Permanent cardiac pacemaker therapy is widely recognized as beneficial in the treatment of various types of symptomatic bradycardia. Early pacemakers were only capable of pacing one chamber of the heart, usually the right ventricular apex. Dual-chamber permanent cardiac pacing was introduced as a more physiological pacing system at the beginning of the 1980’s and has spread for clinical use in patients with sinus node dysfunction and/or atrio-ventricular conduction block (AV block). Since the 1990’s, rate adaptive cardiac pacing for sinus node dysfunction has been available as the most physiologic pacing system providing a means by which an adequate heart-rate response to exercise can be achieved without atrial sensing. At present, the guidelines for pacing in bradycardia patients are largely based on observational rather than randomized studies. The findings from observational studies show that physiological pacing is associated with reduced mortality, fewer strokes, reduced heart failure, and less atrial fibrillation when compared with ventricular pacing. Furthermore, more recent advancements in pacemaker technology are believed to improve patient quality of life and cardiac function. Indeed, the use of physiological pacing (DDD mode or DDDR mode) has decreased the incidence of atrial fibrillation and improved quality of life compared to non-physiological pacing (VVI mode or VVIR mode) in patients with permanent pacemakers.

Recent large clinical trials (1–5), however, have shown that physiological pacing (DDD or DDDR modes) does not improve all cause mortality, cardiovascular death, or hospitalization for heart failure compared to non-physiological pacing (VVI or VVIR mode). In 1997, the Danish trial (6), which was a relatively small, randomized study comparing physiological pacing (AAI or AAIR mode) with ventricular pacing (VVI or VVIR mode) in patients with sinus-node disease, demonstrated a significant reduction in the risk of stroke, and an extended 8-year follow-up showed a significant reduction in the rates of death and atrial fibrillation as well. Nevertheless, the Canadian Trial of Physiological Pacing (CTOPP) in 2000 reported (3) that physiological pacing (DDDR mode) provided little benefit over ventricular pacing (VVIR mode) for the prevention of stroke or death due to cardiovascular causes. In 2002, results of the Mode Selection Trial in Sinus-Node Dysfunction (MOST) reported (2) that dual-chamber pacing did not improve stroke-free survival in sinus-node dysfunction as compared with ventricular pacing. In this trial, however, dual chamber pacing reduced the risk of atrial fibrillation, lowered signs and symptoms of heart failure, and slightly improved the quality of life.

Most recently, it has been shown that dual-chamber physiological pacing (DDDR mode) at a lower rate of 70 ppm, as compared with ventricular back-up pacing (VVVI mode) at a rate of 40 ppm, significantly increased the incidence of cardiovascular death and heart failure hospitalization in patients with low ejection fraction (<40%) who had no indication for bradycardia pacing during only a 1-year follow-up (4, 5). These trials suggest that pacing from the right ventricular apex might reduce cardiac function. In fact, the MOST and CTOPP sub-studies have shown that an increase in cumulative percentage of right ventricular apical pacing correlates with increased incidence of heart failure hospitalization, cardiovascular death, and atrial fibrillation (7, 8). The ventricular desynchronization imposed by ventricular apical pacing even when AV synchrony is preserved increases the risk of heart failure hospitalization and atrial fibrillation in sinus node disease with normal baseline QRS duration (8).

Tse et al (9) have shown very interesting data related to this discussion. They investigated cardiac function in 24 complete AV block patients with permanent pacemakers by comparing pacing from the right ventricular outflow septal (RVS) position in 12 patients with pacing from the right ventricular apical (RVA) position in the remaining 12 patients. In their study, cardiac function in both systolic and diastolic was superior in patients with RVS pacing, as compared with RVA pacing, during 18 months follow-up. However, they have not yet reported the clinical outcome of these two patient groups. Related to the study of Tse et al, a case report in the present issue of Internal Medicine by Mitsuya et al (10) describes how pacing thresholds at several sites in the right ventricle were investigated in a patient with systolic cardiac dysfunction due to chronic myocarditis.
Following steroid therapy in their case, the pacing threshold was decreased and stabilized, but the cardiac function did not improve. Therefore, the right ventricular pacing site may be an important factor for the improvement of cardiac function when a permanent pacing system is implanted in patients with left ventricular dysfunction caused by progressive myocardial disease.

To conclude, previous randomized trials in which patients were paced from the RVA have shown that dual-chamber pacing led to a moderate reduction of the incidence of chronic atrial fibrillation, reduced symptoms of heart failure in patients with sinus node disease, prevention of pacemaker syndrome, and modestly improved quality of life (11). Therefore, prospective randomized clinical trials of right ventricular outflow septal versus apical pacing to prevent heart failure are needed in the future, especially in patients with left ventricular systolic dysfunction.

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