Coronary Angioplasty for Total Occlusion: Ongoing Problems Despite Improving Results*

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The original (1979) National Heart, Lung, and Blood Institute guidelines for coronary angioplasty recommended that it not be attempted in total occlusions because of concerns about expected low success and high complication rates. Within 4 years, however, groups (1-3) including our own began reporting on small series of patients in whom angioplasty was attempted despite the presence of a total occlusion. Each of these series showed lower rates for primary success (53% to 67%) and emergency surgery (0 to 2%) than were prevalent for angioplasty of subtotal stenoses. Most unsuccessful attempts resulted from failure to cross the occluded segment with the angioplasty guide wire, a problem that appeared to increase in frequency as the duration of the occlusion and the length of the occluded segment increased.

The present study. In this issue of the Journal, Stone et al. (4) report the results of attempted angioplasty in 971 totally occluded coronary segments. Their primary success rate of 72% is somewhat higher than that of earlier reports, although it remains well below their 96% success rate in subtotal stenoses. The overall complication rates for emergency bypass surgery and myocardial infarction were lower for the total occlusion group than for the subtotal stenosis group, but procedural mortality rates (0.8% and 0.9%, respectively) were similar. These findings can be explained in large part by concurrent intervention in lesions other than the total occlusion: all seven deaths occurred in patients with multivessel disease, and 2 of the 10 nonfatal complications were a result of dilation of vessels other than the total occlusion. What else is to be learned from this impressively large series?

Total occlusions remain an important part of coronary intervention. Experienced angioplasty operators report that up to 20% of patients undergoing diagnostic catheterization have one or more chronic total coronary occlusions (5). If the occlusion appears favorable for dilation (see later) and responsible for the clinical syndrome, angioplasty is usually attempted. Angioplasty of total occlusions thus represents an important subgroup of balloon dilation attempts. The 905 patients with total occlusion accounted for 12% of total angioplasty practice at the institution of Stone et al. (4), a finding consistent with the 10% to 20% range reported by others (6). Among patients with multivessel disease, however, the presence of one or more chronic total occlusion of vessels supplying viable areas of myocardium is still among the most common reasons for referral to bypass surgery rather than balloon angioplasty.

Case selection, technique and experience are important determinants of short-term success. Stone et al. (4) found that the absence of bridging collateral vessels and the presence of a tapered funnel leading into the occluded segment were significant predictors of short-term success in a subgroup of 100 consecutive patients who underwent detailed angiographic analysis. The distinction between an absolute total occlusion (100%, with no anterograde filling beyond the lesion) and a functional total occlusion (99%, with faint late anterograde opacification of the distal segment without discernible luminal continuity) did not emerge as an important predictor of short-term success. This distinction was clearly significant, however, in earlier reports by Serruys et al. (7) (45% versus 81% success rate) and our own group (6) (63% versus 78%) for total and functional total occlusions, respectively. We still believe that this characteristic is an important determinant of success and that reports of angioplasty in total occlusion should be stratified accordingly. The duration of total occlusion (>3 or <3 months) was not a significant predictor of success, in contrast to data from earlier reports (2,3). Perhaps (as has been our experience) the negative effects of occlusion duration are largely negated by selecting only patients with favorable anatomic features for attempted dilation of more chronic occlusions.

In an effort to cross the total occlusion asatraumatically as possible (and minimize the chance of causing intimal dissection), we have advocated the serial use of floppy, intermediate and stiff guide wires (6). Nearly half of "chronic" occlusions (i.e., those not in the setting of acute infarction) can be crossed with a floppy guide wire, whereas an additional 25% require a stiffer guide wire and the final 25% cannot be crossed at all. Stone et al. (4) appear to rely more heavily on the use of stiffer guide wires, although they still advocate a progressive approach. Whatever stiffness of guide wire is used, successful crossing of a chronic total...
occlusion can require a great deal of finesse, an observation supported by their data relating operator experience to success rate.

Attempted angioplasty of total occlusion is exceptionally safe. Because the distal bed of a total occlusion is fully supported by collateral inflow (which maintains a distal occluded pressure of nearly 40 mm Hg) (1), attempted angioplasty is safe and is unlikely to cause a major complication. Stated simply, "it's hard to make a totally occluded artery worse." The study of Stone et al. (4), however, emphasizes that such safety is not absolute. Fatal and nonfatal complications can still occur (particularly in patients with multivessel disease) as a result of guiding catheter dissection, small distal emboli or coronary dissection that interferes with collateral inflow. Any of these problems may overwhelm the relative protection provided by well established collateral vessels. Because of the potential for distal embolization, we believe that total occlusions with large associated thrombi are most successfully dilated after administration of heparin, coumadin or, possibly, a thrombolytic agent if patient stability permits. Total occlusions in vein grafts pose additional problems and should probably be avoided (8).

Better technologies are still needed for the treatment of total occlusion. Although the primary success rate reported by Stone et al. (4) is slightly higher than that reported in previous series, it is still significantly below that currently achieved in subtotal stenoses. Because of the pivotal role that a chronic total occlusion frequently plays in determining overall revascularization strategy, the search for new technologies to allow safe and reliable crossing of totally occluded segments must continue. Aggressive mechanical devices that appear successful in peripheral applications may carry the risk of perforation when used in the coronary circulation. Preliminary experience with a ball-tip guide wire (9) and with low-speed rotational angioplasty (10), however, suggests relative safety and some increase in crossing rate compared with conventional guide wire technology. Ablative laser or laser-thermal technologies have yet to undergo adequate evaluation in this regard.

Beyond the search for techniques to improve short-term success is the need to develop techniques to maintain long-term patency. Successfully dilated total occlusions are somewhat more prone than are subtotal stenoses to subacute thrombotic closure during the first week (often manifested by chest pain without striking electrocardiographic changes as a result of the re-recruitment of collateral flow). They also have an unusually high (>40%) incidence rate of late restenosis (6,9). Ultimate mastery of total occlusion angioplasty will therefore require the perpetuation of drug regimens or adjunctive devices to minimize the incidence of late restenosis, an issue not addressed in the report of Stone et al. (4).

References