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Percutaneous angioplasty of venous Y-bypass-graft in patient with unstable angina: Y-bypass graft bifurcation lesions remain a challenge

Przezskórna angioplastyka Y-pomostu żylnego u pacjenta z niestabilną dławicą piersiową. Czy zwężenie bifurkacji Y-pomostu żylnego jest nadal wyzwaniem?

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Abstract

A 71 year-old patient with a history of coronary artery bypass grafting was admitted to the Department of Interventional Cardiology, John Paul II Hospital, Krakow with acute coronary syndrome — unstable angina. Coronary angiography revealed significant narrowing of a bifurcated venous bypass graft as the last remaining vessel. After consultation from the Heart Team, he underwent percutaneous coronary angioplasty of the venous bypass with implantation of a self-apposing sirolimus-eluting stent (Stentys). The technical aspects of this procedure, such as the use of a left ventricle assist device, additional imaging (intravascular ultrasound), the type of approach and stent, and the protection of the vessel are discussed in this article. A patient with numerous co-morbidities and severely decreased function of the left ventricle was in fact a candidate for percutaneous revascularisation. Eight months later, the patient had a cardioverter-defibrillator implanted in primary prevention of sudden cardiac death due to symptomatic chronic heart failure with reduced ejection fraction. This discussion raises the topic of the long-term effectiveness of angioplasty in this group of patients. Myocardial revascularisation in a patient with severe symptoms and a diseased last remaining vessel should be obligatory. However, multiple comorbidities increase the risk of cardiac surgery as well as of percutaneous angioplasty. The critical question here is: should the treatment be invasive or would the better option be optimal medical treatment?

Key words: angioplasty, revascularisation, coronary artery disease, heart failure, venous bypass, bifurcation

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Case report

A 71 year-old patient was admitted to our department with unstable angina, recently advancing to class III of the Canadian Cardiovascular Society classification. Levels of myocardial necrosis markers were within the normal range [high-sensitivity troponin T (hsTnT) 0.011 ng/mL, creatine kinase myocardial bound [CK-MB] 11 U/L; Table 1). The patient had a previous history of arterial hypertension, dyslipidemia, chronic heart failure with reduced ejection fraction, persistent atrial fibrillation, Leriche syndrome and chronic kidney disease (stage III).

In 1995, the patient underwent coronary artery bypass grafting with Y-graft [saphenous vein grafts (SVG)] to diagonal and marginal branches as treatment of acute coronary syndrome. Since then, the patient had had two

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Table 1. Laboratory results during follow-up

Parameter	Admission	Discharge	9 months
Haemoglobin [g/dL]	12.9	13.6	11.8
K^+ [mmol/L]	4.2	4.2	4.1
Creatinine [μmol/L]	122	120	133
eGFR	51	52	46
Total cholesterol [mmol/L]	3.24		2.39
LDL [mmol/L]	2.13		1.46
HDL [mmol/L]	0.83		1.04
Triglycerides [mmol/L]	0.86		0.5

K — potassium; eGFR — estimated glomerular filtration rate; LDL — low-density lipoproteins; HDL — high-density lipoproteins

non-ST-segment myocardial infarctions (NSTEMI). These were treated with coronary angioplasty of SVG to marginal branch in 2009 (bare metal stent), and of SVG to diagonal branch in 2012 (drug eluting stent).

The echocardiography performed on admission showed severely reduced left ventricular ejection fraction (LVEF = 26%), mild mitral regurgitation, and severe tricuspid regurgitation with features of severe pulmonary hypertension [RVSP (right ventricular systolic pressure) = 69 + 13 mm Hg]. Coronary angiography revealed severe stenosis in the Y-graft (SVG) prior to its bifurcation, with an optimal effect of the previous angioplasty procedures (Figures 1A, B).

The patient was consulted by the local Heart Team, who suggested percutaneous revascularisation. This procedure was performed through right brachial access using an Amplatz Right 2.0/7 F guide catheter. A FilterWire was delivered to the SvG-Dg graft branch supplying the larger area of the myocardium and a Whisper ES was delivered to protect the second branch of the Y-graft [SVG to obtuse marginal branch (OM)] as a side branch (Figure 1C). Predilatation with non-compliant (NC) balloons (3.5/15 mm and 4.0/15 mm) was performed (Figure 1D). A Stentys X-Position 3.5–4.5/22 mm stent was implanted in the Y-junction (bifurcation) over the FilterWire (Figure 1E). Proximal optimisation was carried out with the balloon, and rewiring of OM was carried out with the Whisper ES. A final kissing technique using an NC 5.0/15 mm balloon in SVG to Dg and an NC 3.0/15 mm balloon in SVG to OM was performed (Figure 1F). Finally, the FilterWire was removed, and we achieved the optimal result, with TIMI (Thrombolysis in Myocardial Infarction) III flow to both branches (Figure 1G, H). The patient received 440 mL of isotonic contrast (Visipaque 320). The radiation dose was 2,382 mGy. We observed slightly increased levels of myocardial necrosis markers (hsTnT 0.120 ng/mL, CK-MB 22 U/L) without other criteria for type IV acute coronary syndrome (ACS) (Fourth Universal Definition of Myocardial Infarction). The patient was discharged home after four days.

On discharge, the patient received: acetylsalicylic acid (ASA), clopidogrel, dabigatran at 110 mg, metoprolol succinate, ramipril, spironolactone, furosemide, atorvastatin, and pantoprazole. ASA was discontinued after one month.

Follow-up

Follow up was performed seven months later. All symptoms had decreased [class I/II Canadian Cardiovascular Society (CCS)] with persistent symptoms of heart failure [class II New York Heart Association (NYHA)]. The patient reported intermittent claudication at class IIb Fontaine with a distance < 100 m.

Echocardiography showed severely reduced LVEF (22%), moderate mitral regurgitation, and severe tricuspid regurgitation with features of severe pulmonary hypertension (RVSP = 65 + 15 mm Hg). The result of N-terminal fragment pro-B-type natriuretic peptide (NT-proBNP) was elevated (2,925 pg/mL).

An implantable cardioverter-defibrillator (ICD) was successfully implanted in August 2017. At the most recent follow-up, the patient's family informed us that the patient died in November 2017.

Discussion

The advantages of venous Y-graft over multiple venous grafts are: fewer anastomoses on the ascending aorta and better position of the graft around the heart. On the other hand, proximal narrowing or the occlusion of the Y-graft causes ischaemia of the larger area of the myocardium [1]. Coronary angioplasty of bifurcation lesions remains a complex and insufficiently studied subject, particularly in SVG. The treatment of recurrent significant atherosclerotic lesions in grafts has always been a challenging issue, and should be considered as such [2].

In cases of unusual anastomoses, it may be beneficial to consider the Heart Team's advice and be especially careful regarding equipment selection. As has been demonstrated, appropriate referral to the Heart Team has beneficial long-term effects on clinical events after revascularisation [3, 4]. Gradually progressing reduction of left

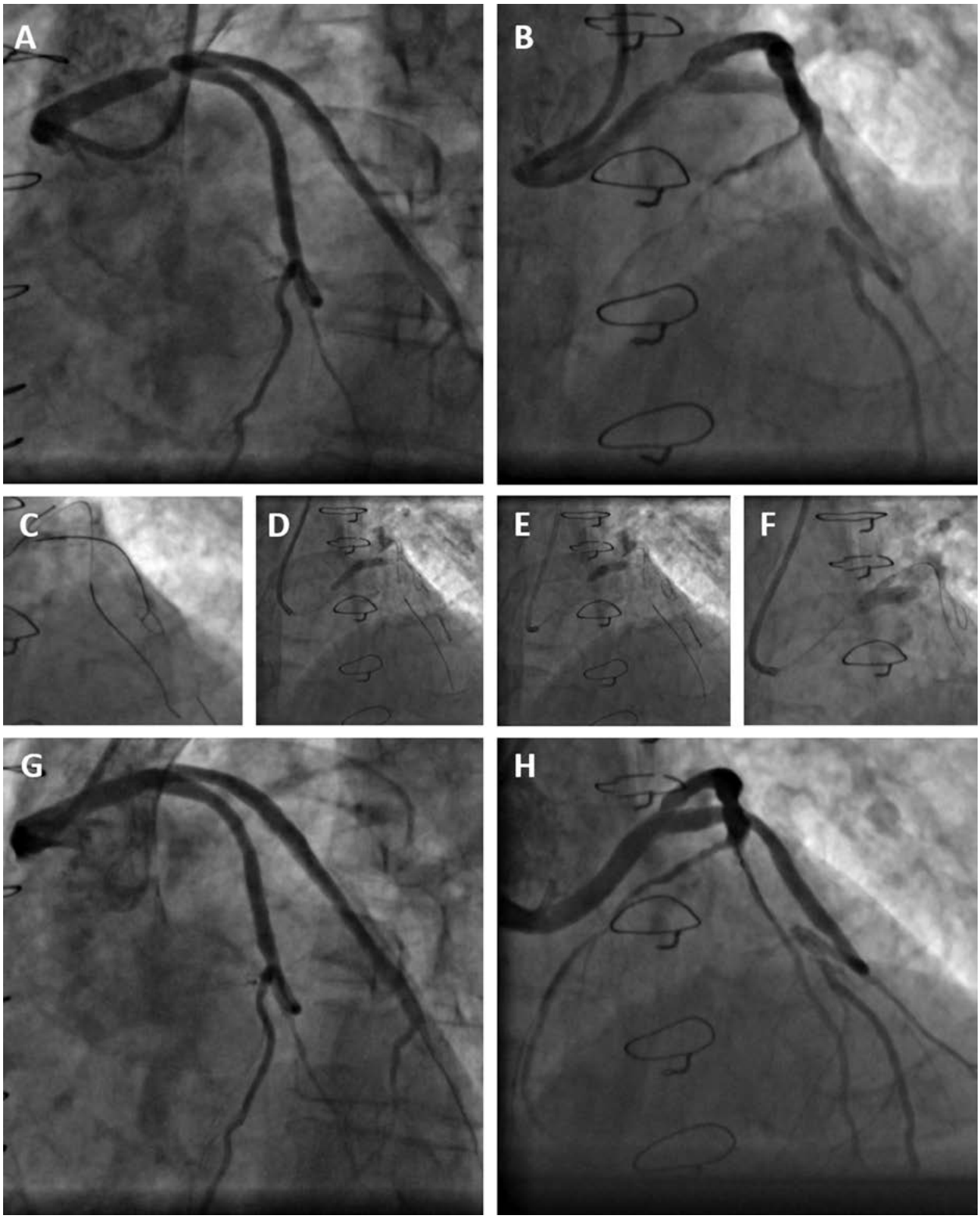

Figure 1A, **B.** Coronary angiography presenting bifurcation lesion before percutaneous coronary intervention (PCI); **C.** Protection of venous graft's branch to Dg; **D.** Pre-dilatation of bifurcation lesion; **E.** Implantation of self-apposing sirolimus-eluting stent (Stentys); **F.** Optimisation using the 'kissing balloons' technique; **G, H.** Coronary angiogram presenting the final result of bifurcation lesion angioplasty

ventricle function is in fact the result of factors other than weak myocardial perfusion [5].

In this case, a significantly narrowed venous graft as the last remaining vessel in a patient with ACS was an indication for performing coronary angioplasty. As we mentioned before, the Heart Team suggested percutaneous revascularisation as the preferred option for a patient with (last remaining vessel/such coronary status) and low ejection fraction. Referring such patients to centres with highly experienced staff is advisable in order to ensure patient safety. The efficiency of the percutaneous coronary intervention (PCI) technique is gradually evolving as new devices are introduced. We prefer a radial approach for coronary percutaneous procedures; however we did not use a sirolimus-eluting coronary stent-on-a-wire Integrated Delivery System (Slender IDS), nor a sheathless guide. Since this patient had Leriche syndrome and we needed 7 F access, a brachial artery was chosen. Because of the lack of an available proximal protection device, or any other solutions to protect both branches of the venous graft during the angioplasty, we decided to use distal protection with a FilterWire to the branch supplying the larger myocardial area. The morphology of the bifurcated venous graft in our patient, especially the disproportion in the vessel lumen diameter, encouraged us to use a self-apposing sirolimus-eluting coronary stent (Stentys), as this device has been widely recommended in such complex conditions. In bifurcation lesions, provisional stenting is the preferred technique.

In our case, we used a self-apposing stent, although in the literature other techniques such as 'DK crush stenting' have been described [6, 7]. In a case of intervention in a patient afflicted with numerous co-morbidities and a low ejection fraction, the use of a left ventricle assist device (LVAD) should be considered. We could not use any LVAD, but because the haemodynamic status remained stable during the whole procedure, we decided not to use an intra-aortic balloon pump (IABP).

Additional imaging methods [*e.g.* intravascular ultrasound (IVUS)] could be considered to verify the effectiveness. However, in this case we decided not to perform it since a self-apposing system ensures optimal stent apposition. The patient obtained a high radiation dose as well as a high volume of contrast dye simultaneously during this procedure.

Ischaemic aetiology of cardiomyopathy is one of the most common reasons for chronic heart failure. Myocardial revascularisation in patients suffering from chronic heart failure should be obligatory when there are severe symptoms. However, due to the high risk of recurrent surgery, percutaneous intervention is the preferred option. Multiple comorbidities increase the risk of cardiac surgery as well as that of percutaneous procedures.

Therefore the decision whether to treat invasively, or to defer and treat with optimal medical therapy, is a question of critical importance.

Conflict(s) of interest

The authors declare no conflict of interest.

Streszczenie

Pacjenta w wieku 71 lat po przebytej operacji pomostowania aortalno-wieńcowego przyjęto do Kliniki Kardiologii Interwencyjnej Krakowskiego Szpitala Specjalistycznego im. Jana Pawła II z powodu ostrego zespołu wieńcowego — niestabilnej dławicy piersiowej. W angiografii wieńcowej wykazano obecność istotnego zwężenia rozwidlonego żylnego pomostu wieńcowego jako ostatniego funkcjonującego naczynia. Po kwalifikacji przez lokalny zespół sercowy u pacjenta wykonano angioplastykę rozwidlonego pomostu żylnego z implantacją samorozprężalnego stentu uwalniającego sirolimus (Stentys). W opisie przypadku jest mowa o technicznych aspektach, takich jak wykorzystanie urządzeń do wspomagania funkcji lewej komory, dodatkowych metod obrazowania wieńcowego, rodzaju dostępu zabiegowego, rodzaju stentu i dystalnej protekcji naczynia. Pacjent z licznymi obciążeniami i istotnie obniżoną frakcją wyrzutową lewej komory jest raczej kandydatem do przezskórnej rewaskularyzacji niż do klasycznej operacji. Osiem miesięcy po zabiegu pacjentowi implantowano automatyczny kardiowerter-defibrylator w ramach prewencji pierwotnej nagłej śmierci sercowej w związku z objawową przewlekłą niewydolnością serca. W dyskusji omówiono problem długoterminowego efektu leczenia przezskórnego w tej grupie chorych. Rewaskularyzacja wieńcowa pacjenta z silnymi objawami ze zwężeniem ostatniego funkcjonującego naczynia wieńcowego powinna być obowiązkowa, choć liczne choroby współtowarzyszące zwiększają ryzyko zarówno operacji klasycznej, jak i przezskórnej angioplastyki. Zasadnicze pytanie brzmi: leczyć zabiegowo czy zachowawczo?

Słowa kluczowe: angioplastyka, rewaskularyzacja, choroba wieńcowa, niewydolność serca, pomost żylny, bifurkacja

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