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Editorial

# Thrombus aspiration in AMI patients with cardiogenic shock: is thrombus burden the missing piece of the puzzle?

## Tromboaspiración en pacientes con IAM y *shock* cardiogénico. ¿Es la carga trombótica la pieza que falta en el puzle?

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Acute myocardial infarction (AMI) is still the leading cause of mortality in developed countries. Indeed, despite the improvement in logistics with faster mechanical reperfusion, the refinement in antithrombotic therapies[1,2] and stent/balloon technologies,[3,4] outcomes remain unsatisfactory in high-risk patient subgroups.

Coronary thrombosis in the context of an AMI represents one of the major challenges for interventional cardiologists, due to the high risk of distal embolization and slow-flow/no-reflow phenomena, worsening the acute clinical scenario. Pharmacological antithrombotic treatment has been shown to improve both angiographic and clinical outcomes.[1,2] However, this treatment comes at the cost of an increased bleeding risk and is insufficient in advanced cases with massive thrombosis.[5]

Thrombus aspiration (TA) allows mechanical removal of thrombotic material from coronary arteries in order to reduce the risk of distal embolization, improving final thrombolysis in myocardial infarction (TIMI) flow and procedural outcomes. Nonetheless, despite the intuitive pathophysiological considerations, expected benefits and initial positive data,[6] recent large randomized clinical trials evaluating TA in the setting of ST-segment myocardial infarction (STEMI) did not confirm that this technique significantly improved cardiovascular outcomes.[7,8]

Although current guidelines discourage its routine use in the acute setting (class III recommendation), TA is probably the most widely used "not recommended" technique, since its efficacy in selected patients with specific lesion characteristics and thrombus burden is broadly recognized among operators.[9] Indeed, beyond its benefits in reducing mortality and reinfarction, thrombus removal may have additional benefits such as reducing distal embolization, improving visualization of atherosclerotic disease and stenosis, reducing vasospasm and enhancing estimation of vessel diameter, thereby allowing optimal stent selection and implantation with a potentially lower risk of late stent malapposition.

The benefit of TA in patients with high thrombus burden is already acknowledged[6,10]; however currently available randomized data have shown a higher incidence of stroke, which has limited the spread of this technique in high risk populations.[11]

The main goal remains the proper selection of individuals who could benefit from this procedure. Particular attention should be paid to patients with advanced Killip class and cardiogenic shock, who have been reported to have a higher risk of distal embolization and impaired reperfusion,[12,13] despite optimal antithrombotic therapy.

Against this background, a recent article published in *Revista Española de Cardiologia* by Kwon et al.[14] report the results of TA use in patients with AMI complicated by cardiogenic shock (CS) using data from the RESCUE multicenter Korean registry (a retrospective and prospective observational study to investigate the clinical outcomes and efficacy of a left ventricular assist device for Korean patients with cardiogenic shock; NCT02985008).

Among 575 AMI patients with CS, TA was performed in 232 (40.3%), while 368 (64%) had the highest thrombus burden (TIMI grade V), causing coronary occlusion. There were no differences in the primary outcome (defined as all-cause death or heart failure rehospitalization at 6 months) or in in-hospital death between the TA vs no TA groups in the overall population. Conversely, in high-risk patients with grade V thrombus burden (368 patients, including 177 treated with TA), primary events were significantly reduced with this treatment (33.4% vs 46.3%; adjusted hazard ratio = 0.59; $P = .004$), with a significant interaction between thrombus load and TA use (adjusted $P$ for interaction = .03); these results were also maintained after propensity score matching ($P = .05$) and inverse probability weighting ($P = .04$). In line with the results of previous studies, a higher incidence of stroke emerged in the overall TA group (1.4% vs 0%; $P = .04$).

Because AMI patients with a higher thrombus burden are more likely to present with CS, and this unstable condition usually represents an exclusion criterion for major randomized trials, no consistent data are currently available from randomized trials on TA in this high-risk population. Indeed, high thrombus burden was present only in 6.2% of patients in the TASTE study, while Killip class IV was present in 0.8% in a meta-analysis of more than 18 000 patients from the TOTAL, TAPAS and TASTE trials.[11,15]

In this real-world registry enrolling consecutive CS patients, Kwon et al. focused on this specific population, showing a clinical

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benefit of TA performed in AMI with a high prevalence of coronary thrombus. Assuming the highest thrombotic risk in CS patients, due to low-flow rate, the efficacy of TA treatment in those presenting with an already high thrombus burden can be easily explained. The registry focused on CS, which positively impacted on the strict definition, selection and inclusion of patients with CS.

While the authors should be commended for their efforts in providing additional data on this important issue, their study has some limitations, as acknowledged by the authors themselves, which should be taken into account in the interpretation of the results.

The major limitation of the study[14] is its retrospective, nonrandomized design, with the decision to use thrombectomy left to the operators' discretion. Therefore, several differences were observed in baseline characteristics. The authors applied a multivariate adjustment and propensity score analysis. However, even the most sophisticated statistical approach may not completely overcome the selection bias. Furthermore, a quota of patients was excluded but not exactly reported in the manuscript, conferring an additional risk of selection bias. No data are reported on the type (mechanical vs manual) of thrombectomy. Furthermore, thrombus grade was assessed in the baseline angiogram and not after initial crossing or gentle predilatation, potentially leading to a misclassification of the extent and severity of intracoronary thrombus.

Despite these limitations, some interesting data emerged, confirming the results of previous studies[6] relating the risk profile, thrombus burden and benefits of thrombectomy that represent the missing piece of the puzzle.

However, the analysis on thrombus grade was not prespecified. Therefore, these data can only be hypothesis generating, which, in addition to the retrospective observational analysis and the risk of selection bias, indicate that further large randomized trials are warranted to evaluate the balance between the procedural risk of stroke with improvement in mid-term all-cause death and HF rehospitalization.

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## CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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