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Hall F, West Concourse

The Pathophysiology of Balloon Angioplasty

**METHODOLOGICAL PROBLEMS RELATED TO THE ASSESSMENT OF RECOIL AND BALLOON-ARTERY RATIO**

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Overstretching (balloon-artery ratio) of the dilated vessel wall is known to result in more acute and late complications following balloon coronary angioplasty. Elastic recoil of the dilated vessel wall has a negative effect on the immediate result of the angioplasty procedure. The balloon (bal) is used as scaling device to measure the balloon-artery ratio (bar) and recoil. For correct use of the balloon as a scaling device one assumes a uniformly inflated balloon. However this latter assumption has never been properly addressed. In this study, 431 lesions (122 RCA, 202 LAD, 107 LCX) and balloons were quantitatively analyzed using an automated edge detection technique. Single identical views were used for analysis of the lesion and contrast filled balloon at maximum pressure. The balloon was analysed over its entire length (mean 16.5 ± 3.9 mm) excluding the tapered proximal and distal parts. The pressure used varied between 3 and 16 atmosphere (atm) (mean 8.3 ± 2.6 atm). To standardize for vasomotion, nitrates were given intracoronary pre and post angioplasty. Four different angiographic parameters of the balloon were measured. Beside a minimal and maximal diameter, a mean balloon diameter is measured as the average diameter over the entire length of the balloon. The reference balloon diameter was defined as the diameter at the site of the minimal width of the balloon using an interpolated method. Recoil was defined as the ratio between balloon diameter minus the obstruction diameter post-PTCA and the reference diameter of the segment. Bar was determined by the relation between the balloon diameter and the reference diameter pre-PTCA of the segment.

		recoil	bar
minimal bal diameter (mm)	:2.37	0.21	0.90
maximal bal diameter (mm)	:2.96	0.44	1.13
mean bal diameter (mm)	:2.64	0.31	1.00
reference bal diameter (mm)	:2.75	0.35	1.05

**Conclusion:** The balloon is not uniformly inflated along its entire length with a maximum difference of 0.59 mm with a maximum pressure of 8.3 atm. Consequently, the extent of recoil and bar is highly dependent on the selected balloon diameter variable with a maximal variation of 100% for recoil and 25% variation in the balloon-artery ratio.

**DETERMINANTS OF STENOSIS COMPLIANCE DURING CORONARY ANGIOPLASTY**

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Knowledge of the radial force required to dilate a given coronary stenosis may be useful in the selection of appropriate balloon materials and inflation strategies. Sequential inflation pressures of 2, 3, 4, 6, 8, and 10 atm were applied to 114 stenoses in 89 patients undergoing PTCA. At each pressure the minimal lesion diameter was quantitatively derived from analysis of the pattern of indentation upon the balloon. A compliance index (CI) was computed as the pressure at which 75% of the maximum stenosis expansion had been achieved; hence, larger values represent less compliant lesions.

We evaluated the relation between CI and 13 different angiographic variables that might impact the force required for dilation, including lesion calcification, length, eccentricity, location, appearance, angulation, percent stenosis, and prior dilations. The degree of eccentricity was found to be the strongest predictor ( $p < 0.02$ ), with eccentric lesions requiring less dilating force (CI = 3.85 ± 2.35 atm [SD] vs 5.56 ± 2.64 atm for concentric lesions). Additionally, the location of the lesion within the arterial tree correlated significantly with CI ( $p < 0.03$ ). LAD stenoses were generally more compliant (3.93 ± 2.44 atm) than RCA (5.43 ± 1.99 atm) or LCx (5.50 ± 2.89 atm) lesions. No other variables, including the presence and severity of calcification, related significantly to compliance.

Thus, inflation compliance differs greatly between stenoses, and is greatest in eccentric lesions located in the left anterior descending artery. This knowledge may help optimize inflation pressures, permitting enhanced efficacy with reduced risks.

**REFLEX VASOMOTOR RESPONSE OF DIFFERENT EPICARDIAL CORONARY ARTERY SEGMENTS BEFORE AND AFTER PTCA**

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To study the effect of acute segmental damage on the vasomotor response of epicardial coronary arteries to reflex sympathetic stimulation, coronary arteriography was performed in the basal state and during the cold pressor test immediately before and 5 minutes, 4 hours and 8 days after PTCA in 10 patients with single vessel stenosis and on no vasoactive drugs. Quantitative arteriographic measurement of minimum vessel diameter within the dilated (PTCA) segment, the distal segment and a segment of a branch not subjected to PTCA (control) was performed. During the cold pressor test before PTCA there was a decrease in diameter of both the PTCA and the distal segment in all patients ( $p < 0.008$  vs basal), but the diameter of the control segment increased in 5 patients and decreased in the other 5. At 4 hours the diameter of the PTCA segment increased in all patients ( $p < 0.002$  vs basal) and that of the distal segment increased in 6 patients and decreased in the other 4; however, the control segment decreased in all patients ( $p < 0.001$  vs basal). The segmental pattern of response at 8 days was identical to that before PTCA ( $p < 0.001$  vs basal, for both PTCA and distal segment).

Therefore, PTCA causes an acute alteration of the response to reflex sympathetic stimulation which extends throughout the epicardial coronary arterial tree and has resolved by 8 days. The altered response appears to be unrelated to arteriographic evidence of atherosclerosis and is suggestive of a neurohumoral change.

**INCREASED VON WILLEBRAND FACTOR AND CORONARY ANGIOPLASTY: RELATIONSHIP WITH A COMPLICATED PROCEDURE**

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Previous reports suggested a link between an increase of von Willebrand factor (VWF) level and coronary diseases associated with coronary thrombus. The aim of this prospective study was to investigate the role of VWF level in the acute outcome of coronary angioplasty. VWF was measured within 24 hours before angioplasty. All patients received the same drug regimen including aspirin 250 mg (once a day) before the procedure. Normal VWF values were 100-50%. Mean level in 60 Pts was 167-73%. VWF level was higher in case of unstable angina (212-87%,  $p < 0.01$ ) and recent acute myocardial infarction (190-43%,  $p < 0.05$ ) compared to Pts with stable angina (137-45%). Seven Pts had a complicated acute outcome (acute closure: 3; early restenosis: 4); in this group, VWF level was 260-82% versus 147-50% in remaining Pts ( $p < 0.001$ ). In Pts with VWF > 200% (17 Pts), we noted acute or subacute event in 30% versus 4.6% in other Pts ( $p < 0.01$ ). Thus, VWF might constitute a predictive factor of complicated outcome after coronary angioplasty.