



Refractory Angina Secondary to Large Unligated Side Branch of Internal Mammary Artery

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Highlights

Coronary artery disease (CAD) has become a common diagnosis. Managing the symptoms of CAD continues to be an ongoing dilemma requiring optimal medication management or potential revascularization with either percutaneous coronary interventions or coronary artery bypass grafting (CABG). We present a case of debilitating refractory angina in a patient with severe CAD after optimal medical therapy and CABG secondary to coronary steal phenomenon via the left internal mammary artery conduit supplying a large unligated side branch to the internal chest wall. While current data are inconclusive on this phenomenon, our patient had complete resolution of angina following coil embolization of unligated side branch of the internal mammary artery.

Keywords: Coronary artery disease; Coronary steal phenomenon; Refractory Angina

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Introduction

Coronary steal phenomenon (CSP) occurs when there is an alteration of blood flow away from the coronary circulation in patients who have undergone coronary artery bypass grafting (CABG) utilizing an internal mammary conduit. The left internal mammary artery (LIMA) is commonly used as a bypass graft to the left anterior descending artery (LAD) because of its favorable long-term patency rates [1]. CSP has been seen in patients with LIMA grafts and proximal left subclavian stenosis but has been controversial in patients with LIMA grafts and large unligated side branches (LIMA-SB). We present a case of recurrent chest pain in a patient with chronic total occlusion (CTO) of the right coronary artery (RCA), patent LIMA-to-LAD graft with left-to-right collaterals, and a large unligated LIMA-SB that completely resolved after coil occlusion of the LIMA-SB.

A 66-year-old male with coronary artery disease (CAD) status post CABG 15-years ago and ischemic cardiomyopathy was referred to the cardiology clinic for daily recurrent chest pain. His medical therapy included aspirin, atorvastatin, amlodipine, carvedilol, lisinopril, spironolactone, and isosorbide mononitrate. He underwent coronary angiography which was significant for known CTO of the native RCA and saphenous vein bypass graft

(SVG) with left-to-right collaterals from the LAD. The LIMA-to-LAD graft was widely patent with a large thoracic side branch supplying blood flow to the inner chest wall (figure 1). Myocardial perfusion imaging (MPI) was significant for perfusion defects along the inferior wall with associated wall motion abnormalities. Percutaneous revascularization of the native RCA and SVG was attempted but was unsuccessful and the patient was discharged home with ranolazine in addition to his previous antianginal therapy. He continued to have chest pain and was brought back to the cardiac catheterization laboratory where he underwent coil embolization of the LIMA-SB (figure 2) leading to complete resolution of his chest discomfort.

The use of the internal mammary artery in CABG has been shown to have superior graft patency and long-term survival when compared to the saphenous vein grafts [2, 3]. The incidence of large thoracic side branches from the LIMA has been approximated between 10-30% [3, 4]. While large side branches of the LIMA are typically ligated during surgery, doing so remains controversial as the incidence of coronary steal from these branches is thought to be rare.

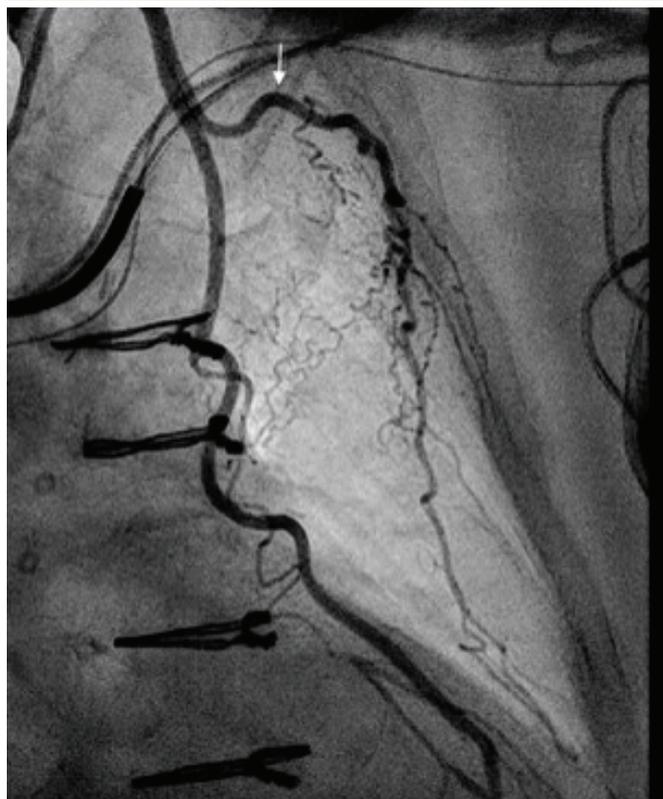


Figure 1. Angiography of left internal mammary artery with large side branch (arrow).

Critics to the idea of CSP have pointed out that coronary blood flow predominantly occurs during diastole when the myocardium is less resistant to perfusion whereas the LIMA-SB flow to the chest wall predominantly occurs during systole negating a steal phenomenon [5, 6]. Gaudino, et al. found that the only significant change in blood flow through the LIMA occurs with selective muscular relaxation which leads to increased systolic flow with a corresponding decrease in diastolic flow [7]. Others have also found no significant intracoronary hemodynamic changes using fractional flow reserve (FFR) measurements in hyperemic states and that flow near the LIMA-LAD anastomosis is predominantly diastolic [6].

While some have failed to produce data to support refractory angina secondary to CSP, several LIMA-SB cases with refractory angina have found symptomatic improvement with coil occlusion [1, 3, 4, 8-10]. Previous studies have utilized intracoronary flow measurements with inconsistent data, however, Benton, et al. utilized MPI to evaluate-exercise induced anterior wall ischemia in patients with a LIMA-SB and found a 95.8% sensitivity and a 100% specificity in predicting anterior ischemia in patients with LIMA-SB greater than 11.0 cm in length and 1.3 mm in diameter [3].

Our patient presented with recurrent angina limiting his quality of life. While his MPI was significant for reduced perfusion to the inferior portion of his heart, PCI of the native RCA and RCA-SVG were not feasible. Intracoronary FFR of the LIMA, pre and post occlusion of the large unligated side branch, were not performed due to paucity of other treatment options. Given that he had developed left-to-right collaterals from his LAD to RCA, a coil was successfully placed in the LIMA-SB leading to complete resolution of his angina and an improved quality of life.

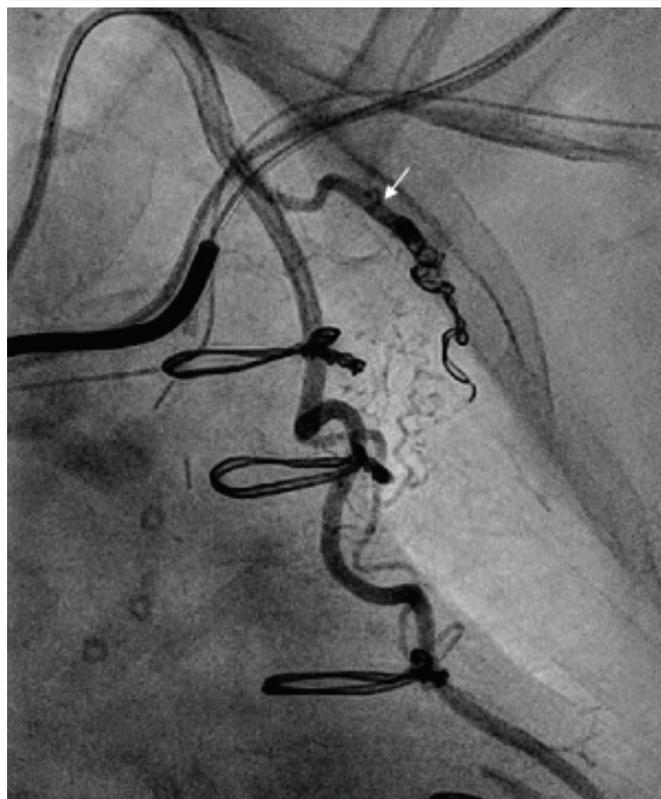


Figure 2 Angiography of left internal mammary artery after successful coil embolization (arrow) of large side branch leading to resolution of chest pain.

The evidence for coronary steal phenomenon due to internal mammary artery side branches continues to be controversial. The exact pathophysiology as to why some patients are more affected than others warrants further investigation. We presented a patient plagued by recurrent angina with complete resolution of symptoms after successful coil embolization of large internal mammary side branch artery.

Declaration of Interest

The authors declare no conflict of interest.

Acknowledgements

The authors state that they abide by the authors' responsibilities and ethical publishing guidelines of the International Cardiovascular Forum Journal [11].

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