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IMAGING VIGNETTE

ADVANCED

CLINICAL VIGNETTE

Combined Cardiac PET-CT and Transcatheter Closure for Left Internal Mammary Artery Side Branch Steal Syndrome

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ABSTRACT

We report on a patient with left internal mammary artery (LIMA) side branch steal syndrome and refractory angina who underwent successful transcatheter LIMA side branch closure after cardiac positron emission tomography–computed tomography assessment. The procedure resulted in improved myocardial ischemia, hyperemic blood flow, coronary flow reserve, and anginal symptoms. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2021;3:297–9) © 2021 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

The left internal mammary artery (LIMA) side branch steal syndrome is a rare cause of refractory angina in patients after coronary artery bypass grafting (CABG) (1). However, the hemodynamic significance of large LIMA thoracic side branches and the potential clinical benefits of transcatheter side branch occlusion for angina relief remain controversial (2). Decision-making for LIMA side branch intervention in the management of LIMA side branch coronary steal syndrome relies on the documentation of myocardial ischemia and the effective contribution of the LIMA side branch to coronary blood flow in the native coronary artery (1,2). Cardiac positron emission tomography–computed tomography (PET-CT) represents an attractive noninvasive imaging modality to assess both myocardial ischemia and coronary blood flow, identifying patients with LIMA side branch steal phenomenon who may benefit from invasive treatment.

A 64-year-old woman was admitted for recurrent typical chest pain on exertion. Two years earlier, she underwent a coronary angiogram for de novo exertional angina that showed a chronic total occlusion (CTO) of the proximal right coronary artery (RCA) and an intermediate-grade hemodynamically significant mid-left anterior descending artery (LAD) stenosis (Videos 1 to 2). After heart team discussion, the patient underwent CABG with a LIMA graft to the LAD artery and Y-anastomosed right internal mammary artery (RIMA) to the posterior descending artery (PDA). During the current admission, the coronary angiogram demonstrated patent native LAD and left circumflex coronary arteries, a proximal RCA CTO, an occluded LIMA graft to LAD beyond the LIMA-RIMA Y-anastomosis, a patent RIMA graft to the PDA, and a large-sized unligated LIMA thoracic side branch (**Figure 1A to 1C**, Videos 3 to 5). A cardiac PET-CT scan showed significant myocardial ischemia in the mid-inferior septal, inferior, and inferior lateral segments (total perfusion defect [TPD], 10% of the left ventricular volume) (**Figure 1D**). The global hyperemic blood flow (2.15 ml/g/min), global coronary flow

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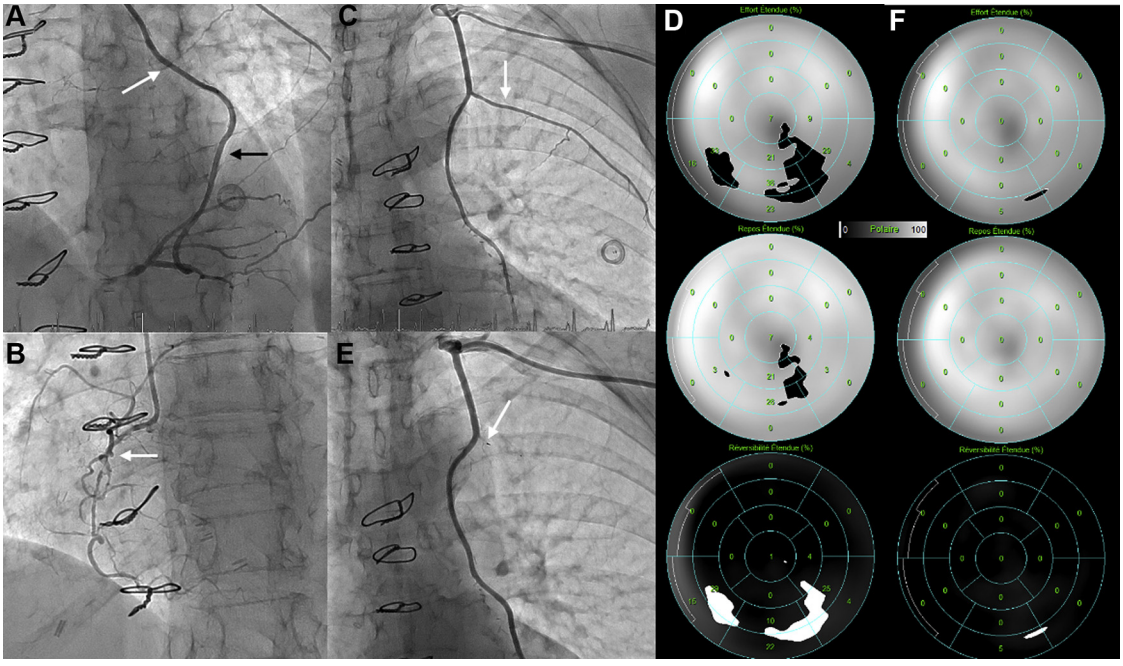
FIGURE 1 Multimodality Imaging Assessment of LIMA Side Branch Steal Syndrome



Coronary angiogram demonstrating an occluded **(A)** left internal mammary artery (LIMA) graft to the left anterior descending artery **(white arrow)**, and a patent right internal mammary artery (RIMA) graft to the posterior descending artery (PDA) **(black arrow)**; **(B)** a chronic total occlusion of the proximal right coronary artery (RCA) **(white arrow);** and a **(C)** large-sized unligated LIMA thoracic side branch **(white arrow)**. **(D)** Cardiac positron emission tomography-computed tomography (PET-CT) scan before LIMA side branch intervention showing significant perfusion defects in the inferior septal, inferior, and inferior lateral segments at stress **(upper panel, black area),** with partial perfusion reversibility at rest **(mid panel, black area)** suggesting significant myocardial ischemia in the RCA territory **(lower panel, white area)**. **(E)** Coronary angiogram after transcatheter closure of the LIMA side branch confirming the occluded LIMA thoracic side branch **(white arrow)** and a patent RIMA graft to the PDA. **(F)** Cardiac PET-CT after LIMA side branch intervention showing normalized perfusion defects at stress **(upper panel, black area)** and at rest **(mid panel)**, and the absence of significant residual myocardial ischemia in the RCA territory **(lower panel, white area)**.

reserve (CFR) (2.80), and CFR in the RCA territory (2.44) were preserved, whereas the hyperemic blood flow in the RCA territory was reduced (1.90 ml/g/min). Due to refractory angina despite optimal medical therapy, the patient underwent successful percutaneous closure of the LIMA side branch using an MVP Microvascular Plug 5.3 × 12 mm (Medtronic Inc., Minneapolis, Minnesota) (**Figure 1E**, Videos 6 to 8). At 3-month follow-up, the patient was free from anginal symptoms. The control cardiac PET-CT demonstrated normalized perfusion defects in the inferior wall and the absence of significant residual myocardial ischemia in the RCA territory (TPD, 2% of the left ventricular volume) (**Figure 1F**). After LIMA side branch intervention, global CFR (3.61), global hyperemic blood flow (3.15 ml/g/min), as well as CFR (2.84) and hyperemic blood flow (2.35 ml/g/min) in the RCA territory improved.

Our case highlights the potential combined role of cardiac PET-CT for the noninvasive assessment of coronary blood flow and transcatheter closure for the effective treatment of selected symptomatic patients with LIMA side branch steal syndrome after CABG.

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KEY WORDS coronary artery bypass, myocardial ischemia, nuclear medicine

APPENDIX For supplemental videos, please see the online version of this paper.