

Urgent Hybrid Approach in Treatment of the Acute Myocardial Infarction Complicated by the Ventricular Septal Rupture

Mina Radosavljević-Radovanović^{1,2}, Nebojša Radovanović^{2,3}, Aleksandra Arandjelović^{1,2}, Predrag Mitrović^{1,2}, Ana Ušćumlić^{1,2}, Goran Stanković^{1,2}

¹Cardiology Clinic, Clinical Center of Serbia, Belgrade, Serbia;

²Faculty of Medicine, University of Belgrade, Belgrade, Serbia;

³Emergency Center, Clinical Center of Serbia, Belgrade, Serbia

SUMMARY

Introduction Ventricular septal rupture (VSR) in the acute myocardial infarction (AMI) is a rare but very serious complication, still associated with high mortality, despite significant improvements in pharmacological and surgical treatment. Therefore, hybrid approaches are introduced as new therapeutic options.

Case Outline We present an urgent hybrid approach, consisting of the initial percutaneous coronary intervention (PCI) of the infarct-related artery, followed by immediate surgical closure of the ventricular septal rupture, for treatment of high risk, hemodynamically unstable female patient with AMI caused by one-vessel disease and complicated by VSR and cardiogenic shock. Since the operative risk was also very high (EUROSCORE II 37%), this therapeutic decision was based on the assumption that preoperative PCI could promptly establish blood flow and thereby lessen the risks, duration and complexity of urgent cardiosurgical intervention, performed on the same day. This approach proved to be successful and the patient was discharged from the hospital on the fifteenth postoperative day in stable condition.

Conclusion In selected cases, with high operative risk and unstable hemodynamic state due to AMI complicated by VSR, urgent hybrid approach consisting of the initial PCI followed by surgical closure of VSR may represent an acceptable treatment option and contribute to the treatment of this complex group of patients.

Keywords: acute myocardial infarction; primary angioplasty; ventricular septal rupture

INTRODUCTION

Ventricular septal rupture (VSR) in the acute myocardial infarction (AMI) is a rare but very serious complication, still associated with high mortality. Despite significant improvements in medical treatment and revascularization and surgical techniques, mortality ranges from 24%-87% in surgically and higher than 90% in medically treated patients [1, 2, 3]. The diagnosis is confirmed by echocardiography, which differentiates VSR from the acute mitral regurgitation, and locates and quantifies the rupture. Left ventricular dysfunction and magnitude of the left-to-right shunt are primary determinants of survival, as well as of the acute and chronic heart failure. According to current guidelines for diagnosis and treatment of AMI, early surgical repair of the ventricular septal defect (with concomitant bypass surgery, if required) is the treatment of choice, even in hemodynamically stable patients, since there is always a risk of rupture extension and hemodynamic collapse [4]. Still, the operative risk is high, especially in hemodynamically unstable patients [3, 5]. Therefore, hybrid approaches are introduced as new therapeutic options.

CASE REPORT

An 80-year-old woman was admitted to Coronary Care Unit (CCU) with clinical and electrocardiographic signs of the anterior AMI, accompanied by congestive heart failure and harsh systolic murmur along the left parasternal border. According to history data, she had chest pain on the evening before, but continued to be active and carry out home jobs. The following day, the chest pain recurred and was followed by dyspnea and fatigue, so she decided to go to hospital. On admission, the patient was adynamic, hypotensive, oliguric, with cold extremities and the heart rate was 100/min. Laboratory findings showed increased levels of troponin I (3,8 µg/L) and decreased creatinine clearance (50 ml/min), while the rest was within normal limits. Echocardiographic exam revealed 13 mm wide defect in the apical part of the ventricular septum, with significant left-to-right shunt (pressure gradient 75 mmHg) (Figure 1). Left ventricular systolic function was severely depressed – the apex was entirely akinetic, septum and anterior wall were severely hypokinetic, the overall ejection fraction (EF) was 30% (biplane method). Based on tricuspid regurgitation 2-3+, indirectly estimated pres-

Correspondence to:

Mina RADOSAVLJEVIĆ-RADOVANOVIĆ
Cardiology Clinic
Clinical Center of Serbia
5 Dr. Koste Todorovića St.
11000 Belgrade
Serbia
radovanovic@sbb.rs

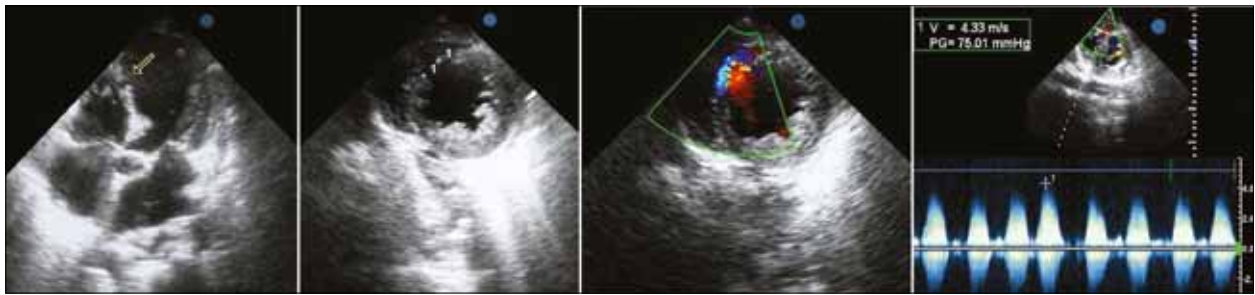


Figure 1. Echocardiographic findings showing VSR

sure in pulmonary artery was 61 mmHg. Treatment was started initially with diuretics, nitrates and inotropes, but since hemodynamic instability persisted despite medical therapy, urgent coronary angiography was performed in order to proceed with surgical treatment as soon as possible. Coronary angiogram showed one-vessel disease, i.e. thrombotic occlusion of the “hook like” left coronary artery (LAD) in its proximal part. Immediately formed Heart team, consisting of cardiologist from the CCU, interventional cardiologist and cardiac surgeon, decided that, because of extremely high operative risk (EUROSCORE II 37%), percutaneous coronary intervention (PCI) of the infarct related artery should be performed before surgery, in order to establish coronary blood flow as soon as possible and decrease risk, duration and complexity of the cardio-surgical intervention. Optimized balloon angioplasty was performed on proximal part of LAD (Figure 2) and, since adequate TIMI flow was achieved, the coronary stent was not implanted in order to lessen the risk of bleeding by withdrawal of loading dose of dual antiplatelet therapy. The patient was operated on the same day – successful surgical closure of VSR with patch plastic technique was performed. In the postoperative course, the symptoms and signs of heart failure gradually regressed and dual antiplatelet therapy was started on the second postoperative day. Postoperative transthoracic echocardiographic exam revealed 1 cm wide hyperechogenic patch, on the position of previous VSD, without the signs of residual shunt. Left ventricular function was improved, an overall EF was 40%. On postoperative day 15, the patient was discharged from the hospital in stable condition.

DISCUSSION

Reviewing the literature, we found that, with the development of interventional cardiology techniques, various hybrid approaches in the treatment of complex coronary patients have been described, mainly combining percutaneous transcatheter closure of VSR and surgical coronary bypass grafting. For instance, in most severe patients, percutaneous closure of the defect was done as the initial, less invasive procedure, enabling hemodynamic stabilization of the patient until the final surgical treatment [6]. Hybrid approach was also successfully used in hemodynamically stable patients with posterior VSR complicating AMI, when the initial coronary bypass grafting was followed by elective percutaneous transcatheter closure of the ventricular septal

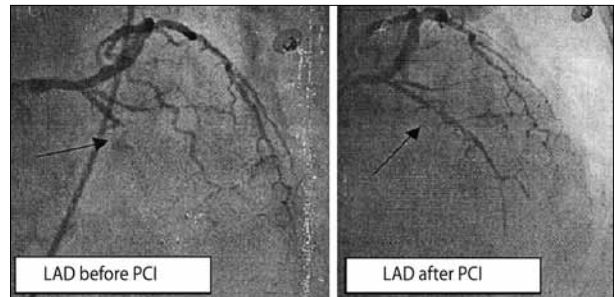


Figure 2. Coronary angiogram showing infarct-related artery (LAD) before and after percutaneous coronary intervention (PCI)

defect [7]. Although recently published data from non-randomized retrospective study by Sathanathan J. have shown non-inferiority of percutaneous closure compared to surgical [8], still, the experience with this approach is limited, and residual shunts are common [9]. Therefore, further technical developments and prospective trials are required to identify patients best suited for transcatheter closure. In our institution, early percutaneous closure of post-infarction VSR is not routinely performed.

Although according to current guidelines emergency surgical repair of the ventricular septal defect is necessary in patients with AMI complicated by VSR, there is still no agreement on the optimal timing of this intervention, because the operative risk is high (caused by necrotic, friable myocardium and often the hemodynamically unstable state of the patient) and, on the other hand, delayed surgery carries the risk of rupture extension and hemodynamic deterioration [4, 9]. Our patient had most important predictors of death - older female with reduced renal function, large myocardial infarction with severely reduced ejection fraction and acute heart failure, as well as significant left-to-right shunt caused by VSR. Furthermore, she had signs of cardiogenic shock resistant to medical therapy. Since in patients with cardiogenic shock, the only therapeutic option that shortens its duration and prevents end-organ damage is early correction of the defect [3], urgent surgical intervention was inevitable. On the other hand, the operative risk was also very high – calculated EUROSCORE was 37%, so we assumed that preoperative, less invasive opening of the infarct-related artery by primary PCI, could promptly establish blood flow and thereby provide better outcome by lessening the risk, duration and complexity of urgent cardio-surgical intervention. Reviewing the literature, we could not find any description of similar approach, probably because of very rare first patient's presentation with

AMI already complicated by VSR (it more often happens in the early postinfarction period). In the presented case, this approach proved to be successful.

In selected cases, with high operative risk and unstable hemodynamic state due to AMI complicated by VSR, ur-

gent hybrid approach consisting of the initial percutaneous coronary intervention, followed by immediate surgical closure of VSR may represent an acceptable treatment option and contribute to the treatment of this complex group of patients.

REFERENCES

1. Poulsen SH, Praestholm M, Munk K, Wierup P, Egeblad H, Nielsen-Kudsk JE; for the GUSTO Trial Investigators. Ventricular septal rupture complicating acute myocardial infarction: clinical characteristics and contemporary outcome. *Ann Thorac Surg.* 2008; 85:1591-6.
2. Moreyra AE, Huang MS, Wilson AC, Deng Y, Cosgrove NM, Kostis JB, for MIDAS Study Group (MIDAS 13). Trends in incidence and mortality rates of ventricular septal rupture during acute myocardial infarction. *Am J Cardiol.* 2010; 106:1095-100.
3. Menon V, Webb JG, Hillis LD, Sleeper LA, Abboud R, Dzavik V, et al. Outcome and profile of ventricular septal rupture with cardiogenic shock after myocardial infarction: a report from the SHOCK Trial Registry. Should we emergently revascularize occluded coronaries in cardiogenic shock? *J Am Coll Cardiol.* 2000; 36:1110-6.
4. Steg PG, James SK, Atar D, Badano LP, Blömstrom-Lundqvist C, Borger MA, et al; for The Task Force on the management of ST-segment elevation acute myocardial infarction of the European Society of Cardiology. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. *Eur Heart J.* 2012; 33(20):2569-619.
5. Crenshaw BS, Granger CB, Birnbaum Y, Pieper KS, Morris DC, Kleiman NS, et al; for GUSTO-I (Global Utilization of Streptokinase and TPA for Occluded Coronary Arteries) Trial investigators. Risk factors, angiographic patterns, and outcomes in patients with ventricular septal defect complicating acute myocardial infarction. *Circulation.* 2000; 101:27-32.
6. Avgerinos DV, Feldman DN, Salemi A. Unplanned staged hybrid management of postmyocardial infarction ventricular septal defect. *Cardiology.* 2011; 118:38-41.
7. Boyle MJ, Sibal AK, Ruygrok PN, Edwards M, Alison P. Hybrid management of an unusual presentation of acute ischemic ventricular septal defect. *N Z Med J.* 2008; 121(1285):119-22.
8. Sathananthan J, Ruygrok P. Evolution in the management of postinfarct ventricular septal defects from surgical to percutaneous approach: a single-center experience. *J Invasive Cardiol.* 2013; 25(7):339-43.
9. O'Gara PT, Kushner FG, Ascheim DD, Casey DE Jr, Chung MK, de Lemos JA, et al. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol.* 2013; 61(4):e78-140.

Хитан хибридни приступ у лечењу акутног инфаркта миокарда компликованог руптуром коморског септума

Мина Радосављевић-Радовановић^{1,2}, Небојша Радовановић^{2,3}, Александра Аранђеловић^{1,2}, Предраг Митровић^{1,2}, Ана Ушћумлић^{1,2}, Горан Станковић^{1,2}

¹Клиника за кардиологију, Клинички центар Србије, Београд, Србија;

²Медицински факултет, Универзитет у Београду, Београд, Србија;

³Ургентни центар, Клинички центар Србије, Београд, Србија

КРАТАК САДРЖАЈ

Увод Руптура коморског септума (РКС) је ретка, али веома тешка компликација акутног инфаркта миокарда (АИМ). Праћена је високом стопом смртности болесника и данас, упркос значајном напретку фармаколошког и хируршког лечења ових болесника. Због тога се све више уводе хибридни приступи, као нове терапијске опције.

Приказ болесника Представили смо хитан хибридни приступ који се састојао од иницијалне примарне перкутане коронарне интервенције (ПКИ) инфарктне артерије, непосредно праћене хируршким затварањем дефекта коморског септума, у лечењу високоризичне, хемодинамски нестабилне болеснице са АИМ узрокованим једносудовном коронарном болешћу и компликованим РКС и кардиогеним шоком. Како је операциони ризик такође био веома висок

(*EUROSCORE II* 37%), ова терапијска одлука је била заснована на претпоставци да би преоперациона ПКИ могла да смањи ризик, трајање и комплексност хитне хируршке интервенције брзим успостављањем протока у инфарктној артерији. Овај приступ се показао успешним у приказаном случају и болесница је отпуштена из болнице 15. постоперационог дана у стабилном стању.

Закључак Код хемодинамски нестабилних, високоризичних болесника са АИМ компликованим руптуром коморског септума хитан хибридни приступ (иницијална ПКИ праћена хируршким затварањем дефекта) може да буде прихватљива терапијска опција и допринесе лечењу ове комплексне групе болесника.

Кључне речи: акутни инфаркт миокарда; примарна ангиопластика; руптура коморског септума

Примљен • Received: 22/07/2013

Ревизија • Revision: 23/09/2013

Прихваћен • Accepted: 07/10/2013