

Primary percutaneous transluminal coronary angioplasty in the acute infarction of the right ventricle

Branko Gligić*, Vjekoslav Orozović*, Slobodan Obradović*, Siniša Rusović†, Jelena Kostić†, Branislav Baškot‡, Dragan Dinčić*, Anđelka Ristić-Anđelkov*

Military Medical Academy, *Clinic for Urgent Internal Medicine, †Institute of Radiology, ‡Institute of Nuclear Medicine, Belgrade

Background. Predilection site for the acute myocardial infarction of the right ventricle, (AMI-RV) is the upper third of the right coronary artery and for this reason such an infarction is followed by numerous complications, primarily by conduction disorders and very often by sudden and rapid cardiogenic shock development. **Methods.** Primary percutaneous transluminal coronary angioplasty (PPTCA) was performed on three patients, in whom the acute infarction of the right ventricular was diagnosed and who had been hospitalized six hours after the beginning of chest pain. In all three patients intracoronary stent was implanted. On the admission patients had been in the threatening cardiogenic shock, with the prominent chest pain and with the elevation of ST-segment in $V_4R > 2$ mV. In the course of intervention patients were administered low-molecular intracoronary heparin, with direct platelet glycoprotein IIb/IIIa inhibitors (abciximab), according to the established procedure applied in such cases. **Results.** The complete dilatation of the infarcted artery was established with the signs of reperfusion and the further clinical course was completely normal, there was no heart failure and patients had no subjective difficulties. **Conclusion.** Invasive approach in the treatment of AMI-RV is justifiable, and possibly the therapy of choice of these patients, providing well trained and equipped team is available.

Key words: myocardial infarction; ventricular dysfunction, right; angioplasty, transluminal, percutaneous coronary; coronary vessels; stents; platelet aggregation inhibitors; heparin, low-molecular-weight; platelet glycoprotein GpIIb-IIIa complex.

Introduction

The goal of the current therapy of myocardial infarction of the right ventricle (AMI-RV) is rapid, and if possible, complete patency achievement of the infarction artery in order to reduce the size of necrosis, establish the reperfusion of the affected area and at the same time prevent other possible complications, and reduce mortality rate (1, 2). The extensive necrosis is affecting inferoposterior segment of the right ventricle associated with the infarction extension to the free wall of the right ventricle (RV), distal half of interventricular septum, papillary muscles, valvular apparatus with cardiac con-

duction system. Owing to these facts prognosis and early clinical course within the first 24 hours are quite uncertain, and the mortality rate is from 20 do 50% (3-5). Parallel with fibrinolytic therapy administration, there is a growing interest for mechanical reperfusion by using primary or delayed (life saving or rescue) balloon dilatation (6-8).

Three patients with the diagnosed AMI-RV associated with inferoposterior infarction of the left ventricle in whom specific treatment protocol and primary percutaneous transluminal coronary angioplasty (PPTCA) were applied are presented in this paper. On the admission, patients received aspirin 300 mg perorally together with the combination of intracoro-

intracoronary low-molecular heparin (enoxaparin 20 mg) and intravenous unfractionated heparin 5000 intravenous (i.v.) immediately before angioplasty. All patients received abciximab, glycoprotein IIb/IIIa inhibitor 10 mg before and 10 mg after the stent implantation into the right coronary artery. The therapy was continued with enoxaparin 1 mg/kg subcutaneously (s.c.) every 12 hours and with 10 mg of abciximab in i.v. infusion during the first 12 hours after the performed PPTCA.

Case reports

1. Female patient, 60 years of age, first infarction: on the admission there was a slow atrial fibrillation with ventricular response 60/min, together with the signs of inferoposterior infarction of the right ventricle. Blood pressure was 80/40 mmHg. Risk factors were smoking and the in-

creased cholesterol level. Ultrasound of the heart performed immediately after admission showed dilated right ventricle associated with tricuspid failure and RV pressure of 40 mmHg. Three hours after the onset of AMI-RV, PPTCA and intracoronary stent implantation were performed. ECG taken immediately after PPTCA showed the rapid resolution of ST segment for more than 70% with the early formation of the negative T-wave (signs of the early mechanical reperfusion). Control echocardiography before discharging still showed dilated right ventricle and RV pressure was still 40 mmHg. After the discharge clinical finding was normal and there were no subjective difficulties during the four months follow-up period.

Fig. 1) ECG on the admission. Fig. 2) ECG right-sided leads. Fig. 3) Before and after the dilatation (PPTCA). Fig. 4) ECG immediately after the dilatation. Fig. 5) ECG right-sided leads after the dilatation.

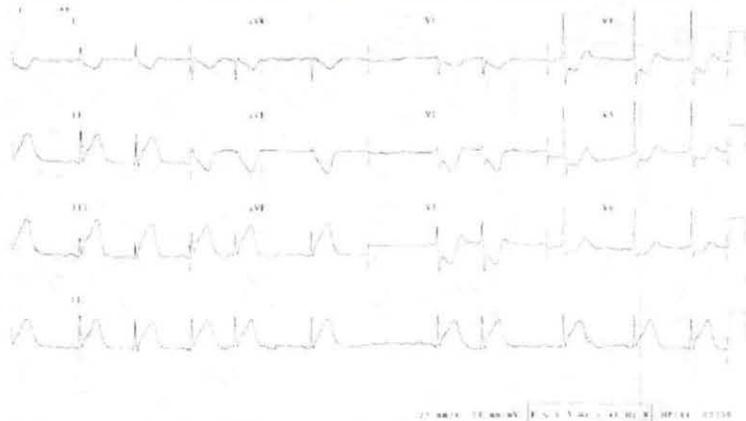


Fig. 1 – ECG on the admission.

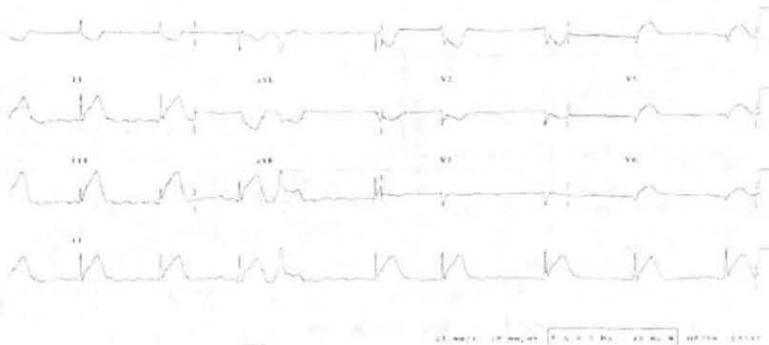


Fig. 2 – ECG right-sided leads.

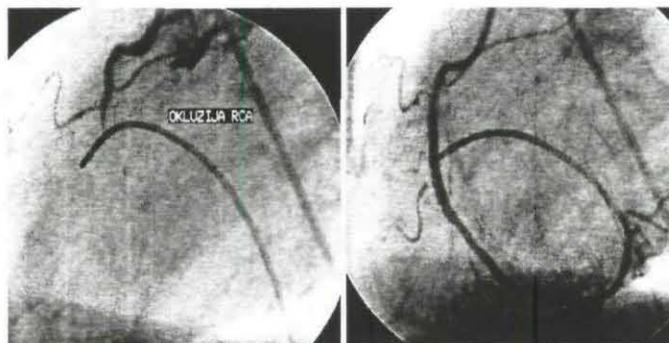


Fig. 3 – Before and after the dilatation (PPTCA).

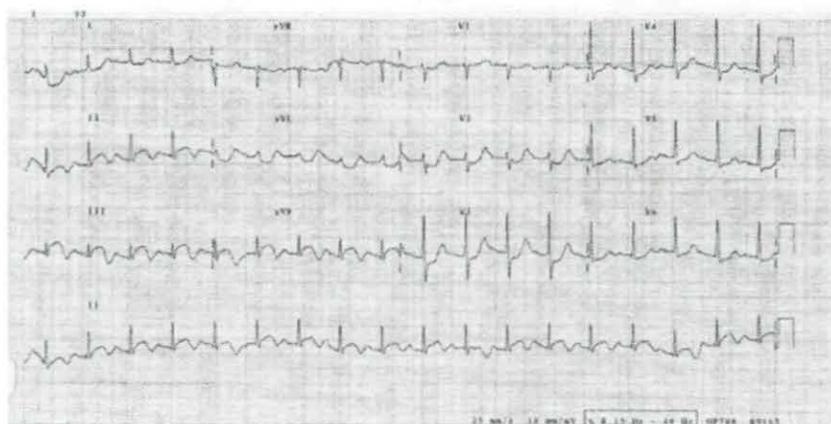


Fig. 4— ECG immediately after the dilatation.

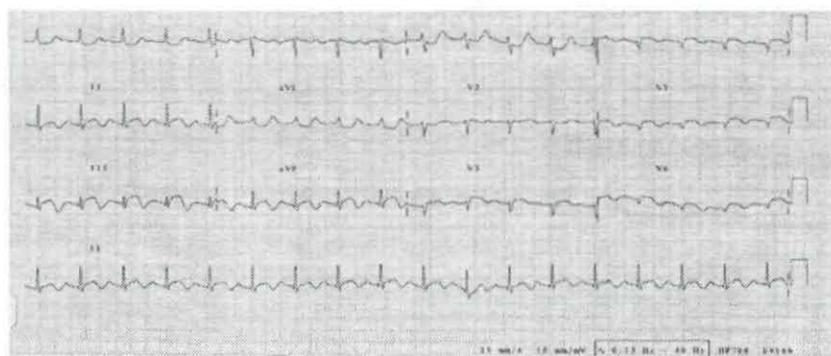


Fig. 5 – ECG right-sided leads after the dilatation.

2. Female, 69 years of age, first infarction: on the admission sinus bradycardia was 55/min, AV block grade II⁰ (Mobitz II), and there were signs of inferoposterior infarction of the right ventricle. Blood pressure was 80/40. Risk factors were smoking and the increased cholesterol level. Ultrasound of the heart on the admission showed dilated right ventricle, tricuspid regurgitation 2+ and RV pressure higher than 30 mmHg. PPTCA was performed two hours after the infarction and due to the dissection of the right coronary artery intima 3 intracoronary stents were implanted

successfully. Echocardiography finding before the discharge estimated ejection fraction (EF)=50%, with the inferior wall hypokinesis and normal RV. Clinical findings were normal, and after being discharged from the hospital the patient was without subjective difficulties within the three months follow-up period.

Fig. 6) ECG on the admission. Fig. 7) ECG right-sided leads. Fig. 8) High stenosis of the RCA. Fig. 9) Coronarography after PPTCA with 3 stents in a series.

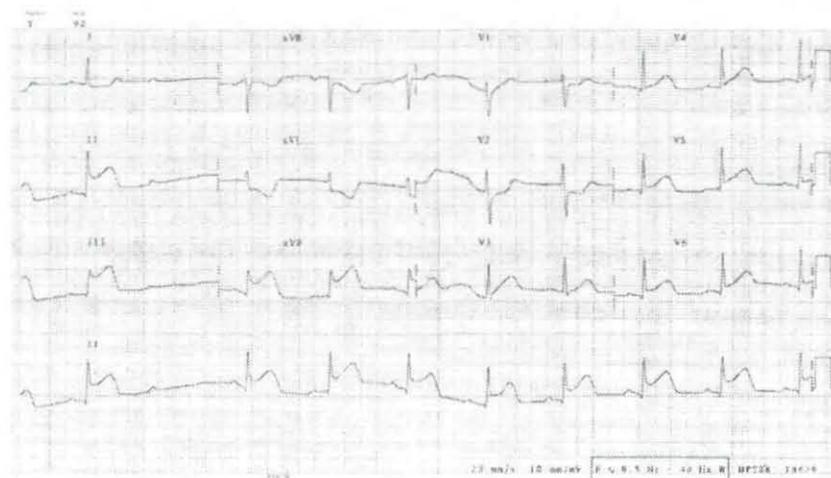


Fig. 6 – ECG on the admission.

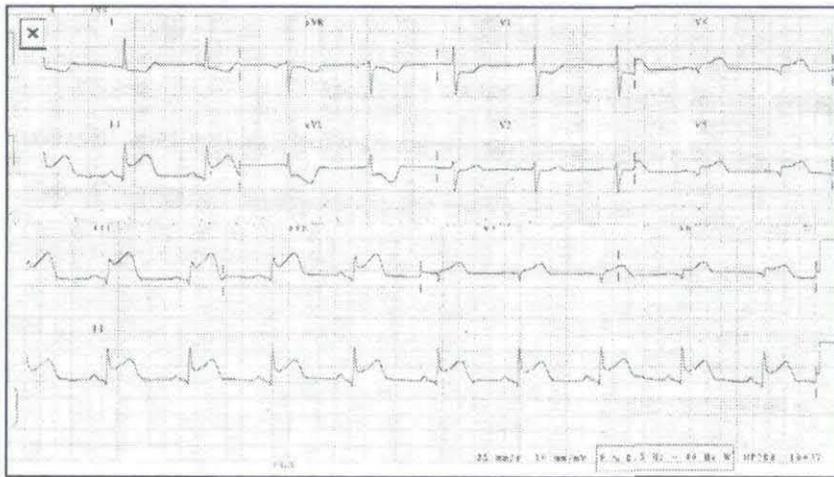


Fig. 7 – ECG right-sided leads

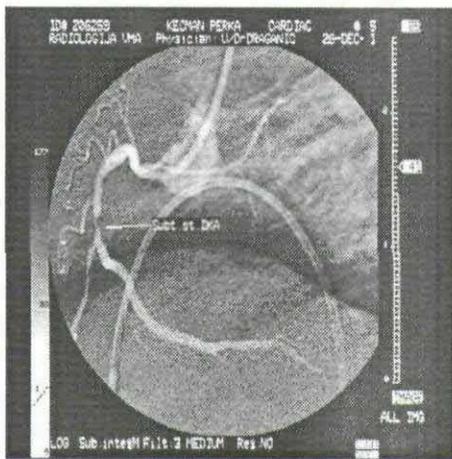


Fig. 8 – High stenosis of the RCA



Fig. 9 – Coronarography after PPTCA with 3 stents in a series

3. Male, 77 years of age, first infarction: on the admission, sinus rhythm, heart rate 70/min., AV block was I⁰, with signs of inferoposterior infarction of the right ventricle. Blood pressure was 120/70. Risk factors were peripheral arterial disease (intermittent claudication of the lower leg), diabetes type 2, and stable angina pectoris. Six hours after the onset of chest pain PPTCA of the right coronary artery was performed and intracoronary stent was implanted. The patient also had the complete left anterior de-

scendent (LAD) occlusion. Cardiac ultrasound finding before the discharge showed EF 45%, akinesia of the medial and apical segment of inferior wall together with hypokinesia of inferior segment of the lateral wall and RV of normal dimensions. After being discharged, patient's clinical findings were normal and without subjective difficulties during the three months follow-up period.

Fig. 10) ECG on the admission. Fig. 11) Dilatation of RCA with the stent implantation.

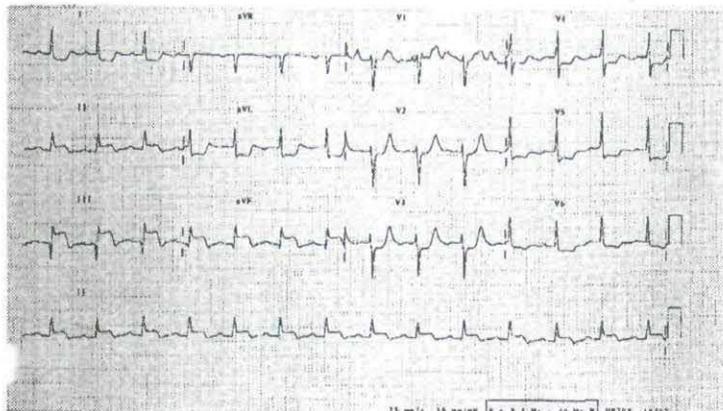


Fig. 10 – ECG on the admission.

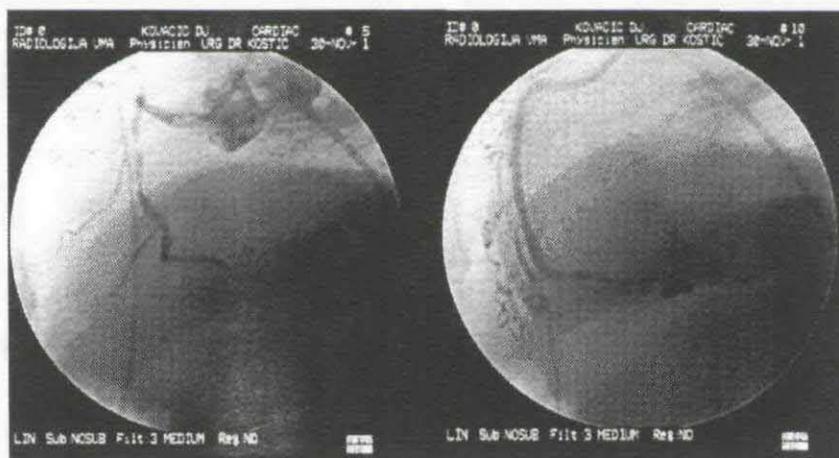


Fig. 11 – Dilatation of RCA with the stent implantation.

Discussion

Patients with combined myocardial infarction of the left and right ventricle generally require complex therapy: volume replacing, in order to increase the reduced minute volume, fibrinolytic or PPTCA therapy in combination with antiaggregatory and anticoagulant therapy, or delayed PTCA and intracoronary stent. First communications on successful application of PPTCA in patients with AMI-RV and rapid haemodynamic recovery of the patient previously being in cardiogenic shock indicated a new era of interventional cardiology in the treatment of these patients (9). A great number of following studies dealing with the problem of PPTCA or the delayed PTCA in the treatment of the acute myocardial infarction cited that in about 90% of patients the maximum blood flow (TIMI-3) through the infarcted artery was achieved after the balloon dilatation, giving much better results in comparison with the common intravenous fibrinolytic therapy (10–12).

The results of an extensive randomized study GUSTO IIb by comparing effects of the accelerated protocol with tissue-type plasminogen activator and PPTCA showed that mechanical reperfusion had reduced mortality rate for 33% in AMI and in serious cerebrovascular accidents during the first 30 days of the hospital treatment. However, during the following 4 months the percentage of the engaged artery restenosis was even 45%, which significantly diminished the efficiency of this method of treatment (13).

For this reason modified PPTCA was introduced and direct glycoprotein inhibitors (abciximab) in combination with antiaggregation agents and low-molecular heparin were included into the therapeutic protocol. A great number of following studies, as well as several randomized ones, showed that therapy modified in this way and administered within the first 12 hours from the onset of AMI reduced the mortality rate, myocardial reinfarction, urgent revascularization and postinfarction angina for 48% in comparison with the patients underwent PTCA, but without glycoprotein inhibitors (14, 15).

This is the first report in our medical literature of the successful treatment of AMI-RV by PPTCA in combination with abciximab and low-molecular weight heparin together with intracoronary stent implantation in all 3 patients and is in accordance with ACC/AHA recommendations (16). Patients who displayed the threatening cardiogenic shock confirmed by ECG, with conduction disorders in the form of AV block grade I⁰-III⁰ and who came within the first 6 hours from the onset of AMI-RV were urgently sent to catheterization room due to their serious condition, where pacemaker was implanted and urgent coronarography with PPTCA was performed in the same act. Rapid clinical recovery, ST elevation regression for more than 50% within the first 6 hours after the intervention and the maximum increase of cardiospecific enzymes within the first 12 hours from the onset of AMI convincingly confirmed favourable clinical course. The SPECT performed within two weeks after the intervention confirmed successful reperfusion in the area of the infarcted artery. Only in one case echocardiographic finding showed slower course of the right ventricle recovery with persisting tricuspid failure and right ventricle pressure of 40 mmHg, but all other clinical indicators were normal.

Our experience in the treatment of patients with PPTCA was also confirmed by other studies which undoubtedly upheld our attitude that invasive approach with urgent coronarography was the only hope for survival of these patients and that it should be performed whenever possible, if personnel and technical equipment are provided (17–20).

Conclusion

Patients with AMI-RV represent a subgroup with the very high risk within the scope of inferoposterior engaging of the left ventricle with numerous and hardly predictable complications resulting in high mortality rate. Our initial experience in the treatment of these patients by PPTCA completely confirmed that this therapeutic approach was absolutely justifiable in patients with cardiogenic shock, if there were contraindications for fibrinolytic therapy, or if

the optimal period of 6 hours after the onset of infarction had passed. Complete recovery of our patients and their normal clinical course within the first three months after being discharged from the hospital showed that the invasive

approach in the treatment of AMI-RV was justifiable and the possible therapy of choice of these patients, providing both trained personnel, including a team of interventional cardiologists, and technical equipment.

REFERENCES

1. *Kinch JW, Ryan TJ.* Right ventricular infarction. *N Engl J Med* 1994; 330(17): 1211-7.
2. *Isner JM, Roberts WC.* Right ventricular infarction complicating left ventricular infarction secondary to coronary heart disease. Frequency, location, associated findings and significance from analysis of 236 necropsy patients with acute or healed myocardial infarction. *Am J Cardiol* 1978; 42(6): 885-94.
3. *Dell'Italia LJ.* The right ventricle: anatomy, physiology and clinical importance. *Curr Probl Cardiol* 1991; 16(10): 653-720.
4. *Cohn JN, Guha NH, Broder MI, Limas CJ.* Right ventricular infarction. Clinical and hemodynamic features. *Am J Cardiol* 1974; 33(2): 209-14.
5. *Etiene Y, Bosch J, Poinson P, Guiserix J, Bellet M, Blanc JJ, et al.* Right ventricular function during the convalescence phase of posterior primary infarction. *Arch Mal Coeur Vaiss* 1985; 78(3): 396-403. (in French)
6. *Zehender M, Kasper W, Kaunder E, Schonhaler M, Geibel A, Olchewski M, et al.* Right ventricular infarctions as an independent predictor of prognosis after acute inferior myocardial infarction. *N Engl J Med* 1993; 328(14): 981-8.
7. *Serrano Junior CV, Ramires JA, Cesar LA, Zweier JL, Rati M, De Luz P, et al.* Prognostic significance of right ventricular dysfunction in patients with acute inferior myocardial infarction and right ventricular involvement. *Clin Cardiol* 1995; 18(4): 199-205.
8. *Erhardt LR.* Clinical and pathological observations in different types of acute myocardial infarction. A study of 84 patients deceased after treatment in a coronary care unit. *Acta Med Scand* 1974; 560 Suppl: 1-78.
9. *Moreyra AE, Such C, Porvay MN, Kostis JB.* Rapid hemodynamic improvement in right ventricular infarction after coronary angioplasty. *Chest* 1988; 94(1): 197-9.
10. *Movahed A.* Treatment of right ventricular infarction. *Am Fam Physician* 1999; 60(6): 1640-9.
11. *Orozović V, Krgović M, Rafajlovski S.* Thrombolytic therapy and percutaneous transluminal coronary angioplasty in patients with right ventricular infarction. *Kardiologija* 2001; 22(1-2): 33-41. (in Serbian)
12. *Jorgensen B, Simonsen S, Forfang K, Endersen K, Thaulow E.* Effect of percutaneous transluminal coronary angioplasty on exercise in patients with and without previous myocardial infarction. *Am J Cardiol* 1998; 82(9): 1030-3.
13. *THE GUSTO II INVESTIGATORS.* A clinical trial comparing primary coronary angioplasty with tissue plasminogen activator for acute myocardial infarction [editorial]. The Global Use of Strategies to Open Occluded Coronary Arteries in Acute Coronary Syndromes (GUSTO IIb) Angioplasty Substudy Investigators. *N Engl J Med* 1997; 336(23): 1621-8.
14. *Schomig A, Kastrati A, Dirschinger J, Mehilli J, Schricke U, Pache J, et al.* Coronary stenting plus platelet glycoprotein IIb/IIIa blockade compared with tissue plasminogen activator in acute myocardial infarction. Stent versus Thrombolysis for Occluded Coronary Arteries in Patients with Acute Myocardial Infarction. Study Investigators. *N Engl J Med* 2000; 343(6): 385-91.
15. *Montalescot G, Barragan P, Wittenberg O, Ecollan P, Elhadad S, Villain P, et al.* Platelet glycoprotein IIb/IIIa inhibition with coronary stenting for acute myocardial infarction. *N Engl J Med* 2001; 344(25): 1895-903.
16. *Ryan TJ, Anderson JL, Antman EM, Braniff BA, Brooks NH, Califf RM, et al.* ACC/AHA guidelines for the management of patients with acute myocardial infarction: executive summary. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol* 1996; 28(5): 1328-428.
17. Comparison of invasive and conservative strategies after treatment with intravenous tissue plasminogen activator in acute myocardial infarction [editorial]. Results of the thrombolysis in myocardial infarction (TIMI) phase II trial (Committee on Management of Acute Myocardial Infarction). The TIMI Study Group. *N Engl J Med* 1989; 320(10): 618-27.
18. *O'Rourke RA.* Treatment of right ventricular infarction: thrombolytic therapy, coronary angioplasty or neither? *J Am Coll Cardiol* 1998; 32(4): 882-4.
19. *Goldstein JA.* Right heart ischemia: pathophysiology, natural history, and clinical management. *Prog Cardiovasc Dis* 1998; 40(4): 325-41.
20. *Berger PB, Ruocco NA Jr, Ryan TJ, Jacobs AK, Zaret BL, Wackers FJ, et al.* Frequency and significance of right ventricular dysfunction during inferior wall left ventricular myocardial infarction treated with thrombolytic therapy (results from the thrombolysis in Myocardial Infarction [TIMI] II trial). The TIMI Research Group. *Am J Cardiol* 1993; 71(13): 1148-52.

The paper was received on April 4, 2002.

A p s t r a k t

Gligić B, Orozović V, Obradović S, Rusović S, Kostić J, Baškot B, Dinčić D, Ristić-
-Anđelković A. Vojnosanit Pregl 2003; 60(1): 81–87.

**PRIMARNA PERKUTANA TRANSLUMINALNA KORONARNA ANGIOPLASTIKA U
AKUTNOM INFARKTU DESNE KOMORE**

Uvod. Predilekcijsko mesto za nastanak akutnog infarkta miokarda desne komore (AIM-DK) je gornja trećina desne koronarne arterije, zbog čega je ovakav infarkt praćen mnogobrojnim komplikacijama, u prvom redu poremećajima sprovođenja i često naglim i brzim razvojem kardiogenog šoka. **Metode.** Primarna perkutana transluminalna koronarna angioplastika (PPTKA) urađena je kod tri bolesnika kod kojih je dokazan akutni infarkt desne komore (AIM-DK), a koji su primljeni na bolničko lečenje u prvih šest sati od početka anginoznih bolova i sva tri bolesnika su dobila intrakoronarni stent. Pri prijemu, bolesnici su ispoljavali simptome pretećeg kardiogenog šoka, sa izraženim anginoznim bolovima i elevacijom ST-segmenta u V_4R većom od 2 mV. U toku intervencije svi su dobili niskomolekulski heparin intrakoronarno uz direktni inhibitor glikoproteina trombocita IIb/IIIa (abciximab), prema ustaljenom protokolu koji primenjujemo u takvim slučajevima. **Rezultati.** Postignuta je potpuna dilatacija zahvaćene arterije uz znake reperfuzije i dalji klinički tok je prošao potpuno normalno, a u daljem praćenju u sledeća tri meseca po izlasku iz bolnice, bolesnici su kardijalno kompenzovani i bez ikakvih subjektivnih tegoba. **Zaključak:** Invazivni pristup lečenju AIM-DK je opravdana i moguća terapija izbora za ove bolesnike, pod uslovom da je sprovodi dobro obučeni i opremljen tim.

K l j u č n e r e č i : infarkt miokarda; srce, disfunkcija desne komore; angioplastika, translumenska, perkutana, koronarna; A.A.coronariae; stentovi; antiagregaciona sredstva; heparin, niskomolekulski; glikoproteini trombocita, GPIIb-IIIa kompleks.