Case reports

An uncommon cause of angina during upper limb exercise

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Subclavian artery stenosis or occlusion may be a cause of myocardial ischemia in patients treated using an internal mammary artery graft. Subclavian stenosis may cause myocardial ischemia during arm exercise by a coronary-subclavian steal phenomenon, with flow inversion in the graft from the coronary tree to the left subclavian artery. We here describe a case of a patient developing left subclavian occlusion after coronary artery bypass grafting with the left internal mammary artery. The lesion was successfully treated with a carotid-subclavian bypass. The article underscores the importance of an early diagnosis (possibly before bypass surgery) and discusses possible treatments. Percutaneous interventions with stent implantation appear the treatment of choice, but surgery has an important role in case of total occlusion.

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Subclavian artery stenosis or occlusion is an uncommon cause of myocardial ischemia in patients treated with coronary bypass surgery with an internal mammary artery graft. We here describe a case of a patient developing left subclavian occlusion after coronary artery bypass grafting (CABG) with the left internal mammary artery (LIMA).

A 52-year-old woman with a history of hypertension was referred to our clinic for a recent worsening of effort angina which had initially manifested about 18 months earlier. She complained of typical angina with episodes occurring mainly during seated lightweight activities. The patient had been submitted to CABG 3 years earlier with anastomosis of the LIMA to the left anterior descending artery (LAD), and three saphenous vein grafts: to the right coronary artery (RCA), to the first obtuse marginal branch of the circumflex artery (OM1) and to the first diagonal branch (D1). Three months after CABG she suffered an inferior uncomplicated acute myocardial infarction followed by a period of relative wellbeing lasting 1 year.

Clinical examination revealed normal cardiac findings but reduced brachial and radial left pulses with a systolic blood pressure 140/80 mmHg at the right arm and of 110/60 mmHg at the left arm. Basal ECG showed a previous inferior myocardial infarction. Chest X-ray and routine laboratory tests were normal. Despite optimal therapy, the patient suffered angina episodes and left arm paresthesia with ST-segment downsloping in the anterior precordial leads during upper limb movements and prompt regression with rest.

Control angiography revealed a 50% LAD stenosis proximal to the graft anastomosis and a prompt back flow from the LAD through the LIMA graft to the left subclavian artery (Fig. 1) which showed a proximal occlusion at aortography (Fig. 2). Other findings were the patency of the vein graft to D1, the occlusion of the vein grafts to the RCA and OM1, and the occlusion of both the native RCA and of the OM1 proximal to the graft anastomoses.

The patient underwent a left carotid-subclavian bypass and after 3 years is still asymptomatic.

Discussion

The most common cause of an early LIMA graft insufficiency is the patency of the intercostal branches in the graft body. More rarely a subclavian stenosis or occlusion, proximal to the LIMA origin, may cause myocardial ischemia during arm ex-

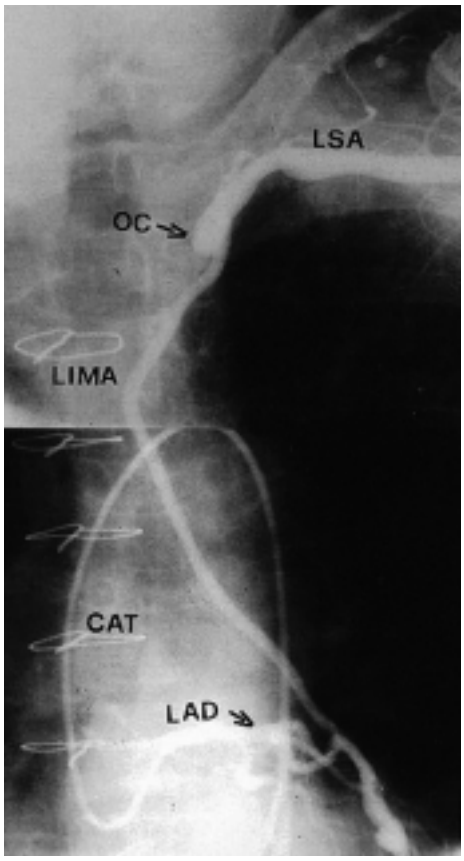

Figure 1. *Angiography of the left coronary artery and left internal mammary artery (LIMA) in the antero-posterior view. The figure is a composite of two images obtained during the same injection. Note the backflow from the left anterior descending coronary artery (LAD) to the left subclavian artery (LSA) through the LIMA. CAT = diagnostic catheter; OC = proximal occlusion of the LSA.*

ercise by a coronary-subclavian steal phenomenon with flow inversion in the graft from the coronary tree to the left subclavian artery[1-3].

Systematic physical examination should reveal subclavian stenosis and should be performed in all patients. Bilateral simultaneous brachial blood pressures (with a pressure difference > 20 mmHg) is a good and simple screening test. However, this simple screening may be insufficient and a routine injection into the orifice of the subclavian artery during diagnostic catheterization may help avoiding a catastrophic outcome[4].

In a recent study, the prevalence of subclavian artery stenosis in 86 patients with prior CABG surgery was relatively high (5%)[5]. In most cases (up to 70%) subclavian stenosis is present prior to the intervention[2].

The most frequent manifestations are myocardial ischemia, sometimes related to arm exercise, arm paresthesias and a difference in blood pressure between the two arms[2]. A coronary-subclavian steal may be missed because it is a rare condition and cardiac symptoms appear late in relation to the severity of the subclavian stenosis. Indeed, in our patient the relation of the symptoms to arm exercise appeared only when the symptoms became severe, probably in relation to the occlu-

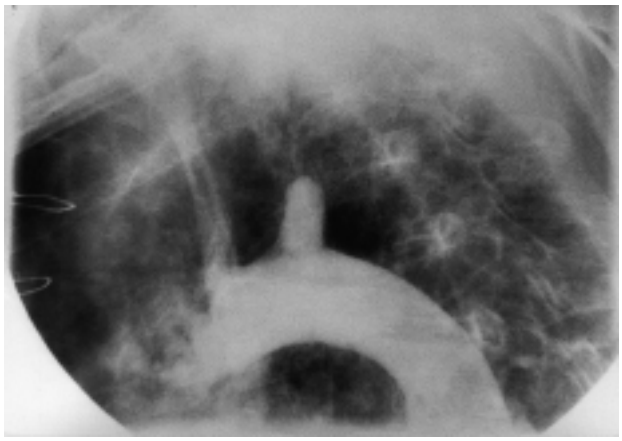

Figure 2. *Aortogram showing proximal occlusion of the left subclavian artery in the left anterior oblique view.*

sion of the left subclavian artery. Besides, the arterial pressure difference between the two arms was also detected late.

Our patient became symptomatic 1.5 years after CABG which, considering the slow rate of progression of subclavian stenoses, suggests that the stenosis was already present at the time of the initial surgery[2]. An earlier diagnosis of the coronary-subclavian steal may have permitted a percutaneous subclavian intervention[6]. Percutaneous transluminal angioplasty with stent implantation is usually the treatment of choice for subclavian stenosis. There is a general agreement that percutaneous transluminal angioplasty (usually with stent implantation) should be performed in all cases with significant subclavian stenosis and a mammary artery graft[7]. In a recent study on 14 patients with subclavian stenosis and coronary-subclavian steal (11 of them with angina and/or congestive heart failure after CABG), percutaneous transluminal angioplasty and stenting was performed in 11 patients, angioplasty with balloon only in 2 patients, and carotid-subclavian bypass grafting in 1 patient. There were 2 cases of restenosis with recurrent angina, which were successfully treated with a new angioplasty[8]. In a previous study including 21 patients treated with balloon angioplasty (with stents only as a bailout), the long-term primary patency rate was 80%, but with widespread use of stenting this percentage is now clearly higher[9]. Restenosis is rare after stent implantation and may be successfully treated with a new angioplasty[10]. Carotid-subclavian bypass should be reserved for a symptomatic coronary-subclavian steal due to subclavian occlusion or stenosis not amenable to percutaneous interventions. In these cases carotid subclavian bypass may be performed safely with an excellent mid-term durability[11].

In patients with subclavian stenosis diagnosed before bypass surgery, every effort should be made to offer a mammary artery graft. Recently, Cooley's group in Houston treated 5 consecutive patients (all with con-

comitant subclavian and coronary artery disease diagnosed before operation) with direct subclavian artery bypass and a simultaneous CABG procedure using the ipsilateral internal mammary artery. After a 3.7-year follow-up, the patency rate was 100% and all patients were symptom-free[12].

Taken together, these observations underscore the importance of investigating the presence of a subclavian stenosis prior to CABG surgery.

The possibility of a coronary-subclavian steal should be considered in patients with angina after bypass surgery using a mammary artery graft, since this condition may be successfully treated either by surgery or angioplasty.

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