



Successful treatment of cardiogenic shock by stenting of the left main coronary artery in acute myocardial infarction

Uspešno lečenje kardiogenog šoka uzrokovanog akutnim infarktom miokarda zbog stenozе i tromboze glavnog stabla leve koronarne arterije implantacijom stenta

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Abstract

Introduction. Patients with non-ST elevation acute coronary syndromes (NSTEMI-ACS) are sometimes severely hemodynamically compromised. Urgent coronary angiography should be performed in these patients in percutaneous coronary intervention (PCI) centers according to the ESC NSTEMI-ACS guidelines to determine suitability for percutaneous or surgical revascularization. **Case report.** We reported a 62-year-old male with chest pain admitted to the Coronary Care Unit. ST segment depression of 2 mm in leads I, L and V4-6 was revealed at electrocardiogram. After following 6 hours the patient had chest pain and signs of cardiogenic shock despite of the therapy. Chest x-ray showed pulmonary edema. Echocardiographic examination showed dyskinetic medium and apical segments of septum. The patient underwent coronary angiography immediately which revealed 75% stenosis of the left main coronary artery with thrombus. The use of a GPIIb/III inhibitor-tirofiban and stent implantation resulted in TIMI III flow. After that the patient had no chest pain and acute heart failure subsided in the following days Echocardiography done at the fourth day from PCI showed only hypokinesis medium and apical segment of septum. The patient was discharged at day 11 from admission in a stable condition. **Conclusion.** Stenting of left main coronary artery stenosis in patients with cardiogenic shock and non-ST segment elevation acute coronary syndromes may be a life saving procedure.

Key words:

myocardial infarction; electrocardiography; coronary angiography; thrombolytic therapy; stents.

Apstrakt

Uvod. Bolesnici sa akutnim koronarnim sindromom (AKS) bez ST elevacije ponekad su teško hemodinamski kompromitovani. Takvim bolesnicima treba izvršiti urgentnu koronarnu grafiju u centrima za perkutane koronarne intervencije (PKI) prema preporukama Evropskog kardiološkog društva za AKS bez ST elevacije radi procene pogodnosti za perkutanu ili hiruršku revaskularizaciju. **Prikaz bolesnika.** Bolesnik, star 62 godine, sa bolom u grudima primljen je u Koronarnu jedinicu. Na EKG-u registrovana je depresija ST segmenta 2 mm u odvodima DI, aVL i V4-6. Narednih šest sati od prijema i pored terapije bolesnik je imao anginozne bolove i kliničke znake kardiogenog šoka. Na radiografiji pluća nađen je plućni edem. Ehokardiografskim ispitivanjem nađeni su diskinetični srednji i apikalni segmenti septuma. Bolesniku je odmah urađena koronarnografija koja je pokazala 75% stenozu glavnog stabla leve koronarne arterije sa trombom. Dat je inhibitor GpIIb/IIIa – tirofiban i implantiran je stent nakon čega je registrovan TIMI III (*thrombolysis in myocardial infarction*) protok. Narednih dana bolesnik je bio bez bola u grudima i bez znakova srčane insuficijencije. Ehokardiografski pregled koji je izvršen četvrtog dana od PKI pokazao je samo hipokineziju srednjeg i apikalnog segmenta septuma. Bolesnik je otpušten 11. dana u stabilnom stanju. **Zaključak.** Postavljanje stenta kod stenozе glavnog stabla leve koronarne arterije kod bolesnika sa kardiogenim šokom i akutnim koronarnim sindromom bez ST elevacije može biti životno spašavajuća procedura.

Ključne reči:

infarkt miokarda; elektrokardiografija; angiografija koronarnih arterija; tromboliza, terapijska; stentovi.

Introduction

Congestive heart failure (CHF) is a common complication in patients presenting with non-ST segment elevation

acute coronary syndrome (ACS) strongly associated with adverse clinical outcomes¹. There are the results which demonstrate CHF incidence of approximately 5% in these patients¹. Cardiogenic shock can occur in the setting of both

ST-elevation myocardial infarction (STEMI) and non-ST-elevation myocardial infarction (NSTEMI) and there is a high mortality and morbidity in each ². The SHOCK (Should we emergently revascularize occluded coronaries for cardiogenic shock) studies find out that approximately 20% of all cardiogenic shock complicating are associated with NSTEMI. The data from TIMI-3B show that the incidence of left main coronary artery narrowing in patients with unstable coronary syndromes is 4 to 8% ³.

Nonrandomized studies report markedly lower mortality rates among patients who have already undergone revascularization for shock ⁴. In a cohort of 27 patients with cardiogenic shock complicating AMI, O'Neill et al. ⁵ reported an in-hospital mortality rate of 67%. The rate was dramatically reduced to 25% in patients treated with successful emergency angioplasty of the infarct-related artery.

Emergency cardiac catheterization and possible angioplasty is an instrument in saving life of patients, particularly when left main coronary artery (LMCA) stenosis is present ^{6,7}.

ADMIRAL trial was a study designed to examine the effects of abciximab on primary stenting in 300 patients with AMI. There was a significant 59% reduction at 30 days in the composite end point of death, recurrent myocardial infarction or urgent target vessel revascularization in the stent-abciximab group compared with the stent-placebo group ⁸.

Also, emergency coronary artery bypass grafting (CABG) is effective but time-consuming and carries the risk of extensive, irreversible myocardial damage ⁹. Lee et al. ¹⁰ have recently reported 1-year unprotected-LMCA PCI outcomes that are equivalent to outcomes from CABG.

One of the most commonly used methods for mechanical circulatory support is an intra-aortic balloon pump counterpulsation and is a class I recommendation from the American College of Cardiology/American Heart Association guidelines for management of acute myocardial infarction in the presence of cardiogenic shock ¹¹.

Case report

A 62-year old man was admitted to a Coronary Care Unit. He had typical anginal pain of 10 min duration, with back irradiation on effort and at rest a couple of days before the admittance. On admission he had more intensive and frequent chest pain. He had only one of classical risk factors for coronary artery disease – smoking. The data of personal history – by-pass grafting of both femoral artery 7 years ago. On physical examination the patient appeared generally well. Blood pressure (BP) was 115/85 mmHg. The electrocardiogram (ECG) showed ST segment depression of 2 mm in leads I, L and V4-6 (Figure 1). After the admission the patient had persistent chest pain, BP was 80/60 mmHg pulmonary edema developed (Killip grade III/IV) and diuresis stopped. Electrocardiographic changes were the same except tachycardia. On admission biomarkers were positive: creatin kinase (CK) 1825 IU/l, troponin I 110 µg/l. Other laboratory analyses were: glucose 8.2 mmol/l, urea 5.0 mmol/l, creatinine 116.2 µmol/l, cholesterol 4.8 mmol/l, HDL cholesterol 0.75 mmol/l, LDL cholesterol 3.43 mmol/l, triglycerides 1.6

mmol/l, arterial blood gases: oxygen partial pressure (pO₂) 6.86 mm Hg, oxygen saturation (sO₂) 84%, carbon dioxide partial pressure (pCO₂) 4.03 mm Hg, pH 7.38. Next day glucose was 5.2 mmol/L, AST (aspartate aminotransferase) 232.7 IU/l, ALT (alanine aminotransferase) 55.7 IU/l, C-reactive protein (CRP) 149.9 mg/l and BNP (brain natriuretic peptide) 392.8 pmol/l.



Fig. 1 – The admission electrocardiography shows ST depression of 1 mm in leads I, L V4-6

Chest x-ray showed very prominent pulmonary stasis (Figure 2). Echocardiographic finding was: end-diastolic

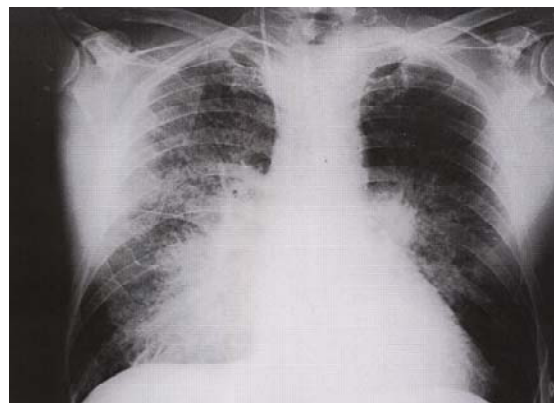


Fig. 2 – Evidence of very prominent pulmonary stasis on the admission day

diametar (EDD) 6.7 cm, end-systolic diametar (ESD) 5.5 cm, left ventricular ejection fraction (LVEF) 35% (assessed by Simson's equation), medium and apical segments of septum were dyskinetic. The patient was treated with enoxaparine, aspirin, nitrates, dopamine, furosemide, digoxin and oxygen and underwent coronary angiography 6 hours after the admission. The coronarography showed 75% stenosis of LMCA with thrombus (Figure 3). The coronary angiogram of the other coronary artery was normal. Tirofiban was given per standard protocol (17 ml bolus continued for 36 h infusion of 15 ml/h) with 600 mg of clopidogrel and thereafter direct stenting with Taxus 3,5 × 12 mm and inflated to 10 bars for 30 seconds. Subsequent coronary angiography showed TIMI III flow without residual stenosis of LMCA (Figure 4). The procedure was without complications. After

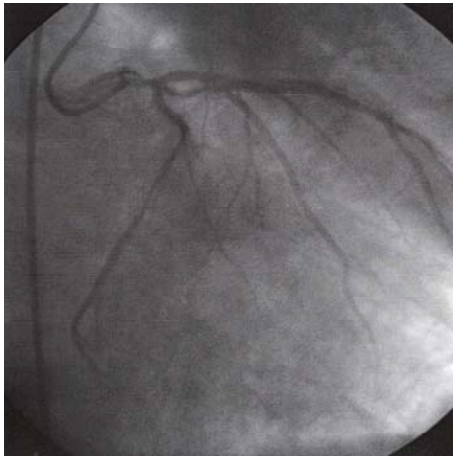


Fig. 3 – Coronary angiography revealed significant stenosis of the left main left coronary artery with thrombus (arrowhead)

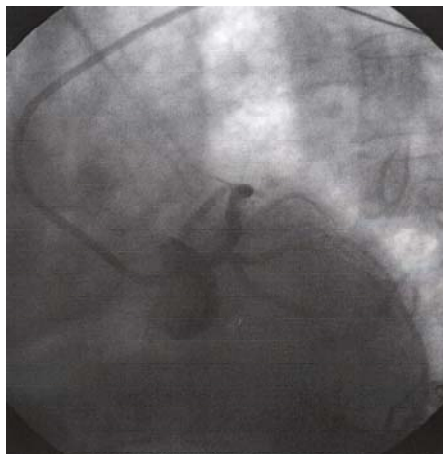


Fig. 4 – After direct stenting with Taxus normal flow to the vessel was reestablished

that the patient had no chest pain. Next days pulmonary finding was normalized, chest x-ray was also normal (Figure 5).

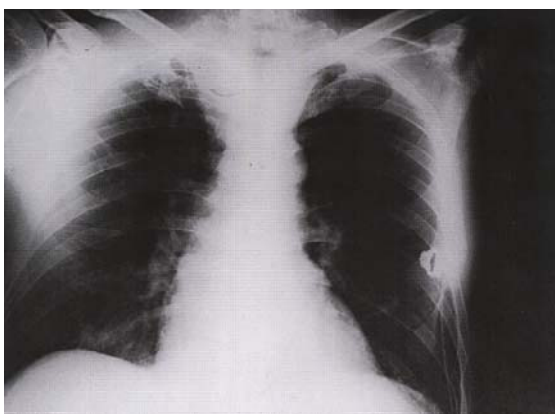


Fig. 5 – Chest X-ray four days after stenting was normal

Echocardiography finding performed after the fourth day was: EDD 5.8 cm, ESD 4.6 cm, EF 0.50 (assessed by Simson's equation) with mild hypokinesia medium and apical segments of septum (Figure 6). All valves were normal, aortic root dimension 3.5 cm, left atrial dimension 3.8 cm and

right ventricular dimension 2.5 cm (assessed by Simson's equation). At discharge ECG registered ST depression of 0.5 mm in leads I, L, V3-6 with neg. T waves (Figure 7). The patient was discharged from the hospital at day 11 in stable condition free of chest pain and other cardiac symptoms with aspirin, clopidogrel, metoprolol, simvastatine, captoprile, isosorbide-dinitrate, furosemide 40 mg, spironolactone 25 mg and potassium.

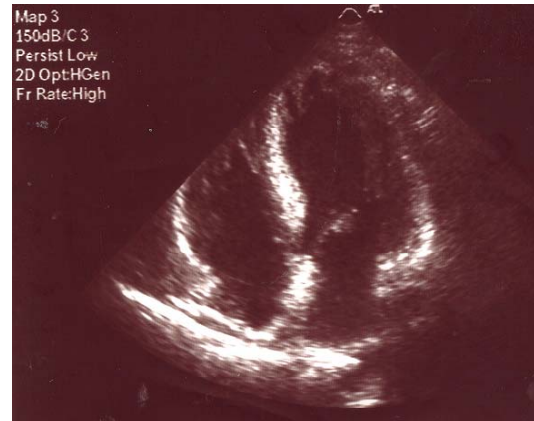


Fig. 6 – Echocardiography performed after four days showed EF 0.50 and mild hypokinesia of medium and apical segments of septum



Fig. 7 – Electrocardiography at discharge: ST depression of 0,5 mm in leads I, L, V3-6

Discussion

The patient had cardiogenic shock as the consequence of NSTEMI caused by reversible ischemia rather than myocardial ischemic necrosis demonstrated by good left ventricular ejection fraction (LVEF) after a successful and early stenting left main coronary artery (LMCA). Patients with acute heart failure due to ischemia may respond to treatment and myocardial dysfunction can return to normal when ischemia is reversible. Patients with ACS are at substantially increased risk of recurrent ischemic events and death during the acute phase (OASIS-2). There is an increased risk of heart failure development in patients with NSTEMI compared with patients with unstable angina, suggesting that myocardial cell necrosis is an important determinant for

heart failure development in patients with ACS¹. The second mechanism of heart failure, is a reversible myocardial stunning and third preexisting impairment of the left ventricular function. Heart failure (HF) in the patients with ACS on admission is associated with a marked increase in mortality rate during hospitalization (the Global Registry of Acute Coronary Events – GRACE). Invasive strategy is associated with a better outcome in NSTEMI patients at high risk and as demonstrated in TACTICS-TIMI 18 when a GP IIB/IIIa inhibitor is used¹². The ISAR-COOL (Intracoronary Stenting with Antithrombotic Regimen Cooling-off) trial randomized 410 intermediate – to high-risk patients to very early angiography and revascularization versus a delayed invasive strategy. All the patients were treated with intensive medical therapy that included aspirin, heparin, clopidogrel (600 mg loading dose), and the intravenous GP IIB/IIIa receptor inhibitor tirofiban. A very early invasive strategy was associated with significantly better outcome at 30 days.

Therapy of ischemia relieves not only symptoms but also prevent and attenuate ventricular remodeling and progression of HF thereby improving prognosis¹³. In NSTEMI there exists nontransmural myocardial ischemia and enzyme rise is associated with myocardial necrosis. Echocardiography may demonstrate myocardial ischaemia and possible myocardial salvage after angioplasty. In LE MANS study the patients with LMCA treated PCI had improved significantly LVEF in comparison with the CABG group at 1 year¹⁴.

Cardiac troponins are the preferred markers because of their diagnostic and risk stratification purposes and in most cases their rise has been shown to be associated with bad outcome¹⁵. C-reactive protein may be useful in prediction of the long term prognosis¹⁶.

In patients with unstable angina and non-ST-elevation myocardial infarction, high levels of BNP is accompanied by a two-to threefold greater risk of death and with the occurrence of subsequent heart failure, also¹⁷.

Coronary artery bypass surgery (CABG) has been considered the therapy of choice for patients with unprotected LMCA stenoses¹⁸. The favorable Veterans Administration surgical trial and poor initial angioplasty results in patients

with LMCA stenoses have made coronary artery bypass surgery (CABG) the accepted therapy of choice for patients with LMCA stenosis and a gold standard. However, elective angioplasty and stenting of the left main coronary artery in selected patients was associated with a high immediate success rate¹⁸. Conventional LM coronary artery angioplasty due to mortality which was 65% at 20 months has been restricted to patients for whom surgery is a high-risk procedure and to those who need urgent treatment¹⁸. Our patient was severely hemodynamically compromised and prompt revascularization by means of LMCA stenting was a turning point in saving his life. Also, previous studies have demonstrated low in-hospital complication rates with unprotected LM stenting. However, in the study which determined long term clinical outcomes in patients with ostial or bifurcation LM stenting adverse events (myocardial infarction, sudden death) occurred during the follow-up period (mean 28 mos) in both groups with equal frequency. The two-year outcomes of the patients with unprotected LM stenosis who were treated with drug-eluting stent (DES) compared with those treated with bare-metal stent (BMS) were evaluated and showed lower incidences of cardiac death and stent thrombosis in DES groups. The results at 1-year of retrospective analysis which was performed to adjust for the differences between the patients with LM stenosis treated with DES implantation or coronary artery bypass grafting (CABG) did not reveal the differences in the occurrence of major adverse cardiac and cerebrovascular event¹⁹. In the study of unprotected LM stenting versus bypass surgery (LE MANS study) the patients with LM stenosis treated with percutaneous coronary intervention had favorable early outcomes in comparison with patients treated with CABG¹⁴.

Conclusion

The introduction of stents has increased the number of indications for LM coronary artery angioplasty making this procedure safe and effective in selected patients.

Aggressive and immediate treatment by angioplasty and stenting an unprotected left main coronary artery stenosis may be effective in the patients with NSTEMI and heart failure.

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