P2068 | BENCH
Shear elasticity-pressure relationship in normal and infarcted myocardium
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Shear-wave methods (SW) by ultrasound or magnetic resonance have been introduced for noninvasive measurements of myocardial shear elasticity (μ). Recent studies have shown a correlation between μ and left ventricular pressure (LVP) or contractility. How these factors interact, particularly in vivo, remains unclear. Stiffness increases due to several factors, from active contraction to passive stretch, changes with disease, and so on. We studied whether there is a unique μ-LVP relationship in vivo in active vs. passive state.

Methods: μ of anterior LV myocardium was measured in 10 pigs by 2 methods, the SW method (SDUV) and from classical stress-strain relationships (compliance and pressure data). In 5 animals, a reperfused MI was induced. The active (systole) and passive (volume loading) μ-LVP relations in the same animal were compared.

Results: In all animals, there was a linear relationship between μ and LVP during the heart cycle (left Figure), regardless of whether the myocardium was normal or infarcted (R²: 0.84 ± 0.10 in 10 normal animals and 0.87 ± 0.14 in 5 animals with MI). The slopes of these relations tended to be lower post-MI. In MI, μ was higher at end-diastole (P < 0.05) but pseudo-normal during systole. The reconstructed μ-LVP relations indicated that, at the same LVP, μ was higher in contracting myocardium vs. the passive state (right Figure). Animals with small subendocardial infarcts had more complex pattern.

Conclusions: The results suggested that, in diseased myocardium, the absolute values of shear elasticity during systole as measured by SW do not purely reflect local contractile function. The contribution of passive tissue properties (pressure-dependent) needs to be accounted for.

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Simultaneous evaluation of perfusion by myocardial contrast echocardiography is incrementally beneficial beyond wall motion analysis only: results from a real-world stress echocardiography service
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Purpose: The diagnostic accuracy of myocardial contrast echocardiography (MCE), performed during stress echocardiography (SE), for evaluation of known or suspected coronary artery disease (CAD), has been proven in research studies. However, the feasibility and value of MCE incorporated into a real-world clinical SE service are unknown. This prospective study thus aimed to determine the clinical role of MCE.

Methods: All patients had been referred for SE on clinical grounds. We performed MCE during SE, using a continuous infusion of Sonovue contrast, in patients undergoing pharmacological stress and those performing exercise in whom we suspected a high workload or target heart rate may not be attained. We documented clinical SE and MCE images. We defined: incremental benefit over wall motion (WM), more confidence with WM, and MCE data and angiography findings, where significant CAD was defined as ≥50% stenosis.

Results: Over 21 months, 220 patients underwent MCE by 8 operators. Mean age was 66 ± 14 years, 74% were men. MCE demonstrated excellent feasibility, with diagnostic images in 94% studies. Mean contrast use was 2.8 vials/study. MCE provided incremental benefit over WM analysis in 56 (25%) cases, gave more confidence with MCE in 49 (22%) cases, had more added value with MCE in 102 (47%) cases and was uninterpretable in 13 (6%) cases. Of the 60 patients with confirmed CAD at angiography, MCE detected more patients with LAD disease compared to WM only (60% vs 53%, p < 0.03) and a greater ischemic burden than WM on a per-patient basis (median segments 5 [MCE] vs. 4 [WM], p < 0.001) and in both the anterior (3 vs. 1 segments, p < 0.001) and posterior (4 vs. 2 segments, p < 0.001) coronary circulation. Multivessel disease (MVD) - LAD + LCX + RCA was correctly detected by MCE in 26/34 (76%) patients but only 19/34 (56%) patients by WM (p = 0.02); in MVD patients, MCE also identified a significantly greater ischemic burden than WM (7 vs. 5 segments, p < 0.001) and, furthermore, identified LAD disease missed by WM in >50% MVD patients.

Conclusion: MCE is feasible by multiple operators when incorporated into a clinical SE service. MCE data provides the reporting cardiologist with incremental benefit or greater confidence in a significant proportion of cases. MCE is more sensitive than WM for detecting flow-limiting LAD disease, correctly predicting presence of MVD and identifies a greater burden of ischemia.

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Factors affecting myocardial blood flow in patients with chest pain and unobstructed coronary arteries
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Purpose: Patients with chest pain and unobstructed coronary arteries have an increased adverse cardiovascular outcome compared to those with normal coronary arteries. The aetiology is unclear but may be due to coronary microvascular dysfunction. In the largest study to date, we studied the relationship between risk factors (RF) for coronary disease (CD) and myocardial blood flow (MBF) in patients with chest pain and unobstructed coronary arteries.

Methods: We recruited patients with chest pain and low or intermediate probability for CD, to undergo CT coronary angiography (CTCA). Those with either mild stenosis on CTCA or moderate stenosis and normal functional imaging, had myocardial contrast echocardiography (MCE) at rest and during dipyridamole stress. MBF baseline (MBFB), stress (MBFS) and MBF reserve (MBFR) was obtained. High-sensitivity CRP (hs-CRP), arterial stiffness index (ASI) and carotid intima-media thickness (IMT) were measured.

Results: 205 patients, mean age of 60.1 ± 9.7 (range 32 – 81) years and 108 (53%) male were studied. Multiple regression analysis demonstrated the following to be significant independent predictors of reduction in MBF: Diabetes, for each decade increase in age there was a 14% (p < 0.05) reduction in MBFs. Male gender was associated with a reduction in MBFs and MBFR by 11% (p < 0.05) and 14% (p < 0.01), respectively. Diabetes reduced MBFS by 17% (p < 0.05), and for each 10 kg/m² increase in BMI there was a 9% (p < 0.05) and 12% (p < 0.05) reduction in MBFS and MBFR, respectively. Increase in total cholesterol by 1 mmol/L was associated with a 4% (p < 0.05) reduction in MBFs. A 1 mmol/L increase in ASI correlated with a 2% (p < 0.05) reduction in MBFs. Smoking was associated with a 7% (p < 0.05) reduction in MBFs. A 10 mg/mL increase in hs-CRP was associated with a 9% (p < 0.05) increase in MBFs. IMT was not an independent predictor of MBF. Age was inversely associated with MBFR (p < 0.05). Patients were divided into 3 groups according to number of RF: group A <3 RF, group B 4-6 RF, group C >6 RF. Between groups comparison indicated increasing RF was cumulatively associated with a reduction in MBFR: group A 39.5 ± 7.8 dB/²/s, group B 29.3 ± 7.2 dB/²/s, group C 26.6 ± 6.0 dB/²/s (p < 0.05), and also MBFs: group A 69.8 ± 13.7 dB/²/s, group B 59.2 ± 15.7 dB/²/s, group C 52.0 ± 14.7 dB/²/s (p < 0.01). There was no significant relationship with MBFB (group A 2.3 ± 0.4, group B 2.2 ± 0.5, group C 2.1 ± 0.5).

Conclusion: In patients with chest pain and unobstructed coronary arteries, MBF is significantly affected by risk factors for CAD. This effect is more pronounced as the number of risk factors increase.
individuals who were of similar age, gender, CAD risk factors and symptom presentation.

Results: 1337/2 patients (56.2±12.8 years, 51% male) were followed for 2.0±0.9 years follow up, with 279 (21.4%) MACE occurring. Compared to non-smokers, current and past smokers had higher prevalence of obstructive CAD (<50%) (1-vessel disease (VD): 11.2% vs. 16.6% vs. 16.2%, p<0.001, 2VD; 4.8% vs. 7.3% vs. 7.5%, p<0.001, 3VD; 2.3% vs. 5.1% vs. 5.0%, p<0.001). Current smokers experienced higher risk of MACE compared to non-smokers (HR 1.9, 95% CI 1.4-2.5, p<0.001), while past smokers did not (HR 1.2, 95% CI 0.9-1.6, p=0.29). Even amongst matched individuals, current smoking was associated with increased risk of MACE (HR 2.3, 95% CI 1.2-4.4, p=0.01), while past smoking was not (HR 1.0, 95% CI 0.5-2.1, p=0.98).

Conclusion: While both current and past smokers possess a greater prevalence, extent and severity of CAD compared to non-smokers, current smokers experience higher risk of MACE than past smokers and non-smokers.

P2073 | BENCH
Myocardial perfusion scintigraphy (Gated-SPECT) in patients with ischemic ST-segment only during recovery phase of the exercise testing
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Purpose: The ST-segment depression occurring only in the recovery phase (≤30 mmHg) and occurs in 1-3% of the exercise testing (ET). The diagnostic and prognostic value is less investigated as compared with that observed during exercise only. For few studies have investigated the clinical significance of this finding. Objective: The aim of this study was evaluate the association between the ST of the ET with the gated-SPECT imaging alterations.

Methods: We analyzed 92 patients with ST (≥ 1 mm), who underwent gated-SPECT associated with ET and Bruce protocol, mean age 60±9.9 years, 74 (60.4%) male, with previous coronary artery bypass graft in 20%, myocardial infarction in 25%, and percutaneous coronary intervention in 35.2%. Qualitative analysis of imaging used 5-point score (0-normal; 4-no uptake) for perfusion (17 myocardial segments), and 6-point score (0-normal; 5-disksinesia) for motility. Left ventricular ejection fraction (LVEF) was assessed after ET. ST, blood pressure (BP), heart rate (HR), time of tolerance to exercise (TTE), functional capacity (MET), appearance time to ST (AT); ST, and presence of arrhythmias were evaluated during ET.

Results: Abnormal perfusion was observed in 58 patients (63.04%), 50% with isolated ischemia or associated with persistent defect: abnormal motility in 31 patients (33.7%) and mean LVEF of 57.8±11.6%. AT; ST: 202±38.8 sec, magnitude of ST 1±2±0.3 mm, 10.4±2.7 MET; angina in 16pts (17.6%) and ventricular arrhythmias in 58 pts (63%). There were significant differences in the association between perfusion alterations with: male p=0.006, positive predictive value (PPV) 73%; AT; ST; p=0.011, PPV 76.2%; increase in systolic blood pressure ≤30mmHg during ET p=0.002, PPV 91.3%; and typical angina p=0.025, PPV 87.5%. In patients with only transient defect, there were significant differences for male (p=0.01), hypertension (p=0.04) and marginal significance when systolic blood pressure ≤30mmHg (p=0.09). The PPV of ST to any perfusion, motility on LVEF alteration was 64%.

Conclusion: ST of the ET occurred late, and was a relevant finding due to the high incidence of documented alterations in the gated-SPECT.

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Atherosclerotic plaque characteristics improve diagnosis of ischemia for non-obstructive coronary artery lesions: a direct comparison to fractional flow reserve
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Purpose: Fractional flow reserve (FFR) at the time of invasive coronary angiography (ICA) is the gold standard for determining lesion-specific ischemia, and identifies ischemia in a significant proportion of lesions considered anatomically non-obstructive. Beyond luminal severity, coronary CT angiography (CTA) enables evaluation of atherosclerotic plaque characteristics (APCs) that include positive remodeling (PR), low attenuation plaque (LAP) and spotty intra-plaque calcification (SC). The relationship of these APCs to ischemia in non-obstructive coronary lesions has not been evaluated to date.

Methods: Nineteen patients from 17 centers in 5 countries were prospectively enrolled. Patients underwent CT and ICA, with clinically indicated FFR performed at the time of invasive coronary angiography. We analyzed 92 patients with 3 months. Patients ranged in age 58±11 years (58% male). 93/284 patients (33%) undergoing CTA after single troponin who had no plaque on CTA were discharged without serial troponin and no further investigation following discharge. Patients undergoing CTA after single troponin who had any plaque and up to mild stenoses were discharged after repeat troponin with no further investigation following discharge. Patients with moderate stenoses were discharged with outpatient stress echocardiography and patients with severe stenoses were admitted for invasive angiography. Discharged patients were contacted by telephone and medical records reviewed to determine safety outcomes.

Results: Mean age was 58±11 years (58% male). 39/284 patients (33%) undergoing CTA after single troponin who had no plaque and were discharged after only a single troponin. 486/585 patients overall (83%) had no plaque or mild stenoses on CTA and were discharged with no further investigation, 24/585 (4%) had moderate stenoses on CTA and were discharged with outpatient stress echocardiography and 74/585 (13%) had severe stenoses on CTA and were admitted for invasive angiography. At median 47.1-month follow-up (range 20-53 months), there were 5 repeat chest pain readmissions (1%, 95% confidence interval 0.2-2.3%), no revascularisation procedures, no myocardial infarctions and no deaths (95% confidence interval 0-0.8%). Follow-up was 99% complete.

Conclusion: In a low risk, low-to-intermediate risk patients with a CTA-guided strategy is safe at long-term follow-up, including patients discharged after a single negative troponin.

CONGENITAL HEART DISEASE - INTERVENTIONAL AND SURGICAL ISSUES

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Transcatheter closure of perimembranous ventricular septal defect with a new occluder: one-year follow-up
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Purpose: Transcatheter closure of peri-membranous ventricular septal defects (pVSDs) has been associated with a significant risk of complete heart block, leading most groups to abandon the technique. We describe the initial world experience of pVSD closure with a newly designed occluder.

Methods: Patients with pVSD underwent catheter closure using the Amplatzer™ Membranous VSD Occluder 2 (St. Jude Medical, MN, USA).

Results: Nineteen patients from the 4 centers initially involved worldwide were prospectively included and followed for a 12±3 months. Patients ranged in age from 1.4 to 62 years (median 6 years) and in weight from 9.3 to 96 kg (median26 kg). The Qp/Qs ratio was (mean ± SD) 1.9±1.6. The size of the defect on left ventricular side was (mean ± SD) 9.9±3.5 mm (range 4.6 – 16 mm) and the orifice on right ventricular side was 8.1±2.8 mm (range 3.9 – 14 mm) by echocardiography. Mean device size was 9.4±2.4 mm (range 5 – 14 mm). An eccentric device was used in 9 patients (47%) and a concentric device in 10 (53%). A device was suc-