Volume 2: Issue 1

January/February 2004

HeartFacts

Southern California Cardiovascular Consultants

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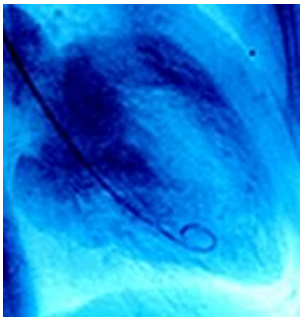
Complex Coronary Intervention– Getting it Right

When Andreas Gruentzig performed the first balloon angioplasty on a human being in 1977, he probably did not realize that he chose the ideal first case. He obtained a perfect result and the patient survives to this day. "Patient 1" underwent restudy some years ago and there was no evidence of restenosis or dissection at the treatment site. He had what we would now call a Type A lesion: short, concentric, non-disrupted, noncalcified, and no adherent clot. Type A lesions are associated with a 99 percent primary success rate. Unfortunately, as our population ages, the interventional cardiologist encounters more complex and challenging lesions than Dr. Gruentzig's "lesion 1" in "patient 1".



In fact most lesions are not Type A but depending on the number of unfavorable characteristics are graded Type B1, B2, or C. Reported success rates for these lesion types vary from 95 percent down to 85 percent. (Success with chronic total occlusions at best is only 60 percent). Type B1 lesions have one unfavorable characteristic, B2 have two and Type C lesions have three. (Please see Table 2 on reverse).

This being said, it is still possible with case selection and planning to achieve success rates of 95-99 percent even in the most challenging cases. A simplified way of looking at lesion severity is to count up the number of "Cs": calcium, clot, cracks, curves, bifurcations, ostial location and chronic total occlusions (CTO). Good strategies exist for all but CTOs. (See Table 1) Results with CTO are still disappointing but help may be on the way with a device called the Frontrunner.

Let's start with calcium. Calcified lesions are noncompliant in direct proportion to the quantity of calcium contained. They have a nasty tendency to shatter with simple balloon angioplasty and the shards produced may cause a severe linear or spiral dissection. This in turn may result in slow flow and require the deployment of multiple stents to seal the disruption. A better strategy is to modify the compliance of such a lesion with rotational atherectomy. This device is essentially a diamond-encrusted dental burr on a long flexible drive shaft. It spins at 50,000-55,000 RPM and burnishes plaque off the lumen wall. When used appropriately -- short ten second runs with a light touch so burr speed never drops more than 5000 RPM -- this technique produces microparticles that are less than 5 microns in diameter. Since red blood cells are approximately eight microns, these particles flow through the capillary bed without sludging up the microcirculation. If the burr speed is allowed to drop by 'leaning' on the lesion, larger particles are created and a bolus of sludge may cause "slow or no flow." This can be a disaster. It is also important to keep burr runs short so that the bolus of microparticles is always brief. Multiple short runs are the ticket. A nice feature of rotational atherectomy that is unique to this device is the burr will go almost anywhere the guidewire goes. It is a superior way to prepare the lumen for stent deployment when dealing with calcified lesions.

Clot is the next challenge. As discussed in a previous newsletter, plaque rupture or erosion

TABLE 1

Simplified Assessment of Lesion Severity:

Calcium
Clot
Cracks
Curves
Bifur**c**ations
Ostial lo**c**ations
Chronic total occlusion

continued on page 2...

Complex Coronary Intervention (continued)

TABLE 2

Lesion Classification:

This is the classification of the American Heart Association/American College of Cardiology Task Force:

Type "A" Lesions:

Discrete (10mm. Length)
Concentric
Readily Accessible
Non-angulated segment, <45 degrees
Smooth contour
Little or no calcification
Less than totally occlusive
Not ostial in location
No major branch involvement
Absence of thrombosis

Type "B" Lesions:

Tubular (10 to 20 mm length)
Eccentric
Moder. tortuosity of proximal segment
Moderate angulated segment, 45-90 °
Irregular contour
Moderate to heavy calcification
Total occlusion > 3 months old
Ostial in location
Bifurcation lesions requiring double guidewires
Some thrombus present

Type "C" Lesions:

Diffuse (> 2 cm length)
Excessive tourtuosity of proximal segment
Extremely angulated segment, > 90 °
Total occlusion > 3 months old
Inability to protect major side branches
Degenerated vein grafts with friable lesions

leads to clot formation in virtually all cases of troponin-positive Acute Coronary Syndrome. Advancing the guidewire across the lesion with adherent clot involves patience, care and good eye-hand coordination. Prior to introduction the guide wire is gently shaped with a 30-45 degree angle about 3-4 mm from the tip. Torquing the wire allows guidewire advancement through the most serpentine, clot-burdened channels without dislodging significant amounts of thrombus. Prolapsing a loop of guidewire or jamming the wire through the lesion is fraught with peril, namely downstream embolization. This invariably results in loss of a divisional branch and sometimes loss of the major artery itself. Once the guide wire is finessed past the lesion there are a number of choices. Increasingly, data support "direct stenting" the lesion so as to trap thrombus between the stent and the vessel wall. A disrupted plaque tends to be soft and compliant so that achieving full stent expansion is not usually an issue. Thus pre-dilatation with a balloon catheter can usually be skipped and with it the chance of major downstream embolization. If there is a very large thrombus burden at the site, extraction with the Angiojet catheter is a superb option prior to stent deployment.

We come then to cracks -- better known as dissection, rupture, and ulceration. In all of these the endothelium has been breached but there is little or no angiographically visible thrombus burden. There may however be a substantial flap of endothelium fluttering in the lumen. Dealing with this is relatively straightforward -- stent it! It is wise however to test the compliance of the remnant lesion with a low pressure balloon inflation. If a lesion doesn't "give" at low atmospheres as judged by the persistence of an indentation on the silhouette of the inflated balloon, one of the cutting devices should be used to enhance compliance (cutting balloon or Fx-minirail). Rotablator should never be used in this circumstance as it may pick up and wind the endothelial flap on the drive shaft peeling away the endothelium for some distance down the vessel.

In the next newsletter we will discuss more of the complexities of coronary intervention. To borrow from Shakespeare, "double double, toil and trouble...". Stay tuned; the cauldron bubbles. •

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"most lesions are not Type A but depending on the number of unfavorable characteristics are graded Type B1, B2, or C" •

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