85 CARDIAC RESYNCHRONISATION THERAPY ACUTELY ALTERS METABOLIC SUBSTRATE UPTAKE, CORRELATING WITH IMPROVEMENTS IN SYSTOLIC FUNCTION AND LONG TERM REVERSE REMODELLING

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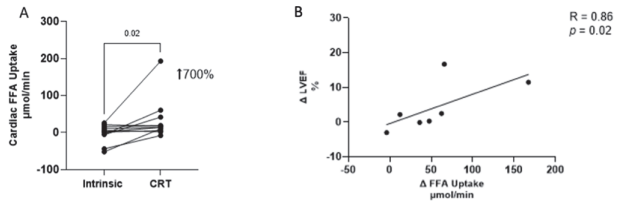
Introduction The failing heart is thought to be metabolically inflexible, and oxygen limited, shifting from free fatty acid (FFA) oxidation towards glucose metabolism. Whilst glucose metabolism is more oxygen efficient, fatty acid (FA) metabolism generates more adenosine triphosphate (ATP) per mole of substrate. Cardiac resynchronisation therapy (CRT) acutely improves cardiac haemodynamics in patients with severe heart failure and a left bundle branch block. However, whether CRT alters metabolic substrate usage and whether this correlates with functional improvement is unknown.ObjectivesTo assess acute cardiac work, efficiency, and metabolic substrate uptake in response to CRT and correlate this with reverse remodelling.

Methods Participants with non-ischaemic cardiomyopathy were started on an insulin/dextrose infusion prior to CRT implant. During implant, measurements of left ventricular (LV) contractility (using a pressure-volume loop catheter), coronary flow (using a Doppler guide wire) and paired arterio-venous blood samples (from the left main stem and coronary sinus) were obtained with and without CRT at rest and during stress, pacing at 65% of predicted maximum heart rate. All measurements were repeated on a FFA infusion. Participants had cardiac magnetic resonance imaging at 6 months, with biventricular pacing in MRI-safe mode, to assess reverse remodelling.

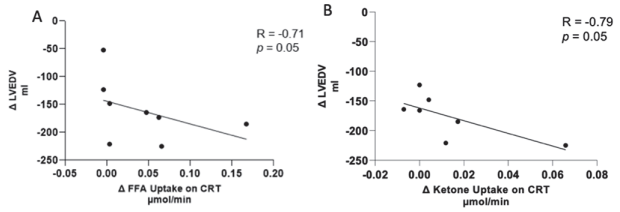
Results Twelve participants were recruited (7 male, median age 64 [IQR 60–71]). Measures of LV contractility (work and dP/dtmax) were significantly improved by CRT at rest and stress on both infusions, without an increase in myocardial oxygen demand, resulting in improvement in cardiac efficiency (insulin/dextrose at rest:+7.9%, p = 0.02; stress: +67%, p = 0.03; FFA at rest: +31%, p = 0.02; stress: +57%, p = 0.09). Metabolic flexibility was therefore retained. On insulin/dextrose, CRT at rest increased cardiac FFA uptake (Figure 1A), which positively correlated with improvement in LV ejection fraction (LVEF, Figure 1B). When FFA uptake was already increased during stress, CRT increased lactate uptake (p = 0.02). When FFA uptake was maximised on a FFA infusion, CRT increased ketone uptake both at rest and during stress, which positively correlated with improvement in cardiac work (R = 0.55, p = 0.04). At all points, the heart was a net lactate consumer rather than producer, implying that oxygen supply was not limited. Participants underwent significant reverse remodelling at 6 months with reduction in LV end-diastolic volume (LVEDV) and this correlated with acute changes in FFA (Figure 2A) and ketone uptake (Figure 2B) with CRT.

Conclusion CRT improves cardiac efficiency and reverses the metabolic phenotype of heart failure towards more physiological lipid-based metabolism. Acute increases in FFA and ketone uptake correlate with improvements in contractility and reverse remodelling at 6 months. Therapy targeting lipid metabolism may therefore be a useful strategy in the failing heart.

Conflict of Interest Nil



Abstract 85 Figure 1



Abstract 85 Figure 2

86 LONG TERM CLINICAL OUTCOMES IN PATIENTS REQUIRING CARDIAC PACING DUE TO CONGENITAL COMPLETE HEART BLOCK

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Background Isolated congenital complete heart block (CCHB) is rare cardiac condition associated with maternal Anti-Rho antibodies. It is managed with permanent pacemaker insertion. We sought to determine the long-term outcomes of individuals with CCHB who had undergone pacemaker insertion.

Methods A database search was performed at a UK tertiary cardiac referral centre. The online medical records of patients with CCHB were analysed for pacing requirements and complications, echocardiographic data, and clinical status.

Results A total of 72 patients (female n = 46) were identified, 20% of whom were autoantibody positive. Mean age of initial implantation was 15.5 years (SD 12.7) with mean follow up of 21 years (SD 8.3). 88% of patients were NYHA class I at censure of data. Major adverse cardiac events (MACE) were observed in 2 patients with 0% mortality throughout the follow up period. 10 patients (13.9%) developed cardiomyopathy. Five patients had device related infections and 7 required system extractions. Mean left ventricular ejection fraction on most recent echocardiogram was 53.7% (SD 8.40) with no significant change compared with their historic scan. Mild tricuspid regurgitation was the most frequently observed valvular pathology, identified in 28% of patients. Only 2 patients (2.7%) had severe valve incompetence.

Conclusion Long-term outcomes for patients with congenital complete heart block who undergo pacemaker insertion are highly favourable. Despite high pacing requirements over an extended period, the incidence of MACE and pacing related complications is low. Cardiac function and valvular

Abstract 86 Table 1 Pacemaker data, including indication for insertion, pacemaker mode and complications. Data presented as n (% of total patients) or mean (standard deviation)

Pacemaker				
Indication for insertion				
Maternal Anti Rho	15 (20.8%)			
Symptoms	30 (41.7%)			
Asymptomatic Bradycardia	13 (18.1%)			
Unknown	14 (19.4%)			
Chambers paced				
Single chamber		*Dual Chamber*		*Biventricular*
8 (11.1%)		49 (68.1%)		15 (20.8%)
Lower rate (bpm)				
<50	*50-59*	*60*	*70*	*>70*
Mode	*DDD*	*DDDR*	*VVI/ VVIR*	*Other*
	53	7	10	2 (VDD, DDI)
Device related Infections		5 (6.9%)		
System Extractions		7 (9.7%)		
Lead Revisions		14 (19.4%)		
Device upgrades		20 (27.7%)		
Single to Dual chamber		5		
Dual chamber to CRT-P		15		

Abstract 86 Table 2 Echocardiographic data, presented as n(%) or mean (standard deviation). Only patients with recent echo (within the last 5 years) and historic echo (over 5 years old) were compared. Preference was given to echo results contemporaneous with pacemaker insertion

Echo data			
Patients with recent and historic echo	46 (63.9%%)		
Most recent EF (%)	53.7 (SD 8.40)		
Historic EF (%)	54.9 (SD 9.60)		
Mean difference in EF (%)	-1.196% (SD 10.06)		
Valvular pathology			
Valve pathology present?	38 (52.8%)		
	Mild	*moderate*	*severe*
Tricuspid Regurgitation	20 (27.8%)	6 (8.3%)	2 (2.7%)
Mitral Regurgitation	9 (12.5%)	2 (2.7%)	0
Pulmonary valve regurgitation	1 (1.4%)	2 (2.7%)	0
Aortic valve regurgitation	1 (1.4%)	2 (2.7%)	0

competence are largely preserved but dilated cardiomyopathy remains a late complication.

Conflict of Interest Nil

87

CRT UPGRADE IS SAFE, CAN BE ACHIEVED IN 99% OF CASES AND IS ASSOCIATED WITH AN IMPROVEMENT IN LEFT VENTRICULAR FUNCTION IN MORE THAN HALF OF PATIENTS

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Background Left ventricular (LV) lead upgrade in patients with implantable cardioverter defibrillators (ICD) or bradycardia pacemakers may reverse pacing induced cardiomyopathy or reduced heart failure hospitalisations, but complication rates are higher than new implants.

Purpose To report the indications and outcomes of LV lead upgrades to cardiac resynchronisation (CRT).

Methods We retrospectively studied consecutive patients undergoing CRT upgrades from January 2014 to August 2021. 3345 pacing procedures were performed of which 347 were de novo CRT implants (10.4%) and 160 were CRT upgrades (4.7%).

Results Of the 160 upgrades mean age was 75±11 and 129 were male (81%). There were 3 indications for upgrade; to treat (90) or prevent (26) pacing-induced cardiomyopathy, specifically prior to atrioventricular (AV) node ablation in (5/26), and conventional CRT indication with left bundle branch block and ejection fraction <35% (43). The types of devices upgraded can be found in table 1.Upgrade was prompted by symptoms 95 (60%), box change 42 (26%), ventricular arrhythmias in 9 (6%), routine follow up echo or surveillance in 12 (7%), or a new RV lead 2 (1%). Beta blockers were prescribed in 97 (61%), angiotensin converting enzyme inhibitors in 78 (49%) or angiotensin receptor blockers in 41 (26%).Median time from implant to upgrade was 6.9 years (2.7–11). 43% had a normal ejection fraction (EF) at implant. Mean change from implant to upgrade was -13% ± 10 and mean EF at upgrade was 30% ±9.57% were responders to CRT with a mean change in EF of 16% ± 6. 33% did not respond and 12% deteriorated further. 26 (16%) had a heart failure hospitalisation (HFH) pre upgrade of which only 6 had further HFH. 26 (16%) patients had a HFH after

Abstract 87 Table 1 Types of devices upgraded

Device	Upgraded device	Number
VVI(R)	CRT-P	23
VVI(R)	CRT-D	2
ICD-DR	CRT-D	33
ICD-VR	CRT-D	17
DDD(R)	CRT-P	64
DDD(R)	CRT-D	21
	Total	161