Magnetic Resonance Imaging Can Reliably Identify Heart Iron Overload in Patients With B-Thalassemia Major

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Background: Patients with B-thalassemia major depend on continuous blood transfusions for survival. As a consequence, iron overload occurs in all organs including the heart. Heart biopsy is the only way to detect heart iron deposition, but it is invasive and not easily repeatable. We applied magnetic resonance imaging (MRI) for the assessment of myocardial iron deposition in patients with B-thalassemia and compared the results with cardiac biopsy data.

Methods: Twenty-five consecutive thalassemic patients, NYHA II-III, were studied using a 0.5 T system, ECG-gated, with TE=17-68 ms. T2 relaxation time of the interventricu-lar septum was calculated assuming simple monoexponential decay in one square centi-meter region of interest. Heart biopsy was performed within a week after the MRI study.

Results: Seven of the 25 patients had heart biopsy indicative of low iron deposition (Group A) and the remaining 18 patients had heart biopsy indicative of high iron deposition (Group B). T2 relaxation time of the heart (T2H) was in agreement with heart biopsy in 86% of the patients in Group A vs. 78% of the patients in Group B (overall agreement 80%). However, for ferritin levels were in agreement with heart biopsy in 28% vs. 88%, respectively (overall agreement 72%). In Group A, MRI was in better agreement with biopsy compared to ferritin (86% vs. 28%, p=0.05).

Conclusions: Heart T2 relaxation time appears in agreement with cardiac biopsy, both in high and low iron deposition, and is a useful non-invasive index for serial evaluation in B-thalassemia.

Myocardial Infarct Age Determined by Contrast-Enhanced Cine Magnetic Resonance Imaging

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Background: In patients with acute chest pain and resting wall motion abnormalities, differentiating acute myocardial infarction (AMI) and chronic myocardial infarction (CMI) can have important therapeutic implications. Contrast-enhanced cine magnetic resonance imaging (CEC) has been shown to sensitively diagnose microvascular obstruction (MO), a signature of AMI that is rarely seen in CMI. The present study was designed to determine if CEC can distinguish between AMI and CMI.

Methods: In 43 patients with enzyme-documented AMI treated by reperfusion, we performed CEC within 6 hours of admission, and repeated this examination after 3 months. CEC imaging was performed approximately 1 minute after 0.20 mmol/kg of I.V. gadolinium-DTPA contrast. Nine 8mm short-axis slices and two long-axis slices acquired, using an-EKG gated, segmented k-space true-FISP pulse sequence. At 10 minutes post-injection, after an ECG-determined time scan for optimum myocardial nulling, an inversion-recovery turboFLASH delayed hyperenhancement (IR-DE) study was done in identical slices. MO was defined as discrete endocardially-based hyperenhancing regions that became all or partially enhanced on IR-DE. All studies were read by two blinded observers.

Results: Microvascular obstruction on CEC was seen in 35/43 (81%) of patients with AMI, and in only 4/43 (9%) after 3 months. The presence of MO on CEC 81% sensitive and 91% speci-fic for AMI.

Conclusions: The presence of microvascular obstruction on contrast-enhanced cine MRI is a sensitive and specific predictor of acute MI. Its absence suggests chronic MI.

Systolic and Diastolic Strain Rates by Tagged Magnetic Resonance Imaging Distinguishes Regions With Different Degrees of Myocardial Injury After Acute Myocardial Infarction

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Background: Myocardial injury after acute myocardial infarction (AMI) is a regional and heterogeneous process that affects both systolic and diastolic function. Using tagged MRI, we evaluated regional systolic and diastolic function in areas with different degrees of myocardial injury after AMI and assessed whether both measures combined would allow us to better characterize and distinguish these regions.

Methods: Fourteen dogs underwent 90-min coronary artery occlusion followed by reperfusion. Five short-axis slices were acquired for each dog within the first 24h of reperfu-sion using 3 techniques: tagged MRI, first-pass perfusion and delayed-enhancement (DE). Regional blood flow >50% of remote by radioactive microphereses during coronary artery occlusion was used to define risk region. Each slice was divided in 6 segments that were classified in 4 categories: transmural AMI (DE>50% area, n=99), subendocar-dial AMI (DE>50% area, n=82), risk region (n=80) and remote area (n=163). For each segment, circumferential systolic strain (Ecc), systolic strain rate (SSR) and early diastolic strain rate (DSR) were calculated.

Results: Transmural AMI segments displayed depressed systolic contractility compared to subendocardial AMI segments (P<0.01), and both showed reduced systolic and diastolic function compared to remote areas (Ecc = –2.5±0.9% vs. –13.1±0.5%, SSR = –0.11±0.10s–1 and –0.82±0.12s–1 versus –2.15±0.08s–1 and DSR = 1.26±0.09s–1 and 1.50±0.08s–1 versus 2.99±1.0s–1, for transmural and suben-docardial AMI segments versus remote areas, P<0.01 for all). In contrast, risk region significantly exhibited diastolic impairment (DSR=1.62±0.09s–1, P<0.001 versus remote), but not systolic dysfunction (NS versus remote). Importantly, after controlling for segmental infarct extension, the presence of microvascular obstruction (“no reflow”) was related to further impairment of systolic and diastolic regional function (P<0.05 for both).

Conclusion: Regional systolic and diastolic functional assessment using strain rate analyses provides for superior characterization and distinction of regions with different degrees of myocardial injury after AMI.
Diltiazem Attenuates the Coronary Vasodilatory Response to Adenosine and Reduces the Regional Myocardial Blood Flow Disparity and Septal defect Magnitude in Dogs With Critical Coronary Stenoses

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Methods: In 4 anesthetized dogs, hemodynamic responses to Ado boluses (60 µg/kg) were recorded in the absence or presence of increasing doses of Dtz (0.003-0.048 mg/kg/min). Ten min later, Ado was infused (250 µg/kg/min) and sestamibi (296 MBq) and microspheres were injected at peak Lcx flow. Ex vivo imaging of heart slices and gamma well counting was performed.

Results: Dzt produced dose-dependent decreases in resting HR and aortic pressure and, as shown, increased resting flow (open bars). As with Ver, Dzt markedly attenuated the Ado flow increase (x-axis) compared with our historical data without Dtz (0.62). Likewise, Ado produced only a 2:1 myocardial flow disparity between the normal and stenotic zones and the septal defect magnitude was relatively mild (LAD/Lcx count ratio=0.74±0.02) compared with our historical data without Dtz (0.62).

Conclusion: Dtz markedly attenuated the vasodilatory response to Ado giving further evidence that calcium channel blockers should be withheld temporarily in patients undergoing Ado stress perfusion imaging to avoid the potential for a submaximal stress test.

Caffeine Acutely Decreases Coronary Flow Reserve in Patients With Coronary Artery Disease

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Aim: Caffeine antagonizes adenosine-induced hyperemic myocardial blood flow (MBF). Its impact on exercise-induced coronary flow reserve (CFR) remains unknown. As exercise may induce hyperemia via adenosine mediated mechanisms, our aim was to determine the acute effect of caffeine on CFR during exercise.

Methods: 15O-labelled H2O and Positron Emission Tomography (PET) was used to measure CFR in 7 patients with coronary artery disease (mean age 59±6 years) before and 50 minutes after oral ingestion of caffeine (200mg). Supine bicycle exercise (mean workload 98% of predicted) was used as stress.

Results: Caffeine levels were zero at baseline in all subjects and increased to 18+/−9mmol/l forty minutes after caffeine intake. Rate pressure product (rest and exercise) was not affected by caffeine. Caffeine did not affect resting MBF; whereas hyperemic MBF decreased significantly by 20+/−20 (2.8+/−0.64 m/min/min vs. 2.19+/−0.58 m/min/min, p=0.05), resulting in a decrease in CFR of 23% (2.16+/−0.45 vs. 1.59+/−0.33, p=0.05).

Conclusions: Caffeine decreases coronary flow reserve in patients with CAD during physical exercise. This might raise some concerns about safety of caffeine-containing food or beverages particularly when consumed shortly before physical exercise.