Since the inception of transvenous pacing, the right ventricular apex (RVA) has been the conventional pacing site. However, it is becoming increasingly evident that this may be deleterious in some patients, particularly those with prior clinical heart failure or evidence of impaired left ventricular function. RVA pacing causes asynchronous patterns of right and left ventricular depolarization and contraction. This produces abnormal regional myocardial blood flow, changes in cardiac metabolism, and impairs systolic and diastolic function. Experimental studies have indicated that long-term RVA pacing induces abnormal histologic change with myofibrillar disarray and asymmetrical left ventricular hypertrophy and thinning. There is mounting clinical evidence that chronic RVA pacing increases the risk of developing heart failure and atrial arrhythmias. In the DAVID trial, patients in whom RVA pacing predominated (the dual chamber group) were at greater risk of reaching the composite end-point of death and hospitalization for heart failure compared to those with less RVA pacing. These patients had significant left ventricular impairment prior to device implant. The situation is less clear whether LV function is preserved prior to pacing but even the large-scale pacing studies have shown only a modest benefit as far as dual chamber pacing (compared to RVA pacing) is concerned. As yet, the ideal pacing site remains to be determined. Small-scale studies of right ventricular outflow tract (RVOT) pacing have shown amelioration of the reduction of LV function and prevention of myofibrillar disarray, but clinically RVOT pacing has produced inconsistent results. Only atrial (AAI) pacing has shown a consistent survival benefit with less heart failure and atrial fibrillation, reinforcing that ventricular depolarization via the His-Purkinje system is preferable.

However, it does appear that chronic RVA pacing produces dysynchrony of left ventricular contraction, induces deleterious changes in LV mechanics, and increases the risk of developing heart failure. These effects are more clinically significant in patients with poor LV function prior to pacing. Biventricular pacing has a beneficial effect on both morbidity and mortality where LV function is already impaired. All the large-scale cardiac resynchronization studies have shown a positive effect, and the CARE-HF has shown a clear mortality benefit. The PAVE study also showed a beneficial effect of biventricular pacing in patients with preserved LV function undergoing His Bundle ablation for chronic atrial fibrillation, and compared with standard RVA pacing, had a better outcome over the relatively short study period. In the presence of impaired left ventricular function, broad QRS complexes, and signs and symptoms of heart failure, biventricular pacing should now be the mode of choice until newer studies identify alternate or superior pacing sites.

An important issue for clinicians now is how best to manage patients in whom devices were implanted years ago, who require generator change, and in whom LV function is impaired. Should they be upgraded to a biventricular system? Many of these patients are elderly and some will have signs and symptoms of heart failure. If the rhythm is predominantly paced, they will have demonstrable dysynchrony by echocardiographic criteria. The paced QRS complexes will be broad. Even symptomatology may not be a sufficient reason to consider upgrading the unit as more than 20% of the patients in the CARE-HF study had few or no symptoms. Currently, LV pacing remains a relatively unpredictable procedure, and achievement of a satisfactory result may not be quick. The implications for every implanting center are significant in terms of both catheter laboratory time and number of cases. It will be a challenge to deliver the increased implantation numbers within current limitations of trained personnel and resources. Increasing the numbers of dedicated pacing specialists may be the only way forward. Despite these practical and resource challenges, pacing cardiologists should now weigh up the clinical benefits and risks of upgrading to a biventricular device in every patient with impaired LV function who requires routine generator change.
References