Cor et Vasa

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/crvasa

Kasuistika | Case report

Stent graft implantation in spontaneously recanalized LIMA graft after redo coronary bypass operation

Tamas Maros[a], Tamas Szerafin[a], Arpad Peterffy[a], Ildiko Racz[b], Zsolt Koszegi[b]

[a] *Department of Cardiac Surgery, Institute of Cardiology, University Medical School of Debrecen, Debrecen, Hungary*
[b] *Department of Cardiology, Institute of Cardiology, University Medical School of Debrecen, Debrecen, Hungary*

ARTICLE INFO

Article history:
Received: 1. 4. 2015
Received in revised form: 20. 5. 2015
Accepted: 22. 5. 2015
Available online: 16. 6. 2015

Klíčová slova:
Implantace stentgraftu
Kompetitivní průtok krve
Opakovaný koronární bypass
Rekanalizace štěpu LIMA

SOUHRN

Autoři popisují případ muže po posterobazálním infarktu myokardu, u něhož byl o rok později proveden koronární bypass se třemi anastomózami pro nemoc tří tepen (včetně levé mamární tepny-ramus interventricularis anterior [LIMA-RIA] a žilních štěpů). Po 13 letech opakovaná koronarografie prokázala kromě uzávěrů žilních štěpů a nativních věnčitých tepen průchodný štěp LIMA. Po neúspěšném pokusu o rekanalizaci žilního štěpu byl následně proveden opakovaný bypass s cílem nahradit uzavřené štěpy sekvenční žilou. Čtvrtý den po výkonu došlo k rozvoji bolesti na hrudi a změn segmentu ST na EKG a akutně provedená rekanalizace prokázala uzávěr bypassu LIMA-RIA, přičemž žilní štěp byl průchodný; na operačním sále byla proto urgentně provedena anastomóza pravé mamární tepny (RIMA) na RIA bez mimotělního oběhu. O dva roky později prokázalo koronarografické vyšetření kvůli recidivě symptomů anginy pectoris rekanalizaci RIMA bez významné stenózy v místě uzávěru. Bypass RIMA-RIA byl průchodný, pouze s nedostatečným plněním distální části RIA. Proto byl do rekanalizované, ale stenotické části bypassu LIMA implantován 3/26mm stentgraft Jostent GraftMaster; angiografie prokázala vynikající výsledek. Šest měsíců po výkonu si pacient při kontrole nestěžoval na anginu pectoris. Pokud je nám známo, jde o první popsaný případ spontánní rekanalizace uzavřeného štěpu arteria thoracica interna.

ABSTRACT

The authors present the case of a male patient who sustained posterobasal myocardial infarction and one year later for three vessel disease a coronary bypass operation with three anastomoses (including LIMA-LAD and vein grafts) was performed. After 13 years repeat coronary angiography showed patent LIMA graft besides occluded vein grafts and native coronary vessels. Since attempt for recanalization of a venous graft was unsuccessful subsequent redo bypass surgery was performed substituting the occluded grafts with a sequential vein. On the fourth postoperative day chest pain and ST changes on the ECG developed and the acute re-catheterization showed the occlusion of the LIMA-LAD bypass while the vein graft was patent therefore RIMA was anastomosed to LAD without ECC urgently in the operating room. Two years later subsequent coronary angiogram due to reoccurrence of angina symptoms proved recanalization of the LIMA graft with significant stenosis at the site of the occlusion. RIMA-LAD bypass was patent showing only unsatisfactory filling to the distal part of the LAD. For this reason a 3/26 mm Jostent GraftMaster stent graft was implanted into the recanalized but stenosed part of the LIMA bypass with excellent angiographic result. After 6 months of the intervention the patient was free of angina at the follow up. To the best of our knowledge, this is the first reported case about spontaneous recanalization of an occluded internal mammary graft.

Keywords:
Competitive flow
Coronary stent graft implantation
Recanalization of the LIMA graft
Redo coronary bypass

Address: Tamas Maros, MD, Department of Cardiac Surgery, Institute of Cardiology, University Medical School of Debrecen, Nagyerdei krt. 98., 4012 Debrecen, Hungary, e-mail: marosszabo@hotmail.com
DOI: 10.1016/j.crvasa.2015.05.015

Please cite this article as: T. Maros, et al., Stent graft implantation in spontaneously recanalized LIMA graft after redo coronary bypass operation, Cor et Vasa 57 (2015) e330–e333 as published in the online version of *Cor et Vasa* available at http://www.sciencedirect.com/science/article/pii/S0010865015000661

The authors present the case of a male patient born in 1942. He was on pharmacological antihypertensive treatment since 1985 and suffered from angina pectoris since 1987. He sustained a posterobasal myocardial infarction in 1989. In this year coronary angiography revealed three vessel disease, therefore a coronary bypass operation with three anastomoses (LIMA-LAD, SV-OM, SV-RCA) was performed in 1990. From the year 2000 his diabetes mellitus required oral treatment. After recurrent severe angina and positive stress test repeat coronary angiography in 2003 showed patent LIMA graft besides occluded vein grafts and native coronary vessels. Attempt for recanalization of a venous graft was unsuccessful. For this reason subsequent redo bypass surgery was performed substituting the occluded grafts with a sequential vein. On the fourth postoperative day chest pain and ST changes on the ECG developed and the acute re-catheterization showed the occlusion of the LIMA-LAD bypass while the vein graft was patent. No attempt for opening the left mammary artery was carried out in the cath lab but RIMA was anastomosed to LAD without ECC urgently in the operating room.

In 2005 the patient was hospitalized due to reoccurrence of angina symptoms. Myocardial perfusion SPECT showed severe reversible perfusion defect in the territory of the LAD. Subsequent coronary angiogram unexpectedly proved recanalization of the LIMA graft with significant stenosis at the site of the occlusion with irregular lumen surface (Fig. 1.). The RIMA-LAD bypass was patent but showed only thin filling to the distal part of the LAD. A 3/26mm Jostent GraftMaster stentgraft was implanted into the recanalized but stenosed part of the LIMA bypass with excellent angiographic result (Fig. 2.). After 6 months of the intervention the patient was free of angina at the follow up.

Redo cardiac operations with patent LIMA-LAD bypass are technically always challenging. During aortic cross-clamp the LIMA has to be occluded temporarily therefore the surgeon must find and isolate the vessel without inducing any injury. In our case the LIMA graft was free preparated and occluded with a 'bulldog' clamp as routinely performed in the majority of cases in our department. Postoperative occlusion of the LIMA after redo surgery could have been caused by the clamping and this possibility was also supported by the repeated coronary angiography.

Nevertheless, temporary occlusion of the LIMA graft is one of the pivotal points of redo operations hence the method should be considered in advance. The applied procedure can be surgical using the above mentioned bulldog clamp or soft vascular rubber band combined with isolation of the graft amongst other methods. Another possibility is a temporary balloon occlusion of the LIMA with percutaneous technique [1] necessitating preoperative placement of an angioplasty balloon into the graft and meticulous determination of the occlusion threshold. The balloon is inflated subsequently intraoperatively for the duration of the aortic cross-clamping. Both surgical and transcatheter methods involve the risk of a potential LIMA injury and dysfunction of various severity and appearance. However, as presented above, any harm to a patent graft can cause serious complications and can jeopardize the success of the operation highlighting the importance of a careful and rational decision making in every case.

Spontaneous recanalization of an occluded internal mammary graft [2–4] is a rare phenomenon and to the best of the knowledge of the authors it has not been published after total occlusion of a LIMA graft associated with intraoperative clamping during a redo bypass sur-

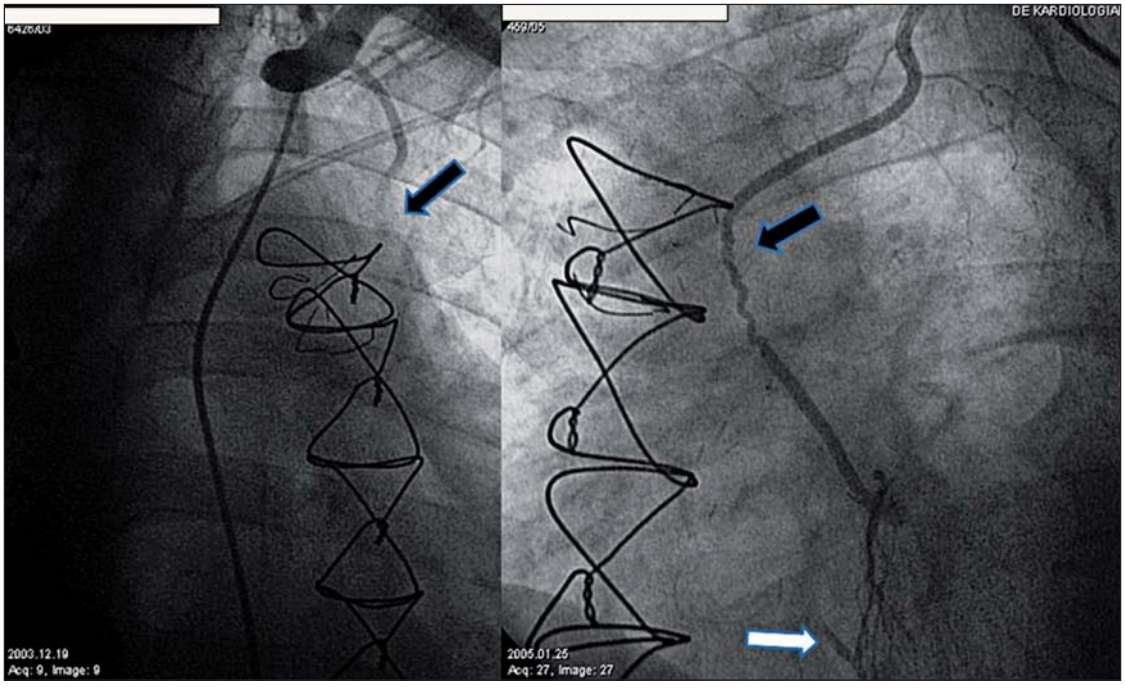

Fig. 1 – The occluded and then spontaneously reopened LIMA graft is indicated by the black arrows. White arrow shows the retrograde filling of the patent RIMA-LAD bypass.

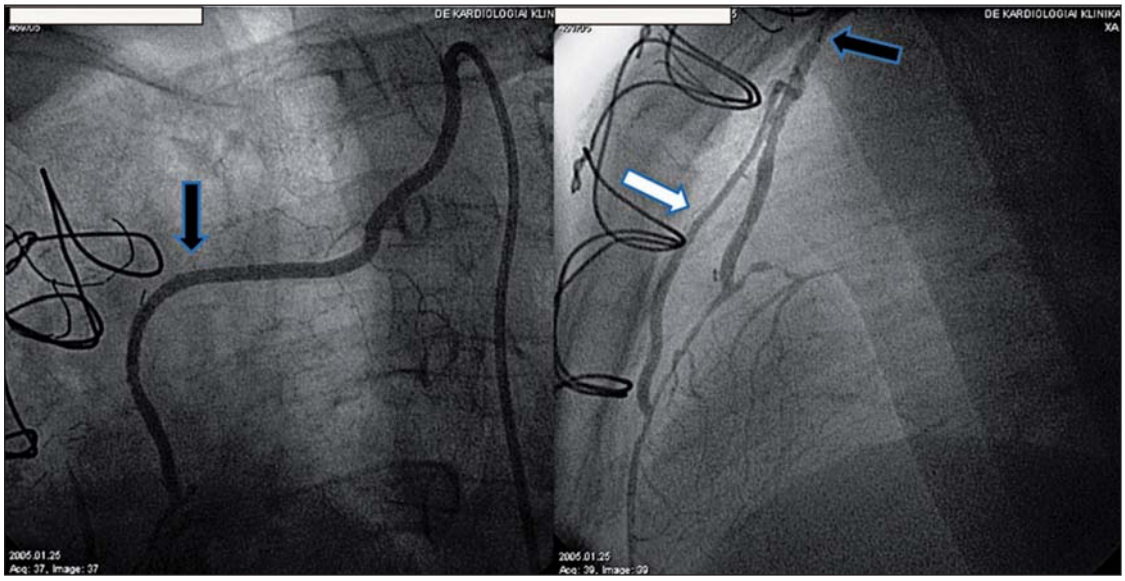

Fig. 2 – After the successful stent graft implantation both the LIMA (black arrows) and RIMA (white arrow) bypasses give satisfactory blood supply to the severely atherosclerotic and narrow LAD.

gery. Generally the total occlusion or the atresia of the LIMA graft (string sign phenomenon) can be observed due to anastomotic failure, week graft material, serious competitive flow or undiscovered subclavian stenosis [5]. Fundamentally, intravascular pressure gradients determine the patency of LIMA since the internal mammary graft is a physiologically active living conduit which is highly dependent on flow dynamics. In the previously published cases the spontaneous recanalization of the LIMA graft was associated to the decreased competitive flow and resulted in a homogenous lumen of the graft. In our case we could identify the predilection site of the occlusion at the clamping, which showed significant residual stenosis after the reopening. The poor flow of the distally anastomosed RIMA bypass not producing significant competitive flow could play an important role in the mechanism of the spontaneous recanalization of the LIMA graft. The special angiographic appearance of the detected residual LIMA lesion raised the suspicion that the bulldog clamp could injure the vessel from the adventitial tissue therefore covered stent was chosen to prevent a possible perforation of the vessel during the stent implantation.

The implanted stentgraft was a PTFE coated covered stent, which was introduced to the market more than 10 years ago in the hope that beside the emergency treatment of coronary perforation it would have benefit for prevention of distal embolization during SVG interventions. Regarding vein graft interventions, procedural success rate and short term results were promising, but late occlusion rate was higher using covered stents than conventional ones [6]. Unfortunately later studies proved that embolic events were not prevented sufficiently and intimal hyperplasia may be augmented by this of stent. Target vessel failure and restenosis rates proved not to be advantageous using stentgrafts [7,8]. On the contrary, coronary aneurysms, partly after drug eluting stent implantations were successfully treated in several cases by various covered stents [9,10].

However, covered stents still have life-saving indications for the treatment of coronary and graft perforations, too. According to the literature the usage of covered stents in internal mammary artery grafts has been reported only in a few cases repairing graft perforation or pseudoaneurysm rupture [11,12] and closing left internal mammary artery to pulmonary artery vasculature fistula [13] successfully.

In conclusion, stentgraft application is a known feasible choice in various instances of coronary bypass graft failure in vein grafts [14], the nice angiographic and clinical results in our report show that also in case of the very exceptional spontaneous recanalization of a LIMA graft with significant residual stenosis the percutaneous stent graft implantation could be an effective treatment option.

Conflict of interest
None declared.

Funding body
None.

Ethical statement
All authors declare that the research was conducted according to Declaration of Helsinki.

Informed consent
All authors declare that informed consent was obtained from all patients participating in this study.

References

[1] T. Velissaris, O.A. Khan, S. Asopa, et al., Myocardial protection during reoperative cardiac surgery: early experience with a new technique, Texas Heart Institute Journal 37 (2010) 75–78.
[2] F.E. Shamoon, J. Goldstein, J.I. Haft, Restoration of patency of left internal mammary artery graft with progression of the underlying left anterior descending coronary artery disease,

Catheterization and Cardiovascular Diagnosis 42 (1997) 213–215.
[3] H. Feld, V. Navarro, H. Kleeman, J. Shani, Early postoperative occlusion of a left internal mammary artery bypass graft with subsequent restoration of patency, Catheterization and Cardiovascular Diagnosis 27 (1992) 280–283.
[4] R. Nawaz, S.J. Brener, Flow-dependent changes resulting in restoration of patency of the left internal mammary artery graft after documented atresia, Journal of Invasive Cardiology 23 (2011) 207–210.
[5] R. Kolozsvari, Z. Galajda, T. Ungvari, et al., Various clinical scenarios leading to development of the string sign of the internal thoracic artery after coronary bypass surgery: the role of competitive flow, a case series, Journal of Cardiothoracic Surgery 7 (2012) 12, http://dx.doi.org/10.1186/1749-8090-7-12.
[6] V. Schächinger, C.W. Hamm, T. Münzel, A randomized trial of polytetrafluoroethylene-membrane covered stents compared with conventional stents in aortocoronary saphenous vein grafts, Journal of the American College of Cardiology 42 (2003) 1360–1369.
[7] G.W. Stone, S. Goldberg, C. O'Shaughnessy, et al., 5-year follow-up of polytetrafluoroethylene-covered stents compared with bare-metal stents in aortocoronary saphenous vein grafts. The randomized BARRICADE (barrier approach to restenosis: restrict intima to curtail adverse advents) trial, JACC: Cardiovascular Interventions 4 (2011) 300–309.
[8] M.A. Turco, M. Buchbinder, J. Popma, Pivotal, randomized US study of the Symbiot covered stent system in patients with saphenous vein graft disease: eight-month angiographic and clinical results from the Symbiot III trial, Catheterization and Cardiovascular Interventions 68 (2006) 379–388.
[9] S. Bajaj, R. Parikh, A. Hamdan, M. Bikkina, Covered-stent treatment of coronary aneurysm after drug-eluting stent placement: case report and literature review, Texas Heart Institute Journal 37 (2010) 449–454, (Review).
[10] N. Boyer, R. Gupta, A. Schevchuck, et al., Coronary artery aneurysms in acute coronary syndrome: case series, review and proposed management strategy, Journal of Invasive Cardiology 26 (2014) 283–290.
[11] R. Albiero, T. Nishida, N. Corvaja, et al., Left internal mammary artery graft perforation repair using polytetrafluoroethylene-covered stents, Catheterization and Cardiovascular Interventions 51 (2000) 78–82.
[12] S.U. Nair, N.C. Patel, D.A. Cox, Endovascular repair of ruptured pseudoaneurysm of left internal mammary graft following redo aortic valve replacement and coronary artery bypass grafting, JACC: Cardiovascular Interventions 8 (1 Pt A) (2015) e3–e5. http://dx.doi.org/10.1016/j.jcin.2014.08.008 (Epub 2014 Dec 10).
[13] B.M. Glover, M.M. Khan, The novel use of a covered stent in the management of a left internal mammary artery to pulmonary vasculature fistula, Journal of Invasive Cardiology 16 (2004) 663–664.
[14] T.W. Koh, A. Mathur, Coronary stent fracture in a saphenous vein graft to right coronary artery – successful treatment by the novel use of the Jomed coronary stent graft: case report and review of the literature, International Journal of Cardiology 119 (2) (2007) e43–e45 (Review, Epub 2007 Apr 27).