Long-term outcomes of redo coronary-artery bypass grafting

Odległe wyniki reoperacji pomostowania naczyń wieńcowych

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Abstract

Background: Surgical revascularization, though a well-accepted method of treatment for coronary artery disease, does not prevent complications resulting from the progression of disease. Therefore, some patients with recurrent angina require invasive reinterventions including coronary artery bypass grafting (CABG). The purpose of this study was to evaluate early and late results of reoperative coronary artery bypass grafting in patients operated in our institution in the years 2003-2008.

Material and methods: We retrospectively analyzed morbidity, mortality, and functional status of 26 patients (23 men and 3 women) with follow-up time after the redo procedure ranging from 2 months to 29 years.

Results: There was only one in-hospital death (3.8%). Two patients died within 30 days of the surgery (7.7%), one of them being dialyzed due to acute renal failure. No remote deaths were recorded. Intra-aortic balloon pump (IABP) counter-pulsation was used in 2 patients (7.7%). No sternal infections or neurological incidents were reported. All patients were asymptomatic or a significant reduction in angina symptoms was observed in late follow-up.

Conclusions: Redo CABG is a safe procedure associated with a relatively low morbidity and low early mortality rate.

Key words: redo coronary artery bypass grafting, survival, long-term graft patency.

Streszczenie

Wstęp: Chirurgiczna rewaskularyzacja naczyń wieńcowych jest powszechnie akceptowaną procedurą leczenia choroby wieńcowej, ale nie zapobiega komplikacjom wynikającym z progresji zmian miażdżycowych. Część chorych z nawrotową stenokardią wymaga ponownych interwencji, włącznie z ponowną rewaskularyzacją mięśnia sercowego (ang. *coronary artery bypass grafting* – CABG). Tematem pracy była ocena wczesnych i późnych wyników ponownych operacji pomostowania naczyń wieńcowych chorych operowanych w latach 2003–2008.

Materiał i metody: Retrospektywnie analizowano powikłania, śmiertelność i stan kliniczny 26 chorych (23 mężczyzn i 3 kobiet) poddanych reoperacji w czasie od 2 miesięcy do 29 lat.

Wyniki: Jeden chory zmarł w szpitalu po operacji (3,8%). Śmiertelność 30-dniowa (2 chorych) wyniosła 7,7%, jeden z tych chorych był dializowany z powodu ostrej niewydolności nerek. Nie zanotowano zgonów w obserwacji odległej. Balon do kontrapulsacji wewnątrzaortalnej (ang. *intra-aortic balloon pump* – IABP) zastosowano u 2 chorych (7,7%). Nie zanotowano infekcji mostka ani powikłań neurologicznych. U wszystkich chorych stwierdzono ustąpienie bądź znaczną redukcję dolegliwości dławicowych w późniejszym okresie obserwacji.

Wnioski: Ponowny zabieg rewaskularyzacji serca jest procedurą bezpieczną z niewielką liczbą powikłań i niewielką śmiertelnością wczesną.

Słowa kluczowe: ponowna rewaskularyzacja naczyń wieńcowych, przeżywalność, wieloletnia drożność pomostu.

Introduction

Surgical revascularization, though a well-accepted method of treatment for coronary artery disease, does not prevent the development of complications due to progression of the disease. Therefore, some patients with recurrent angina require invasive reinterventions including CABG. We reviewed the outcomes of the patients who underwent CABG in our institution in the seventies. The results showed 2.7% reoperation rate after 5 years, 11.4% after 10 years [1] and a significant 50% reduction in the reoperation rate when left internal thoracic artery (LIMA) was used [2]. Young age of patients, incomplete revascularization, good left ventricle (LV) function and single or double vessel disease were additional factors predisposing to surgical reintervention [3].

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Accepted standards of pharmacological postoperative management including using of aspirin, angiotensin converting enzyme (ACE) inhibitors, beta-blockers and statins seemed to improve the outcomes.

Material and methods

The study population included 26 patients (23 men and 3 women) undergoing coronary reoperation from 2 months to 29 years after the primary procedure; mean 12.3 ±6.8 years (Fig. 1).

Mean age for primary operation was 50.6 ±8.1 (from 33.5 to 68.1) years and for the redo operations it was 62.1 ±7.9 (from 46.8 to 73.2) years. Surgical reintervention within the first 12 months was performed in 2 patients only. The mean follow-up time after the redo procedure was 45 ±4 months. Continuous variables are presented as mean values with standard deviation. Operations were performed through a complete median sternotomy in systemic normothermia, using a standard cardiopulmonary bypass technique in 24 cases and using an off-pump coronary artery bypass (OPCAB) technique in 2 patients. In all cases, antegrade St. Thomas Hospital II cold crystalloid cardioplegia was used to achieve heart arrest and myocardial protection. Left internal thoracic artery (LITA) to left anterior descending (LAD) anastomosis was performed if the vessel was significantly constricted or the patency of the previous vein graft was questioned. In the latter case, the vein graft was preserved to avoid hypoperfusion of the vessel. To replace old, constricted vein grafts to the right and circumflex arteries, new vein anastomoses were performed if necessary. In 18 (77%) patients LIMA was used, in another 3 (15.4%) cases radial artery graft was done, 2.46 ±0.4 per patients was performed including vein grafts. One patient required additional mitral and the other – aortic valve replacement. In the eldest patient after CABG in 1977, diagnosed for a redo procedure, we found a patent though severely stenosed vein anastomosis to the LAD, giving collaterals to amputated right coronary artery (RCA) (Fig. 2).

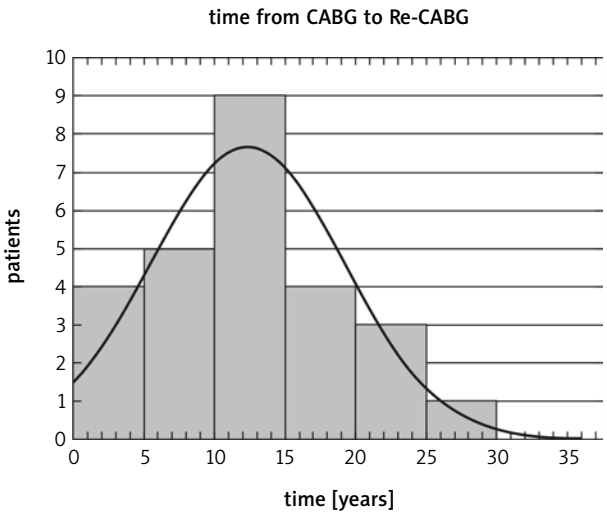

Fig. 1. Time from primary operation to redo operations (years) and number of patients in 5 years periods

Results

There was only one in-hospital death (3.8%). Two patients died within 30 days of the surgery, one of them being placed on dialysis due to acute renal failure. No remote deaths were recorded. Intra-aortic balloon pump (IABP) counter-pulsation was used in 2 patients (7.7%). No sternal infections or neurological incidents were reported.

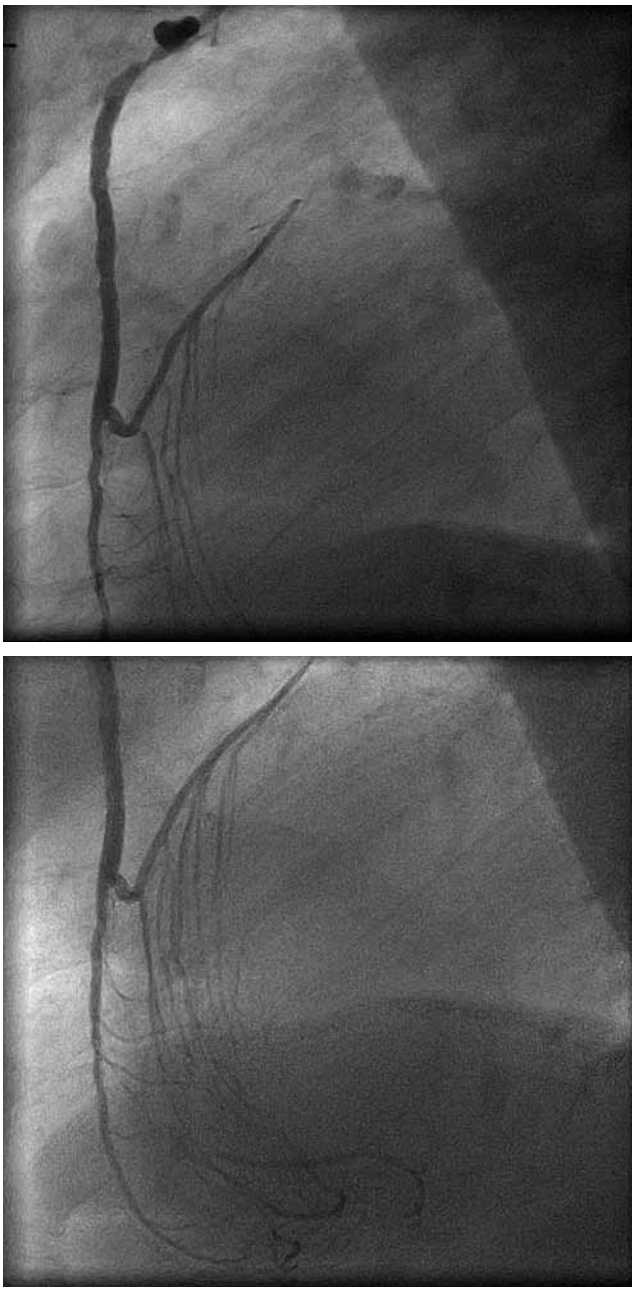

Fig. 2. Patent though severely stenosed vein anastomosis to the LAD, giving collaterals to amputated right coronary artery (RCA) – patient after CABG in 1977 diagnosed for a redo procedure after 29 years

The results of follow-up examination revealed a significant improvement of the patients' clinical state. All patients were asymptomatic or a significant reduction in angina symptoms was observed in late follow-up; mean 45 months.

The mean CCS class was 3.21 and decreased to 1.43 after CABG. Mean NYHA class was 2.51 and decreased to 1.65.

Discussion

Coronary artery bypass grafting (CABG) surgery has been an accepted treatment for patients with severe angina pectoris since the 1970s. The primary goal of such an operation was and still is to relieve symptoms of angina and to improve the quality of life.

Progression of atherosclerosis not only in the native coronary arteries but also in the anastomoses, mainly vein grafts, is the most common reason for a redo bypass surgery. Early reinterventions seem to be related to either technical issues during the initial operation or increased prothrombotic state after the surgery. The three vascular conduit structures particularly prone to damage are a saphenous vein graft (SVG) to the RCA running in front of the right ventricle (RV), a prominent serpentine midline SVG to the left coronary artery branches, and LIMA, which is exposed to injury if the intact pleura in an emphysematous patient displaces it to the midline. Injury to the SVG during sternotomy can produce a larger laceration, which will cause a sudden loss of arterial blood, making the operation even more difficult. A median sternotomy is not always the best and safe incision for redo cardiac surgery. To avoid complications the surgeon might consider a left thoracotomy which has a number of indications: presence of a prominent, patent, functional single or more important, a double internal mammary artery graft, a graft-dependent heart with the grafts positioned underlying the sternum, thus presenting a risk of catastrophic bleeding during sternal reentry, a history of mediastinitis, radiation therapy, presence of a tracheostomy, and in the case of calcification of the ascending but not the descending aorta. Controversy exists regarding the management of angiographically disease-free saphenous vein grafts at the time of redo coronary artery bypass grafting. Some authorities favour replacement of all grafts older than 5 years. Others believe that insignificantly diseased grafts should not be replaced. We think that all constricted or occluded grafts should obviously be replaced but those disease-free ones can stay and function properly. Our approach to coronary reoperation is based on a plan designed to prevent complications. Due to its unstable nature, vein graft atherosclerosis is associated with a high incidence of cardiac events. Postmortem examinations repeatedly showed atheroemboli in the distal portion of the distribution of atherosclerotic plaque in the myocardium. Vein graft atherosclerosis may readily embolize during manipulation of the heart. Substantial improvement in the mortality rate and perioperative myocardial infarction rate was achieved by the ligation of patent atherosclerotic vein grafts, compared with no ligation [4]. This probably occurs because the ligation prevents atherosclerotic emboli during the operation and manipulation of the heart. Vein graft atherosclerosis is both common and extensive and can be vastly underestimated by angiography. Because of the diffuse nature of vein graft atherosclerosis, the patent, stenotic vein graft should be doubled ligated or replaced if it is possible. Another attempt should be performed in the case of vein graft-dependent LAD. In this situation, the LAD artery is totally obstructed so that the entire LAD distribution is dependent on the vein graft. The reoperations were done because the vein grafts were old, atherosclerotic, or even stenotic. According to Cosgrove's [5] experience, he found that the patients were in trouble immediately after coming off extra-corporal circulation (ECC), as well as subsequently in the intensive care unit, and he found that the ability to supply the LAD of the IMA may be not sufficient as well as was supplied by even a stenotic vein graft. A multivariate analysis of predictors of mortality in these patients showed that the absence of the stenotic vein graft was a very important predictor of operative risk. He also found an 18% incidence of sudden deterioration of the hemodynamic status in the intensive care unit among surviving patients who had their stenotic vein graft divided, manifested as ST-segment changes to a hypoperfusion syndrome. None of this was noticed in a group of patients who had an "old" vein graft to the LAD left in place or added. The best way to treat this hypoperfusion syndrome was to add a vein graft. Survival was much better in these patients when they were treated by the addition of a vein graft than when treated with an intra-aortic balloon.

According to STS (the Society of Thoracic Surgeons) database, 1991-1993 in-hospital mortality rate for redo-CABG was 6.95% and 1996 data show an overall mortality rate of 7.2% [3] which makes it comparable to 30 days' mortality rate in the group. Salomon et al. reported a redo CABG mortality rate of 6.9% with 2% after the first surgery, and an almost 4 times higher rate when reoperation was urgent.

According to Goldman et al. [7], patency at 10 years was 61% for SVGs in comparison to 85% for IMA grafts. If a SVG or IMA graft was patent at 1 week, that graft had a 68% and 88% chance, respectively, of being patent at 10 years. The SVG to the LAD (69%) was better than to the right coronary artery (56%), or circumflex artery (58%). The recipient vessel size was a significant predictor of graft patency, in vessels > 2.0 mm of diameter, SVG patency was (88%) vs. (55%) in vessels ≤ 2.0 mm. The 10-year patency of SVGs to the LAD is better than that to the right or circumflex. The strongest long-term predictors of SVG graft patency are grafting into the LAD with grafting into a vessel of diameter bigger than > 2.0 mm. Shah et al. [8] has observed patients operated between 1977 and 1999, saphenous vein graft patency improved over the course of the study. The best results were obtained in older patients with a good LV function. Large diameter arteries of the left coronary system, when grafted with a small-diameter SVG, were associated with the best outcome. Due to Lytle et al. [9], the improvement in survival with reoperation was particularly strong for patients with a stenotic vein graft to

the left anterior descending artery. For that subset, survival was 84% and 74% for the reoperative group versus 76% and 53% for the group put on medication at 2 and 4 years after catheterization, respectively. For patients with stenotic vein grafts to the right coronary artery or circumflex coronary artery, survival was 92% and 87% for the reoperative group versus 89% and 78% for the group put on medication at 2 and 4 years after catheterization. Reoperation improves the survival of patients with late vein graft stenosis, particularly those with stenotic grafts to the LAD. Patients who are 5 years or more after the CABG, with stenosis of vein grafts to the LAD, 50% or more have a survival of 70% and 50% at 2 and 5 years after catheterization, compared with 97% and 80% of those with 50% or bigger stenosis of the native left anterior descending artery. Late vein graft stenosis is more dangerous than native coronary stenosis. Late stenosis in saphenous vein grafts to the LAD predicts a high rate of death and cardiac events and are an indication for reoperation [10]. The patency rates of sequential conduits were markedly higher than those of individual ones (82 vs. 68%). Also, the anastomoses of the sequential conduits had better patency (75 vs. 68%). This difference was even more pronounced in coronary arteries of poor quality and small diameter (< 1.5 mm). Also, when the most distally located coronary artery supplied by a sequential graft was of poor run-off, the patency rate for the entire conduit was considerably low (42.5%). The patency rate of a sequential vein graft conduit is generally better than that of an individual one, especially for poor run-off coronary vessels, provided that the most distally located anastomosis is done on a good coronary artery in terms of quality and diameter. Using a minimal length of conduits is another advantage. However, failure of a single sequential conduit jeopardizes all the anastomoses along that graft segment [11].

Coronary artery bypass graft surgery using vein grafts is safe and has a reasonable long-term prognosis for survival in 20 years' follow-up [12, 13]. To find better results, total arterial revascularization is currently propagated to prevent premature death due to graft atherosclerosis. A beneficial effect of this strategy on long-term survival is well known because of reducing the coronary reinterventions rate. Also, more efficient medical treatment modalities for angina pectoris have been introduced since then. More importantly, the possibilities and awareness of the importance of secondary prevention have increased in the last few years. Aspirin, beta-blockers, ACE inhibitors, statins and life-style changes are now routinely considered following CABG. Therefore, one may hope that the outcomes of CABG performed nowadays will be even better.

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