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EDITORIAL COMMENT

# Cardiac magnetic resonance imaging analysis in STEMI: quantitative or still visual?

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Cardiac magnetic resonance imaging (CMR) has long been recognized as an accurate and reliable means of evaluating cardiac anatomy and ventricular function. Considerable progress has been made in the field of CMR, providing accurate evaluation of left ventricular function parameters in coronary artery disease, heart failure, hypertrophic cardiomyopathy, and many other cardiac diseases [1–12]. Stress first-pass contrast-enhanced myocardial perfusion CMR can be used to detect subendocardial ischemia and recent studies have demonstrated the high diagnostic accuracy of stress myocardial perfusion CMR for detecting significant coronary artery disease [13–16]. Magnetic resonance angiography has been introduced as a method that can provide visualization of all three major coronary arteries, coronary anomalies, coronary bypasses and the aorta within a single three-dimensional acquisition [17–19]. CMR has become the first choice imaging modality in complex congenital heart disease [20–26], imaging great vessels, and evaluation of therapy such as cardiac resynchronization therapy [27–38].

Over the past years, contrast-enhanced CMR has been used to visualize the transmural extent of myocardial infarction with high spatial resolution [39–45]. Infarcted myocardium appears hyperenhanced compared with normal myocardium when imaged by a late enhancement MRI technique with the use of T1-weighted sequence after injection of gadolinium chelates. Late gadolinium-enhanced CMR can clearly delineate subendocardial infarction and the transmural extent of delayed enhancement potentially predicts functional outcome after revascularization in acute myocardial infarction and chronic ischemic heart disease [46–49].

In the current issue of the *International Journal of Cardiovascular Imaging*, Husser et al. [50] compared quantitative assessment of contrast CMR with visual analysis in patients with ST-segment elevation myocardial infarction (STEMI) for predicting reduced ejection fraction and major adverse cardiac events such as death, re-infarction, and re-admission for heart failure. The authors studied 192 patients who underwent CMR at 1 week and 6 months after a sustained STEMI. Three quantitative indices (initial slope, maximal signal intensity and contrast delay in first-pass imaging) and two visual perfusion indices (hypo-enhancement in first-pass and microvascular obstruction in late enhancement imaging) were evaluated. Quantification of infarct mass and visual assessment of the extent of transmural necrosis was

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also performed on the basis of the standard 17-segment model. At 6 months, 69 patients showed reduced ejection fraction; during follow-up of mean 655 days, 20 major adverse cardiac events occurred. Quantification of the perfusion images was very time-consuming and proved not superior to visual perfusion analysis to predict reduced ejection fraction and/or major adverse cardiac events. Similarly, quantification of infarct size was not superior to visual assessment of the extent of transmural necrosis. In multivariate analysis, only visual assessment of extent of transmural necrosis predicted reduced ejection fraction and major adverse cardiac events. The authors concluded that visual analysis of CMR in patients with STEMI is not time-consuming and predicts reduced ejection fraction and major adverse cardiac events comparable to quantitative analysis. The extent of transmural necrosis turned out to be the strongest parameter. The present study is the first to investigate whether a complete quantitative analysis of a post-infarct-CMR study would be more accurate than a complete visual analysis of microvascular perfusion and myocardial necrosis to predict late ejection fraction and major adverse cardiac events in a large group of patients with STEMI. The data confirm previous findings from the same group showing that neither qualitative nor quantitative myocardial perfusion nor time-consuming quantification of infarct mass provides incremental predictive value over visual assessment of transmural necrosis [51–53].

Despite these interesting findings, it should be realized that quantification of perfusion and infarct size offers the potential advantages of being less operator-dependent, more objective, and more accurate. At present, CMR offers several acquisition techniques for precise and highly reproducible assessment of global and regional ventricular function, flow, and perfusion at rest and under pharmacological or physical stress conditions [54–56]. Moreover, CMR allows quantification of blood flow over the valves, and automatic vessel wall contour detection and quantification of wall thickness of in-vivo MR images of the human aorta [57–59]. Recent advances in hardware and software have resulted in strong improvement of image quality and in a significant decrease in the required imaging time for each of these acquisitions. However, quantitative image analysis often still relies on manual tracing of contours in the images, being indeed time-consuming thereby limiting the clinical applicability of CMR for routine analysis. Methods for automated and robust assessment of the parameters of cardiac function, blood flow and morphology, are still being developed to overcome the limitations associated with manual image processing [60]. Until these issues are fully solved, the present study clearly indicates that, for prediction of late cardiac events in patients with STEMI, a comprehensive visual approach may suffice in routine clinical practice.



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