EDITORIAL

Cardiac Magnetic Resonance After an Acute Myocardial Infarction: a Rising Technique

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In Spain,[1] the well-established practice of introducing interventionist techniques in acute myocardial infarction (AMI) has promoted interest in determining the status of myocardial segments in which successful angioplasty should prevent irreversible necrosis as this informs-prognosis. Simple, though indirect and somewhat crude signs exist that indicate post-primary angioplasty prospects for AMI-affected myocardium: for example, the persistence or not of ST-segment elevation in the electrocardiogram.[2] However, given the profusion of imaging techniques available, we should logically try to determine the contribution each of these can make to a more precise study of the situation. The role played by radioactive isotope studies[3] is well known but more recent techniques, such as contrast echocardiography (ECO) or cardiac magnetic resonance imaging (MRI), are still being evaluated and it is these we focus on in the present text.

The physiopathologic processes involved in early AMI revascularization, whether by pharmacologic therapy or angioplasty, can be considered on various levels. Firstly, we have restoration of repermeabilization patency to a previously occluded epicardial coronary artery, easily identified after angioplasty and judged successful in terms of TIMI flow grade. Secondly, we have restoration of regional myocardial flow, also evaluated by angiographic techniques such as myocardial blush grades[4] or opacification of the myocardial segment in question in angiography of the reopened artery. In principle, new imaging techniques such as contrast ECO[5] or contrast MRI[6] seem more appropriate when evaluating myocardial reperfusion. Both permit well defined recognition of the presence of regional myocardial flow, and contrast MRI also detects and quantifies irreversible myocardial necrosis.[7] Thirdly, we have early or long-term recovery of myocardial contractile function, for which MRI seems the most adequate technique, given its excellent reproducibility.[8]

From the abrupt reopening of an occluded artery to the functional recovery of the myocardial segment it irrigates, this series of processes is what we would hope might happen in every patient. In practice, though, developments are not always so linear. In effect, the fact that apparently successful primary angioplasty is occasionally not followed by adequate myocardial reperfusion has been observed in all series and is caused by regional microvascular dysfunction.[9] Achieving apparently adequate reperfusion does not guarantee long-term recovery of myocardial function.[5,6] The final outcome of the process is conditioned by many factors. Some of these appear easy to understand: for example, time elapsed after opening the vessel or presence of collateral circulation; others, such as the very concepts of hibernation and myocardial stunning,[10] have yet to be fully understood.

In short, although early revascularization in patients with AMI unquestionably entails clinical benefits, in each patient our knowledge of the status of the myocardium involved and its future remains a cause of concern for the cardiologist. Similarly, we have yet to determine the role that may finally be played by two promising new imaging techniques: contrast ECO and contrast MRI.

The current issue of REVISTA ESPAÑOLA DE CARDIOLOGÍA presents 2 insights into the subject, both of which make valuable contributions by virtue of excellent research design. Peteiro et al[11] focus on the study of myocardial perfusion ECO following successful primary angioplasty. They report that normal perfusion occurs in only just over half of the segments involved although, in turn, long-term functional recovery is only found in just over half of them. On the other

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hand, most (two thirds) segments with perfusion defects in ECO images do not achieve functional recovery. At the same time, these authors also performed first pass gadolinium perfusion MRI followed by delayed myocardial enhancement (DME). This technique is very reliable in detecting irreversible myocardial necrosis with results similar to those of ECO in MRI perfusion studies and a better correlation with functional recovery. We have to remember that following successful primary angioplasty only one third of myocardial segments finally recover functionality. That is, as we have commented earlier, Peteiro et al confirm that maintaining an artery open following angioplasty does not guarantee recovery of myocardial function, and that post-angioplasty myocardial perfusion contrast ECO and first pass MRI perfusion studies, are only moderate predictors of recovery, although their predictive value improves if DME by MRI is used.

López Lereu et al[12] analyze various options offered by MRI in the study of perfusion and myocardial viability in a group of patients similar to those in Peteiro et al's series. Impeccable research methods place López Lereu et al on a par with current clinical research in MRI. As in the previous study, results for this series highlight the fact that functional recovery of myocardial segments occurs in only one third of patients. The authors endorse gadolinium DME as an outstanding predictor of long-term functional recovery, with positive and negative predictive values approaching 90%. Curiously, first pass gadolinium myocardial perfusion shows conserved perfusion in almost half of the patients, as does contrast ECO. However, its predictive value here is only moderate.

One interpretation of these interesting results would lead us to consider that analysis of myocardial perfusion after reperfused AMI with restored patency is of limited value in the prognosis of recovery of myocardial function. At least, this is the case of studies such as these, in which perfusion is evaluated by contrast ECO or resting first pass MRI, and qualitative assessment of perfusion is visual only. Myocardial perfusion constitutes a substantial challenge for intravenous contrast agent imaging techniques because of the reduced volume of coronary flow and still limited spatial resolution it entails. This is evident when these limitations are countered by using techniques such as immediate post-primary angioplasty intracoronary injection of ECO contrast agents. Using this method, Bodí et al[13] report good correlation between perfusion and global long-term left ventricular systolic function. In truth, we probably need to introduce MRI protocols that are more complex than the analysis of baseline first pass studies. These could take the form of post-pharmacologic stimulation studies, which have been shown to increase the diagnostic value in detecting perfusion defects secondary to obstructive coronary artery lesions.[14] Or, we could await the definitive introduction of the semiquantitative methods of MRI perfusion analysis that have yet to be standardized but which have given good results in this field.[6] It is not a question of undervaluing the knowledge of regional myocardial perfusion as an indicator of the state of microcirculation after primary angioplasty but of improving analytical method for ECO and MRI.

However, it is fortunate that MRI offers an alternative that has proven more valid in the prognosis of myocardial segment functionality following revascularization by primary angioplasty. The high reliability of gadolinium DME to detect areas of irreversible myocardial necrosis and delimit the scale of transmural extension has, when combined with the study of ventricular segment function in the same MRI sessions, become standard practice in determining myocardial viability,[7] and identifying as potentially recoverable hibernating or stunned myocardium, those segments with contractile dysfunction, without DME, or limited in extension to the subendocardium. Findings of the two studies presented here confirm the value of this technique, recognizing its high diagnostic value in determining recovery of myocardial function.

The other great advantage of DME by MRI is its relative simplicity and innocuousness. It requires up-to-date magnetic resonance equipment—widely used today—and technical care and precision in performing the study. Despite this, DME by MRI has become an essential part of basic protocols for any MRI study in patients with ischemic heart disease.

Consequently, it is no great surprise that this technique should be favored by scientific society study groups in their most recent recommendations.[15] Nor is it out of place to affirm that in the near future obtaining a study of function, extension of necrosis and viability may well become standard practice in attending all AMI survivors, with or without primary revascularization, given that it provides valuable information for a full evaluation of each patient, with highly reliable implications for prognosis, therapy and with reference to follow-up. It is satisfying to be able to affirm that the articles presented here make a decisive contribution to the process of incorporating this technique into the arsenal of diagnostic imaging resources in cardiology.

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