

Atrial Fibrillation, Atrioventricular Nodal Ablation and Biventricular Pacing: A New Concept

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Key words:

Biventricular pacing, atrial fibrillation, atrioventricular node ablation.

Manuscript received:
December 11, 2003;

Accepted:
January 30, 2004.

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Atrial fibrillation (AF) is a common arrhythmia with high morbidity and mortality^{1,2}. Although effective drugs exist today, in certain patients they are unable to control the heart rhythm and/or heart rate³. In recent years, the “ablate and pace” approach—radiofrequency ablation of the atrioventricular node (AV), followed by implantation of a permanent pacemaker—has proved to be a useful practice for either avoiding or treating the “tachycardiomyopathy” caused by the rapid ventricular rate, while alleviating the symptoms of these patients⁴⁻⁷. Recent studies, however, have shown that pacing from the apex of the right ventricle, which is commonly used after AV node ablation, may cause or worsen existing symptoms of heart failure⁸⁻⁹. This way of pacing causes asynchronous ventricular stimulation similar to that seen in left bundle branch block. The latter condition has been found to lead to mechanical desynchronisation of the ventricles and also of the various regions of the left ventricle. The role of biventricular pacing, or pacing from the left ventricle, has begun to be examined as a possible solution to this problem. This new approach has already proved its value in another category of patients: those with a severe degree of heart failure and disturbances of intraventricular conduction.

AV node ablation and pacemaker implantation in patients with drug-refractory AF

It is well known that in 12% of patients with AF drug treatment is unable to control the heart rhythm and/or the heart rate³.

The chronically increased heart rate may cause “tachycardiomyopathy” and a reduction in ejection fraction, while an irregular heart rhythm has also been found to entail a reduction in cardiac output^{10,11}. Patients with drug-refractory AF often exhibit intense symptoms and a decreased quality of life. Radiofrequency ablation of the AV node has been used successfully over the last decade for symptom control. Already, findings from early studies, involving a small number of patients, have shown that, in certain patients, this therapeutic approach led not only to the relief of symptoms, but also to an improvement in ejection fraction and the quality of life¹²⁻¹⁵. On the downside, however, a small number of patients who had undergone this treatment suffered sudden cardiac death^{16,17}, later studies with large numbers of patients failed to confirm this initial observation.

In a study of 350 patients, Ozcan et al⁸ found that the survival rate in patients with AF following AV node ablation and pacemaker implantation was the same as that expected in the general population,

provided that there was no underlying cardiac disease. Furthermore, the long-term survival was the same in AF patients whether they received drug treatment or “ablate and pace” therapy. The findings from a meta-analysis of 21 studies were similar⁹. In all the parameters that were analysed, such as exercise tolerance, ejection fraction, quality of life, symptoms and morbidity, significant improvement was seen. The annual total mortality and incidence of sudden death were 6.3% and 2.0%, respectively, values that are low and comparable with those for drug treatment.

These deaths were attributed directly to the AV node ablation and pacing. Thus, apart from the possible inadequacy of the pacing system, the appearance of polymorphous ventricular tachycardia following AV node ablation was also recognised as a cause of death^{16,18}. This complication, however, appears to have been minimised by the programming of a higher basic rate (80-90 beats/min) for one or two months after the ablation. Thus, in more recent studies^{15,17,19}, using higher rates, no sudden deaths were observed during follow-up periods as long as 25 months.

In a recent study it was found that the survival rate after AV node ablation in patients with AF and an ejection fraction $\leq 40\%$ was clearly lower than in those with an ejection fraction $>40\%$ or in age- and sex-matched healthy controls²⁰. Moreover, it was found that in 29% of patients the ejection fraction was restored to around normal levels ($\geq 45\%$) after AV node ablation. This demonstrates that at least in some patients the reduction in ejection fraction due to AF is reversible. Indeed, the survival rate is better in those patients whose ejection fraction returns to normal levels and is comparable with healthy individuals of the same age and sex.

Implantation of a biventricular pacemaker in patients with permanent AF who need AV node ablation

In patients with permanent, drug-refractory AF who undergo AV node ablation and pacing, the latter is usually achieved by the implantation of an electrode at the apex of the right ventricle. This site is preferred not just for reasons of ease, but mainly because it ensures stable, long-term pacing with a low displacement rate and sensing and pacing thresholds that are both low and stable. However, pacing from the right ventricular apex is not the optimum solution, since it leads to the loss of the normal ventri-

cular activation sequence, resulting in a reduction in cardiac performance. Experimental animal and clinical studies have shown that it reduces the ejection fraction, while in the long term it causes disturbances of left ventricular innervation, perfusion and myocardial structure²¹⁻²⁴.

In recognising this problem it is reasonable for one to suppose that, in patients with permanent, drug-refractory AF, the benefit from the regularisation of rhythm and the reduction in heart rate achieved by AV node ablation is not as great as it might be, in view of the negative results of pacing from the right ventricular apex.

In recent years, in patients with dilated cardiomyopathy, sinus rhythm and disturbances of intraventricular conduction, cardiac resynchronisation through biventricular pacing or pacing from the left ventricular free wall has proved useful²⁵⁻²⁸. This way of pacing has also been investigated in patients with heart failure and AF who underwent AV node ablation^{29,30}. The findings of most studies were encouraging, showing the superiority of biventricular pacing versus pacing from the right ventricular apex in terms of left ventricular systolic function, exercise tolerance and quality of life.

In two recent studies, the role of biventricular pacing or left ventricular pacing was examined in patients who underwent AV node ablation for drug-refractory AF, with or without heart failure and regardless of the existence of intraventricular conduction disturbances. In one of these³¹ it was found that pacing from the left ventricular free wall ensured a higher ejection fraction than pacing from the right ventricular apex. Furthermore, it also significantly reduced the mitral regurgitation that was present both before the AV node ablation and during right ventricular apical pacing. A study in our own centre³² produced similar results. Using a conductance catheter we found that both the systolic performance and the diastolic filling of the left ventricle were significantly greater during biventricular pacing or pacing of the left ventricle compared to right ventricular pacing, in pts after AV junction ablation for drug refractory AF. Moreover, the mitral regurgitation was significantly reduced during biventricular and right ventricular pacing.

The above studies, however, refer to the immediate effects of the different methods of pacing. Results concerning their long-term effects on exercise tolerance and quality of life are expected soon from

the multi-centre OPSITE study³³. Of course, it must be stressed that in patients who undergo AV node ablation and are thus rendered pacemaker-dependent the overriding concern is safety. For that reason, since the technique of biventricular pacing is still difficult, with a high probability of complications and lead displacement, while its long-term superiority is still unproven, it cannot be recommended as the optimum approach in these patients.

In conclusion, regularisation of the cardiac rhythm and rate through AV node ablation and ventricular pacing in patients with drug-refractory AF improves left ventricular function, reduces symptoms, increases exercise tolerance and improves the patients' quality of life. Biventricular pacing or pacing from the left ventricular free wall seem to have a better immediate haemodynamic result compared with pacing from the right ventricular apex, while results are expected soon concerning their possible long-term superiority with regard to important parameters such as exercise tolerance and quality of life.

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