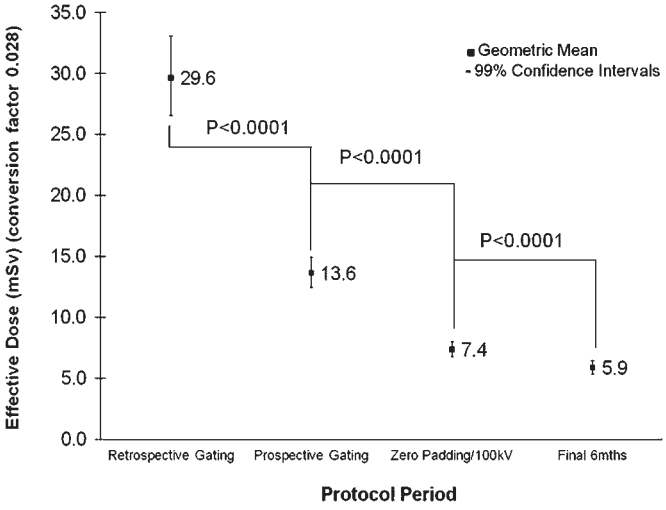
between September 2007 and August 2010 was included; the total dose for the whole examination is used including the scout and non-enhanced scan (calcium score). Scans were performed on a Lightspeed VCT or HD750 (GE Healthcare). To calculate the effective dose a conversion factor was applied to the dose length product of each examination. The DLP is the radiation dose in one CT slice multiplied by the length of the scan. A cardiac specific conversion factor was used rather than a chest conversion factor (0.014) which significantly underestimates the effective dose from CTCA. Data was transformed and expressed as a geometric mean with 99% CI. For each analysis period all scans were included; retrospective, prospective, low kV and zero padding.

Results In the 3-year period 1736 scans were performed. The mean radiation dose in the first 6 months of the study (retrospective gating) was 29.6 mSv; using the accepted conversion factor at the time the mean dose was 14.9 mSv. In March 2008 prospective ECG gating was installed; this resulted in a halving of the mean radiation dose to 13.6 mSv. In March 2009 the scanner parameters was set to zero padding and 100 KV reducing the dose to 7.4 mSv. For the final 6 months the mean radiation dose for a cardiac scan was 5.9 mSv; this Abstract 114 figure 1 incorporates scans performed with standard filtered back projection, iterative reconstruction, high definition scanning and retrospective ECG gating for a variety of differing clinical scenarios.



Abstract 114 Figure 1 Effective dose (mSv) by protocol period.

Conclusion The introduction of dose saving strategies and appropriate physician training has lead to a significant reduction in the radiation dose from cardiac CT. As CTCA programmes become established in hospitals around the UK it is important that clinicians have the appropriate training and experience to keep the radiation dose to the patients as low as reasonably practical.

Abstract 114 Table 1

Scanning protocol	Retrospective Gating—dose modulation	Prospective gating	Zero padding—100 kV	Final 6 months
Number of Patients	150	489	636	461
Mean Effective Dose (mSv)	29.6	13.6	7.4	5.9
CIs (99%) (mSv)	33	14.9	8	6.5
	26.6	12.5	6.8	5.3

115 ATRIAL HIGH RATE EPISODES AND ATRIAL FIBRILLATION BURDEN: DO THEY HAVE SIMILAR ASSOCIATION WITH CARDIAC REMODELLING?

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Background and Objectives Contemporary pacemaker devices allow quantification of atrial high-rate episodes (AHREs) and atrial fibrillation burden (AFB) accurately. Cumulative ventricular pacing (Vp) is associated with development of atrial fibrillation, but it is not clear if AHREs and AFB share similar pathophysiologic associations with left atrium (LA) and ventricle (LV) function and remodelling.

Methods In total, 87 patients with dual-chamber pacemaker underwent two-dimension (2D) and tissue Doppler imaging (TDI) echocardiography. LA volume (LAV) was evaluated by area-length method and indexed to body surface area. Septal A′ was used to measured regional LA function. LV systolic and diastolic parameters were evaluated by mitral inflow velocity (E, A, E/A), LV ejection fraction (biplane Simpson's) and septal TDI velocity. The presence of AHREs (defined by atrial-rate ≥220 beats/min and ≥5 minutes) and AFB were derived from pacemaker diagnostics. Plasma markers of remodelling, matrix metalloproteinases-1 (MMP1) and tissue inhibitors of metalloproteinases-1 (TIMP1), were analysed by ELISA.

Results Baseline characteristics and comorbidities were comparable between groups (Abstract 115 table 1). Patients with AHREs had significantly larger indexed LAV (p=0.011) and higher cumulative Vp (p=0.012), but this was not associated with elevation of MMP1 and TIMP1. Plasma markers, LV systolic and diastolic parameters were comparable between groups. In patients with AHREs, the AFB ranged from 0 to 99% and correlated with E/A (r=0.966, p<0.001), and inversely correlated with late acceleration velocity (A) (r=−0.612, p=0.009). On linear regression analysis, A, E/A, septal A′ were independently associated with AFB (all p<0.01).

Conclusion Cumulative Vp and increased LAV are associated with the development of AHRE, but AFB is independently associated with changes in LA function and LV diastolic function. This study suggests AHREs and AFB have dissimilar pathophysiologic associations with left atrium and ventricle remodelling.

Abstract 115 Table 1

	No AHRE (n=70)	AHRE (n=17)	p Value
Age (years)	71.0±11.6	75.4±8.8	0.1
Body mass index (kg/m2)	26.4±4.4	27.6±4.7	0.38
Indexed LA volume (ml/m2)	27.4±7.9	34.8±9.4	0.01
LV ejection fraction (%)	52.8±11.9	55.1±9.2	0.4
E/A	0.8±0.2	1.0±0.6	0.23
Septal A′ (cm/s)	8.9±2.2	7.9±2.6	0.16
Septal S′ (cm/s)	6.6±1.8	6.5±1.4	0.71
Septal E/E′	13.7±6.2	14.1±3.5	0.74
Percentage Vp	21.9 (1.8—99.0)	98.6 (41.0—99.9)	0.01

116 CRT OPTIMISATION: IMPROVING ECHOCARDIOGRAPHIC TECHNIQUES BY ACCOMMODATING BIOLOGICAL VARIABILITY WITHIN DIFFERENT ECHOCARDIOGRAPHIC PARAMETERS

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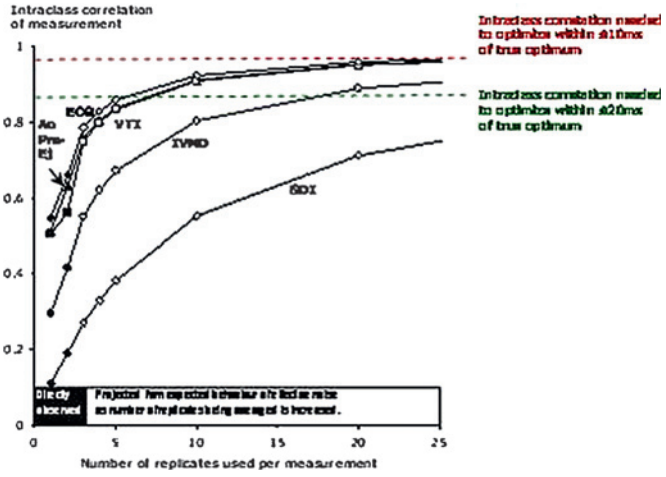
Background In optimisation of CRT (and even selection for implantation) we may have underestimated the impact of beat-to-beat

variation on echocardiographic measurements. This can be quantified most clearly in the optimisation process, in which genuine small changes in cardiac function (signal) must be detected among potentially large beat-to-beat variation (noise).

Methods and Results In this large study of biological variability, we performed over 2000 echocardigraphic measurements in 12 patients. We performed separate, replicate measurements at a series of interventricular delays of each potential optimisation modality at rest. This included (i) 3D systolic dyssynchrony index, (ii) aortic pre-ejection time, (iii) interventricular mechanical delay, (iv) LVOT VTI and (v) QRS width. The equivalent of 31 optimisations per patient were performed. For single measurements at each setting, agreement between successive optimisations was low, at 39% for SDI, 41% for aortic pre-ejection time, 32% for IVMD, 54% for LVOT VTI and 58% for QRS width. Agreement between one method and another, using single replicates, was similarly low, with the average agreement between optima by two methods being only 18% similar to pure guesswork. The intraclass correlation coefficient was low for all methods at 0.11, 0.51, 0.30, 0.50 and 0.55 respectively. The intraclass correlation coefficients improved to 0.19, 0.63, 0.42, 0.54 and 0.66 (p=0.001) when averages of paired measurements were used. To optimise within 20 ms or 10 ms of the true optimum, requires a greater number of measurements, as seen in Abstract 116 figure 1, dependant on the intraclass correlation coefficient. The scatter of optima obtained reduced (improved) significantly when using averaged pairs of measurements compared to single measurements from 23 ms to 18 ms (3D SDI), 14 ms to 10 ms (aortic pre-ejection time), 28 ms to 22 ms (IVMD), 21 ms to 16 ms (LVOT VTI) and 14 ms to 10 ms QRS duration (p=0.0002).



Abstract 116 Figure 1

Conclusions Because of beat-to-beat variability, VV delay optimisation by any of the echocardiographic techniques is not realistic unless multiple replicates are performed and averaged. Smoothing biological variation by averaging multiple measurements allows the full potential of echocardiographic optimisation to be achieved and improves the consistency of optimisation. Trying to save time by performing inadequate numbers of replicates is a false economy and leads to optimisation being a form of randomisation. These observations may also cast light on to why attempts to identify future responders from CRT has not — when tested in externally monitored randomised trials—been fruitful: dyssynchrony assessment to select patients for implantation may need averaging too, and of far more replicate measurements than is current practice. Integration of this biological insight into technological achievements of clinical imaging is necessary, if reliable predictors of which patients will benefit from CRT, are to be developed.

117 TRICUSPID VALVE ANNULAR DYNAMICS IN NORMAL VS DILATED RIGHT HEARTS; A 3D TOE STUDY

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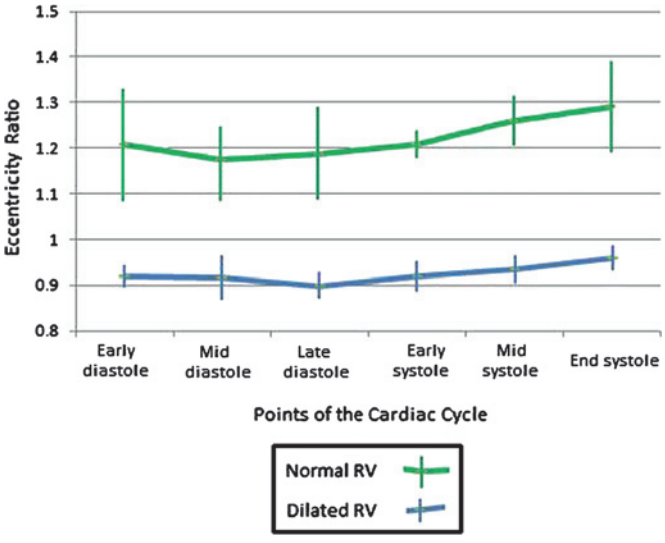
Background The tricuspid valve annulus (TVA) is a complex three dimensional structure that is non-planar, and is incompletely understood. The dynamics of the normal TVA has not been described in any significant detail, nor has the impact of abnormal right hearts on the TVA been described. This study was designed to assess the feasibility of assessing the TVA throughout the cardiac cycle using 3D transoesophageal echo (TOE).

Methods 20 patients were included, divided into 2 groups: normal right hearts (n=10), and dilated right hearts (n=10). 3D zoom images of the TVA were acquired using an iE33 imaging platform and X7-2t transducer (Phillips, Andover, Massachusetts, USA). Antero-posterior (AP) diameter, septo-lateral (SL) diameter, area and height were measured at 6 points of the cardiac cycle adapting commercially available software designed for assessing the mitral valve (MVQ, Phillips). The eccentricity ratio was calculated as AP/SL.

Results TVA area decreases during systole in both groups, and is greatest in mid-diastole. The area is significantly larger in the abnormal group (mean 1795 mm^2 abnormal vs 1204 mm^2 normal; p<0.01). The SL diameter increased more in the abnormal group, resulting in a circular orifice and lower eccentricity ratio throughout the cycle (mean 0.91 abnormal v 1.22 normal; p<0.01, see graph). Annular height is similar in both groups but has an upward trend in systole in normals and reduces in abnormals, reaching significance at end systole (6.7 mm vs 4.9 mm; p=0.046).

Conclusions In patients with abnormal right hearts, the TVA dilates in a septo-lateral direction, resulting in a more circular orifice. The dynamic changes of the TVA are similar in dilated vs normal right hearts, with the exception of annular height. This pilot study suggests that 3D TOE provides insight into understanding tricuspid annular dynamics.



Abstract 117 Figure 1 Eccentricity ratio of the tricuspid valve annulus during the cardiac cycle: normal vs dilated rated hearts.