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EDITORIAL COMMENT

Thrombus Aspiration in Primary Percutaneous Coronary Intervention

How to Manage Failure*

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More than 30 years ago, thrombotic occlusion of a coronary artery was identified as the pathophysiological mechanism causing myocardial infarction (1). Mechanical and/or thrombolytic reperfusion has subsequently become the standard of care for patients with ST-segment elevation myocardial infarction (STEMI). However, reperfusion of the epicardial coronary artery does not guarantee reperfusion at the myocardial tissue level. Distal embolization of atherothrombotic debris after primary percutaneous coronary intervention (PCI) contributes significantly to the occurrence of microvascular obstruction, which occurs in 15% to 70% of cases, depending on the sensitivity of the diagnostic modality used, and is associated with a worse prognosis (2,3).

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Distal protection devices and mechanical thrombectomy have not succeeded in improving clinical outcome after primary PCI in STEMI (4). However, the use of relatively simple manual thrombectomy devices, which also facilitate direct stenting, has been shown to improve angiographic markers of reperfusion and improve survival compared with primary PCI alone in a number of trials and meta-analyses (5–7). In the 2009 update of the American College of Cardiology/American Heart Association guidelines for the management of patients with STEMI, thrombus aspiration (TA) received a Class IIa, Level of Evidence: B recommendation (8). However, a recent meta-analysis using more conservative Bayesian methods failed to show a significant survival benefit with manual TA (9).

In light of these somewhat conflicting data, 1 potentially important factor hitherto largely unexplored is failure of attempted manual TA. Failure to reach and/or cross the culprit lesion occurs in approximately 4% to 11% of patients according to previous studies that reported this information (10,11). Moreover, after successful deployment of the device, thrombotic material cannot be collected in approximately 25% of patients (7).

In this issue of *JACC: Cardiovascular Interventions*, Vink et al. (12) report predictors and clinical significance of failed TA in primary PCI for STEMI. In this report from a large, single-center STEMI registry, the TA catheter failed to reach and/or cross the culprit lesion in 10.3% of cases. The investigators identified several lesion-specific characteristics such as tortuosity, calcification, and bifurcations as independent predictors of failure to reach and/or cross the coronary lesion with the TA catheter. Moreover, no thrombus material could be retrieved in 27.3% of patients in whom the TA catheter successfully crossed the lesion. Age older than 60 years and the circumflex artery as the culprit vessel were predictors of the lack of aspirate after successful deployment of the TA catheter.

The clinical relevance of failed TA is still unclear. The 1-year mortality rate was similar in patients with successful TA with aspirate (6.3%), successful TA without aspirate (6.7%), and failed TA (6.2%). Multiple explanations can be hypothesized to explain this finding. First, successful TA with debris aspiration might have reduced mortality in STEMI patients with large thrombus burdens to comparable levels of mortality as seen in presumably not-as-thrombotic lesions (i.e., in stiffer arteries, uncrossable by the TA catheters) in which no debris could be aspirated. Second, the relatively small sizes of the failed TA (n = 144) and successful TA without aspirate (n = 283) groups could mean that the study was underpowered to detect meaningful differences in the 1-year mortality rates.

After the identification of predictors of TA failure, the question remains whether the failure rate can be limited. Although 3 different TA catheters were used in this study, its retrospective nature and differences in device design precluded a comparison of failure rates among the devices. Hypothetically, improved TA devices engineered for optimized delivery may increase success rates. Likewise, improved aspiration capacity of manual TA devices may lead to an increased yield of thrombotic debris. Moreover, success rates will intuitively increase with operator experience. However, the present study did not investigate whether higher operator volume increases TA success rates.

An important limitation of this study is the fact that TA was not performed routinely, but rather at the discretion of the operator. As a result, TA was only attempted in approximately one-third of primary PCIs. Therefore, predictors of

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TA failure may be different in practices where TA is performed routinely during primary PCI for STEMI. Ideally, we would have liked to see a comparison between patients in whom TA was attempted and those in whom it was not. In light of this report, future TA trials should collect data on failure to deliver the device and failure to aspirate debris to clarify the uncertainties that currently still remain.

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Key Words: primary PCI ■ STEMI ■ thrombus aspiration.