NORTH & SOUTH: NON-CARDIAC REVASCULARIZATION

Intravascular Flow Prior To and Following Angioplasty in Peripheral Vessels (Arteries)

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ABSTRACT: ***Objectives.*** **The aim of this study was to assess mean values of velocities in peripheral arterial vessels prior to and following angioplasty in patients with peripheral arterial occlusive disease. Standard values are evaluated with the guidewire positioned proximal to the lesion, inside the lesion and distal to the lesion.**

Methods. **Twenty-five measurements were taken prior to and following angioplasty in 22 patients with peripheral arterial occlusive disease. The Doppler guidewire was inserted over a 5 French sheath and a Cobra catheter. During measurements, the catheter was totally pulled back and the sheath was placed as proximal as possible.**

Results. **Prior to angioplasty, the velocities in the arteries were 69 ± 60 cm/second proximal to the lesion, 186 ± 112 cm/second inside the stenoses and 47 ± 36 cm/second distal to the lesion. The values increased to 97 ± 105 cm/second, 89 ± 89 cm/second and 83 ± 72 cm/second, respectively. Proximal velocities were lower inside occlusions and increased more markedly compared to stenoses.**

Conclusion. **The Doppler guidewire is a practical and valuable tool in assessing technical success after angioplasty of peripheral lesions. In successful angioplasties, no flow acceleration should be observed. Standard values were evaluated.**

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Key words: arteries, stenoses or obstructions, transluminal angioplasty, ultrasound (US), Doppler studies

Intravascular measurements are superior when assessing lesions in peripheral arterial disease.[1,2] Besides the intravascular ultrasound (IVUS), one method is the guidewire-mounted intravascular Doppler (IVD) probe.[3–5] This device gives information about flow in the vessel segment under investigation and data are quantitative. Standardized results are not available. The importance of this technique has been detected mainly by cardiologists.[7] We tested the IVD device in a prospective study, taking measurements prior to and following dilation of peripheral arterial lesions in different parts of the vessel to be treated.

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METHODS

The FloWire (Cardiometrics, Mountain View, California) is a guidewire with a 0.018″ diameter and a Doppler crystal on its tip. The mean ultrasound frequency is 12 MHz with a range gate of 5.2 mm and an angle of 30°. The sampling rate is 100 Hz. We examined 25 lesions in 22 patients. All patients had occlusion or high-grade stenosis of the superficial femoral artery, which was traversed and treated with angioplasty. First, a 5 French sheath was inserted into the common femoral artery while trying not to disturb the proximal flow. The first measurement was performed distal to the lesion. Pullback measurements were done inside of the stenosis and proximal to the stenosis. In total occlusions, the first values were taken proximal to the lesion. After traversing the lesion, measurements were performed both prior to and following angioplasty. Care was taken to reproduce the same position of

Figure 1. *Pre- and post-angioplasty maximal peak velocities in the proximal part of the vessel, in the lesion, and distal to the lesion (cm/second). Black circles = maximal peak values prior to angioplasty; white circles = maximal peak values following angioplasty.*

the guidewire. It is important to maintain the wire position in midstream and in the same location prior to and following the treatment. The velocity was estimated to be zero in total occlusions.

RESULTS

Fourteen lesions were occlusions or stenoses with > 95% degree and 11 stenoses varied between 50% and 90% occlusion. Recanalization was never a problem. The degree of stenosis did not correlate with the mean peak value (MPV) in the stenosis.

Maximal peak values prior to and following therapy are shown in Figure 1. After angioplasty, there is a significant increase in the maximal flow parameters. MPV values increased from 69 ± 60 cm/second to 97 ± 105 cm/second proximal to the lesion. Distally, the velocities rose from 47 ± 36 cm/second to 84 ± 72 cm/second.

In occlusions, velocities prior to angioplasty measured at 60 ± 38 cm/second, while velocities in stenoses were 69 ± 32 cm/second (Table 1). Post-angioplasty values were 105 ± 34 cm/second and 97 ± 44 cm/second, respectively. Values post-angioplasty showed a linear decrease from 97 ± 105 to 89 ± 89 to 84 ± 72 cm/second. In 7 lesions, the velocity was still significantly higher following angioplasty compared to the proximal part of the vessel.

DISCUSSION

Early intravascular Doppler studies were performed to assess results following coronary angioplasty. These results were of limited utility. We did not find a correlation between stenosis degree and mean peak value. More recent studies reveal positive immediate information regarding angioplasty results.[3,4] Our patients showed a clear response following angioplasty. Values increased markedly following angioplasty. Prior to angioplasty, the highest values were found in the lesion. Following angioplasty, the velocities showed a linear decrease from proximal to distal. Zero flow measurements were performed as well as assessment of collateral flow estimations by intravascular Doppler equipment.[6,8] The result was a zero flow/pressure of about 14 ± 7 mmHg and 11 ± 8 cm/second. Therefore, the best judgement of angioplasty results can be obtained if intravascular ultrasound and intravascular Doppler are used in a combined methodological approach.[9]

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Table 1. Mean peak values pre- and post-angioplasty in stenoses and occlusions (degree of stenosis 95%). Measurements were taken with a proximally positioned Doppler guidewire as well as both inside and distal to the lesion (n = 25)

	Pre-Angioplasty			Post-Angioplasty		
	Proximal	Inside Lesion	Distal	Proximal	Inside Lesion	Distal
Occlusions (cm/second)	60 ± 38	112 ± 102	36 ± 21	105 ± 34	89 ± 25	72 ± 64
Stenoses (cm/second)	69 ± 32	186 ± 130	47 ± 22	97 ± 44	89 ± 32	83 ± 49