1011 Stent Restenosis

Wednesday, March 27, 1996, Noon–2:00 p.m.
Orange County Convention Center, Hall E
Presentation Hour: Noon–1:00 p.m.

1011-105 Excimer Laser Angioplasty in the Treatment of Instent Restenosis: An Intravascular Ultrasound Study

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Treatment of instent restenosis using PTCA extrudes some neointimal tissue out of the stent and redistributes the residual tissue over a greater stent circumference (post-repeat PTCA). Alternatively, we used excimer laser angioplasty (ELCA) to ablate neointimal tissue prior to repeat PTCA (especially in longer or more severe restenotic lesions) and assessed the results using intravascular ultrasound {IVUS: measurement of stent, lumen, and intimal hyperplasia areas (mm^2)} before ELCA and after adjunctive PTCA.

	Pre-Intervention	Post ELCA + PTCA	p
Stent area	7.2 ± 2.1	8.4 ± 2.3	< 0.0001
Lumen area	1.6 ± 0.8	6.4 ± 1.7	< 0.0001
Intimal hyperplasia area	5.3 ± 2.3	2.0 ± 1.3	< 0.0001

The 30 restenotic stents treated with ELCA + PTCA were then compared to 45 restenotic stents treated with PTCA alone. Despite longer lengths of neointimal tissue within the stents (17.8 ± 9.9 vs 13.1 ± 10.0 mm, p = 0.0662), the combination of ELCA + PTCA resulted in (1) a greater lumen gain (3.9 ± 2.2 vs 2.5 ± 3.5 mm^2, p = 0.0640), (2) a greater *decrease* in intimal hyperplasia distributed within the stent (2.2 ± 2.0 vs 0.6 ± 3.1 mm^2, p = 0.0249), and (3) less residual intimal hyperplasia within the stent (2.2 ± 1.4 vs 3.2 ± 2.4 mm^2, p = 0.0431). *We conclude:* ELCA offers an attractive alternative to PTCA for the treatment of instent restenosis, particularly severe diffuse instent restenosis with a large burden of neointimal tissue. Rather than extruding tissue out of the stent or redistributing tissue over a greater stent circumference, ELCA appears to ablate (ie., remove) neointimal tissue facilitating adjunctive PTCA.

1011-106 A Serial *Volumetric* Intravascular Ultrasound Analysis of Instent Restenosis

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We performed serial volumetric intravascular ultrasound analysis {IVUS post-intervention and at follow-up (F/U) @ 3.9 ± 1.8 months} in 32 native coronary and 9 vein graft lesions treated with 52 Palmaz-Schatz stents and adjunctive high-pressure PTCA (15.5 ± 3.7 atm). Motorized transducer pullback @ 0.5 mm/sec through a stationary imaging sheath permitted measurements of stent and lumen areas in 2 mm axial increments and calculation of stent, lumen, and neointimal hyperplasia (stent-lumen) volumes (in mm^3) using Simpson's rule. Overall, stent volume was 131 ± 72 mm^3 post-PTCA and did not change at F/U. Lumen volume decreased from 129 ± 71 mm^3 post-PTCA to 88 ± 67 mm^3 (p < 0.0001) at F/U, due to the accumulation of 43 ± 26 mm^3 of neointimal tissue/stent. A comparison of 24 restenotic and 17 nonrestenotic lesions showed:

	No restenosis	Restenosis	p
Post-PTCA stent volume	169 ± 80	103 ± 52	0.0029
Post-PTCA lumen volume	167 ± 80	102 ± 50	0.0027
F/U stent volume	169 ± 80	104 ± 52	0.0028
F/U lumen volume	134 ± 69	54 ± 40	< 0.0001
Δ stent volume	0 ± 3	0 ± 2	NS
Intimal hyperplasia volume	34 ± 22	50 ± 27	0.066

We conclude: Serial volumetric IVUS analysis shows that intimal hyperplasia causes in-stent restenosis. Regardless of lesion location (native vs SVG), stent compression does not occur as there is no chronic decrease in stent volume even in restenotic stents.

1011-107 Determination of the Mechanisms Responsible for Stent Restenosis: A Quantitative Angiographic Study

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The purpose of this study was to determine the relative contribution of three distinct mechanisms [elastic recoil (REC), stent compression (SC), and intimal hyperplasia (IH)] in the late lumen loss that follows coronary stent implantation. Eighty pts who underwent elective or emergency Palmaz-Schatz stent placement and had a late angiogram performed were evaluated. Repeat catheterization was performed due to completion of the follow-up period (6 month) or evidence of recurrent ischemia. The paired angiograms (initial and follow-up) were analyzed by quantitative coronary angiography using an automated edge-detection algorithm. Twenty-two pts developed restenosis at the stented site (> 50% stenosis). The following angiographic measurements were performed after stenting and at follow-up: reference vessel diameter (RD), elastic recoil (REC), minimal lumen diameter (MLD), and stent diameter (SD, vessel free of contrast). Values are expressed in mm:

	After Stenting		Follow-up		REC	SC	IH
	MLD	SD	MLD	SD			
Without RE	3.5 ± 0.4	3.6 ± 0.4	2.9 ± 0.6	3.3 ± 0.4	−0.4 ± 8.2	0.2 ± 0.2	0.4 ± 0.5
With RE	3.3 ± 0.4*	3.5 ± 0.4	1.4 ± 0.7	3.2 ± 0.3	4.4 ± 8.4*	0.2 ± 0.1	1.8 ± 0.6*

*p < 0.05 compared to Without RE

On average, IH was responsible for 70% of the late loss in the without RE group and 97% in the with RE group. We conclude that intimal proliferation is the major mechanism off late lumen loss (and consequently, restenosis) after Palmaz-Schatz stent implantation. Elastic recoil and stent compression play a minor role in the renarrowing process (although the former is significantly greater in pts with restenosis).

1011-108 Radiation Parameters Associated With Coronary Irradiation Pilot Study to Inhibit Restenosis After Stenting

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Restenosis is a major problem associated with coronary balloon angioplasty as well as stent implantation. Low dose brachy radiotherapy immediately after stenting may reduce the restenosis rate. To examine this issue, a pilot study has been launched to deliver localized radiation to the stented vessel with the use of radioactive Ir-192 sources. Ir-192 decays with a half life of 74 days by emitting 350 keV x-rays. The sources were in the form of cylindrical seeds (0.3 cm × 0.05 cm) and were imbedded in a nylon ribbon of ≤ 0.08 cm in diameter. The ribbon had either 5 or 9 seeds with a spacing of 0.1 cm to allow flexibility needed for catheterization. A probing catheter (0.135 cm OD) was utilized to guide the radioactive ribbon to the implanted Palmaz-Schatz stent(s). A minimum radiation dose of approximately 800 centiGray (cGy) was delivered to the atherosclerotic lesion while keeping the maximum tissue dose at ≤ 3000 cGy. Treatment time depended upon the radioactive strength of the Ir-192 seeds and was in the range of 20–40 minutes. The radiation dose distribution around our ribbon was analyzed by using film dosimetry and thermoluminescent dosimeters. Also, we examined radiation exposure levels in and around the catheterization rooms during the radiation procedure. By utilizing portable radiation shields, we were able to reduce room radiation levels to well below 2 mR/hr limit set by regulatory agencies for non-occupational exposure. Our experience with 30 patients to date indicates this is a safe procedure with no early adverse effects.

1012 Angioplasty and Restenosis: Markers

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1012-101 Lipoprotein(a) Concentration Does Not Correlate With Angiographic Restenosis

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Background: Although some research groups have reported a good corre-