

COMBINED DELIVERY OF MYOCARDIAL PROTECTION (ANTEROGRADE AND RETROGRADE) IN A PATIENT WITH ACUTE MYOCARDIAL INFARCTION AND SECONDARY SEVERE ISCHEMIC MITRAL REGURGITATION

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Keywords: myocardial infarction, acute mitral regurgitation, retrograde cardioplegia

Abstract: In patients with severe coronary injuries, antegrade cardioplegia does not provide adequate protection due to an inhomogenous distribution. In these situations, combined administration (anterograde and retrograde) of cardioplegic solution may be an alternative for myocardial protection during aortic crossclamp. The aim of our work is to present a case in which myocardial protection was achieved by intermittent antegrade and retrograde administration of warm blood cardioplegia. A 62 years old patient presented to interventional cardiology with symptoms of severe pectoral angina and severe dyspnea followed by acute pulmonary edema. ECG demonstrates acute postero-inferior myocardial infarction. Echocardiography reveals severe mitral regurgitation by rupture of the posterior papillary muscle. Coronary angiography showed critical stenosis of the left main coronary artery, 70-80% stenosis of the anterior descending artery, obtuse marginal artery and right coronary artery. Given the severe and the severe altered clinical status, the proximal coronary lesions and the mechanical complications of the myocardial infarction, emergency surgical intervention was performed: replacement of the mitral valve with a mechanical prosthesis and double aorto-coronary bypass with autologous saphenous vein. During aortic crossclamp (109 minutes) myocardial protection was achieved by combined administration of 500 ml warm blood administered antegrade in the aortic root, followed by another 500 ml administered retrograde in the coronary sinus, this cycle being repeated intermittently every 20 minutes. After aortic declamping aortic the heart start beating spontaneously, at the weaning of the extracorporeal circulation being needed only small doses of Dobutamine (7 µg/kg/minute) and Norepinephrine (180 ng/kg/minute) and intraaortic balloon counterpulsation (IABP). The postoperative recovery was good, the patient being discharged home at 12 days after the operation. In conclusion we can say that the cardioplegic solution administered intermittently in combined mode (anterograde and retrograde) offers a good myocardial protection in the patient with of severe coronary lesions.

Cuvinte cheie: infarct miocardic, insuficiență mitrală acută, cardioplegie retrogradă

Rezumat: La pacienții cu leziuni coronariene severe, cardioplegia administrată anterograd nu oferă o protecție miocardică adecvată datorită distribuției limitate. În aceste situații, administrarea combinată (anterograd și retrograd) a soluției cardioplegice poate fi o alternativă pentru protecția miocardului în timpul clampajului aortic. Scopul lucrării noastre este prezentarea unui caz la care protecția miocardică s-a realizat prin administrarea intermitentă, antero- și retrogradă a cardioplegiei cu sânge cald. Un pacient în vârstă de 62 de ani a fost adus de urgență în serviciul de cardiologie intervențională cu durere precordială și dispnee ulterior cu edem pulmonar acut. ECG relevă infarct miocardic acut postero-inferior. Ecografia cardiacă evidențiază insuficiență mitrală severă secundar ischemică prin ruptura de mușchi papilar posterior. Coronarografia efectuată în urgență decelează stenoză critică de trunchi artera coronară stângă și stenoze de 70-80% pe artera descendentă anterioară, artera marginală obtuză și artera coronară dreaptă. Având în vedere starea clinică alterată marcat și leziunile coronariene proximale severe cu complicații mecanice ale infarctului miocardic, s-a intervenit chirurgical de urgență, practicându-se înlocuire valvulară mitrală cu proteză mecanică, dublu bypass aorto-coronarian cu venă safenă autologă și implantarea arterei mamare interne pe artera descendentă anterioară. Pentru protecția miocardului, în timpul clampajului aortic (109 minute) s-a administrat cardioplegie cu 500 ml sânge cald introdus anterograd în rădăcina aortei, urmat de încă 500 ml administrați retrograd în sinusul coronarian, cicluri repetate intermitent la 20 minute. După declamparea aortei, cordul a pornit spontan, iar pacientul a fost sevrat de circulația extracorporeală cu doze mici de Dobutamină (7 µg/kg/minut) și Norepinefrină (180 ng/kg/minut). Evoluția postoperatorie a fost favorabilă, pacientul a fost externat la 12 zile după intervenție. În concluzie cardioplegia administrată intermitent în mod combinat anterograd și retrograd oferă o protecție miocardică bună la pacienții cu leziuni coronariene severe.

INTRODUCTION

For the patients with severe coronary lesions, the cardioplegia administered in antegrade manner does not offer

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adequate protection due to de fact that its distribution is not uniform intra-myocardially because of the stenosis.(1) In the literature, the retrograde administration of the cardioplegia is indicated in the patients with multiple and severe stenotic lesions on the coronary arteries and also in the coronary re-interventions.(2)

Recently, the data from literature mortality indicates that the retrograde administration of the cardioplegia is an independent predictive factor for mortality in coronary re-interventions.(3)

Efficacy and the safety of the retrograde administration is limited for the right ventricle.(4) The continuous retrograde administration of the cardioplegia appears to reduce the global myocardial ischemia and increases the ventricular performance.(5)

The acute myocardial infarction due to acute coronary artery occlusion determines an incomplete myocardial protection in the case of antegrade administration of cardioplegia. In these situations, the combined administration antegrade and retrograde of the cardioplegia can be an alternative solution for the myocardial protection during aortic cross clamping.

PURPOSE

The purpose of our work is to present the case of a patient with three vessel coronary artery disease who suffered an acute myocardial infarction complicated with acute mitral insufficiency situation in which, the myocardial protection was realized by intermittent antegrade and retrograde administration of cardioplegia with warm blood.(6)

CASE REPORT

A 62-year-old patient was admitted at the Interventional Cardiology with the symptomatology of acute myocardial infarction, severe chest pain and dyspnoea.

At clinical examination, there were systolic murmurs in the mitral area and the third ventricular sound, pulmonary crepitant crackles bilaterally. On ECG ,there were signs of acute inferior myocardial infarction with positive values for the enzymes of myocardial necrosis. The cardiac echography (figure no. 1) reveals severe mitral insufficiency (figure no. 2) and decrease kinetics of the inferior wall of the left ventricle (figure no. 3).

Figure no. 1. Echocardiographic study

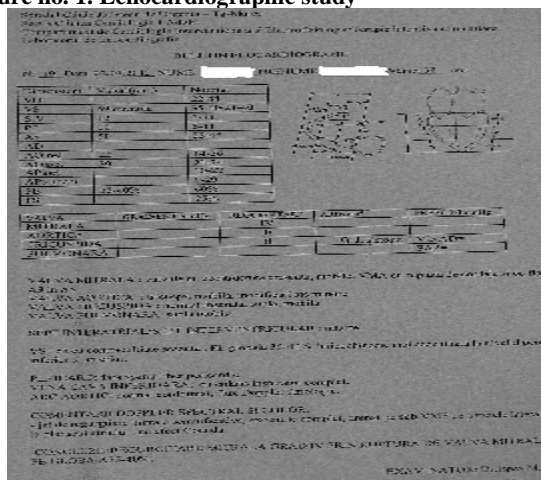


Figure no. 2. Acute mitral regurgitation echography

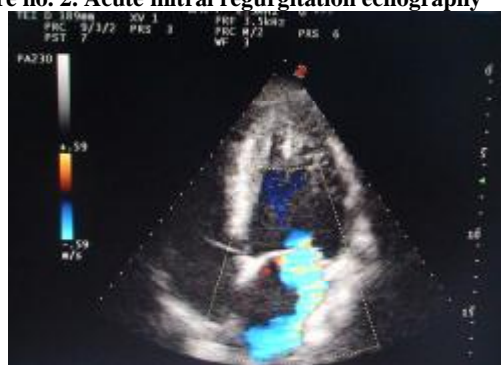
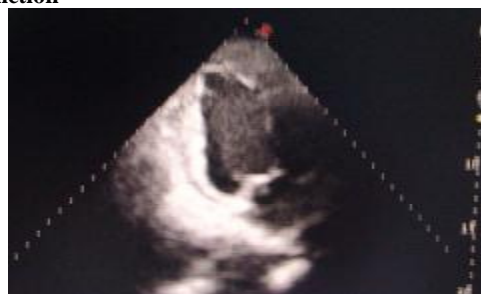


Figure no. 3. Posteroinferior ventricular wall contractility dysfunction



The coronarography showed acute occlusion of the right coronary artery in the first segment (figure no. 4) and severe stenoses 70-80% on „left main” and left anterior descending artery (figure no. 5), circumflex artery and obtuse marginal artery (figure no. 6).

Figure no. 4. Right coronary obstruction



Figure no. 5. Left main stenosis and anterior interventricular artery stenosis



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Figure no. 6. Circumflex arteria severe stenosis



In the setting of this clinical status complicated with acute pulmonary edema due to the mechanical complication (acute mitral insufficiency), the patient was sent to the operating room where on the base of three coronary lesions, the acute status and the described complications, the cardioplegic solution was administered retrograde and after the coronary artery bypass grafting was done the administration was combined anterograde into the aortic root and through the grafts and retrograde through the coronary sinus. The approach to the coronary sinus was direct by the incision of the right atrial wall, so the approach of the mitral valve was done through the atrial septum. In total, cardio-pulmonary bypass (complete clamping of the vena cavae on the canulas) (figure no. 7) in mild hypothermia at 33 degrees Celsius the aorta was cross clamped and 500 ml of the "calafiore" solution (warm blood with potassium) were delivered into the aortic root so anterogradely into the coronary arteries, than after it was open the right atrial wall and a catheter was inserted directly into the coronary sinus and other 500 ml of cardioplegic solution were administered retrogradely (figure no. 8).

Figure no. 7. Total cardiopulmonary bypass- two venous canulae



Figure no. 8. Retrograde cardioplegic administration

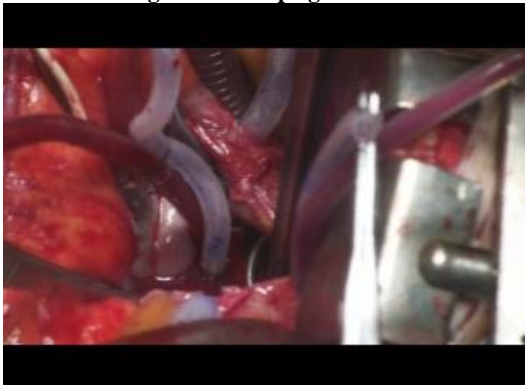


Figure no. 9. Coronary venous safena bypass



Then the left anterior descending artery and the right coronary artery were bypassed (figure no. 9) with autologous venous grafts (if we would use internal mammary artery the operation time would have been prolonged). The obtuse marginal artery was too small and calcified so it could not be bypassed. After this was done the cardioplegia was administered combined anterogradely into the aortic root and through the grafts (500 ml) and retrogradely into the coronary sinus (500 ml) in cycles repeated on every 20 minutes during all the time of the mitral valve replacement (figure no. 10, 10^{''}) until aortic declamping, when the heart start beating spontaneously and was weaned from extracorporeal circulation with small doses of Dobutamine (5 µg/kg/min) and Norepinephrine (180 ng/kg/min) plus intra-aortic balloon pump.

Figure no. 10. Mitral valve replacement

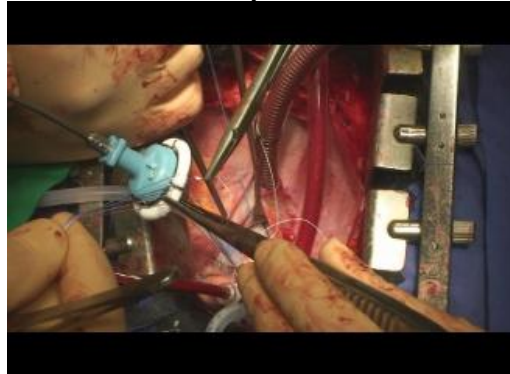
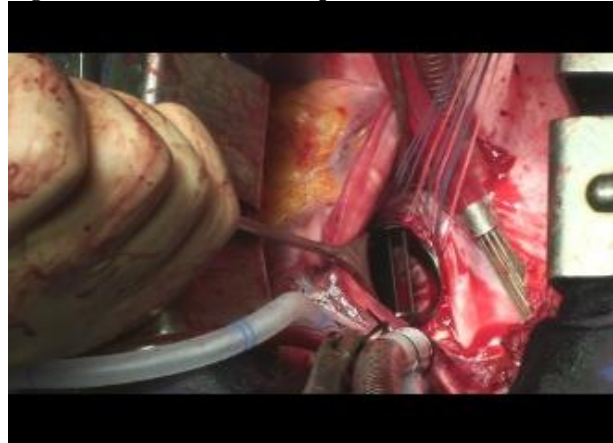


Figure no. 10^{''}. Mitral valve replacement



The cross aortic time was 109 minutes and the cardiopulmonary bypass was 140 minutes. During the administration

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of cardioplegia anterogradely it were determined the values of lactic acid and the markers of acidosis (ph, BE, standard bicarbonate) from coronary sinus and from cardioplegia respectively when administered retrogradely from aortic root and cardioplegia in order to compare them and to determine the efficacy of the myocardial protection in these two ways of administration. The values for lactic acid are in table no. 1.

Table no. 1. Lactic acid value

Stage	Input			Output			Ttest p value
	average	min	max	average	min	max	
preclamp	1,25	0,4	1,85	1,42	0,7	2,21	0,0023
Retrograde cardioplegia	1,58	0,5	2,72	2,38	1,2	4,93	
Anterograde cardioplegia	1,63	1,3	2,28	4,12	2,2	4,98	
Antero and retrograde cardioplegia	1,7	0,8	2,35	4,9	1,5	4	
	1,83	1,5	2,68	5,31	3,24	5,01	
	2,2	1,3	2,41	7,01	5,72	5,35	
declamp 0	2,16	0,7	3,05	5,01	1,39	5,48	
declamp 10	2,12	1,32	2,68	2,4	1,38	3,33	

DISCUSSIONS

From the table no. 1, it can be observed that the lactic acid in retrograde administration present values under 4 mmol / L compared with the first anterograde administration initial when the values are over 6 mmol / L. (the normal Astrup values determined on Cobas b 221 device are untill 2,5 mmol / L). The graphic representation of the data (figure no. 11) shows a superior myocardial protection, with small values of the lactic acid, if you compare retrograde with anterograde administration. The postoperative evolution was good the patient being extubated at 48 hours (due to acute pulmonary edema), the intra-aortic balloon pump was stopped at 72 hours and there was no need of inotropics at 4 days when the patient went on the normal ward from ICU and it was discharged home 12 days after the operation. Postoperator ehco-cardiographic study describes normal cord recuperation (figure no. 12).

Figure no. 11. Lactic acid evolution during cardiac cardioplegia administration

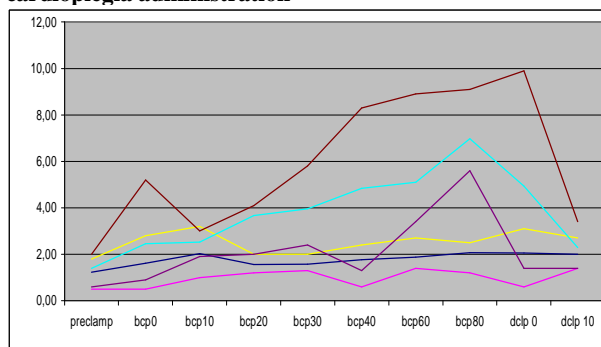
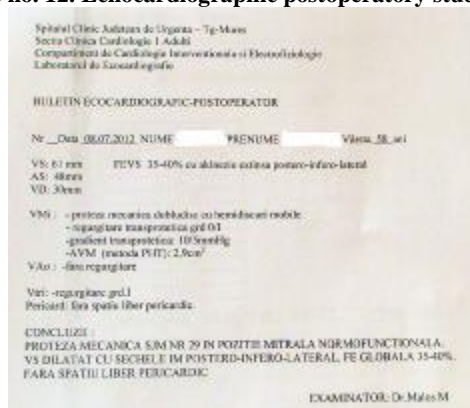


Figure no. 12. Echocardiographic postoperative study



CONCLUSIONS

The cardioplegic solution administered anterogradely and retrogradely offers a "better" myocardial protection in the case of patients with severe coronary artery disease especially in the setting of acute myocardial infarction when that myocardial area in unprotected during aortic cross clamping only by the anterograde administration of cardioplegia.

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