Emergency redo coronary bypass surgery with application of both radial arteries and small saphenous vein in a 55-year-old male. Case report

Ratunkowa reoperacja wieńcowa z zastosowaniem dwóch tętnic promieniowych i żyły odpiszczelowej małej u 55-letniego mężczyzny. Opis przypadku

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Abstract

Myocardial infarction as an early complication after CABG contributes to higher postoperative mortality. Redo CABG is connected with higher risk than first time CABG. Choice of the conduit during redo surgery is influential for postoperative follow-up. Radial arteries are relatively infrequently applied during redo emergency surgery.

One of the factors influencing the results of redo CABG is myocardial protection. Retrograde
administration of cardioplegia (RCP) resuscitates the ischaemic myocardium and gives good
myocardial preservation. We present a case of emergent redo coronary surgery with the
application of radial arteries.

Key words: postoperative infarction, redo CABG, RCP.

Streszczenie

Zawał mięśnia sercowego jest wczesnym powikłaniem po zabiegu CABG i związany jest ze zwiększoną pooperacyjną śmiertelnością. Powtórne zabiegi CABG są obarczone większym ryzykiem niż operacje pierwotne. Wybór odpowiedniego konduitu ma znaczenie dla przebiegu pooperacyjnego. Tętnice promieniowe są stosunkowo rzadko używane w powtórnych operacjach wieńcowych. Zastosowanie kardioplegii podawanej wstecznie powoduje dobrą protekcję mięśnia sercowego w tego typu zabiegach. Przedstawiamy przypadek pilnej powtórnej rewaskularyzacji z zastosowaniem dwóch tętnic promieniowych.

Słowa kluczowe: zawał pooperacyjny, redo-CABG, RCP.

The 55-year-old patient was diagnosed in the local cardiology department. The angiography revealed severe stenosis in the left main (LM) 90%, and 80% stenosis in the right coronary artery (RCA). The patient was referred to cardiac surgeons and the decision to operate was made at once.

The patient was transported to the cardiothoracic department and operated on a regular basis as an elective case. Local examination before surgery revealed moderate varicose veins. The Allen test was performed to establish circulation in the radial arteries (RA) in case of no saphenous vein acceptable for grafting (SVG). The operation was conducted in typical fashion with the use of cardiopulmonary bypass (CPB). The first left internal mammary artery (LIMA) was harvested. After cutting the distal part of the harvested artery there was no flow in the vessel, although the artery wall seemed unchanged. LIMA was taken as a free graft. After establishing CPB and cross-clamping the aorta, protection was used with warm blood cardioplegia solution – Calafiore cardioplegia. Three distal anastomoses were made: to the left anterior descending artery (LAD), to the marginal branch (Mg I) and to the RCA. The remaining grafts were made from two relatively good parts of the SVG which were taken from the left and right leg. During the operation a problem emerged with anastomosis to the RCA. The coronary artery turned out to be heavily calcified in the region of incision and had a big plaque on the posterior wall. The operation was finished in typical fashion and after transferring the patient to ITU, electrocardiographic changes were seen on the inferior wall and the

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patient was assessed as being unstable. After transferring the patient to OR (approximately 90 minutes after the first operation), bypass to the RCA was repeated with the assistance of CPB.

Perioperative infarct was confirmed by increase of troponin level to a value of 110 ng/ml. In the early postoperative period the patient remained stable and on the second postoperative day was transferred to the intensive cardiac unit. On the fourth postoperative day the patient had the following symptoms: changes in ECG such as depression on the anterior wall in V1 to V5 and angina symptoms which started on the night of the fourth/fifth postoperative day. After referral to the invasive cardiology department, the patient was examined on haemodynamic call. The examination revealed no flow in the bypass to the marginal branch in the region where the internal thoracic artery was anastomosed to the vein and narrowing in the side of the SVG anastomosis to the RCA. After the examination the patient with a catheter left in the femoral superficial artery was sent to the intensive cardiac unit, and after one hour the decision to repeat the revascularization was made.

Because of the thrombosis in the internal thoracic artery and previous incision on the bypass to the marginal branch, which could be a potential site for the thrombosis, we decided to replace the bypasses with new conduits. We exposed the saphenous veins on both legs, which were the remaining veins after the first surgery. After distending them with saline, they reached the diameter of approximately 10 mm. The patient remained stable and this was an enhancing factor to harvest some more time-consuming material. Both radial arteries were taken with the clipless technique (this is the current technique of harvesting the radial artery). After harvesting the radial artery, another conduit – the small saphenous vein – was taken from the left leg.

Local examination revealed pulsing bypass to the RCA, and non-pulsing bypasses to the MGI and LAD. The cardiopulmonary bypass was assessed in typical fashion. After the cross-clamping, aorta protection was obtained with cold crystalloid cardioplegic solution given by a retrograde catheter placed in the coronary sinus. The vent was placed into the root of the ascending aorta. On the non-beating heart the revision of the bypasses was performed. The big clot on the side where the LIMA was anastomosed to the SVG was excised. All three bypasses were removed. On this side new conduits were implanted. The LRA was anastomosed to the LAD, the RRA was anastomosed to the RCA, and the SPV was implanted to the MGI. Weaning from cardiopulmonary bypass was enhanced with the use of an IABP (intra-aortic balloon pump) placed with Judkins technique through the left femoral artery. At the beginning the perioperative infarct was diagnosed and the patient's circulatory system was stabilized with infusion of epinephrine, norepinephrine and milrinone. Because of haemodynamic instability, sudden drops of the arterial pressure and symptoms of cardiogenic shock, the operation was not finished with normal closure of the chest. Two drains were put between the parts of the sternum, and the upper layers were sutured in typical fashion. It enabled transfer of the patient to the ITU. Two days after this surgery the patient was transported to OR again and the chest was closed in the proper way. The pharmacotherapy was conducted with haemodynamic measurements support (PA catheter). Dosage of catecholamines and milrinone was steadily reduced (under control of CI value, which was kept at 4.5-5.5 l/min/m^2) and the infusion was completed on the sixth postoperative day. The PCWP reached 12 mm Hg from initial value of 20 mm Hg. On the second postoperative day the rate of IABP was reduced from 1 : 1 to 1 : 2, and on the fifth postoperative day the balloon was reduced to the rate of 1:4, subsequently removed on the sixth postoperative day. The patient was under analgosedation (fentanyl, midazolam). Mechanical ventilation was performed starting with controlled manner (CMV) with changeable concentration of oxygen to CP AP mode before extubation. Metabolic stability was quickly achieved with initially parenteral and next enteral nutrition. The level of glucose was stable within the range from 105 mg% to 115 mg%. Haematocrit remained in the range from 28.9 to 28.2. During the first 5 days on ITU the temperature was raised to 37.8-38.6°C. Microbiological examination revealed Escherichia coli and Pseudomonas aeruginosa in the airway. Antibiotic therapy was applied according to microbiological resu1ts and on the seventh postoperative day the patient was extubated remaining clinically stable. Later postoperative course was without any major respiratory or cardiac complications.

This case illustrates two important clinical problems that can face the cardiac surgeon. First is the role of the cardiac surgeon in an early graft failure and the role of retrograde protection in the urgent reoperation for aortocoronary bypass. Perioperative graft failure following coronary artery bypass grafting (CABG) results in acute myocardial ischaemia/infarction (PMI), which may necessitate an acute secondary revascularization procedure to salvage the myocardium, in order to preserve ventricular function and improve patient outcome. Whether acute percutaneous coronary (re)intervention (PCI), emergency reoperation, or conservative intensive care treatment should be applied is currently unknown. Clotting and bypass dysfunction are obvious in vein grafts, but wall motion abnormalities in areas perfused by a spastic arterial graft are difficult to tell and might be resolved without revising the vessel, simply by correcting perfusion pressure. Pratt [1] suggested in 1898 that oxygenated blood could be supplied to an ischaemic myocardium through the coronary venous system. In 1956, Lillehei and colleagues [2] used retrograde coronary sinus perfusion to protect the heart during an aortic valve operation. Since then, retrograde coronary sinus cardioplegia (RCP) has gained widespread use as a method of myocardial protection in a broad range of cardiac procedures. The advantages of RCP are: (1) the provision of a relatively uniform distribution of cardioplegia even in the presence of severe coronary artery disease which can alter the distribution of antegrade cardioplegia [3, 4] (the coronary sinus venous system is a dense vascular network that is not affected by arteriosc-

lerosis or extensive disease in the coronary arterial system, and in hearts with coronary artery disease there is a richer, more uniform venous network in the subendocardial zone of both ventricles) [5, 6]; (2) it is effective in the presence of aortic regurgitation or an open aortic root and where there is no risk of coronary ostial injury [7]; (3) in certain clinical situations, such as re-operative coronary artery bypass surgery, antegrade cardioplegia is associated with a high risk of atheromatous embolization from patent grafts, whereas RCP may flush distal emboli from the arterial system [8]; (4) RCP may be an effective method for treating coronary air embolism [9]; (5) it can be given without interrupting the surgical procedure.

The next issue is use of the radial artery as a conduit in redo coronary surgery on critically ill patients. An important clinical question is whether to apply in emergency operations limb arteries, which are more prone to spasm due to high contractility and which require more active pharmacological intervention [10, 11]. During stay on the postoperative intensive care unit the patient was treated with catecholamines which could possibly cause spasm of the RA. The second major risk factor was the use of alpha-adrenergic agents in the early postoperative period. Various protocols recommended that these agents should be avoided to protect radial arteries.

Nevertheless, the described treatment was necessary because of signs of cardiogenic shock, and was performed under exact haemodynamic monitoring.

The described patient did not have angiography performed postoperatively. Based on the ECG changes and postoperative assessment of heart contractility in ECHO examination we assume that graft dysfunction and prolonged spasm (string sign) of the grafts did not occur in the postoperative period. String sign is not a frequent complication but should be considered in patients on alpha-adrenergic agents. S. Miwa [12] in his study regarding string sign reports that overall, alpha-adrenergic agents were only used in 25 of 561 enrolled patients, 16 of whom underwent angiography and 5 of whom had radial artery string sign.

Arterial grafts are not uniform in their biological characteristics. Clinical choice of grafts should be based on biological characteristics of the graft, anatomy of the native coronary artery and the match between the coronary artery and the graft, as well as technical considerations including graft antispastic management. In some sudden situations the time for such considerations is limited due to the emergency status of the case. Rather than the method to the patient, the patient to the method is matched. Limb arteries can play an important role in such operations when quick harvesting of the veins is excluded due to their absence. The patient is planned for repeat angiography to reveal the graft function in further follow-up.

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