

TIME COURSE OF FUNCTIONAL RECOVERY OF HIBERNATING MYOCARDIUM – IS IT ALWAYS CORRECTLY ASSESSED BY CONVENTIONAL ECHOCARDIOGRAPHY?

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Keywords: myocardial viability, dobutamine stress echocardiography, myocardial contrast agent

Abstract: Identification of viable myocardium in patients with left ventricular (LV) dysfunction secondary to coronary artery disease has an outstanding importance in establishing the optimal treatment strategy. We report the case of patients with “two types of lesions”: one with a clear indication for revascularisation, and the other requiring additional imaging tests to assess myocardial viability. For this, a dobutamine stress echocardiography with a myocardial contrast agent was performed, and the presence of viable tissue was found in more than three segments. At the one-month and three-month follow-up, the patient was asymptomatic, and bidimensional echocardiographic assessment showed no improvement, but after administration of the myocardial contrast agent (Sonovue), significant improvement of the segmental wall motion score was found. Adding contrast agents to conventional echocardiography can establish the extent of residual myocardial viability and assess resting LV function more accurately than 2D echocardiography.

INTRODUCTION

Identification of viable myocardium in patients with left ventricular (LV) dysfunction secondary to coronary artery disease has an outstanding importance in establishing the optimal treatment strategy. In these patients, coronary revascularisation has been demonstrated to lead to an improvement of symptoms and long-term prognosis, and recovery of left ventricle contractile function.(1,2,3) The data from retrospective studies show that patients who undergo a viability test before revascularisation have better in-hospital and one-year outcomes.(4,5) Over the last decades, several imaging techniques have been proposed for the assessment of myocardial viability such as dobutamine stress echocardiography (DSE), myocardial contrast echocardiography, single-photon emission computed tomography, positron emission tomography and cardiovascular magnetic resonance. DSE evaluates myocardial contractile reserves using initial low dose dobutamine (5–10 µg/kg/min) that can lead to increased contractility in dysfunctional segments, followed by higher doses (up to 40 µg/kg/min plus atropine to increase heart rate) when wall motion in these viable segments may further improve or worsen, suggesting the presence of myocardial viability and residual ischemia.(3,6,7) The “biphasic response” is highly predictive of recovery of ventricular function after revascularisation.(8) One of the main limitations of echocardiography, reduced diagnostic accuracy in patients with poor acoustic windows or significant LV impairment, can be improved by using a contrast agent, which provides a better identification of the LV border.(9)

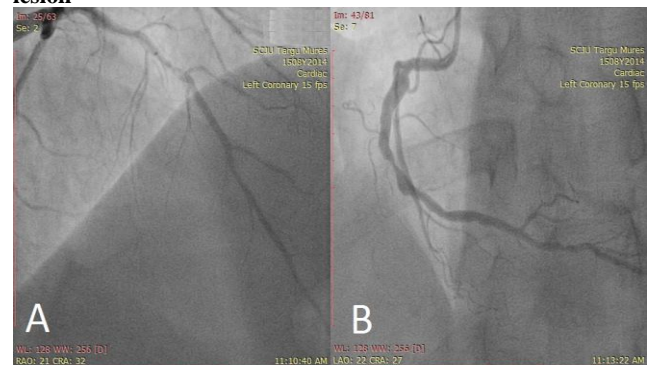
CASE REPORT

We report the case of a 57-year-old male presenting to the emergency room for evaluation of several 20–30 minute episodes of chest pain, dyspnoea in the last 24 hours.

The patient has a history of anterior ST elevation myocardial infarction with thrombolytic therapy (10 years ago,

with no coronary angiography performed after the acute event), hypertension, diabetes mellitus and dyslipidaemia. Electrocardiography (ECG) revealed pathological Q waves in V1–V3, but no other abnormalities. Positive cardiac biomarkers were found (Troponin I 0.3 ng/ml) at presentation. Echocardiographic assessment showed akinesia of the apical third of the interventricular septum, anterior wall and of the apex, hypokinesia of the inferior wall and an ejection fraction of 40%. The calculated GRACE score was 120, the patient was hemodynamic stable and asymptomatic after the medical therapy applied in the emergency room. Coronary angiography was performed after 24 hours and revealed a rechanneled calcified thrombus producing a 90% stenosis on the left anterior descending artery (LAD) (figure no. 1A) and a critical mid-right coronary artery (RCA) lesion (figure no. 1B).

Figure no. 1. Coronary angiograms. A. Right-anterior-oblique cranial view showing rechanneled calcified thrombus producing a 90% stenosis on the left anterior descending artery (LAD). B. Left-anterior-oblique cranial view showing critical mid-right coronary artery (RCA) lesion



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Article received on 12.01.2015 and accepted for publication on 12.05.2015
ACTA MEDICA TRANSILVANICA June 2015;20(2):40-42

CLINICAL ASPECTS

The culprit lesion was considered the RCA lesion and successful coronary angioplasty with bare metal stent implantation was performed (figure no. 2A). Due to the wall motion abnormalities in the anterior descending artery territory, the assessment of myocardial viability of the akinetic segments was required.

For this, a DSE with a myocardial contrast agent was performed, and the presence of viable tissue was found in more than three segments. Based on this, coronary angioplasty with drug eluting stent of the LAD was performed (figure no. 2B).

At the one-month follow-up, the patient was asymptomatic, and bidimensional echocardiographic assessment showed no improvement, but after administration of the myocardial contrast agent (Sonovue), significant improvement of the segmental wall motion score was found (figure no. 3). Three-month follow-up revealed the same aspect.

Figure no. 2. Coronary angiograms. A. Left-anterior-oblique cranial view showing the final angiographic outcome of coronary angioplasty with bare metal stent implantation of the RCA. B. Right-anterior-oblique cranial view showing the final angiographic outcome of coronary angioplasty with drug eluting stent implantation of the LAD

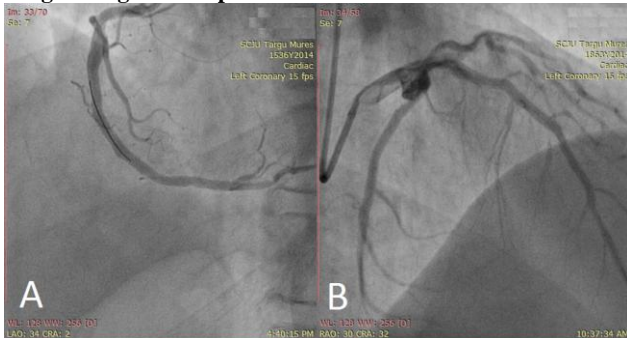
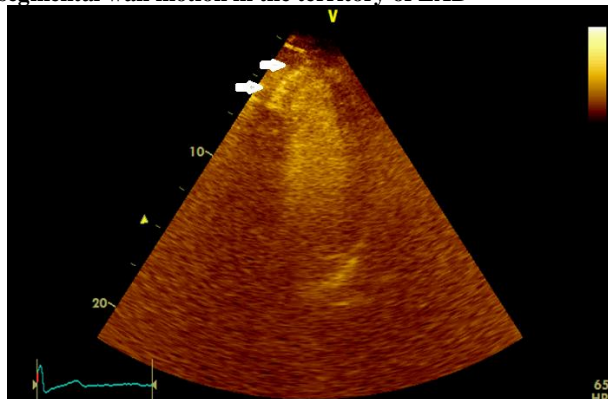


Figure no. 3. Echocardiographic assessment after administration of the myocardial contrast agent (Sonovue) - four chamber view- showing significant improvement of the segmental wall motion in the territory of LAD



DISCUSSIONS

Assessment of viable myocardium has become an important component in the clinical evaluation of patients with chronic ischemic LV dysfunction.(2,10) The meta-analysis published demonstrated an increase in LV ejection fraction in patients with evidence of hibernating myocardium, but no improvement in those without hibernation (11), and a significant association between myocardial revascularisation and improvement in survival rate in patients with LV dysfunction and evidence of myocardial viability independent of the imaging

technique used.(3,12,13) This meta-analysis showed no benefit of revascularisation in patients without viable tissue.

The time course of recovery of viable myocardium after revascularisation may take longer (up to 14 months) for hibernating myocardium compared to stunned myocardium.(10) This prolonged recovery time may be related to the severity of ultrastructural damage from normal, in the case of stunning, to characteristic features of hibernating myocardium such as sarcomere loss, glycogen accumulation and fibrosis.(14) Stunned myocardium showed early recovery of function after revascularisation, whereas hibernating myocardium showed a delayed recovery of function. However, what is important is that both stunned and hibernating myocardium demonstrated a comparable wall motion score at late follow-up, indicating a similar degree of recovery of systolic function after revascularisation.(10) It was also suggested that evaluation of the regional function after revascularisation should be performed first six months or later after the intervention in patients with previous infarctions.(15)

In our case, as we expected, echocardiographic assessment one month after revascularisation showed no improvement in dysfunctional segments; however, after the administration of contrast agents, an improvement was seen in wall motion in these segments. The same result was also found at the three-month follow-up. These findings are due to a better delineation of endocardial borders during rest and stress echocardiography after administration of a contrast agent, making regional wall motion abnormalities and wall thickening easier to evaluate.(9) Contrast echocardiography (by using microbubbles that have a diameter smaller than red blood cells (<7 µm), which remain exclusively within the intravascular space) produces myocardial opacification and facilitates visualisation of left ventricle borders compared with conventional echocardiography.(16,17)

CONCLUSIONS

This case report illustrates patients with “two types of lesions”: one with a clear indication for revascularisation, and the other requiring additional imaging tests to assess myocardial viability.

Adding contrast agents to conventional echocardiography can establish the extent of residual myocardial viability and assess resting LV function more accurately than 2D echocardiography.

Acknowledgement:

“This paper was published under the frame of European Social Fund, Human Resources Development Operational Programme 2007-2013, project no. POSDRU/159/1.5/S/133377”.

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