Another chapter in the story of thrombectomy in ST-elevation myocardial infarction: a story not yet finished

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This editorial refers to ‘Randomized study to assess the effect of thrombus aspiration on flow area in patients with ST-elevation myocardial infarction: an optical frequency domain imaging study—TROFI trial’, by Y. Onuma et al., on page 1050

Microvascular perfusion after primary percutaneous coronary intervention (PCI) in ST-elevation myocardial infarction (STEMI) has been clearly linked to mortality. It seems logical that by removing thrombus prior to PCI, thrombectomy could prevent distal embolization, improve microvascular perfusion and improve outcomes in STEMI.

The early small randomized clinical trials of distal protection devices combined with aspiration failed to show improvements in surrogate outcomes of ST segment resolution or infarct size. As a result, many questioned the concept that by preventing distal embolization during primary PCI, one could improve clinical outcomes. The concept gained new momentum with the publication of the TAPAS trial, a single-centre trial comparing thrombectomy with the Export catheter (Medtronic CardioVascular, Santa Rosa, CA, USA) vs. PCI alone in STEMI (n = 1072). This trial showed not only an improvement in the primary outcome of myocardial blush grade but a nearly 50% reduction in mortality at 1 year. Subsequent meta-analyses of small trials that were dominated by the TAPAS trial showed similar findings. This single-centre trial influenced guidelines in Europe and North America, and manual aspiration became a class IIa recommendation in the guidelines.

Given this evidence, some believed that manual thrombectomy was the most important advance in STEMI since the advent of fibrinolytic therapy or primary PCI itself. The use of thrombectomy has rapidly grown. Manual thrombectomy provides immediate feedback to the operator, when visible thrombus is removed from the artery and visualized in the basket.

More recently, two multicentre randomized trials, INFUSE AMI (n = 452) and MUSTELA (n = 208), did not show differences in the surrogate outcome of magnetic resonance imaging (MRI) determined infarct size with thrombectomy compared with PCI alone. These conflicting findings have left many wondering what the true clinical effect of thrombectomy in STEMI is. Finally, there are now two large multicentre randomized trials powered for clinical outcomes, TOTAL (NCT01149044) and TASTE (NCT01093404), that combined will enrol > 10 000 patients to answer this question definitively.

Onuma and colleagues have now randomized 154 patients with STEMI to thrombectomy with the Eliminate catheter (Terumo, Japan) vs. PCI alone in a multicentre trial. The primary outcome was flow area as measured by optical frequency domain imaging (OFDI; Terumo, Japan). Flow area was defined as stent area – area of atherothrombotic material protruding through or within the stent. The hypothesis of the study is that removal of thrombus would increase the flow area in patients receiving thrombectomy compared with PCI alone.

The TROFI study demonstrated no difference in the primary outcome of flow area. Of interest, 50% of patients in either group had prolapse of material/thrombus through the stent lumen. In a post-hoc analysis, there was a benefit of thrombectomy for the outcome of flow area in patients with the highest thrombus burden [thrombolysis in myocardial infarction (TIMI) grade 4 or 5].

How do we make sense of TROFI? Does this mean thrombectomy does not work?

This is one of the first trials to use an optical coherence tomography (OCT)-derived surrogate outcome in STEMI. In a patient
with an occluded artery, comparing thrombectomy vs. predilatation with a 2.5 mm balloon may yield similar flow areas. However, the mechanism of benefit of thrombectomy may be unrelated to flow area; by removing thrombus with thrombectomy, distal embolization of thrombus may be prevented. Therefore, surrogate outcomes such as ST resolution or myocardial blush still remain the standard in this field.

Of note, TROFI found no difference in ST segment resolution or myocardial blush grade. It is possible that newer lower profile thrombectomy catheters have differential abilities to remove thrombus. However, it is more likely that the TROFI trial was not powered to show a difference in these secondary outcomes.

**Insights from optical coherence tomography in ST-elevation myocardial infarction**

While flow area derived from OCT is not a standard surrogate outcome in STEMI trials, the performance of OCT in 150 STEMI patients provides important insights. The rates of stent thrombosis in STEMI are markedly elevated compared with other PCI populations. The finding that ~50% of patients in TROFI had thrombus or atherothrombotic material protruding through the stent struts helps us provide a mechanism for this marked increase in stent thrombosis in this population. An example of thrombus protruding through a stent in a patient undergoing primary PCI is shown in Figure 1.

In the TROFI trial, operators were blinded to the OCT results. In a survey of operators after the end of the trial, respondents stated that OCT information would have changed management (i.e. post-dilatation or additional thrombectomy) in 52% of the cases. Despite the survey results, prospective studies are needed to determine the relationship of OCT variables such as varying degrees of malapposition with clinical outcomes. Furthermore, OCT guidance in STEMI PCI has not been tested in randomized trials.

The TOTAL and TASTE trials will demonstrate definitively whether the routine use of the current generation of manual thrombectomy catheters improves outcomes in STEMI. Irrespective of the results of these trials, the OCT findings in TROFI suggest that there are opportunities to improve current devices. An optimal device would remove more thrombus, particularly thrombus layered on the vessel wall, prevent distal embolization, and be simple to use. In the last 10 years, there have been great advances in stent technology. Over the next 10 years, improvements in thrombectomy technology could yield important benefits in STEMI.

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**References**


