

Excacerbation of Heart Failure after Discontinuation of Long-Term Left Ventricular Pacing: Resolution after Cardiac Resynchronization Therapy

Michael Geist MD, Izhaki Alexander MD, Vladimir Turkisher MD and Yoseph Rozenman MD

Department of Cardiology, Wolfson Medical Center, Holon, Israel

Key words: heart failure, left ventricular pacing, biventricular pacing, cardiac resynchronization

IMAJ 2003;5:748–749

Cardiac resynchronization with biventricular pacing has recently become a recommended mode of pacing for patients with heart failure [1] and severe intraventricular conduction delay. The conduction abnormalities, mainly left bundle branch block and possibly also right bundle branch block, may be an independent cause of further deterioration in heart failure patients. Cardiac resynchronization is usually achieved by pacing the right and left ventricles simultaneously (as well as the right atrium if patients are in sinus rhythm). The use of such devices has been associated with improvement in dp/dt, oxygen consumption, ejection fraction, 6 minute walk, quality of life, functional class, improved use of defibrillator therapies, and reduction of hospitalizations. The mechanisms proposed in the improved heart function due to BV pacing include improved septal contribution, synchronization in the timing of contraction and relaxation of the ventricular walls, and reduction of mitral regurgitation. Some experimental studies [2] and recent clinical data [3] suggest that the major advantage of pacing both ventricles may be achieved by pacing the left ventricle alone. We describe a patient who developed symptoms of congestive heart failure when ventricular pacing changed from pacing his left ventricle via the coronary sinus to the right ventricle. Symptoms disappeared with BV pacing.

Patient Description

A 75 year old man with ischemic heart disease underwent two coronary bypass operations in 1990 and a repeat operation after an extensive anterior wall infarct in

1991. He was stable until 1997 when he developed sinus bradycardia alternating with slow atrial fibrillation. A dual chamber rate-responsive pacemaker was implanted. His ventricular electrode was inadvertently placed pacing his LV chamber via the coronary sinus. This is an uncommon occurrence that may be left undiagnosed unless one looks for a right bundle branch pattern in the electrocardiogram and a posterior position on lateral view. In this case the diagnosis was made at the time of defibrillator upgrade. The patient did well although he remained in atrial fibrillation for 4 years, until he started having dizzy spells and experienced a syncopal event. A Holter monitor for 24 hours documented atrial fibrillation with paced rhythm, recurrent ventricular premature beats and short episodes of non-sustained ventricular tachycardia. An electrophysiologic study done via his pacemaker easily induced sustained monomorphic ventricular tachycardia at a rate of 220 beats/minute that was promptly cardioverted to normal sinus rhythm. He was referred for implantation of a cardioverter defibrillator.

The patient underwent replacement of his old pacemaker by a Guidant Prizm II DR 1861 defibrillator. His old ventricular lead Medtronic 5024 was capped and left intact and a new ventricular lead, Guidant endurance 0148, was implanted as a pace/shock lead in the RV apex. An ECG after the procedure documented paced rhythm with a left bundle branch block pattern as compared to his previous paced right bundle branch block pattern.

Postoperatively he maintained his sinus

rhythm but his functional class deteriorated. He required an increased diuretic dose, from 80 mg furosemide a day to 160 mg/day. His creatinine increased from 1.8 to 3.0 mg/dl. He was limited by shortness of breath to walking 30–50 meters at a time; prior to the operation he had been active and unlimited in his daily activity.

After deliberation we decided, in view of the fact that he already had a coronary sinus lead in place, to connect his old pacing lead to his defibrillator to achieve BV pacing. This was done as recently described [4] with a Medtronic 2872 lead adaptor (an adaptor that connects the RV and LV lead in a Y connection), which enables BV pacing with a regular pacemaker or defibrillator and avoids the cost of a new dedicated cardiac resynchronization device. During the implant procedure we tested defibrillation and did not encounter any problem in ventricular fibrillation detection or treatment. The QRS during BV pacing was shortened by more than 80 msec, from 240 to 160 msec.

His echocardiogram documented pre- and post-BV pacing, and during RV pacing vs. BV pacing did not show significant changes. He has a severely dilated left ventricle with severely reduced function, mild to moderate mitral regurgitation with moderate to severe tricuspid regurgitation, and severe pulmonary hypertension. There was some improvement in the septal motion and possibly in RV function.

The patient recovered soon after the procedure, within 3 weeks was walking 2.5 km a day and has gone back to swimming 40 minutes a session. He also halved his diuretic intake. His creatinine has decreased to 1.9 mg/dl and he became functional class I.

BV = biventricular

LV = left ventricular
RV = right ventricular

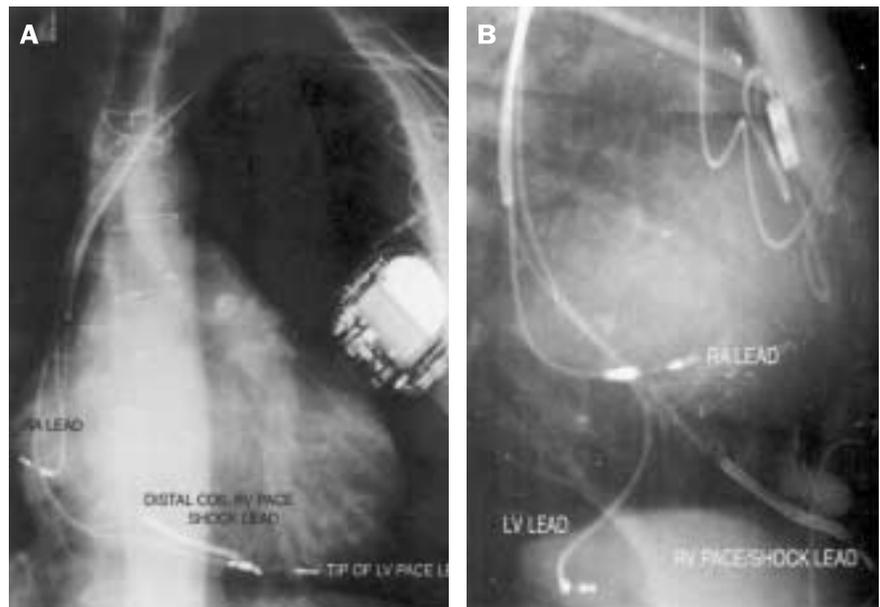
Comment

Cardiac resynchronization therapy has recently been shown to improve quality of life, functional capacity and heart failure functional class [1]. Typically this is done by pacing both ventricles simultaneously, that is, biventricular pacing. Notwithstanding a recently reported case of BV pacing in which clinical deterioration developed after loss of the right-sided pacing, some experimental work may suggest otherwise. It was recently shown [2] that the pressure volume curves as measurements of systolic function in these patients, as well as energy requirements with BV pacing or LV pacing, are similar. Both are superior to RV pacing. In isolated cases [5] it has even been suggested that LV pacing may be superior to BV pacing.

To the best of our knowledge our report is the first in which a patient with severely reduced left ventricular function had primary left heart pacing for a few years and deteriorated when reversing to "normal" RV pacing. LV pacing was superior although the lead was probably in a posterior coronary vein and not in a typical resynchronization position. The patient's functional status recovered only after the change to BV pacing [Figure]. This case raises the issue whether a significant part of the advantage gained from biventricular pacing is actually gained from pacing the left ventricle.

It is noteworthy that this patient deteriorated on RV pacing even though he was cardioverted to sinus rhythm, and has remained in sinus rhythm since receiving his defibrillator. Prior to the electrophysiological study he had been in atrial fibrillation programmed to VVI pacing for 4 years.

We recommend that in patients like the one described here, in whom a ventricular lead is found after implantation to have been inadvertently placed in the coronary sinus with a stable position and good threshold, the lead should be left in place,



[A] Antero-posterior chest X-ray after defibrillator implant. The old left ventricular pacing lead tip is positioned more to the left side. **[B]** Right lateral X-ray view post-resynchronization, showing the posterior position of the pacing lead compatible with LV pacing.

especially in patients with left heart failure. This applies on condition that the left-sided lead is not located endocardially, which is associated with increased thromboembolic risk.

Our case also gives additional support to consideration of primary pacing the left ventricle instead of the right ventricle in heart failure patients even if biventricular pacing is not done. Should this be the case, it will have significant financial as well as practical implications; namely, simplifying pacing in heart failure to achieve cardiac resynchronization.

References

1. Cazeau S, Leclercq C, Lavergne T, et al., for the Multisite Stimulation in Cardiomyopathies (MUSTIC) Study investigators. Effects of multisite biventricular pacing in patients with heart failure and intraventricular conduction delay. *N Engl J Med* 2001;344:873–80.
2. Kass DA, Chen CH, Curry C, et al. Improved left ventricular mechanics from acute VDD

pacing in patients with dilated cardiomyopathy and ventricular conduction delay. *Circulation* 1999;99:1567–73.

3. Touiza A, Etienne Y, Gillard M, Mansourati J, Blanc JJ. Long term left ventricular pacing: assessment and comparison with biventricular pacing in patients with severe congestive heart failure. *J Am Coll Cardiol* 2001; 38:1996–70.
4. Leon AR, Greenberg JM, Kanuru N, et al. Cardiac resynchronization in patients with congestive heart failure and chronic atrial fibrillation: effect of upgrading to biventricular pacing after chronic right ventricular pacing. *J Am Coll Cardiol* 2002;39:1258–63.
5. Alberca T, Ramos M, Vinas J, Nunez A, Pastor A, Garcia-Cosio F. Hemodynamic benefits of left ventricular pacing in two pacemakers syndromes with refractory heart failure. *Rev Esp Cardiol* 2000;53(8):1123–8.

Correspondence: Dr. M. Geist, Electrophysiological Service, Dept. of Cardiology, Wolfson Medical Center, P.O. Box 5, Holon 58100, Israel.

Phone: (972-3) 502-8129/8404

Fax: (972-3) 502-8699

email: geist@wolfson.health.gov.il