2:30

CROSS SECTIONAL MORPHOLOGY OF BALLOON DILATION IN VIVO BY INTRAVASCULAR ULTRASOUND

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The morphologic effects of coronary balloon angioplasty were visualized in 22 patients (pts) immediately following the dilation procedure with a 20MHz intravascular ultrasound imaging catheter (InterTherapy, Inc.). Cross-sectional images were obtained at 30fps as the catheter was advanced and retracted along the length of the artery. Injection of contrast through the guiding catheter was used to help define the boundary of the lumen and to determine if flow occurred in any dissection planes. There were 4 types of tears produced by balloon dilatation. Type A was a linear, partial split of the atheroma from the lumen out toward the media (3 pts); Type B was a full thickness tear of the atheroma out to the media which permitted separation of the ends of the atheroma during each diastole (4 pts); Type C was a partial separation of the atheroma in an arc behind its interface with the media (6 pts); and Type D was a complete (or >270°) circumferential tear of the atheroma away from the media associated with some flow in the dissection plane (2 pts). In addition, there were 7 cases where no tear was visualized (Type E). This tended to occur in smaller vessels with a large percent of residual atheroma and a small lumen (mean diameter 2.2 ± 2.3mm, area 8.0 ± 2.5mm^2, and atheroma % stenosis 60.0 ± 12.6). In this group of 22 pts, 3 developed restenosis and were re-studied. Of the pts who developed restenosis, 2 had Type E morphology (no tears) and 1 pt had a Type B split. Intravascular ultrasound is useful in determining the morphologic characteristics of balloon dilation in vivo.

3:00

INTRAVASCULAR ULTRASOUND OF CORONARY ATHERECTOMY

Gad Keren, Augusto D. Pichard, Lowell F. Satler, Earnst C. Hansch, Caren Oblon, Martin B. Leon, Kenneth K. Kent, Washington Hospital Center, Washington, D.C.

Contrast angiography is inadequate to assess precise endovascular responses after coronary atherectomy (A). Therefore, we used intravascular ultrasound (IVUS) to examine 26 pts (12 LAD, 2 LCX, 3 RCA, 2 left main, 7 vein grafts) after directional A (DVI), transluminal extraction A (IVT), or rotational A (Rotablator). A motor driven single crystal catheter (20 MHz) rotated in a 4.9F sheath was used for imaging. Important IVUS observations include: Directional A (n=13)- 1) smooth lumen contours without dissections; 2) deep focal resections into the media in 31% pts (confirmed by histology); 3) despite excellent angiographic results (average post-A stenosis 15%), significant retained atheroma (atheroma areas proximal, distal, and at A were 4.2±2.5mm^2, 3.3±3.9mm^2, 6.8±1.2mm^2,) suggesting mechanical remodeling; 4) inadequate A results in 2 pts due to extensive circumferential calcification. Transluminal Extraction A (n=10)- 1) superficial intimal disruptions without penetration into media requiring adjunct PTCA to smooth lumen contours; 2) significant retained atheroma with variable A channel size and evidence of mechanical remodeling; 3) effective in vein grafts and in less echogenic ("soft") atheroma in native coronaries. Rotational A (n=3)- 1) smooth lumen contours with intense echogenecity at the lumen interface; 2) circular A channels conforming in shape and size to the A burr; 3) retained atheroma at A sites due to relative undersizing of burrs; 4) striking efficacy in heavily calcified lesions and in more echogenic ("hard") atheroma. In conclusion, IVUS provides new qualitative and quantitative information which may assist in the optimal performance and evaluation of coronary A procedures.

2:45

3-Dimensional Intravascular Ultrasound Facilitates The Evaluation Of Arterial Dissections Following Balloon Angioplasty

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Arterial dissections (DIS) complicating balloon angioplasty (BA) are often inadequately demonstrated by angiography. We hypothesized that 3-dimensional (3-D) reconstruction of intravascular ultrasound (IVUS) would facilitate the evaluation of these DIS which may be important in abrupt closure and restenosis. Nineteen pathologic arterial segments were imaged at physiologic pressure (80-100 mmHg) before and after BA. Images were acquired on a Cardiovascular Imaging System (30 mHz) unit using a timed catheter (5 French) pullback of 1 mm/sec and stored on VHS tape. The data was digitized and 3-D reconstructed using Voxel Space modelling. Pathologic examination was performed after the vessels were longitudinally opened and the lengths of the gross DIS were measured. The 3 dimensional IVUS images were reviewed by two investigators. In 13/19 cases 3-D imaging correctly estimated the length of the DIS while in 14/19 the extent of involvement of intima and or media could be demonstrated. Qualitative features such as luminal distortion and complexity of DIS were readily apparent. The problems yet to be resolved include on line capability and loss of interpretable data secondary to calcification, catheter housing and ring down artifact.

Conclusion: Three dimensional intravascular ultrasound imaging facilitates quantitative and morphologic evaluation of arterial dissection following angioplasty.

3:15

3-DIMENSIONAL INTRAVASCULAR ULTRASOUND IMAGING OF HUMAN CORONARY ARTERIES AFTER PERCUTANEOUS REVASCULARIZATION.

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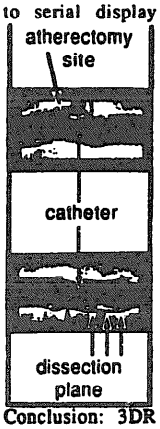
Contrast angiography(ANG) has been shown to underestimate nature and severity of arterial wall(AW) pathology before and after percutaneous revascularization. Intracoronary ultrasound(ICUS) provides tomographic views of both the vascular lumen(VL) and AW, but is limited to serial display of individual cross-sectional images.



We performed 3-dimensional(D) reconstruction(R) of 2-D ICUS images to evaluate the ability of this technique to define morphologic abnormalities of VL and AW after percutaneous revascularization ICUS was performed in a total of 22 patients after: PTCA (n=12), excimer laser angioplasty (n=3), atherectomy(ATH) (n=4), and stent placement (n=3). 3DR revealed morphologic features of the VL and AW which were not appreciated by ANG. These included calcific deposits in AW(n=4), cracks in AW calcium (n=3), and dissections involving the intima(n=3), media(n=3) and adventitia (n=1) In addition, topography of inner VL was readily appreciated as was 3D extent of perturbations of AW integrity, e.g. site and extent of ATH specimen removal.

Conclusion: 3DR of ICUS imaging complements 2D ICUS by "assembling" serial tomographic images obtained by 2D ICUS into profile views familiar to the angiographer, and is complimentary to ANG in evaluation of results and complications of coronary interventions.