Residual ischemia in acute myocardial infarction complicated by cardiogenic shock undergoing VA-ECMO: does complete revascularization hold the key?

Editorial to: “Clinical Significance of Residual Ischemia in Acute Myocardial Infarction Complicated by Cardiogenic Shock Undergoing VA-ECMO”

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Despite advances in treatment modalities, acute myocardial infarction–related cardiogenic shock (AMICS) still carries a high mortality (40 to 50% at 30 days). Early revascularization and immediate percutaneous coronary intervention (PCI) of the culprit-lesion-only with possible staged revascularization has been proven to be beneficial. In around 75% of patients presenting with AMICS, multivessel coronary artery disease is present. The SYNTAX (‘SYNergy between PCI with TAXUS and Cardiac Surgery’) score (SS) was developed in 2005 to assess the extent and complexity of coronary artery disease to help decision-making on the most appropriate revascularization strategy mainly for chronic coronary syndromes (CCS). The prognostic value of this score, however, has been demonstrated in several clinical settings including CCS but also...
Additionally, the residual SYNTAX score (rSS) has been validated to assess the extent and complexity of residual coronary stenoses following PCI.\(^7\) A substudy of the CULPRIT-SHOCK trial showed that the rSS was associated with 30-day and 1-year mortality independently from the type of revascularization strategy, i.e. immediate multivessel PCI or culprit-lesion-only PCI with possible staged revascularization. Complete revascularization was achieved in only 25% of the patients treated. Of note, only a minority of patients in this cohort were supported by venoarterial membrane oxygenation (VA-ECMO).\(^8\) Based on the above findings from CULPRIT-SHOCK, the current 2023 European Society of Cardiology guidelines of Acute Coronary Syndromes recommend to perform culprit-lesion-only PCI with possible staged revascularization in AMICS (class of recommendation IIa).\(^9\)

The observational multicentre study by Hong et al., conducted in a specific group of AMICS patients undergoing VA-ECMO, corroborated these findings.\(^10\) Complete revascularization was achieved in only one-fourth of patients and there was an independent association of rSS measured after all revascularization procedures during index hospitalization with 1-year all-cause mortality.\(^10\) The observational design of the study precludes determination of a causal relationship between incomplete revascularization, defined by rSS, and increased mortality in AMICS patients on VA-ECMO.

The randomized controlled COMPLETE trial showed that complete revascularization as a staged procedure among patients with STEMI and multivessel coronary artery disease – without cardiogenic shock – resulted in a lower risk of a composite of death from cardiovascular causes or new myocardial infarction at 3 years’ follow-up; however, this was mainly driven by the decrease of nonfatal myocardial infarction.\(^11\) Alternatively, a higher rSS could pinpoint a subgroup of high-risk patients with AMICS, for whom achieving a more complete revascularization might not significantly impact prognosis. Patients with a higher rSS also had a higher baseline SS (bSS) which could reflect a higher burden of cardiovascular disease in general. Surprisingly, bSS was not associated with all-cause mortality in this study by Hong et al.\(^10\) This is in contrast with the finding of Guedeney et al. that bSS was strongly associated with 30-day and 1-year all-cause mortality in patients with AMICS and multivessel disease undergoing PCI.\(^6\)

The authors hypothesize that decrease of coronary perfusion pressure and the possibility of a Harlequin syndrome in patients supported by peripheral VA-ECMO aggravate residual ischemia and subsequently suggest more aggressive revascularization strategies.\(^10\) However, complete revascularization may not address a low coronary flow state or affect oxygenation in the supra-aortic branches. Moreover, it could be impossible in some patients to achieve complete revascularization, e.g. when unfavourable anatomic conditions (i.e., chronic total occlusion, small vessel disease, etc.) are present.
At present, it remains unclear whether AMICS patients with VA-ECMO or microaxial flow pumps are more vulnerable to incomplete revascularization compared to AMICS patients without mechanical circulatory support (MCS). interestingly, the successful ECMO weaning rate was significantly higher in the complete revascularization group (rSS=0) than in the other groups in the study, suggesting enhanced cardiac recovery in that group.10 This finding warrants further exploration. In the ECLS-SHOCK trial, AMICS patients planned for early revascularization were randomized to receive early VA-ECMO (or also called extracorporeal life support [ECLS]) plus usual medical treatment or usual medical treatment alone. Immediate multivessel PCI was performed in 24.6% of patients in the VA-ECMO group. The impact of immediate or staged complete revascularization in this large cohort has not been assessed so far.12 In the DanGer-Shock trial, patients with STEMI and cardiogenic shock were randomized to receive a microaxial flow pump plus standard care or standard care alone. Interestingly, immediate multivessel PCI was performed in 44.5% of patients presenting with multivessel coronary artery disease (70%) compared to a very small number of staged PCI. The role of revascularization strategy has also not been analyzed so far.13

Finally, the authors consider rSS, which is based on coronary anatomy, a surrogate for residual ischemia. However, incomplete revascularization is not necessarily linked to the presence of residual ischemia. Residual ischemia post PCI can be detected clinically in patients presenting with persistent angina, by non-invasive testing or by invasive measurement of fractional flow reserve (FFR).4 In AMICS, the last option is probably the most feasible. A functional residual SYNTAX score based on FFR might represent a better estimation of residual ischemia than the anatomically based rSS.14

In conclusion, in the acute phase of AMICS in the presence of multivessel disease and regardless of VA-ECMO or other MCS devices, culprit-lesion-only PCI should be the preferred strategy. At a later stage after stabilization, staged revascularization reducing rSS could be weighed against potential risks of additional procedures. The safe conclusion of this study should be underlined: future randomized controlled trials are needed to evaluate the efficacy and safety of different revascularization strategies reducing rSS in patients with AMICS supported with MCS.

References