Upgrading to Cardiac Resynchronisation Therapy in the UK: An audit of contemporary clinical practice

Dr Christopher Critoph BM MRCP MD

Cardiology Specialist Registrar, St Bartholomew's Hospital, London

Background

Current ESC guidelines recommend upgrade to cardiac resynchronisation therapy (CRT) for patients with pre-existing pacemakers or implantable cardioverter defibrillators (ICDs) requiring frequent right ventricular (RV) pacing and symptomatic left ventricular (LV) systolic impairment. In addition, many patients with pacemakers and ICDs develop indications for upgrade to CRT. Real-world UK data between 2003-7 suggested that in a population of nearly 400 ICD implants that upgrade rates at 1, 3, and 5 years were 0.03%, 2.4%, and 5.1%, respectively [1]. However, the latest edition of NICE guidance with expanded indications for CRT will have increased this number further.

Early data on upgrades indicated a high rate of procedure-related complications and there is a relative lack of data on clinical outcomes in these groups. However, experience of CRT implantation has grown and technology has improved to the extent that a contemporary re-eavaluation is warranted.

Non-randomised European data from 2011 suggested similar clinical and procedural outcomes from pacemakers upgraded to CRT [2]. Patients enrolled in RAFT who required an upgrade to CRT within 6 months (sub-study) had a 90% implant success rate and 3.4% acute complication rate [3]. There is some evidence that pacemaker dependent patients without coronary artery disease (and presumed scar) and no previous ventricular arrhythmia who are being upgraded to a CRT-D device have fewer comorbidities, longer survival, and low risk of appropriate shocks than those with coronary artery disease [4]. In addition, the incidence of ventricular arrhythmia is lower in heart failure patients who demonstrate echocardiographic response following upgrade to CRT-D from ICD devices [5]. In 25 pacemaker patients being upgraded to CRT following the development of heart failure, an LVEF ≥ 43.5% predicted response to CRT, wheras conventional dyssynchrony indices did not [6]. Retrospective data on 72 chronic RV pacemaker patients undergoing upgrade between 2003 – 2008 suggests successful reversal of electical dyssynchrony with CRT predicts clinical response, and that the duration of RV pacing does not determine outcome [7].

At the Barts Heart Centre all patients due elective generator replacement who receive >60% RV pacing are considered for upgrade. These patients are identified by physiologists in

device clinic and transthoracic echocardiography performed. The risks and benefits of an upgrade procedure are then discussed by the medical team and informed consent obtained if appropriate. This presents an opportunity to investigate contemporary, real world UK procedural success and clinical outcome of patients undergoing CRT upgrade.

Methods

We performed a retrospective analysis of consecutive upgrade procedures at our institution between 2011 and 2014.

Results

Seventy-six patients (60 male, age 72 ± 11 years) were included. Indications for device implant included ischaemic cardiomyopathy 56 (74%), dilated cardiomyopathy 13 (17%), pace and ablate strategy for atrial fibrillation (AF) 5 (7%) and valvular 2 (3%).

LV ejection fraction was ≤35% in 66 (87%) patients. AF was paroxysmal in 10 (13%) and persistent / permanent in 41 (54%). QRS width was <120ms in 6 (8%), 120-129 ms 4 (5%), 130-149ms 10 (13%) and >150ms 33 (43%). Seventy (95%) patients had a left bundle branch block ECG pattern, with 100% RV pacing in 23 (30%).

The median (IQR) time from initial device implant to upgrade was 5.4 (5) years. Conventional epicardial LV placement via the coronary sinus was achieved in 74 (97%) patients. A quapripolar LV lead was used in 23 (30%) patients. Complications were infection (3, 3.9%), lead displacement requiring repositioning (2, 2.6%) and erosion requiring reoperation (1, 1.3%). Median follow up was 1.6 years. Median percentage biventricular pacing was 99%. An initial symptomatic improvement was reported in 48 (63%) patients, which was sustained to latest follow up in 46 (61%) ($p<0.001$, NYHA functional class 1 (4, 5%), 2 (52, 71%) and 3 (17, 23%)). Three patients died, at 17, 35 and 51 months.

Conclusions

In a contemporary population with heart failure undergoing upgrade to CRT , procedural success and biventricular pacing percentage was high, with a lower complication rate than has been reported previously. The reason for the observed lower complication rate is likely to be multifactorial, including increased operative experience of the whole catheter lab team, familiarity with and improved design of tools for implantation and good clinical training and supervision of trainees. Sustained symptomatic response was as good as is reported for de novo implants. Patients undergoing elective pacemaker or ICD generator replacement should be assessed and considered for concomitant upgrade to a CRT device.

This can be achieved using a physiologist led device clinic assessment with physician input. There is justifaction for a randomised controlled trial to assess CRT procedural upgrades in a systematic fashion.

1. Scott, P.A., et al., *Rates of upgrade of ICD recipients to CRT in clinical practice and the potential impact of the more liberal use of CRT at initial implant.* Pacing Clin Electrophysiol, 2012. **35**(1): p. 73-80.
2. Bogale, N., et al., *The European Cardiac Resynchronization Therapy Survey: comparison of outcomes between de novo cardiac resynchronization therapy implantations and upgrades.* Eur J Heart Fail, 2011. **13**(9): p. 974-83.
3. Essebag, V., et al., *Incidence, predictors, and procedural results of upgrade to resynchronization therapy: the RAFT upgrade substudy.* Circ Arrhythm Electrophysiol, 2015. **8**(1): p. 152-8.
4. Adelstein, E., et al., *Outcomes in pacemaker-dependent patients upgraded from conventional pacemakers to cardiac resynchronization therapy-defibrillators.* Heart Rhythm, 2014. **11**(6): p. 1008-14.
5. Thijssen, J., et al., *Implantable cardioverter-defibrillator patients who are upgraded and respond to cardiac resynchronization therapy have less ventricular arrhythmias compared with nonresponders.* J Am Coll Cardiol, 2011. **58**(22): p. 2282-9.
6. Chang, P.C., et al., *Remote past left ventricular function before chronic right ventricular pacing predicts responses to cardiac resynchronization therapy upgrade.* Pacing Clin Electrophysiol, 2014. **37**(4): p. 454-63.
7. Rickard, J., et al., *QRS narrowing is associated with reverse remodeling in patients with chronic right ventricular pacing upgraded to cardiac resynchronization therapy.* Heart Rhythm, 2013. **10**(1): p. 55-60.