

Tissue velocity imaging of all patients and controls were accepted in apical two, four and long axis chamber views. Strain rate (SR) imaging was performed on all cases, peak atrial systolic left atrial SR (LASRa) were measured at each segment (septal, lateral, posterior, anterior, and inferior walls of left atrium), mean LASRa was calculated by averaging data in all segments.

**Results** Compared with controls, LAFS and mLASRs of HCM and HLHV were significantly higher ( $p<0.05$ ). Moreover, LAFS and mLASRs of HCM were significantly higher than HLHV ( $p<0.05$ ). mLASRa correlated positively with LAFS of HCM and HLHV respectively ( $r=0.81, 0.88; p<0.01, 0.01$ ).

**Conclusions** The change of left atrial function of HCM and HLHV presented as pump function increased, especially of HCM, which may take some clinical information to identify these two diseases.

# e0687 THE APPLICATION OF VECTOR FLOW MAPPING IN QUANTITATIVE ASSESSMENT OF REGIONAL MYOCARDIAL FUNCTION IN CAD PATIENTS

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**Background** Until now, the study of regional infarct and ischaemic myocardial function in patients with coronary atherosclerotic heart disease is still mainly focused on the abnormal wall motion, how the blood flow dynamics affected by the regional abnormal wall motion in CAD patients is remains unknown. The purposes of the present study are to investigate the blood flow dynamics adjacent to the regional ischaemic and infarct myocardial segments, to explore the correlation between the blood flow dynamics and wall motion and to explore sensitive indexes showing blood flow dynamics change caused by abnormal wall motion in CAD patients.

**Methods** 43 CAD patients were enrolled in our study. Velocity Vector Imaging technique was used to evaluate the wall motion so as to classify the myocardial segments as normal, ischaemic and infarct by systolic peak strain. Vector Flow Mapping (VFM) technique was performed to show the blood flow dynamics in the heart chamber. The blood flow volume heading towards or against the apex in different periods of a heart beat and the time to every peak flow were measured.

**Results** Compared to normal group, systole Q+ is higher ( $p<0.01$ ), diastole Q+ is lower ( $p<0.01$ ), T2 is shorter ( $p<0.01$ ) in ischaemic group. Compared to non-infarct group, systole Q+ is higher ( $p<0.05$ ), diastole Q+ is lower ( $p<0.01$ ), T2 is shorter ( $p<0.05$ ) in infarct group. There are correlations between indexes derived by VFM and Velocity Vector Imaging technique. Systole Q+ is a better index, when the cutoff value reaches 25.32 and 28.046; it has a high sensitivity and specificity for differentiating ischaemic and infarct segments.

**Conclusion** VFM is a novel noninvasive tool to assess the blood flow dynamics and can be used to evaluate the cardiac function.

# e0688 INTRAVASCULAR ULTRASOUND CRITERIA FOR THE ASSESSMENT OF THE FUNCTIONAL SIGNIFICANCE OF INTERMEDIATE CORONARY ARTERY STENOSIS

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**Introduction** In recent years, intravascular ultrasound (IVUS) has evolved as a valuable adjunct to angiography. IVUS allows precise tomographic measurement of lumen area and plaque size, distribution and, to some extent, composition. It is essential in clinic deci-

sion making. Myocardial fractional flow reserve ( $FFR_{myo}$ ) is a special index of the functional severity of coronary stenosis. Although the application of  $FFR_{myo}$  to assess intermediate coronary lesion is widely performed in some centers in developed countries, its use in China was lagged. Because it is relatively expensive to measure  $FFR_{myo}$ , it will be beneficial to save the expenses and to short operation time if CAG and IVUS criteria could be clinically used as tools to discriminate functional significant of intermediate stenosis.

**Materials and methods** In 46 lesions of intermediate severity (eg, 40% to 60% diameter stenosis) we assessed 1. by pressure wire: myocardial fractional flow reserve ( $FFR_{myo}$ , index of functional significance), and 2. by IVUS: minimal lumen cross-sectional area (MLA) and percent area stenosis at the lesion site. Receiver operating characteristic curve analysis was performed to establish the best cut-off values of IVUS indexes (ie, MLA and percent area stenosis) that were most predictive of  $FFR_{myo}<0.75$ .

**Results**  $FFR_{myo}$  in 46 lesions of angiographic intermediate stenosis ( $49\pm11\%$ ) was significantly lower than it was in angiographic normal artery ( $0.83\pm0.15$  vs  $0.97\pm0.02$ ,  $p<0.01$ ). 14 lesions (30%) were functionally critical (eg,  $FFR_{myo}<0.75$ ). By regression analysis, percent area stenosis had a significant inverse correlation with  $FFR_{myo}$  ( $r=-0.68$ ,  $p<0.01$ ). MLA showed a significant positive relation with  $FFR_{myo}$  ( $r=0.63$ ,  $p<0.01$ ). By receiver operating characteristic analysis, we identified a IVUS area stenosis  $\geq 65\%$  (sensitivity 100%, specificity 72%), a minimal lumen cross-sectional area  $\leq 4\text{ mm}^2$  (sensitivity 93%, specificity 77%) to be the best cut-off values to fit with  $FFR_{myo}<0.75$ .

**Conclusion** IVUS area stenosis  $\geq 65\%$  and minimal lumen cross-sectional area  $\leq 4\text{ mm}^2$  reliably identified functionally critical intermediate coronary stenosis.

# e0689 ECHOCARDIOGRAPHIC CHARACTERISTICS OF LEFT VENTRICULAR NONCOMPACTION WITH PAPILLARY MUSCLES INVOLVEMENT

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**Objective** To assess the ultrasonic characteristics of the left ventricular noncompaction with papillary muscles involvement.

**Methods** We reviewed the echocardiographic findings in eight patients having left ventricular noncompaction with papillary muscles involvement at our hospital. We performed transthoracic echocardiography including standard parasternal (short and long axis), apical (two-chamber, three-chamber and four-chamber), and nonstandard parasternal views for all these patients. The left ventricular segments involved in noncompaction, the mitral papillary muscles and the mitral valve were the key observation. When the transthoracic echocardiography of four patients were not satisfactory, contrast echocardiography was used.

**Results** In all 8 patients (5 of them with severe mitral regurgitation, two with hypertrophic cardiomyopathy), the myocardium of the left ventricular segments involved in noncompaction were consist of two layers: a thin, compacted epicardial and an extremely thickened endocardial layer with prominent trabeculations and deep recesses, mitral papillary muscles involved in whole or in part, the myocardium of the papillary muscles looked like moth-eaten, appearance of blood flow from the ventricular cavity into the intertrabecular recesses both in the noncompaction myocardium and papillary muscles as visualised by colour Doppler imaging. With contrast enhancement in four of eight patients, the left ventricular endocardial borders were clearly outlined, and contrast microbubbles filled into the intertrabecular recesses both in the noncompaction myocardium and papillary muscles.

**Conclusion** The left ventricular noncompaction may involve the mitral papillary muscles. Transthoracic echocardiography provides definitive images of the abnormal mitral papillary muscles.

# e0690 CLINICAL STUDY ON LEFT VENTRICULAR VOLUME AND EJECTION FRACTION IN NORMAL SUBJECT BY 4-DIMENSIONAL AUTO LEFT VENTRICULAR QUANTIFICATION

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**Objective** To initial explore the clinical feasibility, accuracy and reproducibility of evaluation of left ventricular (LV) volume and ejection fraction (EF) by 4-Dimensional Auto Left Ventricular Quantification (4D AUTO LVQ) in three-dimensional echocardiography.

**Method** Single heartbeat (SB) and multi-heartbeat (MB) mode three-dimensional echocardiography (3DE) examinations were performed in 20 volunteers, Left Ventricular end-diastolic volume (LVEDV), end-systolic volume (LVESV), and EF were measured by 4D AUTO LVQ. Meanwhile, LV volume and EF were also calculated by 2DE Simpson's method and M-modeTeichholtz method. The measurement value of LV volume and EF by 4D AUTO LVQ in SB and MB mode was separately compared with every measurement value by other methods.

**Results** 1. The values of LVEDV were statistically significant between M-mode method and other three methods ( $p<0.05$ ). LVEDV measured by 4D AUTO LVQ in SB mode correlated and agreed well with MB mode ( $r=0.769$ ). 2. There were significant difference in LVESV between M-mode method and other three methods. The correlation and agreement between SB and MB was well. ( $r=0.86$ ). 3. Significant difference was found between 3DE and 2DE for EF, and also between 3DE and M-mode. Correlation between SB and MB3DE was poor ( $r=0.428$ ), but the agreement was good. 4. There were no statistically significant difference between average store time of the 4D AUTO LVQ and 2DE Simpson's method. 5. Intra-observer variability of SB and MB 3DE for EF measured by 4D AUTO LVQ was 8.50% and 6.50%, and the inter-observer variability was 7.75% and 6.50%.

**Conclusions** 4D AUTO LVQ in three-dimensional echocardiography gives accurate, rapid and reproducible measurements of LV volumes and EF.

# e0691 FEASIBILITY AND REPRODUCIBILITY OF A NEW SEMIAUTOMATED QUANTIFICATION OF LEFT VENTRICULAR VOLUMES AND EJECTION FRACTION IN NORMAL ADULTS USING REAL TIME 3-DIMENSIONAL ECHOCARDIOGRAPHY

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**Objective** We sought to investigate the feasibility and reproducibility of the new semi-automated tool (4DLVQ) quantification of left ventricular (LV) volumes and ejection fraction (EF) compared to standard 3D echo tool (TomTec 4D LV-Analysis) using real time 3-dimensional echocardiography.

**Methods** Real time 3D echocardiography examinations were performed in 24 volunteers. In the apical 3D full-volumetric images, LV end-diastolic volumes (EDV), end-systolic volumes (ESV) and EF

were measured using 4DLVQ and TomTec. The repeatability and agreement of the new method were evaluated compared to TomTec.

**Results** 1. The analysis time of 4DLVQ was significantly shorter than for TomTec ( $156.63\pm33.72$  s vs  $275.55\pm50.64$  s,  $p<0.05$ ). 2. There were no significant difference in LVEDV ( $75.40\pm16.72$  ml vs  $71.65\pm14.81$  ml), LVESV ( $30.25\pm6.69$  ml vs  $28.30\pm6.71$  ml) and LVEF ( $59.65\pm4.96\%$  vs  $60.70\pm3.51\%$ ) between the two methods ( $p>0.05$ ). 3. LVEDV, LVESV and LVEF measured by 4DLVQ had good correlation with those by TomTec. ( $r_1=0.715$ ,  $r_2=0.618$   $r_3=0.532$ , respectively,  $p<0.05$  for all). 4. Bland-Altman analysis revealed high agreement in LV volume and EF between 4DLVQ and TomTec, with 95% limits of agreement of  $-19.8\sim27.3$  ml,  $-9.5\sim13.4$  ml and  $-9.4\sim7.3\%$  for EDV, ESV, and EF respectively. Comparison with TomTec, 4DLVQ showed lower intraobserver and interobserver variabilities, Intra-observer variability of 4DLVQ versus TomTec was 12.29% versus 21.96% for EDV, 16.92% versus 34.35% for ESV, and 6.50% versus 7.24% for EF. Inter-observer variability of 4DLVQ versus TomTec was 9.84% versus 18.13% for EDV, 10.47% versus 25.12% for ESV, and 6.50% versus 6.72% for EF. In comparison with TomTec, 4DLVQ showed higher intra-class correlation coefficient.

**Conclusions** 4DLVQ is a novel, simple, feasible and reproducible tool for LV volumes and EF.

# e0692 ASSESSMENT OF LEFT VENTRICULAR TWISTING AND UNTWISTING IN PATIENTS WITH MYOCARDIAL INFARCTION AND ISCHAEMIA

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**Objective** To assess LV twisting and untwisting in patients with myocardial ischaemia at rest and myocardial infarction (MI) with different sites, searching for the value and characteristics of left ventricular twisting and untwisting in patients with CAD by speckle tracking imaging (STI).

**Methods** Echocardiography were performed in 60 patients with MI (consisting of anteroseptal MI, infer-posterior MI and extensive infarction of the anterior wall), 31 patients with myocardial ischaemia and 26 control individuals who were all received coronary arteriography. It was demonstrated by coronary arteriography that stenosis of one main branch at least of coronary artery was significant ( $\geq 70\%$ ) in patient groups while it was slight ( $<50\%$ ) or none in control group. Twisting and untwisting were measured by STI, and the parameters of them were torsion, torsion rate and untwisting rate.

**Results** The two patient groups, especially in patients with MI, had much lower parameters in torsion ( $6.92\pm3.28$  vs  $11.65\pm2.70$  vs  $17.16\pm5.42$ ), torsion rate ( $45.78\pm19.36$  vs  $72.68\pm20.77$  vs  $99.51\pm32.13$ ) and untwisting rate ( $-49.88\pm24.67$  vs  $-82.91\pm16.37$  vs  $-102.03\pm30.97$ ) than that of control group ( $p<0.001$ ). When comparing with the patients of anteroseptal and infer-posterior MI, torsion ( $7.82\pm2.03$  vs  $9.08\pm3.42$  vs  $4.23\pm2.62$ ), torsion rate ( $53.76\pm14.85$  vs  $54.38\pm18.80$  vs  $30.30\pm19.51$ ) and untwisting rate ( $-56.94\pm21.96$  vs  $-59.11\pm25.76$  vs  $-36.39\pm20.40$ ) were significantly reduced in patients with extensive infarction of the anterior wall ( $p<0.05$ ), while the differences between anteroseptal and infer-posterior MI were small. There were good correlations between torsion and LVEF, untwisting rate ( $r_1=0.618$ ,  $r_2=-0.731$ ,  $p<0.001$  for both).

**Conclusion** Torsion, torsion rate and untwisting rate derived by STI were decreased not only in patients with MI but also in patients with myocardial ischaemia at rest. Besides it is the infarction extent and size rather than the site to influence the twisting and untwisting in patients with MI.