EDITORIAL COMMENT

Angiographic Predictors of Adverse Outcomes in the Modern Intervenotional Era*

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The development of preprocedural angiographic risk stratification criteria was meaningful in the balloon angioplasty era (1). Acute ischemic complications consisted of angiographic complications with impairment of epicardial coronary blood flow. The demonstration that these post-percutaneous coronary intervention (PCl) ischemic complications were related to the preprocedural angiographic complexity of the lesion allowed operators to risk-stratify patients. Current practice strategies have made non-angiographic complications, reflected by rise in creatine kinase MB fraction (CK-MB) enzyme, the most common post-PCI adverse event. The clinical impact of these rises in cardiac enzyme after PCI has been debated, but current evidence supports their negative prognostic value, particularly for larger increases in CK-MB (2).

In this issue of the Journal, Ross et al. (3)—using a modern clinical practice data set and employing stents, IIb/IIIa glycoprotein platelet receptor antagonists, and thienopyridines—have identified preprocedural angiographic variables associated with procedural complications and adverse late outcomes. They studied 4,809 patients enrolled in the Do Tirofiban and ReoPro Give Similar Efficacy Outcomes (TARGET) trial (4). Three variables—intracoronary thrombus, lesion eccentricity, and lesion length. Lesion eccentricity was independently associated with a late survival benefit documented at a median follow-up of 4.8 years (range, 3 to 7 years) (13).

A major limitation of the study, acknowledged by the authors, is that the angiographic lesion assessments were not subjected to the systematic rigor of core lab analysis. Further weakening this analysis is the knowledge that coronary angiography is an unreliable method for identifying both intracoronary thrombus and lesion eccentricity. Using coronary angiography as the gold standard for thrombus identification, angiography has a high rate of both false-positive (17%) and false-negative (55%) findings (5). The imprecision with which thrombi are identified by angiography explains the lack of consensus regarding its importance as an angiographic risk factor.

When intravascular ultrasound is used as the standard for determining lesion eccentricity, angiographic imaging has no better than a random (50%) chance of being correct (6). However, lesion eccentricity is directly related to lesion length. The longer the lesion, the more likely it will be eccentric (6). The third variable, lesion length, is perhaps more reliably determined because the operator can directly compare the length of the angioplasty balloon to lesion length. Lesion length is a surrogate marker for plaque burden, and plaque burden has been well described as a predictor of post-PCI ischemic complications after coronary intervention (7,8).

Although the use of optimal stent deployment strategies and thienopyridines minimizes the risk of acute vessel closure that was the bane of balloon angioplasty, stent placement alone did not lower the risk of post-PCI ischemic complications (death and MI) in the seminal trials that demonstrated the superiority of stents over balloon angioplasty (9,10). In the Stent Restenosis Study (STRESS), death and MI occurred in 5.0% of the stent group and 6.5% of the balloon group. In the Benelux Stent Study Group (BENESTENT) (9), death and MI occurred in 3.4% of the stent group and 3.1% of the balloon group. Not until the trials of IIb/IIIa glycoprotein platelet receptor antagonists was a benefit in the reduction of acute ischemic complications seen in the stent trials (11,12). Furthermore, the reduction of post-PCI CK-MB enzyme elevations with a IIb/IIIa glycoprotein platelet receptor antagonist is associated with a late survival benefit documented at a median follow-up of 4.8 years (range, 3 to 7 years) (13).

The mechanism of post-PCI CK-MB elevation after coronary interventions is due to either angiographic epicardial coronary complications or impairment of the microcirculation (distal embolization or vasoconstriction). Angiographic complications of PCI, such as side-branch occlusion, are uncommon (<5%), leaving impairment of the microcirculation the most likely etiology for post-PCI CK-MB elevations. Cardiac magnetic resonance imaging has shown localized myonecrosis (hyperechancement) in patients with elevated post-PCI CK-MB without side-branch occlusion (14). Further evidence linking impairment of the coronary microcirculation as the etiology of post-PCI ischemic complications is shown in work by Gibson et al. demonstrating that rises in post-PCI CK-MB are related to reduced myocardial perfusion (TIMI myocardial perfusion) and not epicardial blood flow (TIMI flow or TIMI frame count) (15).

Several studies have demonstrated that glycoprotein IIb/IIIa platelet receptor antagonists have little or no effect in reducing post-PCI CK-MB rises in patients with angio-
graphic complications; rather, their major benefit is in patients without angiographic complications—those with microcirculation impairment (16,17). To complete the circle, there is preliminary evidence that glycoprotein IIb/IIIa platelet receptor antagonists do improve tissue level perfusion (18).

Risk assessment and avoidance of procedural and late adverse outcomes is a key concern for every interventionalist when selecting patients for percutaneous therapy. Procedural identification of high-risk lesions allows choices to be made to minimize early and late adverse outcomes. Options range from not performing an intervention to making strategic choices to maximize a safe outcome.

To further enhance the safety of PCI, it appears that we need to protect the microcirculation. The success of distal emboli protection devices (19) and the failure of glycoprotein IIb/IIIa platelet receptor antagonists in reducing post-PCI complications in saphenous vein grafts implies that the volume of atheromatous debris can overwhelm the beneficial effect of glycoprotein IIb/IIIa platelet receptor antagonists (20). It would appear that the greater the volume of atheroembolic debris (plaque burden), the less effective are the glycoprotein IIb/IIIa platelet receptor antagonists.

Therefore, if long lesions reflect increased plaque burden and increased plaque burden is more likely to result in atheroembolism to the microcirculation, manifested by post-PCI CK-MB elevation, then one strategic choice will be to select an emboli protection device. Likewise, the baseline angiographic variables indicative of late adverse events, such as longer lesions, LAD interventions, and restenosis lesions can be used to select specific technologies, such as drug-eluting stents, to reduce late TVR. Future trials will be required to confirm the utility of these variables, particularly lesion length (plaque burden), and to determine the efficacy of strategies designed to minimize both early and late adverse events after percutaneous intervention.

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REFERENCES


