864-6 Quantitative Analysis of Microcirculation of Finger by Intravenous Contrast Echo in Patients With Diabetes Mellitus

Kansu Ueno, Katsu Takenaka, Susumu Sakurai, Masako Asakawa, Akiko Kikuchi, Masashi Matsuraki, Tomoko Takahashi, Kazuhiko Nakahara, Ryozo Nagai, University of Tokyo, Tokyo, Japan.

Background: Microcirculation of finger has never been successfully assessed non-invasively in human. The purpose of this study was to use intravenous contrast echo and evaluate microcirculation of finger in diabetic patients. Methods: LEVOIST (200mg/ml) was administrated as intravenous bolus (4ml) followed by continuous infusion (1ml/min). The middle finger of 12 diabetics and 13 normal controls were studied with 3.6 MHz sector probe (Vingmed System Five) which was fixed to the finger by taping with a spacer of 3 cm thickness. Diabetics had retinopathy and/or nephropathy. An external pulse generator was used to send spurious "ECG" signal directly to the ultrasound machine (pulse rate:40 to 240/min). Power Doppler harmonic contrast images were obtained with "ECG" triggering rate from 3:1 to 1:1. As a result, actual pulsing intervals became gradually shorter in the range of 4:60 to 0:25 sec. Since microbubbles in the finger can be destroyed by a single frame recording, intensity of power Doppler signal measured by ECHOPAC software was assumed to reflect the finger blood flow during each pulsing interval, and plotted against pulsing interval as a logarithmic curve. We measured peak intensity (dB) and slope of the curve before and after cold stress test with one hand dipped in ice water for 2 min. Results: Before cold stress test, peak intensity was similar between diabetics and normals (22.0±5.5 vs 22.3±5.8), and slope was significantly steeper in diabetics than in normals (-13.4±5.3 vs -8.6±4.0; p<0.001), indicating lower intensity in short pulsing intervals in diabetics. During cold stress test, peak intensity decrease was much less prominent in diabetics (22.0±5.5 to 17.6±5.7) than in normals (-3.8±1.0 to -1.7±0.9). Conclusion: As shown in our study, intravenous contrast echo could detect abnormal microcirculatory state in diabetics with retinopathy and/or nephropathy.

ORAL CONTRIBUTIONS

865 Cardiovascular Magnetic Resonance and Atherosclerosis

Tuesday, March 19, 2002, 2:00 p.m.-3:30 p.m.
Georgia World Congress Center, Room 257W

865-1 Noninvasive Analysis of the Remodeling Process in Coronary Artery Disease by Magnetic Resonance Imaging

Paulo J. Bertocci, José P. Parga, Antonio C. Chagas, Carlos E. Rochitte, Luis F. Avila, Desidério Favaro, Protacio L. da Luz, Heart Institute (InCor), University of São Paulo Medical School, São Paulo, Brazil.

Background: Classical analysis of atherosclerosis has been based on the luminal appearance of the vessel; however early adaptation to atherosclerosis involves remodeling of the vessel with relative preservation of the lumen. We analyzed this phenomenon with MRI. Methods: Twenty patients (pts) (57±12 years) and 6 healthy controls (27±5 years) for comparison in a 1.5T magnet (CIVI GE). Coronary artery stenosis >50% in left anterior descending (LAD) and right coronary artery (RCA), by contrast angiography, were documented in all pts. An EKG breath-hold black-blood sequence (TR/TE=2RR/1.5, FOV=18-20mm, matrix=192x256, NEX=1, slice thickness=3mm) was used to evaluate Maximal Wall Thickness(WT), Vessel Wall Area(VWA), Total Vessel Area(TVA) and Luminal Area(LAU) in RCA and LAD. Results: A total of 49 segments (39 in pts and all in controls) was studied. There were no statistically significant difference in LA between pts and controls (14.45±7.67 vs 12.38±4.70; p=0.05) despite an important increase of the VWA in pts. When adjusted for the vessel size using the LA/TVA ratio, a significant difference was found (0.40±0.4 in pts vs. 0.81±0.09 in controls; p<0.005). Figures below illustrate the findings. Conclusion: MRI allowed noninvasive detection of vessel wall abnormalities. The preservation of the luminal area could be explained by the effective positive remodeling of the vessel.

865-2 Lipid-Coated SPIO; Introducing a Novel Tracer for MR Imaging of Macrophage Infiltration in Vulnerable Atherosclerotic Plaque

Muzaffar Azadpour, Chinnasawamy Jaganath, Daniel Chan, Nwora Cornelius, Ward Casscells, James Willerson, Mortaza Naehavi, Center for Vulnerable Plaque Research, University of Texas-Houston and Texas Heart Institute, Houston, Texas.

Background: Super paramagnetic iron oxide(SPIO) is a MRI contrast medium consisting a central core of iron oxide coated by colloidal polycacaylicle mainly Dextran. We have previously shown that dextran coated SPIO including the commercially available SPIO (Feridex) are avidly taken up by macrophages, however, their uptake was followed by a significant rise in intracellular oxidative enzyme activity mainly due to respiratory burst associated with digestion of dextran in macrophages. Here we report a novel liposomal SPIO. We hypothesize that lipid-coated SPIO particles enter into macrophages through a different pathway than dextran-coated SPIO allowing more uptakes with less oxidative stress.

Method: Mouse peritoneal macrophages were isolated in the culture medium and incubated with different SPIOs for 4 hours and then washed. After 24 hours production of nitric oxide(NO) was measured in supernatant by Greiss reagent. In a second series of experiments fluorescent-labeled SPIO (FL-SPIO) was added to macrophages in the presence of two inhibitors of manose receptor, dextran and mannan. Intracellular retention of FL-SPIO was measured after 2 hours.

Results: See Figure 1 (p<0.05). Also FL-SPIO studies showed that mannan a known inhibitor of manose receptor significantly inhibited macrophage uptake of dextran coated SPIO but not lipid coated SPIO.

Conclusion: Liposomal SPIO are promising candidate for MR contrast enhanced imaging of macrophage infiltration in vulnerable plaque.

865-3 Contrast-Enhanced MRI Demonstrates Acute Response to Vascular Injury

Masahiro Terashima, Enseno de la Pena-Almaguer, Phillip C. Yang, Bob S. Hu, Michael V. McConnell, Stanford University, Stanford, California.

Background: Vascular injury and inflammation contribute to atherosclerosis and restenosis. Contrast-enhanced MRI (CEMRI) may improve characterization of the vessel wall, particularly biological changes such as inflammation. We hypothesized that CEMRI would allow us to noninvasively monitor the inflammatory response to vascular injury.

Methods: Six New Zealand White rabbits were fed a hyperlipidemic diet for 1 week, then underwent focal balloon injury (3F Fogarty) of the abdominal aorta. On a 1.5 T system, T1-weighted fast spin echo MRI was performed with and without contrast (Gd-DTPA, 0.1mmol/kg) before and 10 hours, 1 day, 3 days, 7 days, and 28 days after balloon injury (16cm FOV, 0.3mm resolution, 370ms TR, 34ms TE). We analyzed 395 images to measure vessel wall signal-to-noise ratio (SNR) with and without contrast in the injured and uninjured arterial segments at each time point and then compared by ANOVA.

Results: CEMRI demonstrated significant enhancement after acute vascular injury (Figure). Minimal change was seen without contrast or in the uninjured segments. Significant enhancement persisted for 7 days post injury (p<0.005), but was not significant by 28 days.

Conclusions: CEMRI detects signal enhancement in the vessel wall after acute injury and may prove useful in predicting clinical outcome after vascular interventions.