Editorial

What Coronary Stenoses Need PCI/Stent?

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At the American College of Cardiology Annual Scientific meeting in March 2006, Dr. George Beller interviewed Dr. Antonio Colombo for ACCEL. His topic was, “Coronary Bifurcations: Is There a Preferred Approach?” During the course of the interview, Dr. Beller more or less asked Dr. Colombo how one can determine whether the stenoses of

bifurcating lesions have functional significance. For example, he pointed out that oftentimes stress testing with nuclear studies show evidence of poor perfusion in the left anterior descending (LAD) distribution but not in the diagonal distribution perfused by a stenotic vessel. The topic of functional flow reserve came up, and Dr. Colombo strongly favored this approach. Many have used intracoronary ultrasound techniques to assess the severity of a stenosis, but this by itself does not quantify physiologic significance. Dr. Colombo pointed out that a high-grade stenosis of very short lesion length may not have the same physiologic significance as a lesser stenotic vessel with long length. He made the comment that perhaps an 80% diameter stenosis, which is a half millimeter long, may not be functionally important, and although there is a tremendous urge to perform percutaneous coronary intervention (PCI), it may not be warranted—after there has been an objective evaluation for coronary flow reserve. This situation may occur com-

monly in an LAD/diagonal bifurcating stenosis, especially if the diagonal stenosis is ostial and of minimum length.

Although the majority of the discussion by Dr. Beller and Dr. Colombo was based on bifurcating lesions in the coronary circulation, the principles outlined by Dr. Colombo, I think, should be applied to all lesions bifurcating or single. There should be evidence for poor perfusion or myocardial ischemia in the distribution of the lesion being considered for PCI.

If we roll the clock back to 1978–1979, there is experimental evidence to support the concept that short stenoses have less physiologic significance than long stenoses. Dr. Robert Feldman and Dr. Wilmer Nichols, working at the University of Florida, performed elegant experiments in canine models of coronary artery stenosis.¹ Studies were performed in which resting and reactive hyperemic, distal coronary pressure and flow were measured in animals with variable coronary artery diameter reduction. Reactive hyperemia was determined after a 10 s coronary artery occlusion in these animals. A typical experiment consisted of a control measurement with no coronary stenoses, revealing “normal” reactive hyperemia, i.e. a typical increase in distal coronary flow and a mild difference in aortic and coronary perfusion pressure.

With a 60% focal stenosis (produced by a snare occlusion) peak hyperemic response and pressure differential from the aorta—distal coronary artery were somewhat decreased from the control state.

With an 80% focal snare occlusion, the hyperemic response was markedly diminished and there was wide difference between the aortic and distal coronary perfusion pressure.

With a 90% focal stenosis, the reactive hyperemic response was essentially obliterated and the aortic coronary pressure gradient was even wider than in the animals with 80% focal stenosis.

If these experiments were repeated in a 60% stenosis with the lesion length increased to 5 mm, a slight increase in the resting aorto-coronary pressure gradient was seen as well as a slight decrease in resting coronary blood flow. However, the peak reactive hyperemic responses were markedly decreased. At 10 mm lesion length the

reactive hyperemic response was practically obliterated and was comparable to a 90% lumen diameter reduction in a lesion 1 mm in length.

If the lesion length of a 60% stenosis is increased to 15 mm, resting coronary blood flow is practically obliterated, and there is a large pressure gradient from the aorta to the coronary artery. In fact, in this latter experiment, the occluder had to be removed in order to prevent ventricular fibrillation.

Thus, in the animal laboratory, the data indicate clearly that lesion length plays a role in distal coronary blood flow and perfusion.

Summary

In summary, angiographic measurements of coronary lumen reduction may not always correlate with abnormal myocardial physiology. As Dr. Colombo points out that in very short stenoses, there should be additional evidence of myocardial ischemia or decreased myocardial perfusion parameters before PCI is attempted.

A long coronary narrowing will decrease coronary blood flow more than a short narrowing of the same

stenosis severity. In other experiments using the same protocol, sequential narrowings were also found to decrease coronary blood flow more than a single narrowing of the same total length.

The complex effects of percent stenosis and length of stenosis on the physiology of coronary blood flow must always be considered when evaluating angiograms. In addition, the angiographic or photographic artifacts produced by short narrowings tend to overestimate the visual assessment of percent stenosis. Although we have no data in our animal experiments to assess intracardiac ultrasound measurements, these measurements may be useful in some instances, to quantitate the percent stenosis of a short lesion.

Reference

1. Feldman RL, Nichols WW, Pepine CJ, Conti CR: Hemodynamic significance of the length of a coronary artery narrowing. *Am. J. Cardiol.* 1978;41:865-871

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