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## Thrombus Aspiration during Primary Percutaneous Coronary Intervention

**TO THE EDITOR:** I do not agree with Svilaas and colleagues (Feb. 7 issue)<sup>1</sup> that thrombus aspiration during percutaneous coronary intervention (PCI) in patients who have myocardial infarction with ST-segment elevation improves clinical outcomes. In their intention-to-treat analysis, neither the incidence of death, reinfarction, or target-vessel revascularization nor a combination of these events was significantly different between the group with and the group without aspiration.

The authors' implication that aspiration thrombectomy is applicable "in a large majority" of patients who have myocardial infarction with ST-segment elevation is misleading. They suggest that since material was aspirated in almost three fourths of the patients, the myocardial blush grade and clinical outcomes were correlated across groups, and the blush grade was higher in the aspiration group than in the conventional-PCI group, then, ipso facto, aspiration is widely applicable for the improvement of clinical outcomes. A recent meta-analysis of randomized trials showed that distal-protection devices with PCI in patients who have myocardial infarction with ST-segment elevation improved the blush grade without improving the rate of death at 30 days.<sup>2</sup> The current study results are consistent with these data. Thus, I would suggest caution in recommending the use of aspiration thrombectomy without first showing improvement in clinical outcomes.

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larization for acute myocardial infarction: a meta-analysis of randomized trials. *Am Heart J* 2007;153:343-53.

**TO THE EDITOR:** Svilaas and colleagues report on a large, randomized, controlled trial of thrombectomy in acute myocardial infarction. This single-center trial showed improvement in markers of myocardial reperfusion with thrombectomy. Meta-analyses of previous studies have reached the same conclusions.<sup>1-3</sup> Thus, we are concerned about the conclusion that thrombectomy improved clinical outcomes in the Thrombus Aspiration during Percutaneous Coronary Intervention in Acute Myocardial Infarction Study (TAPAS) trial. At 30 days, the confidence interval crossed the unity line for all studied outcomes — namely, death, reinfarction, target-vessel revascularization, and major adverse cardiac events. The authors show a gradient of improvement in clinical outcomes, with better indexes of myocardial reperfusion in a pooled analysis of data from patients in both the thrombectomy group and the control group. However, in the article, it is clear that there were no significant differences in clinical outcomes between the groups. The take-home message would be that improved reperfusion does not translate into fewer clinical events. Insufficient power to show a clinical benefit may explain this finding.

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3. Burzotta F, Testa L, Giannico F, et al. Adjunctive devices in primary or rescue PCI: a meta-analysis of randomized trials. *Int J Cardiol* 2008;123:313-21.

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**TO THE EDITOR:** Svilaas et al. show that thrombus aspiration during primary PCI results in significantly better ST-segment resolution and myocardial blush grades than conventional PCI. Such improvements in myocardial reperfusion with thrombus aspiration, as indicated by these end points, were also reported earlier,<sup>1,2</sup> but whether these results correspond to smaller infarcts or better outcomes has not been clarified.<sup>1-4</sup> Myocardial infarct size as evaluated by means of radio-nuclide myocardial imaging was not reduced by thrombus aspiration.<sup>3,4</sup> Similarly, the left ventricular ejection fraction, assessed by echocardiography or radionuclide imaging, was not improved.<sup>2-4</sup> Thus, as far as thrombus aspiration in acute myocardial infarction is concerned, improvements in ST-segment resolution and myocardial blush grade are not directly connected to smaller infarct size and better left ventricular function. We are not treating electrocardiograms or angiograms; we are treating patients. Whatever the results of ST-segment resolution or the myocardial blush grade might be, without direct proof of reduction of infarct size and improvement in left ventricular function, we should not routinely use thrombus aspiration, which requires additional time and cost.

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**TO THE EDITOR:** Svilaas and colleagues found that thrombus aspiration in the setting of myocardial infarction with ST-segment elevation reduces the risk of poor reperfusion from 26.3% to 17.1% (as manifested by a myocardial blush grade of 0 or 1). Aspiration of thrombus improves reperfusion ostensibly by removing material that would otherwise embolize distally and cause microvascular obstruction. Although the principle of removing thrombus is intuitively appealing, it is difficult to understand how a catheter with a lumen cross-sectional area of only 2.5 mm<sup>2</sup> can extract a sufficient amount of thrombus from a large vessel (a 4-mm vessel has a cross-sectional area of 12.6 mm<sup>2</sup>). Did the authors notice that there was less benefit in larger vessels? If the benefit was similar in large vessels, this might imply that thrombus aspiration improves reperfusion by clearing a channel to facilitate direct stenting, which traps thrombus against the wall instead of removing it. This information would be useful in devising strategies to further reduce poor reperfusion.

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**THE AUTHORS REPLY:** Our trial was designed to evaluate the effect of thrombus aspiration on myocardial reperfusion with the use of myocardial blush grade as the primary end point. The results show beyond any reasonable doubt that thrombus aspiration improves myocardial reperfusion as assessed by blush grade and also by resolution of ST-segment elevation. The concern expressed by the correspondents in the first three letters with respect to extrapolation of these results to clinical outcomes has been addressed, since the power of our study with respect to a surrogate primary end point is a clearly stated limitation. We found an improvement in the clinical outcome,

although it was not significant at 30 days. We observed that myocardial and electrocardiographic measures of reperfusion are strong predictors of the clinical outcome at 30 days; the relationship between these values suggests a better clinical outcome with thrombus aspiration than with conventional PCI. The benefits of restoration of myocardial reperfusion might be seen in terms of a positive effect on left ventricular remodeling, with a significant effect on the late clinical outcome rather than on the early outcome.<sup>1</sup> Recent data on 1-year mortality and reinfarction did show a significant benefit with thrombus aspiration; these data provide support for our hypothesis.<sup>2</sup>

We are aware of meta-analyses evaluating embolic protection devices.<sup>3,4</sup> Although an effort has been made to use strict selection criteria in these analyses, caution is needed in the interpretation of the results because of the heterogeneity documented. The trials included in these meta-analyses evaluated different types of catheters, and inclusion criteria and the definition of variables, as well as antithrombotic regimens, varied markedly. In addition, bias may occur in pooling data from many small trials.<sup>5</sup> Our trial is of value not only because of our results but also from a methodologic point of view. The device used in the study, a manual-aspiration catheter, is relatively simple, flexible, and nontraumatic, and its use does not require additional time or cost. Furthermore, the study size and design — in particular, randomization before angiography, with few exclusion criteria and with adjunctive pharmacologic treatment according to current guidelines — make our data generalizable to a contemporary population of patients with myocardial infarction with ST-segment elevation.

With regard to the question of Amato et al. regarding vessel size and treatment effect, in a subanalysis that was not prespecified, there was no difference in the primary end point of a myocardial blush grade of 0 or 1 between larger ves-

sels ( $\geq 3.5$  mm) and smaller vessels. The blush grade was 0 or 1 in 44 of 209 patients with larger vessels (21.1%) versus 35 of 257 with smaller vessels (13.6%) in the aspiration group (risk ratio, 0.68; 95% confidence interval [CI], 0.49 to 0.94) and in 67 of 216 with larger vessels (31.0%) versus 57 of 244 with smaller vessels (23.4%) in the conventional-angioplasty group (risk ratio, 0.58; 95% CI, 0.40 to 0.85) ( $P=0.83$  for heterogeneity). In interpreting this result, one should keep in mind that during continuous aspiration, the catheter is being moved forward and backward through the infarct-related lesion, resulting in the “vacuuming out” of atherothrombotic material over a larger area than the internal lumen of the catheter.

In conclusion, we believe our trial provides important support for thrombus aspiration as the preferred initial step in angioplasty for acute myocardial infarction.

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## Drug-Eluting Stents vs. Coronary-Artery Bypass Grafting

**TO THE EDITOR:** Hannan et al. (Jan. 24 issue)<sup>1</sup> are to be commended for appropriately selecting patients with multivessel coronary disease for stenting or bypass surgery. Their clinical judg-

ment ensured that unadjusted survival rates were equal in the two groups, even among patients with diabetes.

The authors attempt to equalize the two groups