

Abstract 117 Figure 1 Blood pool correction was performed by sampling from the right atrium instead of the brachio-cephalic vein. 2. The most diseased segment method was used to quantify the PET signal within 2 hottest slices rather than the whole valve/ 3. Contrast CT fused with ECG-gated PET facilitated better localization to leaflets compared to the original approach 4. Bland-Altman plots demonstrated superior scan-rescan reproducibility for the modified technique (2b) compared to the previous approach (2a)

may also be possible to subtract materials from each other, such as calcium from iodine.

Single source DECT, using two energy spectra from a single anode almost simultaneously using rapid tube voltage switching, requires novel detector technology capable of distinguishing signals 0.25 ms apart without artefact from detector artefact. To date, this has not been evaluated in patients with coronary calcification. This feasibility study examined potential

benefits and limitations of virtual monochromatic and material decomposition images for assessing calcified coronary arteries, and their potential diagnostic accuracy compared to invasive angiography.

Methods The study was approved by the National Research Ethics Service. Patients gave informed, written consent. Thirty patients undergoing invasive angiography on clinical grounds, with evidence of coronary calcification, underwent CTCA with a single-source DECT scanner. The results of each test were assessed by experienced, independent, blinded readers and compared in per-segment, per-vessel and per-patient analyses.

Results 403 segments in 86 vessels were analysed. The median Agatston score was 964. The accuracy of virtual monochromatic imaging is outlined in Table 1. Overall the accuracy for the identification of moderate and severe stenosis was 0.88 and 0.88 on a per-segment basis, 0.84 and 0.86 per vessel, and 0.93 and 0.97 per-patient. The weighted kappa score between invasive and CT angiography was 0.71 suggesting good agreement.

The per-segment sensitivity, specificity, PPV and NPV (and 95% confidence intervals) of the material decomposition images were 0.67 (0.57–0.76), 0.82 (0.77–0.86), 0.54 (0.45–0.63) and 0.88 (0.84–0.92) respectively for moderate stenosis, and 0.70 (0.57–0.80), 0.79 (0.75–0.83), 0.40 (0.31–0.49) and 0.93 (0.89–0.96) respectively for severe stenosis. Overall accuracy was 0.78 for both moderate and severe stenosis. Calcium subtraction was highly inconsistent, mainly due to image noise with resultant misidentification of calcium and excessive subtraction.

Conclusions The study suggests that single source DECT is feasible in patients with severe coronary calcification, and virtual monochromatic imaging may improve accuracy compared to conventional CT. A larger study comparing standard and DECT is merited.

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THE EFFECT OF PRELOAD REDUCTION USING HEAD-UP TILT TESTING: AN EXPLORATORY STUDY USING LEFT VENTRICULAR LONGITUDINAL AND TRANSVERSE STRAIN-VOLUME LOOPS

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Introduction Left ventricular (LV) function is dependent on intrinsic contractility and relaxation as well as the prevailing loading conditions. The Frank-Starling mechanism states that

Abstract 118 Table 1

		Per segment	Per vessel	Per patient
>50% stenosis	Sensitivity	0.76 (0.66–0.84)	0.78 (0.64–0.89)	0.93 (0.76–0.99)
	Specificity	0.92 (0.89–0.95)	0.93 (0.80–0.98)	1.00 (0.19–1.00)
	PPV	0.76 (0.66–0.84)	0.92 (0.79–0.98)	1.00 (0.86–1.00)
	NPV	0.92 (0.89–0.95)	0.79 (0.65–0.90)	0.50 (0.08–0.92)
>70% stenosis	Sensitivity	0.73 (0.60–0.83)	0.78 (0.61–0.90)	1.00 (0.85–1.00)
	Specificity	0.91 (0.87–0.93)	0.94 (0.84–0.98)	0.83 (0.36–0.97)
	PPV	0.58 (0.47–0.70)	0.90 (0.74–0.98)	0.96 (0.79–0.99)
	NPV	0.95 (0.92–0.97)	0.86 (0.74–0.94)	1.00 (0.48–1.00)

absolute myocardial shortening would be lower in the presence of a reduced preload, however LV function is complex and must adapt in this setting in order to maintain stroke volume and cardiac output. The impact of preload reduction on cardiac mechanics has been scarcely explored however the direct relationship of strain (s) in different planes and simultaneous volume assessment has not been assessed. This exploratory study utilises a novel technique (s-volume loops) in order to establish the relative temporal contribution of longitudinal (Ls) and transverse strain (Ts) to volume change throughout the cardiac cycle following 1 and 5 min of head-up tilt testing.

Methods Five healthy subjects underwent standard transthoracic echocardiography to obtain an apical 4 chamber orientation with a focus on the LV in a supine position and following 1 min and 5 min of head-up tilt testing. As well as a standard assessment, raw temporal Ls and Ts values were exported and divided into 5% time increments across the cardiac cycle. Concomitant LV volumes were traced at each 5% time increment to provide simultaneous s-volume loops. The s-volume relationship was assessed by 1) polynomial equations to derive absolute strain values for end diastolic volumes (EDV) and 2) systolic¹/₂diastolic coupling (SDcoup) as the difference between systolic and diastolic strain within the same working range of EDV.

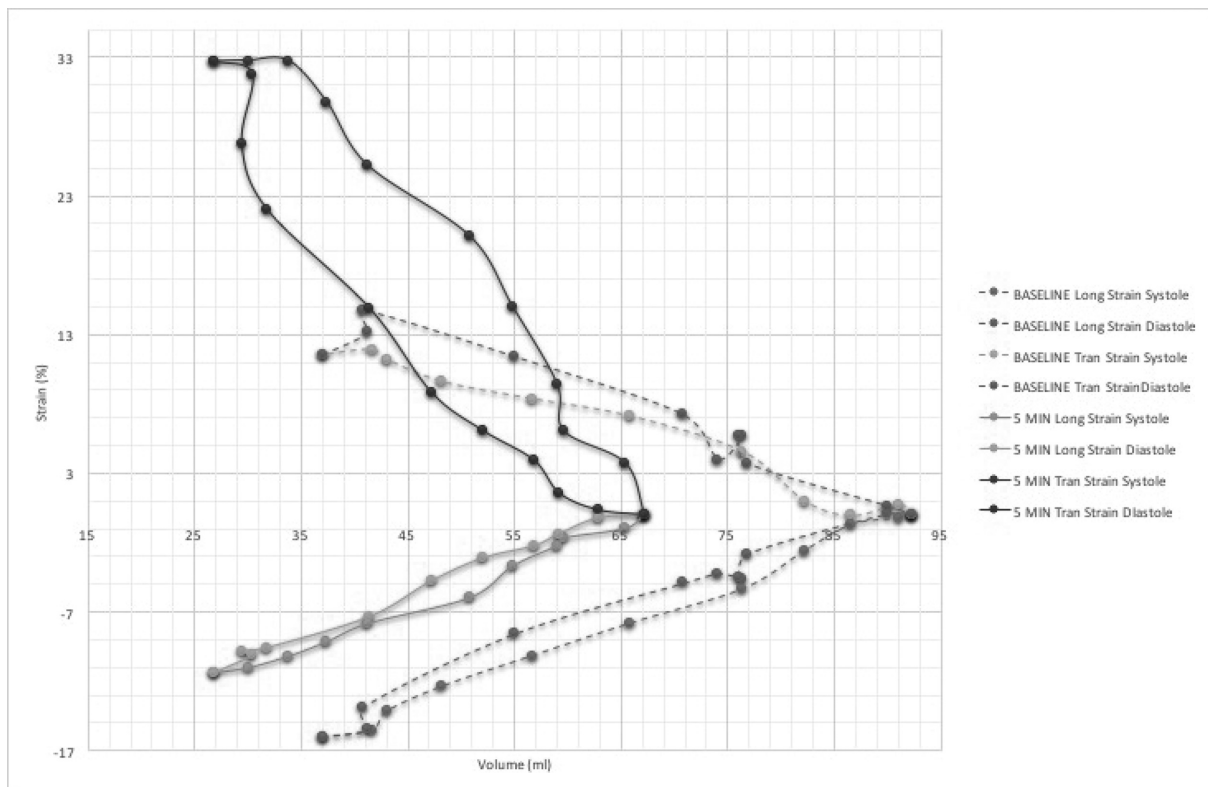
Results There was a significant reduction in EDV at 1 min of head-up tilting (92¹/₂16ml Vs. 64¹/₂6ml) with no further change at 5 min. There was no significant change in EF or effective stroke volume. There was a reduction in peak Ls at 1 min tilting (-16¹/₂1 Vs. -12¹/₂1%) which remained stable at 5 min. Conversely, there was a gradual increase in Ts across time (16¹/₂3 Vs. 37¹/₂11%) as well as a gradual reduction in the time to peak Ts. Following

calculation of s-volume loops the paradoxical relationship of reduced Ls and a concomitant increase in Ts remained at all 10% increments of EDV. There was a marked increase in Ts SDcoup at all 10% EDV increments at 5 min post tilt.

Conclusion Preload reduction as a consequence of head-up tilt testing results in a shift in cardiac mechanics with a reduction in longitudinal and concomitant increase in transverse contribution to volume reduction and maintenance of EF. The systolic-diastolic coupling suggests that LV filling in the setting of a reduced preload is maintained by a greater return to original length of the myocardium in the transverse plane for any given volume. These findings provide important physiological value when assessing LV function in the clinical setting where a reduction in preload is evident.

Abstract 119 Table 1 Conventional echocardiographic indices at supine, 1 minute and 5 minutes of head-up tilting

Conventional Parameters	SUPINE	1 MIN TILT	5 MIN TILT
Heart Rate (bpm)	77 ¹ / ₂ 6	90 ¹ / ₂ 9*	87 ¹ / ₂ 6^
Systolic Blood Pressure (mmHg)	127 ¹ / ₂ 8	125 ¹ / ₂ 10	127 ¹ / ₂ 7
Diastolic Blood Pressure (mmHg)	76 ¹ / ₂ 7	79 ¹ / ₂ 15	83 ¹ / ₂ 5
Cardiac Output (l/min)	4.3 ¹ / ₂ 0.6	3.9 ¹ / ₂ 0.2	3.8 ¹ / ₂ 0.7
End Diastolic Volume (ml)	92 ¹ / ₂ 16	64 ¹ / ₂ 6*	69 ¹ / ₂ 11^
End Systolic Volume (ml)	37 ¹ / ₂ 7	20 ¹ / ₂ 6 *	25 ¹ / ₂ 7
LV Ejection Fraction (%)	60 ¹ / ₂ 4	69 ¹ / ₂ 7	63 ¹ / ₂ 6
E Wave Velocity (m/s)	0.81 ¹ / ₂ 0.19	0.78 ¹ / ₂ 0.09	0.70 ¹ / ₂ 0.10
A Wave Velocity (m/s)	0.55 ¹ / ₂ 0.11	0.59 ¹ / ₂ 0.08	0.66 ¹ / ₂ 0.26
E/A	1.5 ¹ / ₂ 0.6	1.3 ¹ / ₂ 0.2	1.2 ¹ / ₂ 0.6



Abstract 119 Figure 1 Longitudinal and transverse strain-volume loops at supine and at 5 minutes head-up tilting