

Left ventricular thrombus formation after acute myocardial infarction: vigilance still required in the modern era

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Left ventricular (LV) thrombus formation is a feared complication following acute myocardial infarction (MI), predominantly owing to the risk of thromboembolism, in particular, stroke [1]. The combination of blood stasis resulting from LV regional wall akinesia or dyskinesia, subendocardial damage from prolonged ischaemia and a hypercoagulable state (i.e. Virchow's triad – blood stasis, endothelial injury and hypercoagulability) predispose to the development of LV thrombus following an acute MI [2]. However, the exact incidence of LV thrombus formation following acute MI in the contemporary era is difficult to quantify owing to the fact that therapeutic strategies for acute MI have rapidly evolved over the past 20 years, but it is assumed to have decreased [2]. Older studies from the prethrombolytic and thrombolytic eras suggested that LV thrombus may have been present in up to 46% of patients after acute anterior or apical MI [3]. In the present era, the incidence of LV thrombus formation following acute MI is thought to be lower (5%–10%) owing to the widespread use of rapid mechanical reperfusion and potent antiplatelet and antithrombotic agents [2, 4].

The risk of thromboembolic complications from LV thrombus was about 10% in the prethrombolytic era, whereas the risk was much lower in the thrombolytic era (2%–3%) [2, 5]. However, there are few data on the risk of embolic complications among patients with LV thrombus treated with primary percutaneous coronary intervention (PCI). Risk factors for embolisation of LV thrombus include protruding (as opposed to mural) thrombi and thrombi exhibiting independent movement, although it has been reported that up to 40% of embolic episodes occur in patients with neither protruberant nor mobile thrombi [2]. The main aim of treatment strategies for LV thrombus is to prevent systemic embolisation. Oral anticoagulation with vitamin K antagonists is the mainstay of treatment for LV thrombus to prevent systemic embolisation [1, 2]. The evidence supporting this approach mainly comes from a 1993 meta-analysis including 11 studies of 856 patients suffering from an anterior MI [1]. The odds ratio for increased risk of emboli among patients with LV thrombus was 5.45 (95% confidence interval [CI] 3.02–9.83) and the odds ratio of anticoagula-

tion versus no anticoagulation in preventing embolisation (7 studies, 270 patients) was 0.14 (95% CI 0.04 to 0.52) [1]. What is unclear, however, is the optimal duration of oral anticoagulation in patients with LV thrombus, particularly after primary PCI. The implantation of drug eluting stents during primary PCI mandates dual antiplatelet therapy for a minimum of 6 months, and the addition of oral anticoagulation (triple antithrombotic therapy) increases the bleeding risk. This increased bleeding risk with triple therapy therefore mandates the accurate diagnosis of LV thrombus in order not to increase the bleeding risk unnecessarily. The risk of embolisation decreases over time, probably as a result of thrombus organisation and neovascularisation. The most recent European Society of Cardiology (ESC) and American College of Cardiology Foundation/American Heart Association (ACCF/AHA) STEMI consensus documents both recommend oral anticoagulation with vitamin K antagonists for a minimum of 3 months in the presence of LV thrombus complicating acute MI (class of recommendation IIa for both, level of evidence B [ESC] and C [ACCF/AHA]) [6, 7]. The ESC guidelines recommend repeated imaging at 3 months of follow-up before stopping therapy, to see whether thrombus is still present and particularly to see whether there is recovery of apical wall motion [6].

Currently in Swiss Medicine Weekly, Sürder et al. report an interesting substudy of the SWISS-AMI trial attempting to assess the incidence of mural LV thrombus, using cardiac magnetic resonance imaging (CMR), in the contemporary era [8]. They also compared the use of CMR with transthoracic echocardiography in the diagnosis of LV thrombus and evaluated factors predisposing to LV thrombus formation. The analysis included 177 patients presenting with ST-segment elevation myocardial infarction (STEMI) (anterior MI in 93%) undergoing successful primary or rescue PCI within 24 hours after onset of chest pain, with an LV ejection fraction \leq 45%. CMR was performed in all patients a median of 6 days (range 4–8) after AMI, with both cine sequences and late gadolinium enhancement (LGE) imaging, and all CMR data analyses were performed in a central core laboratory [8]. Conversely, transthoracic echocardiography was performed in just 113/177 (64%) of pa-

tients and results were not analysed in a core laboratory, owing to the fact that TTE was not part of the SWISS-AMI study protocol. Overall, LV thrombus was detected in 11/177 (6.2%) patients using CMR and TTE data were available in 10 of these cases. Reassuringly, there was a high agreement between TTE and CMR for the detection of LV thrombus ($\kappa = 0.70$), although two false negative and four false positive diagnoses of LV thrombus were noted on TTE. Importantly, all TTE true positive diagnoses of LV thrombus were made prior to CMR imaging. Contrast echocardiography was used in only a minority of cases (15/113) of which 10 cases were true negative, 2 cases were true positive and 3 cases were false positive. The lack of widespread use of contrast echocardiography represents a major limitation of this study, as the agreement of TTE and CMR might have been even higher had it had been used more frequently. All 11 patients with LV thrombus were treated with oral anticoagulation together with dual antiplatelet therapy together with bridging therapeutic heparin until a therapeutic international normalised ratio (INR) was reached. No strokes were reported among the 11 patients with LV thrombus formation, whereas 2 strokes occurred among patients without documented LV thrombus formation [8].

What does this study add to what we already know? First, this study corroborates previous studies by confirming that the prevalence of LV thrombus does appear to be decreasing with the use of mechanical reperfusion therapy and potent antiplatelet and antithrombotic therapy. In this study, comprising a STEMI patient population at considerably high risk for LV thrombus, the prevalence was 6.2% – a reassuringly low figure. By extrapolating these figures to the general STEMI patient population, where the proportion of patients presenting with large anterior STEMIs would be expected to be lower than in the present study, one could safely assume the overall incidence of LV thrombus to be even less, although further contemporary studies are needed to accurately address this question. Second, TTE performed very well in diagnosing LV thrombus in comparison with CMR. Nevertheless, the fact that TTE was not mandated as part of the original study protocol and was available in fewer than two-thirds of the patients does suggest that these results should be interpreted with caution. Furthermore, contrast echocardiography, which would be considered more sensitive than TTE in detecting LV thrombus, was used in only a minority of patients. Further studies are needed that compare CMR with contrast echocardiography versus TTE. Third, the study provides us with practical variables that can be used at the bedside to help

predict LV thrombus formation (i.e. baseline platelet count, body mass index and infarct size), although it must be borne in mind that these variables were derived from just 11 patients. Finally, this study draws our attention to the fact that LV thrombus remains an important complication of acute MI in the contemporary era and reminds us to remain vigilant and actively seek LV thrombus, particularly in high-risk patients presenting with STEMI (i.e. patients with large anterior STEMI) prior to hospital discharge in order to prevent potentially devastating thromboembolic complications.

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