

Pacing Treatment of Atrial Fibrillation Patients with Heart Failure

His Bundle Pacing Combined with Atrioventricular Node Ablation



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KEYWORDS

• Atrial fibrillation • Heart failure • His bundle pacing • Atrioventricular node ablation

KEY POINTS

- His bundle pacing (HBP) can preserve/restore ventricular synchrony. HBP combined with atrioventricular node (AVN) ablation is demonstrated feasible, effective, and suitable for atrial fibrillation (AF) patients with heart failure (HF) who suffer from insufficient or unbearable medication therapy or failed AF catheter ablation, especially in those with other arrhythmias that need pacemaker therapy.
- In patients who undergo AVN ablation, pacing in the distal His bundle or bundle branch allows adequate space for AVN ablation.
- Ablate from atrial side to keep sufficient safety distance to pacing site, preserving the pacing function of HBP lead.
- Prospective, randomized controlled studies are needed to compare AVN ablation and HBP with medical therapy and AF ablation.

INTRODUCTION

The estimated number of individuals with atrial fibrillation (AF) in 2010 was 33.5 million globally and increases by 5 million each year.¹ The main risk of AF includes thromboembolism, heart failure (HF), and dementia.^{2–5} Previous investigations have demonstrated that HF and AF coexist in approximately 13% to 27% HF patients.⁶ Patients with AF and HF have a higher risk of thromboembolic events and a higher mortality compared with those with only AF or HF.^{7,8} Established treatment of AF includes upstream therapy⁹ of concomitant conditions, anticoagulation, and rate/rhythm management. Nowadays the main methods to achieve rate/rhythm

control include pharmacologic therapy, AF ablation, and atrioventricular node (AVN) ablation in combination with pacing therapy. How to control heart rate/rhythm individually, however, is the most important and debatable key point.¹⁰ Therefore, this article reviews the methods for rate/rhythm control and focuses on the clinical application of His bundle pacing (HBP) plus AVN ablation in AF patients with HF as well as relevant skills associated with HBP lead implantation and AVN ablation.

CURRENT STATE OF RATE/RHYTHM CONTROL

Currently, 3 strategies to control heart rate and rhythm in AF patients are pharmacotherapy,

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catheter ablation of AF, and pacemaker implantation post-AVN ablation. Feasibility and effectiveness of these 3 therapies have been clinically demonstrated.

Pharmacotherapy

Pharmacotherapy as the initial strategy for rate/rhythm control has been practiced for quite a while, but disadvantages of pharmacotherapy of AF have been universally acknowledged. The successful rate of restoring and maintaining sinus rhythm is low. The subgroup analysis of AFFIRM trial showed that recurrence rate of AF in patients with abnormal ejection fraction (EF) was fairly high and up to 84%.¹¹ Some antiarrhythmic drugs (ADDs) used for AF rhythm control, including dronedarone, may make HF worse.^{12,13} Meta-analyses indicate that except for β -blockers, most ADDs for heart rate control, including calcium channel blockers and digoxin, increase mortality.^{14,15} Results from the Rate Control Efficacy in Permanent Atrial Fibrillation: a Comparison between Lenient versus Strict Rate Control II (RACE II) study indicated that in patients with permanent atrial fibrillation, lenient rate control with resting heart rate <110 beats per minute (bpm) is as effective as strict rate control with resting heart rate <80 bpm and heart rate during moderate exercise <110 bpm; the frequencies of the primary outcome were similar in the 2 groups.¹⁶ One reason likely was the adverse effects of drugs for rate control, and another reason was the low quality of rate control by drugs. Low mean ventricular rate does not stand for regular rhythm whereas irregular rhythm during AF under rate control is another important factor causing cardiac dysfunction.

Catheter Ablation of Atrial Fibrillation

Previous research findings^{17–20} with small sample size were similar in outcome to the results of the recently published Catheter Ablation vs. Standard Conventional Treatment in Patients With LV Dysfunction and AF (CASTLE-AF) trial. Catheter ablation of AF in patients with reduced EF is associated with improved all-cause mortality and fewer admissions for worsening HF compared with conventional treatment.²¹ Successful rate of cardioversion to maintain sinus rhythm are impacted by multiple factors, such as the mechanism of AF, underlying cardiac disease, size and fibrosis of left atrium (LA), and duration of AF.^{21–23} A meta-analysis²⁴ evaluating the long-term outcome of 6167 patients who underwent a single radiofrequency ablation procedure for AF revealed that only 54.1% of paroxysmal AF patients and 41.8% of nonparoxysmal AF patients maintained sinus

rhythm. Generally speaking, AF ablation in patients with HF is challenging due to issues, including lack of effective methods to monitor heart rhythm after ablation, high recurrence rate of AF in patients with large LA and long duration of AF, high cost of repeated catheter ablation to maintain sinus rhythm, and procedure-related complications.

Atrioventricular Node Ablation

Experience with AVN ablation and pacing for AF patients who are nonresponders or intolerant to intensive rate and rhythm control therapy includes more than 20 years of therapy.²⁵ A meta-analysis from Wood and colleagues²⁵ using data from 10 studies, including 41% to 54% of patients with paroxysmal AF, showed that radiofrequency ablation of the AVN and permanent pacing could improve exercise duration/ventricular function/quality of life and symptoms compared with medical therapy alone. Although AVN ablation improves symptoms, long-term right ventricular (RV) apical pacing produces left ventricular (LV) dyssynchrony and hemodynamic impairment.²⁶ For some patients, RV apical pacing can lead to pacing-induced cardiomyopathy.²⁷ The PAVE study (Left ventricular-based cardiac stimulation post AV nodal ablation evaluation) and AVAIL CLS/CRT trial (AV-node Ablation With CLS and CRT Pacing Therapies for the Treatment of AF)^{28–30} and meta-analysis³¹ demonstrated superior outcomes with biventricular pacing (BVP) for preserving cardiac function compared to RV pacing. The guidelines for cardiac resynchronization therapy (CRT) from the European Society of Cardiology (ESC) in 2013³² and American Heart Association (AHA)/American College of Cardiology (ACC)/Heart Rhythm Society (HRS) in 2014³³ both recommend that BVP is considered for HF patients unresponsive or intolerant to intensive rate and rhythm control therapy (Class IIa, level of evidence: B). For patients whose intrinsic QRS duration is less than 130 ms after AVN ablation, not enough evidence supports BVP to maintain synchronization of ventricular contraction, and BVP may even induce dyssynchrony.^{34,35} One limitation to BVP is this pacing is not truly physiologic especially in patients with a narrow QRS complex. Recent investigations³⁶ have found that HBP can provide physiologic ventricular activation and hence avoids ventricular dyssynchrony and preserves ventricular function in AF patients with normal His-Purkinje conduction system.

In 2000, Deshmukh and colleagues³⁷ first reported successful AVN ablation and permanent direct HBP in AF patients. Since then, there have been multiple studies with small sample sizes that show similar results probing that AVN ablation and permanent HBP is clinically feasible, safe, and

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