most common tachyarrhythmia in bradycardia–tachycardia syndrome.1,2 and along with atrial flutter (AF), it is also a troublesome arrhythmia in patients with implanted pacemakers3-7 with both arrhythmias sometimes observed in the same patient. The incidence of cerebral embolism is increased in patients who have AFib.8-15

It has been reported that atrial tachyarrhythmias are more likely to occur with ventricular pacemakers than with physiological pacemakers.16-18 but the common types of AF have now been successfully treated by radiofrequency catheter ablation (RF-CA).21 However, the incidence of AF before and after pacemaker implantation has not been clarified so it is not clear whether or not physiological pacemakers may have a preventive effect on the occurrence of AF. The present study investigated the incidence of AF and AFib before and after implantation of physiological pacemakers in patients requiring permanent cardiac pacemakers.

Methods

Subjects
In our hospital, physiological pacemakers are implanted in all patients who need pacemaker implantation, except those with chronic AFib. The subjects were 123 consecutive patients (69.3±11.6 (SD) years old) who were implanted with pacemakers from 1989 to 1993, excluding patients who had chronic AFib; 69 patients with atrioventricular (AV) block and 54 patients with sick sinus syndrome (SSS) including 29 patients with bradycardia–tachycardia syndrome. The underlying diseases were as follows: 28 with hypertension, 9 with chronic heart failure, 9 with diabetes mellitus, 6 with ischemic heart disease, and 3 with dilated cardiomyopathy. Two patients had undergone patch closure of a congenital atrial septal defect before pacemaker implantation. There were no patients with valvular disease. All patients were implanted with physiological DDD(R) pacemakers, DDI(R) or DDIR mode was programmed and the basic pacing rate was set at 60–80 beats/min.

Follow-up
The follow-up period was 4.7±1.9 years with check-ups performed every 1–3 months. A conventional ECG was
Fig 1. (A) Incidence of atrial flutter in patients with AV block and sick sinus syndrome (SSS). (B) Incidence of atrial flutter before and after pacemaker implantation.

Fig 2. (A) Incidence of atrial fibrillation in patients with AV block and SSS. (B) Incidence of atrial fibrillation before and after pacemaker implantation.

recorded then, but if patients complained of palpitations, an ECG and Holter ECG were recorded repeatedly.

Medications
Treatment with any antiarrhythmic agents was stopped after pacemaker implantation and were administered only when AF or AFib occurred after pacemaker implantation. As a result, antiarrhythmic agents were administered in 16 of the 123 patients after pacemaker implantation, with digoxin or methylidigoxin administered in 9 of these.

Statistical Analysis
The results are expressed as mean ±SD. Statistical analysis was performed using Fisher’s exact probability test. Values of p<0.05 were considered statistically significant.

Results
In 11 of the 123 patients (8.9%), AF was observed before pacemaker implantation: 9 of the 54 SSS patients and 2 of the 69 AV block patients (16.7 vs 2.9%, respectively; p<0.01). Nine of the 29 patients with bradycardia–tachycardia syndrome (31%) had AF.

After physiological pacemaker implantation, AF recurred in 9 of the 11 patients, and was newly observed in 1 patient, making a total of 10 of the 123 patients (8.1%) with AF after physiological pacemaker implantation, and 12 (9.8%) had AF before and/or after pacemaker implantation.
Fig. 3. (A) Incidence of atrial fibrillation in patients with and without atrial flutter. (B) Incidence of atrial flutter in patients with and without atrial fibrillation.

Fig. 4. Representative case. Electrocardiogram recorded in 73-year-old male with bradycardia-tachycardia syndrome showing (A) common-type atrial flutter and (B) atrial fibrillation followed by a long pause. (C) Atrial flutter was terminated by 300 beats/min rapid atrial pacing performed by the implanted pacemaker.

Recurrence of AF was not suppressed by physiological pacing (Fig. 1). Thirty of the 123 patients (24.4%) had AFib before implantation of a pacemaker, AFib was observed in 29 of the 54 patients with SSS (53.7%) and in 1 of the 69 patients with AV block (1.4%); the incidence of AFib was higher in patients with SSS than in those with AV block (p<0.001). In 15 of the 123 patients (12.2%), AFib occurred after implantation of a physiological pacemaker, but the incidence was reduced by physiological pacing (p<0.01, Fig. 2). Atrial fibrillation was observed in 9 of the 10 patients (90%) in whom AF was observed, and in 6 of the 113
patients (5.3%) in whom AF was not observed, making the incidence of AFib significantly higher in patients with AF than in those without AF (p<0.001). Atrial flutter was observed in 9 of the 15 patients (60%) in whom AFib was observed, and in 1 of the 108 patients (0.9%) in whom it was not observed, making the incidence of AF significantly higher in patients with AFib than in those without (p<0.001, Figs 3, 4).

Discussion

Atrial fibrillation causes many problems in patients with implanted pacemakers.\textsuperscript{1-7, 9-16} and increases the incidence of cerebral embolism.\textsuperscript{9-15} Nonphysiological VVI pacing has failed to prevent its occurrence,\textsuperscript{16-18} but physiological pacemakers have been shown to have possible preventive effects on the occurrence of AFib by reducing atrial load.\textsuperscript{14-18, 22, 23} However, implantation of atrial-based pacemakers such as DDDR and DDD leads to the tracking of rapid atrial rhythms and inappropriate ventricular responses during atrial tachyarrhythmias.\textsuperscript{1-7, 16}

The occurrence of AF has also been a great problem in patients with implanted pacemakers. Atrial flutter with 1:1 AV conduction may lead to an extremely high ventricular rate, and AFib and AF are sometimes both observed in the same patient? However, the incidence of AF before and after pacemaker implantation has not been clarified and it is also unclear whether or not physiological pacemakers do have preventive effects on the occurrence of AF.

The present study showed that the incidence of AF as well as AFib was higher in patients with SSS than in those with AV block. The common type of AF was usually observed, but the type of AF was not always identified as it was detected not only by conventional ECG but also by Holter ECG. Bradycardia–tachycardia syndrome is one type of SSS and these patients suffer from repeated supraventricular tachyarrhythmias and bradycardia, and mainly AFib,\textsuperscript{2} although AF is also a common atrial tachyarrhythmia in this syndrome. Although the physiological pacemakers had a preventive effect on the occurrence of AFib, recurrence of AF was not prevented. As the frequency and duration of AF before and after pacemaker implantation were not evaluated in the present study, it cannot be ruled out these changes parametered after pacemaker implantation.

Atrial flutter can be terminated by rapid atrial pacing\textsuperscript{19, 20} so automatic AF recognition and termination in an implantable pacemaker would be useful. The common type of AF can be eliminated by RF-CA;\textsuperscript{21} so it should be considered in patients who have AF before pacemaker implantation to prevent recurrence of AF after the pacemaker is implanted.

The present study results suggest that there is a close relationship between the occurrence of AF and that of AFib because most patients with AF also had AFib; the incidence of AF was low in patients who did not have AFib. Atrial fibrillation associated with atrial flutter in patients with implanted pacemakers could not be suppressed by physiological pacing, but AFib not associated with AF could be.

Drugs that slow conduction and prolong refractoriness can convert AFib to AF by slowing conduction and prolonging the wavelength, which results in a more stable organized rhythm; that is, flutter. Atrial flutter is often converted to AFib by digitalis, and a natural transformation between AF and AFib is sometimes observed. Thus, flutter and fibrillation can be best understood in terms of a unified concept of intra-atrial reentry based on both functional and anatomic properties within the atrium? Suppression of AF may possibly suppress the incidence of AFib, but there was no evidence in the present study that AF converted to AFib or that the incidence of AFib could be decreased by the suppression of AF. Further investigations are needed.

Recent studies of the automode switching and diagnostic function of the implantable pacemaker suggest that the incidence of AF in patients with implanted pacemakers is higher than expected.\textsuperscript{24} There is no common pattern in the initiation of AFib, but the initiation of AFib and AF may be detected by the pacemaker. The present study used conventional and Holter ECG to investigate the incidence of atrial tachyarrhythmias and thus the incidence may have been underestimated. However, the incidence of atrial tachyarrhythmias before pacemaker implantation can not be evaluated by this method. Although the rate of detecting atrial tachyarrhythmias may be low in the present study, the atrial tachyarrhythmias detected may have clinical significance, and comparison of the incidence of atrial tachyarrhythmias before and after pacemaker implantation may be possible. The present study, using conventional methods of detection, suggests that AF is not uncommon.

In conclusion, AF is not a rare arrhythmia in patients who need cardiac pacemakers, and its recurrence is not prevented by the pacemaker. There is a close relationship between the occurrence of AF and AFib. RF-CA should be considered in patients who have pre-existing AF.

References

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