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CASE REPORT

A new treatment modality for the treatment of unligated thoracic side branch of left internal mammary artery: Underexpanded stent

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Abstract

The left internal mammary artery (LIMA) is often preferred in coronary artery bypass grafting (CABG). LIMA has additional features such as less fenestration in the endothelial layer, less intercellular permeability, anti-thrombotic activity, rapid lipolysis, and less lipid synthesis, resulting in an excellent long-term patency rate. LIMA side branches or anatomical variations that are not ligated intraoperatively may cause coronary ischemia in the postoperative period. Although various treatment modalities such as coiling, vascular plug embolization, and surgical ligation have been described in treating LIMA side branches, no studies show the superiority of one treatment modality over another. In this case, the advantages, disadvantages, and critical points affecting the success of unligated LIMA side branches treatment methods were discussed.

Keywords: CoronaryArtery Bypass, Stents, Internal Mammary-Coronary Artery, Anastomosis.

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INTRODUCTION

In the world, coronary artery disease (CAD) is a leading cause of mortality and morbidity, as well as the most common cause of hospitalization (1). The coronary artery bypass graft (CABG) surgery is an effective method of revascularization in treating CAD (2). In patients who undergo CABG surgery, the duration of graft patency has an impact on both short and long-term cardiovascular outcomes. Considering the excellent long-term patency rate of the left internal mammary artery (LIMA) grafts in CABG treatment of coronary artery disease, the LIMA is often chosen over saphenous vein grafts (3). Our case relates to a patient who had a ligated 1st intercostal artery during CABG and had a side branch of the LIMA unligated as an anatomical variation. Several percutaneous treatment options have been reported for patients with objective myocardial ischemia due to open LIMA side branches, including vascular plugs, coils, and gel foam (4,5).

This case report aims to present a case in which an unligated LIMA side branch causing coronary ischemia was successfully occluded by the use of our stenting method implanted without optimal patency to prevent coronary ischemia from occurring.

CASE REPORT

Informed consent was obtained from the patient. A 41-year-old woman was operated 12 years ago for valvular pulmonary stenosis and had a coronary artery bypass surgery five years ago. The patient presented to our clinic with Canadian Cardiovascular Society Angina Grade 3 despite maximal antianginal therapy for the past month. There were no specific symptoms on physical examination. Electrocardiography (ECG) was in sinus rhythm with negative T waves in the anterior and inferior leads. Echocardiography revealed anteroseptum, apical septum, and apical hypokinesia, and the left ventricular ejection fraction was 45%. Myocardial perfusion scintigraphy revealed diffuse ischemia in the anterior wall, and coronary angiography was performed. Coronary angiography showed that patency of the left anterior descending (LAD)-LIMA anastomosis was patent but the unligated LIMA side branch was causing coronary steal syndrome (Figure 1). No severe lesions or anastomosis were ascertained in the left circumflex or right coronary arteries. The patient was evaluated by cardiology and cardiovascular surgery. It was decided to occlude the non-ligated LIMA side branch. A Judkins right coronary catheter (JR) through a 6-French (F) sheath from the right femoral artery was selectively inserted into the LIMA. The LIMA side branch was crossed using a 0.014 floppy wire. A 2.25 x 20 mm diameter drug-eluting coronary stent was first implanted in the mid-side branch at 5 atm pressure (Figure 2a). Then, a 2.5 x 9 mm bare metal coronary stent was implanted into the stent at 5 atm pressure to include the proximal part of the stent (Figure 2b). The procedure was terminated before the stents were fully dilated (Figure 2c).

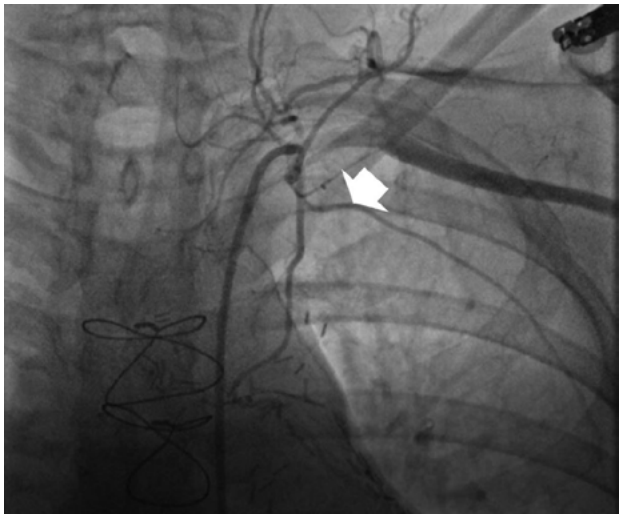

Figure 1. Unligated side branch originating from the left internal mammary artery

Following stent implantation, the patient with no chest pain or no change in ECG was transferred to the coronary intensive care unit for follow-up. During stent implantation, the patient was given unfractionated heparin and acetylsalicylic acid. No clopidogrel or any other antiplatelet drug was given. After 24 hours of follow-up, instead of dual antiplatelet treatment, only acetylsalicylic acid was prescribed, and the patient was discharged. At the 1-month follow-up visit, control CAG was performed, and the unligated LIMA side branch was completely occluded (Figure 2d).

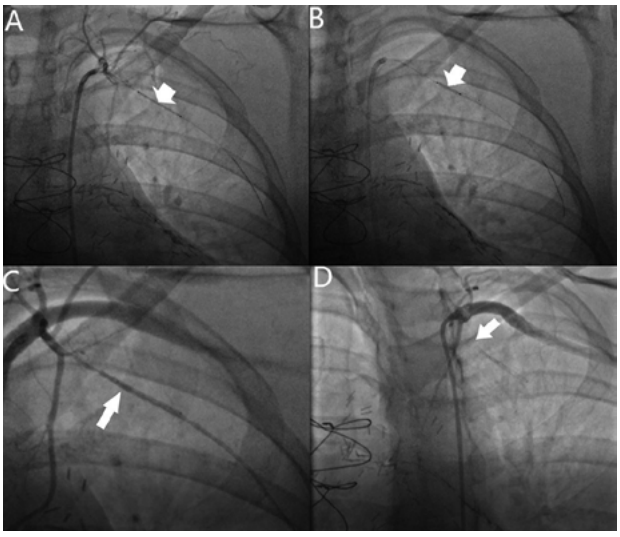

Figure 2. Percutaneous treatment of coronary steal syndrome

A. 2.25 x 20 mm diameter drug-eluting coronary stent was first implanted in the mid-side branch at 5 atm pressure

B. 2.5 x 9 mm bare metal coronary stent was implanted into the stent at 5 atm pressure to include the proximal part of the stent

C. The procedure showing incomplete stenting to the unligated LIMA side branches arteries was terminated.

D. Total occlusion of unligated LIMA side branches arteries was observed in angiography 1 month later

DISCUSSION

CABG is the most frequently performed major cardiac surgery in coronary revascularization treatment. LIMA is used in 81% of coronary revascularization procedures (6). LIMA graft failure is rare in the early period and is frequently caused by hematoma, dissection, and stenosis at the anastomosis site (7). It is unclear when sensitive plaques can cause acute coronary syndrome (8). One cause of long-term LIMA graft failure is an unligated LIMA side branch. While the thin caliber branches of the LIMA, such as the sternal and intercostal branches do not cause ischemia most of the time, the low resistance of the side branch, such as the lateral internal thoracic artery compared to the LIMA may cause blood to be directed to the low-resistance side branch and cause ischemia (9).

There is no definite guideline recommendation on treating unligated LIMA side branches. LIMA side branches may not always cause myocardial damage. Therefore, further examinations are required to test for myocardial ischemia in such patients. In a study consisting of 38 cases, the benefit of working with a myocardial scintigraphy test was demonstrated. As in our case, ischemia of LIMA side branches is mostly seen in myocardial perfusion scintigraphy in the literature (10). In another literature case example, one case was closed with Amplatzer Vascular Plug. In particular, vascular plug embolization is a therapeutic choice for medium to large vessels, whereas coils are more commonly used for small vessels (11). A LIMA side branch of appropriate diameter is required for the vascular plug, otherwise, problems such as device embolization may occur. Even though coil application is frequently preferred, it has a spiral structure and can easily take a curved shape in aneurysmal lesions; it may not take a spiral shape in regular vessels as in our case. Another alternative treatment method is graft stents, which have high success rates, but there is no follow-up data since restenosis is a serious problem (12).

Informed Consent: Informed consent was obtained from the patient.

Declarations

This study was presented as a 'poster presentation' at the 18th International Congress of Update in Cardiology and Cardiovascular Surgery on 1–4 December 2022 in Antalya, Turkey. The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

REFERENCES

1. Ties D, van Dorp P, Pundziute G, Lipsic E, van der Aalst CM, Oudkerk M, et al. Multi-Modality imaging for prevention of coronary artery disease and myocardial Infarction in the general population: Ready for prime time? J Clin Med. 2022;11(11):2965.
2. Halabi AR, Alexander JH, Shaw LK, Lorenz TJ, Liao L, Kong DF et al. Relation of early saphenous vein graft failure to outcomes following coronary artery bypass surgery. Am J Cardiol. 2005;96(9):1254-9.
3. Guzon OJ, Klatte K, Moyer A, Khoukaz S, Kern MJ. Fallacy of thoracic side-branch steal from the internal mammary artery: analysis of left internal mammary artery coronary flow during thoracic side-branch occlusion with pharmacologic and exercise-induced hyperemia. Catheter Cardiovasc Interv. 2004;61(1):20-8.

4. Weinberg N, French WJ, Shavelle DM. Use of the Amplatzer Vascular Plug for treatment of coronary steal. Int J Cardiol. 2008;124(1):109-11.
5. Akilli A, Duygu H, Erturk U, Yildiz A, Zoghi M, Ozerkan F. Transbrachial coil occlusion of unligated thoracic side branch of arterial graft of internal mammary artery leading to silent ischemia in a diabetic patient. Int J Cardiol. 2006;113(1):16-8.
6. Cleveland JC Jr, Shroyer AL, Chen AY, Peterson E, Grover FL. Off-pump coronary artery bypass grafting decreases risk-adjusted mortality and morbidity. Ann Thorac Surg. 2001; 72(4):1282-1289.
7. Nakamura T, Yamamoto S, Funayama H, Mitsuhashi T, Momomura SI. Acute occlusion of the left internal mammary artery graft in the late postoperative period. J Cardiol Cases. 2014; 10(2):51-53.
8. Keskin K, Yıldız SS, Çetinkal G, Kilci H, Çalışkan N, Keskin EB, et al. The Association of Plasma Apelin Levels with Plaque Vulnerability. Sisli Etfal Hastan Tip Bul. 2019;53(3):267-271.
9. Singh RN, Sosa JA. Internal mammary artery--coronary artery anastomosis. Influence of the side branches on surgical result. J Thorac Cardiovasc Surg. 1981;82(6):909-14.
10. Biceroglu S, Karaca M, Yildiz A, Ildizli Demirbas M, Yilmaz H. Can left internal mammary artery side branches affect blood flow rate? Cardiovasc J Afr. 2009;20(2):119-21.
11. Yorgun H, Canpolat U, Kaya EB, Çil B, Aytemir K, Oto A. The use of Amplatzer Vascular Plug(®) to treat coronary steal due to unligated thoracic side branch of left internal mammary artery: four year follow-up results. Cardiol J. 2012;19(2):197-200.
12. Gercken U, Lansky AJ, Buellesfeld L, Desai K, Badereldin M, Mueller R, et al. Results of the Jostent coronary stent graft implantation in various clinical settings: procedural and follow-up results. Catheter Cardiovasc Interv. 2002;56(3):353-360.