

Thursday, March 22, 1990

10:30AM-12:00NOON, Room 36

## New Diagnostic and Therapeutic Modalities

## INTRAVASCULAR ULTRASOUND EVALUATION OF INTERVENTIONAL PROCEDURES: COMPARISON WITH FIBEROPTIC ANGIOSCOPY.

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Real time, high resolution intravascular ultrasound and fiberoptic angiography are useful tools for characterizing arterial pathology, but limited data exist comparing their ability to evaluate results of interventions. Twelve patients undergoing peripheral vascular procedures in the catheterization laboratory or operating room were imaged sequentially with a 5 or 8 French (20 or 30 MHz) intravascular ultrasound catheter (Cvis, Inc., Sunnyvale, CA) and a fiberoptic angioscope (Olympus Corp, Lake Success, NY) immediately pre and post intervention. Procedures included balloon angioplasty (4 patients), atherectomy with Rotablator (Biophysics Int., Bellevue, WA) (2 patients) or TEC extraction catheter (IVT, San Diego, CA) (1 patient), or direct endarterectomy along with a heterograft or in situ venous bypass graft (5 patients). Information obtained from the two imaging methods was compared for clinical utility.

Fiberoptic angiography was a superior method for evaluating graft suture lines, valves and side branches of in situ venous grafts requiring removal or ligation. Angioscopy characterized markedly irregular intraluminal lesions, dissections and thrombi, but was limited by its inability to provide pathological information beyond the intimal surface or to measure intraluminal dimensions. Intravascular ultrasound imaged the depth and tissue character of lesions, eccentric vs concentric architecture, and intraluminal dimensions and thus was helpful in choosing atherectomy vs angioplasty and in evaluating the success of the different interventional procedures.

**Conclusion:** Intravascular ultrasound and fiberoptic angiography are complementary imaging methods for evaluating success of peripheral vascular interventional procedures.

## ACCURACY OF EXTERNAL 2-DIMENSIONAL AND DOPPLER COLOR FLOW IMAGING TO ASSESS PERIPHERAL ARTERY LUMEN MORPHOLOGY AND SIZE VALIDATED BY CATHETER-BASED INTRAVASCULAR ULTRASOUND

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Imaging of vascular structure by 2-dimensional (2-D) ultrasound and imaging of vessel flow by Doppler color flow (DCF), have both been used to measure arterial lumen size. To assess the accuracy of external vascular 2-D and DCF imaging for measurement of cross-sectional arterial lumen diameter and area, 25 normal and diseased external iliac and femoral artery segments, ranging in diameter from 4.2-14.5 mm and 0.16-1.6 cm<sup>2</sup> area were imaged in 14 pts, and compared to morphologic findings and lumen measurements of the same sites using a catheter-based, 20 MHz intravascular ultrasonic (IVUS) imaging system. High resolution images were obtained at all sites using IVUS and DCF, but at only 22/25 (88%) sites by 2-D. External imaging detected all 10 sites of calcific plaque detected by IVUS but only 1/4 sites with soft plaque. Correlation of IVUS with external 2-D and DCF luminal measurements showed:

	2-D Diameter	DCF Diameter	2-D Area	DCF Area
Correlation (r)	0.95	0.91	0.98	0.94
Slope	0.95	1.02	1.06	1.12
Y-intercept	0.49	0.51	-0.02	0.03
Standard error	0.94	1.14	0.07	0.12

These data indicate that while 2-D and IVUS measures of arterial lumen size correlate closely, 2-D imaging may be limited by poor resolution images and inability to detect soft plaque. DCF is useful for vessel identification and localization, but lumen measurements are less accurate than 2-D and usually underestimate true lumen size.

## RECANALIZATION OF TOTALLY OCCLUDED ILIAC ARTERIES USING PULSED LASER ANGIOPLASTY GUIDED BY SPECTROSCOPY

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Recanalization of totally occluded iliac arteries by angioplasty may be an alternative to patients (pts) at high risk for surgery. Twenty pts with total occlusion of the iliofemoral artery (length 1-7 cm) who were not candidates for surgery underwent percutaneous angioplasty. In 8 pts the occlusion could be crossed with the guidewire allowing subsequent dilatation. In the remaining 12 pts laser angioplasty was used to penetrate the occlusion using either ipsilateral (8 pts) or in case of failure contralateral (4 pts) femoral arterial approach. The procedure was performed using a 480 nm pulsed dye laser at 45 mJ/pulse under the continuous guidance of spectroscopic atheroma detection through a 0.2 mm optical fiber. In 11 pts laser angioplasty was able to create a channel allowing a conventional guidewire to be passed through the occlusion for subsequent dilatation so that the residual stenosis was  $\leq 30\%$ . The ankle-brachial index rose from  $0.64 \pm 0.19$  before to  $1.05 \pm 0.21$  after the procedure. One pt had an early reocclusion which was successfully treated by repeat balloon angioplasty and stent implantation. Patency was demonstrated in the remaining 10 pts at a mean 11 month follow-up. There was no complication, namely no abdominal hemorrhage associated with the procedure. Four pts complained of pain during high pressure balloon inflation but there was no pain during laser angioplasty.

**Conclusions:**

1. Pulsed dye laser assisted balloon angioplasty of totally occluded iliac arteries is effective.
2. Vessel wall perforation and the potential risk of abdominal bleeding may be prevented by spectroscopic guidance.
3. The laser catheters are flexible enough to allow contralateral approach which may be appropriate in some iliac occlusions.

## ELECTRONMICROSCOPIC EVALUATION OF PRIMARY AND RESTENOTIC LESIONS AFTER PERCUTANEOUS ATHERECTOMY

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Transmission electron microscopic (TEM) evaluation of 69 plaque specimens from 14 primary lesions and of 14 specimens from 7 recurrent lesions treated with the Simpson atherectomy catheter was performed (Philips CM 10). Ultrastructurally, plaque material consisted of abundant extracellular matrix and embedded smooth muscle cells (SMC) of predominantly elongate shape. The SMC were characterized by peripherally located myofibrillar bundles and invaginations of the plasma membrane (caveolae). They contained numerous cytoplasmic organelles, usually in conjunction with lipid inclusions and glycogen particles (intermediate phenotype). Both histochemistry and TEM revealed small but varying numbers of macrophages; endothelial cells were not seen. Restenotic tissue showed less extracellular matrix and an increased number of SMC, occasionally with irregularly arranged myofibrillar. In addition, the SMC show a greater number of gap junctions and secretory vesicles.

TEM evaluation of atherectomy specimens allows further characterization of the differences between tissue from primary and restenotic lesions, the latter showing evidence of increased cellularity with higher secretory activity.