Several recent randomized clinical trials comparing strategies based on control of ventricular rate versus those based on maintenance of sinus rhythm in elderly or high risk patients with atrial fibrillation have recently been reported. Preliminary data from these trials suggest that the 2 strategies can produce roughly equivalent clinical outcomes. For individual patients, either approach may be appropriate because there appears to be no inherent advantage to a rhythm control strategy. These studies should cause doctors to look again at our techniques for achieving rate control in atrial fibrillation.

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Pharmacological therapy has long been the primary technique for controlling ventricular rates in patients with atrial fibrillation. Cardiac glycosides, β-adrenergic blockers, or calcium channels blockers are used, alone or frequently in combination, to prolong atrioventricular (AV) nodal refractoriness. Increased concealed conduction in the AV node results in moderation of the ventricular rate with conduction now occurring in an irregularly, irregular pattern. Although AV nodal blocking agents are usually considered to be safer and better tolerated than most membrane-active antiarrhythmic drugs, they do have some potential disadvantages. Many patients will require more than one agent. In patients with intermittent atrial fibrillation, excess bradycardia due to intrinsic or drug-induced sinus node dysfunction may be seen. Nocturnal bradycardia is common even if daytime or exercise rates are poorly controlled. Stress from an acute severe illness may make heart rate control difficult even in patients who normally have well controlled rates. Many patients cannot tolerate one or more of the agents for various reasons. AV nodal ablation with permanent adaptive-rate pacemaker insertion is an effective nonpharmacological alternative for those patients who fail attempts at rate control with drugs.

Observational and controlled studies on the value of AV junctional ablation and pacing have shown improvements in a broad range of clinical variables. Several authors have proposed that at least a part of this benefit is due to the regularization of rhythm that occurs after the heart rate becomes pacemaker dependent. Unfortunately, AV junctional ablation is a irreversible intervention and patients are pacemaker dependent for life after the procedure. In addition, pacing from the right ventricular apex may have adverse hemodynamic consequences because it changes the normal sequence of ventricular activation. Although adverse effects of right ventricular pacing are usually subtle, they may be clinically significant in patients with underlying ventricular dysfunction.

In this issue of Circulation, Zhuang and his colleagues report experiments extending their prior work on the use of selective vagal stimulation to control rates in atrial fibrillation. The authors describe a canine model of atrial fibrillation in which they compared hemodynamic parameters under conditions where heart rate was controlled either by selective AV nodal stimulation or by AV junctional ablation. The authors describe a canine model of atrial fibrillation in which they compared hemodynamic parameters under conditions where heart rate was controlled either by selective AV nodal stimulation or by AV junctional ablation. The effects of rhythm regularization were controlled by mimicking the irregularly, irregular ventricular rate seen when AV nodal conduction is intact by using a computer-driven pacing algorithm. In this model, better hemodynamic profiles were seen when AV nodal conduction remained intact and intraventricular conduction was normal.

Although the data presented here are interesting, there are many questions that will need to be addressed before this concept becomes relevant to clinical practice. As proposed by the authors, the first clinical studies are likely to be performed in patients with postoperative atrial fibrillation. In these patients, temporary electrodes could be used for stimulation, and the power source for stimulation could be external. Because many patients have only brief episodes of rapid atrial fibrillation in this setting, the ability to achieve a response and then maintain it would not be critical.

It would be more exciting if this technique could be applied in a long-term setting. Further studies will be needed to see if rate control by selective vagal stimulation can be achieved continuously over extended periods of time. Could an implantable stimulator with a power source of acceptable longevity be developed that would permit automatic regulation of ventricular rates? How would this technique compare to pacing approaches that use biventricular pacing after AV junctional ablation in patients with atrial fibrillation? The latter techniques would also maintain ventricular synchrony and may well be as effective.

If these questions are answered in favor of selective vagal stimulation, devices incorporating this function will likely be designed. This could lessen the need for permanent ablation of AV conduction. Patients who receive such a device might then be able to benefit in the future if breakthroughs in the prevention of atrial fibrillation occur.
References


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Selective Vagal Stimulation for Rate Control in Atrial Fibrillation
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