REVISTA ESPAÑOLA DE CARDIOLOGÍA

Supplementary material

Intracoronary Infusion of Thioflavin-S to Study Microvascular Obstruction in a Model of Myocardial Infarction

Arantxa Hervas[a], Elena de Dios[a], Maria J. Forteza[a], Gema Miñana[a], Julio Núñez[b], Amparo Ruiz-Sauri[c], Clara Bonanad[b], Nerea Pérez[a], Francisco J. Chorro[b] y Vicente Bodí[b,]*

[a]*Instituto de Investigación Sanitaria, INCLIVA, Valencia, España*
[b]*Servicio de Cardiología, Hospital Clínico Universitario, Universitat de València, INCLIVA, Valencia, España*
[c]*Universitat de València, INCLIVA, Valencia, España*

Table 1 of the supplementary material

Left Anterior Descending Artery-perfused Area, Microvascular Obstruction, Infarct Area and Myocardial Wall Thickness in the Right Ventricle in the 3 Series of Experiments

RIGHT VENTRICLE	**1 min**	**1 week**	**1 month**
LAD-perfused area (% of RV)	44 ± 13	45 ± 9	37 ± 12
MVO (% of LAD-perfused area)	11 ± 6[a]	12 ± 10[a]	5 ± 5
Infarct area (% of LAD-perfused area)	0 ± 0	31 ± 19[b]	21 ± 20
Myocardial wall thickness:			
MVO area (mm)	5 ± 0.6	5 ± 0.9	4 ± 0.8[c]
Infarct area (mm)		5 ± 1.3	5 ± 1.8
Adjacent area (mm)	6 ± 1.7	5 ± 1.4	6 ± 1.8
Remote area (mm)	6 ± 1.7	5 ± 1.9	7 ± 2.4

[a]*P*<.05 vs control; [b]*P*<.01 vs control; [c]*P*<.01 vs remote

LAD, left anterior descending artery; MVO, microvascular obstruction; RV, right ventricle.

Table 2 of the supplementary material

Routes, Animal Models and Parameters Evaluated in Experimental Studies Focused on the Analysis of Myocardial Perfusion After Myocardial Infarction.

Thioflavin-S	Animal model	Parameter evaluated	References
Intra-atrial	Mongrel dogs	Microvascular obstruction	Ambrosio et al[1]
Intra-atrial	White rabbits	Microvascular obstruction	Hale et al[2]
Intra-atrial	White rabbits	Microvascular obstruction	Hale et al[3]
Intra-atrial	Mongrel dogs	Microvascular obstruction	Kumar et al[4]
Intra-ventricular	Mongrel dogs	Microvascular obstruction	Rochitte et al[5]
Intra-ventricular	Mongrel dogs	Microvascular obstruction	Wu et al[6]
Intra-venous	Dogs	Flow distribution	Kloner et al[7]
Tail veins	Rats	Microvascular obstruction	Liu et al[8]
Microspheres			
Intra-atrial	Mongrel dogs	Myocardial blood flow	Dörge et al[9]
Intra-atrial	Pigs	Myocardial blood flow	Salminen et al[10]
Intra-ventricular	Mongrel dogs	Myocardial blood flow	Wu et al[6]
Intra-ventricular	Mongrel dogs	Myocardial blood flow	Rochitte et al[11]

Intra-ventricular	Mongrel dogs	Myocardial blood flow	Amado et al[12]
Carbon black			
Intra-atrial	Dogs	Flow distribution	Kloner et al[7]
Evans Blue			
Aortic root	Pigs	Area at risk	Sodha et al[13]
Aortic root	Pigs	Area at risk	Salminen et al[10]
Aorta	Green monkeys	Area at risk	Schumacher et al[14]
Intra-atrial	Mongrel dogs	Area at risk	Schmidt et al[15]
Intra-atrial	Pigs	Area at risk	Poulsen et al[16]
Tail veins	Rats	Area at risk	Liu et al[8]

REFERENCES

1. Ambrosio G, Weisman HF, Mannisi JA, Becker LC. Progressive impairment of regional myocardial perfusion after initial restoration of postischemic blood flow. Circulation. 1989;80:1846-61.

2. Hale SL, Dae MW, Kloner RA. Hypothermia during reperfusion limits 'no-reflow' injury in a rabbit model of acute myocardial infarction. Cardiovasc Res. 2003;59:715-22.

3. Hale SL, Kloner RA. The antianginal agent, Ranolazine, reduces myocardial infarct size but does not alter anatomic no-reflow or regional myocardial blood flow in ischemia/reperfusion in the rabbit. J Cardiovasc Pharmacol and Ther. 2008;13:226-32.

4. Kumar A, Green JD, Sykes JM, Ephrat P, Carson JJ, Mitchell AJ, et al. Detection and quantification of myocardial reperfusion hemorrhage using T2*-weighted CMR. JACC Cardiovasc Imaging. 2011;4:1274-83.

5. Rochitte CE, Lima JAC, Bluemke DA, Reeder SB, McVeigh ER, Furuta T, et al. Magnitude and Time Course of Microvascular Obstruction and Tissue Injury After Acute Myocardial Infarction. Circulation. 1998;98:1006-14.

6. Wu KC, Kim RJ, Bluemke DA, Rochitte CE, Zerhouni EA, Becker LC, et al. Quantification and time course of microvascular obstruction by contrast-enhanced echocardiography and magnetic resonance imaging following acute myocardial infarction and reperfusion. J Am Coll Cardiol. 1998;32:1756-64.

7. Kloner RA, Ganote CE, Jennings RB. The 'No-Reflow' Phenomenon after Temporary Coronary Occlusion in the Dog. J Clin Invest. 1974;54:1496-508.

8. Liu X, Tao GZ. Effects of tirofiban on the reperfusion-related no-reflow in rats with acute myocardial infarction. J Geriatr Cardiol. 2013;10:52-8.

9. Dörge H, Neumann T, Behrends M, Skyschally A, Schulz R, Kasper C, et al. Perfusion-contraction mismatch with coronary microvascular obstruction: role of inflammation. Am J Physiol Heart Circ Physiol. 2000;279:H2587-92.

10. Salminen PR, Dahle GO, Moen CA, Wergeland A, Jonassen AK, Haaverstad R, et al. Reperfusion Therapy with Low-Dose Insulin or Insulin-Like Growth Factor 2; Myocardial Function and Infarct Size in a Porcine Model of Ischaemia and Reperfusion. Basic Clin Pharmacol Toxicol 2014 Apr 19 [E-pub ahead of print]; http://dx.doi.org/10.1111/bcpt.12255.

11. Rochitte CE, Kim RJ, Hillenbrand HB, Chen EI, Lima JAC. Microvascular Integrity and the Time Course of Myocardial Sodium Accumulation After Acute Infarction. Circ Res. 2000;87:648-55.

12. Amado LC, Kraitchman DL, Gerber BL, Castillo E, Boston RC, Grayzel J, et al. Reduction of 'no-reflow' phenomenon by intra-aortic balloon counterpulsation in a randomized magnetic resonance imaging experimental study. J Am Coll Cardiol. 2004;43:1291-8.

13. Sodha NR, Clements RT, Feng J, Liu Y, Bianchi C, Horvath EM, et al. Hydrogen sulfide therapy attenuates the inflammatory response in a porcine model of myocardial ischemia/reperfusion injury. J Thorac Cardiovasc Surg. 2009;138:977-84.

14. Schumacher WA, Grover GJ. The thromboxane receptor antagonist SQ 30,741 reduces myocardial infarct size in monkeys when given during reperfusion at a threshold dose for improving reflow during thrombolysis. J Am Coll Cardiol. 1990;15:883-9.

15. Schmidt SB, Varghese PJ, Bloom S, Yackee JM, Ross AM. The influence of residual coronary stenosis on size of infarction after reperfusion in a canine preparation. Circulation. 1986;73:1354-9.

16. Poulsen RH, Rasmussen JT, Bøtker HE, Waehrens LS, Falborg L, Heegaard CW, et al. Imaging the myocardium at risk with 99mTc-lactadherin administered after reperfusion in a porcine model. Nucl Med Biol. 2014;41:114-9.

FIGURES LEGENDS

Figure 1 of the supplementary material. Dynamics of microvascular obstruction in the right ventricle. Microvascular obstruction was already detected in the 1-min, peaked in the 1-week and partly resolved in the 1-month reperfusion group. A, quantification of microvascular obstruction (represented as percentage of left anterior descending artery perfused area). * *P*<.05 vs control. B, illustrative slices of the 1-min, 1-week and 1-month reperfusion groups. Arrows indicate the microvascular obstruction area.

LAD, left anterior descending artery; MVO, microvascular obstruction; RV, right ventricle.

SUPPLEMENTARY FIGURE 1

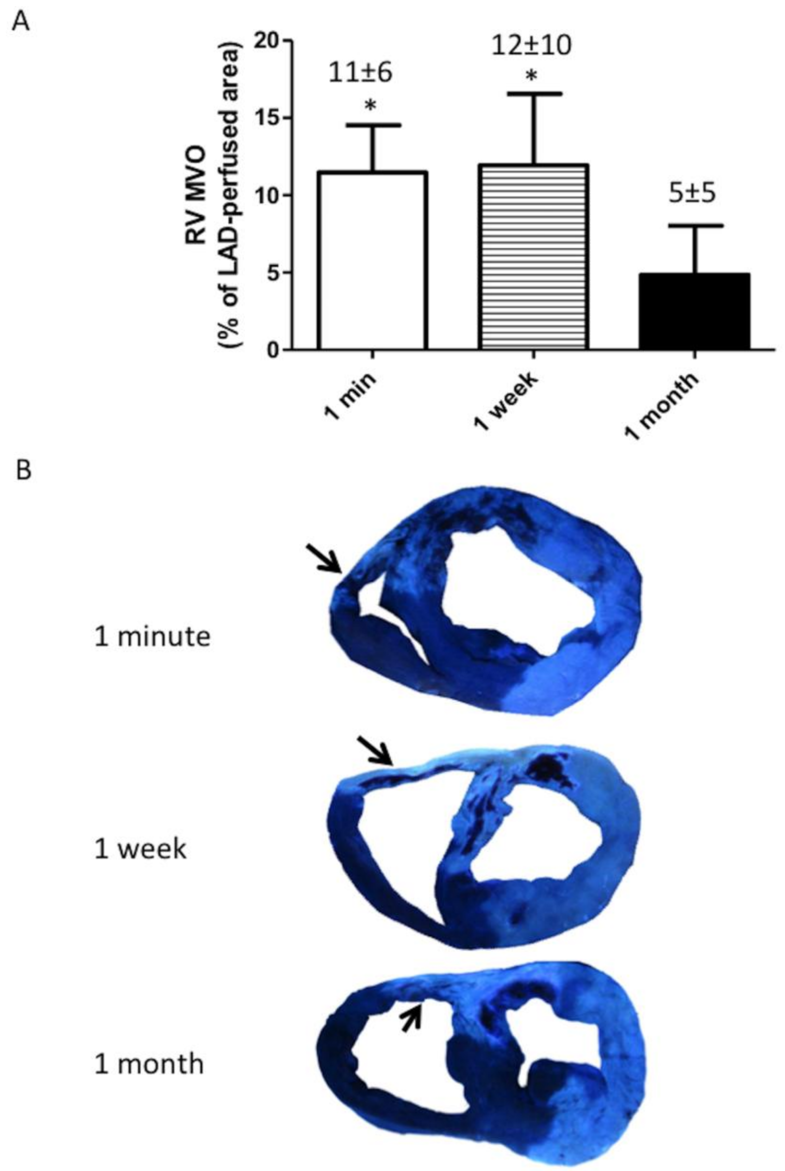

Figure 2 of the supplementary material. Consequences of microvascular obstruction on the right ventricular myocardial wall thickness. A significant thinning of the right ventricle myocardial wall in the microvascular obstruction area took place 1 month after reperfusion.

A, quantification of the right ventricular myocardial wall thickness in the microvascular obstruction, infarct, adjacent and remote areas in the 1-week and 1-month reperfusion groups. ***P*<.01 vs remote area. B, illustrative slices of the 1-week and 1-month reperfusion groups. The white points line indicates the right ventricular myocardial wall thickness in the microvascular obstruction area.

LV, left ventricle; MVO, microvascular obstruction; RV, right ventricle.