2123 The Effect of Vascular Bed Cross-Sectional Area Upon Resistive Index and Initial Systolic Acceleration

Bude RO,* Rubin JM *Department of Radiology, University of Michigan Medical Center, Ann Arbor, MI*

OBJECTIVE: To determine if the progressive increase in total arterial cross-sectional area as a feeding artery branches into a vascular bed (normal approximate in vivo ratios: main artery to pre-arteriolar arteries = 1:4, to arterioles = 1:10) alters the downstream resistive index (RI) and initial systolic acceleration (ISA) compared to upstream values. METHODS: A phantom of branching noncompliant tubing (eliminating compliance effect) and blood-mimicking fluid was devised so that "vascular beds" of increasing downstream cross-sectional area (1, 2, 4, 6, and 8 times the feeding vessel cross-sectional area) were produced. Upstream RI and ISA were compared to downstream RI and ISA (mean values from all tubes in "bed"). RESULTS: Downstream ISA was inversely proportional to the ratio of downstream to upstream cross-sectional area; mean downstream RI decreased linearly with, but not inversely proportional to, increasing downstream cross-sectional area, with the mean RI in the bed of 8 times the upstream cross-sectional area approximately 3/4 the upstream RI. CONCLUSIONS: RI and ISA decrease as the ratio of downstream arterial cross-sectional area to feeding artery cross-sectional area increases. This at least partially explains the normal decrease in these parameters as insonation progresses distally down a vascular bed, independent of other factors which also alter these parameters. Diseases which alter the number and caliber of downstream arteries therefore directly alter the RI and ISA.

6050 PTFE Graft Wall Obstruction of Gray-Scale and Doppler Ultrasound Penetration

Renslo R, Collins JS,* de Virgilio C, Sinow RM *Harbor–UCLA Medical Center, Torrance, CA*

OBJECTIVE: The purpose of this study is to demonstrate that PTFE graft material does not allow ultrasound penetration in vitro or initially after being placed in a patient. METHODS: PTFE (Impra) and woven Dacron graft samples were studied in vitro by scanning immediately, at 24 hr, and 10 days after soaking in sterile water. Six in vivo PTFE grafts were imaged at various time points after surgical placement ranging from 4 days to 15 months. Scans were performed with 3–7 MHz real-time linear and sector transducers. RESULTS: In vitro the PTFE grafts could not be penetrated by ultrasound regardless of transducer frequency used or of the length of time of soaking. The Dacron graft, however, was always penetrable. In vivo a PTFE dialysis shunt was scanned 4 days after surgery. The middle 5 cm could not be penetrated via ultrasound even though normal shunt flow was observed at both ends. PTFE grafts in place 3 months or longer were clearly ultrasound penetrable. CONCLUSIONS: PTFE grafts block gray-scale and Doppler ultrasound penetration in vitro and initially after placement but become penetrable at a later point in time. Those not aware of this artifact may diagnose a false-positive graft occlusion.

6021 Plasma Endothelin–1 Concentration Does Not Reflect Renal Vasoconstriction As Estimated by Duplex Ultrasonography in Cirrhosis

Kitamura H,* Kawasaki S *Department of Surgery, Shinshu University School of Medicine, Matsumoto, Nagano, Japan*

OBJECTIVE: Endothelin, a potent vasoconstrictor, is thought to play a role in liver cirrhosis-related functional kidney failure. Our aim was to investigate the correlation between renal vasoconstriction, as detected by a Doppler ultrasound technique, and plasma concentrations of endothelin in cirrhotic patients. METHODS: Fifty cirrhotic patients underwent Doppler examinations to detect renal vasoconstriction. The plasma concentration of endothelin was measured in 10 patients who exhibited vasoconstriction of the renal microvessels diagnosed by Doppler waveform analysis, and was compared to that of patients in whom there was no sign of such vasoconstriction. RESULTS: No difference was observed in the plasma concentration of endothelin between patients in whom renal vasoconstriction was diagnosed and those in whom it was not. CONCLUSIONS: Our results suggested that the circulating endothelin does not reflect renal vasoconstriction, at least in the early phase of the functional renal failure associated with cirrhosis of the liver.

Basic Sciences/Instrumentation *Moderators: Peter N. Burns, PhD, Robert C. Waag, PhD*

2401 Limited Diffraction Beams for High Frame Rate 2D and 3D Pulse-Echo Imaging

Lu J-y *Mayo Clinic/Foundation, Rochester, MN*

OBJECTIVE: Develop a new method for 2D and 3D pulse-echo imaging of high frame rate. METHODS: Limited diffraction beams have a large depth of field and could have many applications. In this presentation, these beams of different parameters are used to receive echoes returned from 2D or 3D objects illuminated with a broadband incident wave. Received signals are digitized and 2D or 3D images are constructed with FFT and IFFT chips. Because only one transmission is required to construct either 2D or 3D images, the new system has a very high frame rate, up to 3750 frames/second for tissues 200 mm away from transducers. Because of high frame rate, 3D blood flow vector can be constructed with speckle tracking techniques. RESULTS: Theory of the new imaging method is developed. Both 2D and 3D images are constructed with a broadband transducer of 50 mm diameter and 2.5 MHz central frequency. Results show that 3D images of a point scatterer located at axial distances of 30, 100, and 200 mm have a –6 dB width of about 0.833, 2.92, and 5.42 wavelengths, respectively. Sidelobes of the images are low (around –60 dB) and decrease with the number of limited diffraction beams used. Images of other objects such as point scatterers in multiple layers and spherical balls of random scatterers are also constructed faithfully. CONCLUSIONS: The new imaging method is promising for both high frame rate anatomic and blood flow imaging and may have an impact for future pulse-echo imaging systems. (This work was supported in part by grants CA 54212 and CA 43920 from the National Institutes of Health.)

Journal of Ultrasound in Medicine

VOLUME 16, NUMBER 3 (SUPPLEMENT) MARCH 1997

OFFICIAL PROCEEDINGS 41ST ANNUAL CONVENTION

March 23–26, 1997
San Diego, CA

3/23/97
Jian-yu Lu

Official Journal of the American Institute of Ultrasound in Medicine