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# Is Percutaneous Transluminal Coronary Angioplasty the Treatment of Choice for Iatrogenic Stenosis of the Left Main Coronary Artery following Aortic Valve Replacement?

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## ABSTRACT

Iatrogenic coronary ostial stenosis after aortic valve replacement (AVR) is a rare but life-threatening complication. This condition has been treated with urgent coronary bypass surgery, but such surgery is associated with high morbidity and mortality. The clinical symptoms are usually severe and may appear from 1 to 6 months postoperatively. Pains in the chest that are typical for coronary artery disease but occur in patients after the AVR operation suggest a significant threat. We report a case of left main coronary artery ostial stenosis in a patient who had normal preoperative coronary angiography results. The patient was successfully treated with implantation of a drug-eluting stent.

## INTRODUCTION

Iatrogenic left and/or right coronary artery ostial stenosis after aortic valve replacement (AVR) is a rare but life-threatening complication. The potential reasons for this problem are direct obstruction by the prosthetic annular ring or stent and trauma to the ostium during cannulation for the administration of cardioplegia [Yavuz 2002].

Coronary ostial stenosis is a rare but potentially serious complication after AVR. The clinical symptoms are usually severe and may appear from 1 to 6 months postoperatively. The presentation is typically symptoms of acute myocardial ischemia, ventricular arrhythmia, or heart failure that occur within 6 months of cardiac surgery [Funada 2006]. It occurs in the left main or right coronary artery after 1% to 5% of AVR procedures. Although coronary artery bypass grafting is the typical treatment, the hazards of early repeat sternotomy and the difficulties in protecting the hypertrophied myocardium during surgery are associated with high morbidity and mortality [Funada 2006]. Pains in the chest that are typical for coronary artery disease but occur in patients after AVR operation suggest a significant threat. We describe a case of ostial stenosis of the left main coronary artery (LMCA) in a patient with normal results in a preoperative coronary angiography examination. The patient was successfully treated with implantation of a drug-eluting stent [Hadjimiltiades 2005; Placci 2005].

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## CASE REPORT

In April 2010, an 82-year-old female patient presented with class III chest pains, according to the Canadian Cardiovascular Society Angina Classification. The patient had a history of hypertension, hypercholesterolemia, hypothyroidism, and a known history of aortic valve stenosis (AS). An echocardiography examination revealed severe AS (mean systolic aortic valve [AV] gradient, 45 mm Hg; aortic valve area, 1.0 cm2 ) with degree II aortic regurgitation and left ventricular hypertrophy with a preserved systolic function. Cardiac catheterization results showed a normal LMCA ostium (Figure 1) and no lesions in any coronary arteries. Surgical AVR was offered. In September 2010, the patient underwent AVR. A 21-mm porcine bioprosthetic AV (Hancock II; Medtronic, Minneapolis, MN, USA) was implanted. Antegrade warm blood cardioplegic solution was administered by means of selective ostial perfusion and the use of cannulae with self-inflating balloons. A balloon 4 mm in diameter was inserted into the right coronary artery ostium, and a 6-mm balloon was inserted into the LMCA ostium. An intraoperative transesophageal echocardiogram showed no obstruction of the LMCA ostium. Postoperatively, the patient was started on warfarin therapy (international normalized ratio, 2-3), continued on warfarin for 3 months, and then started on aspirin treatment. Four months later, the patient was admitted to our hospital with unstable angina. An electrocardiography examination revealed transient ST-segment depression in the anterior leads (V3-V6). The patient's serum troponin T levels were not elevated. A transthoracic echocardiography examination showed no evidence for bioprosthetic AV dysfunction. The patient refused transesophageal echocardiography. Urgent coronary angiography revealed the presence of a critical ostial stenosis (99%) of the LMCA (Figure 2) and no atheroma in other coronary vessels. The heart team decided to avoid

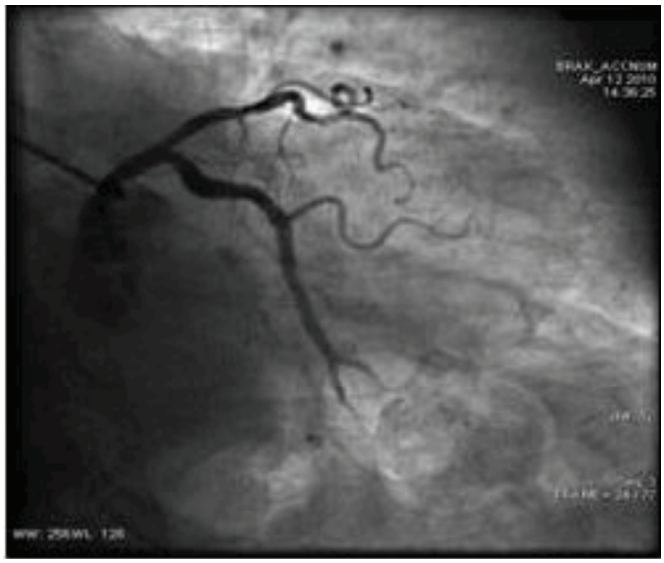

Figure 1. A preoperative angiogram demonstrated a normal left main coronary stem.

Figure 2. Repeat coronary angiography results showed severe proximal stenosis of the left main coronary artery.

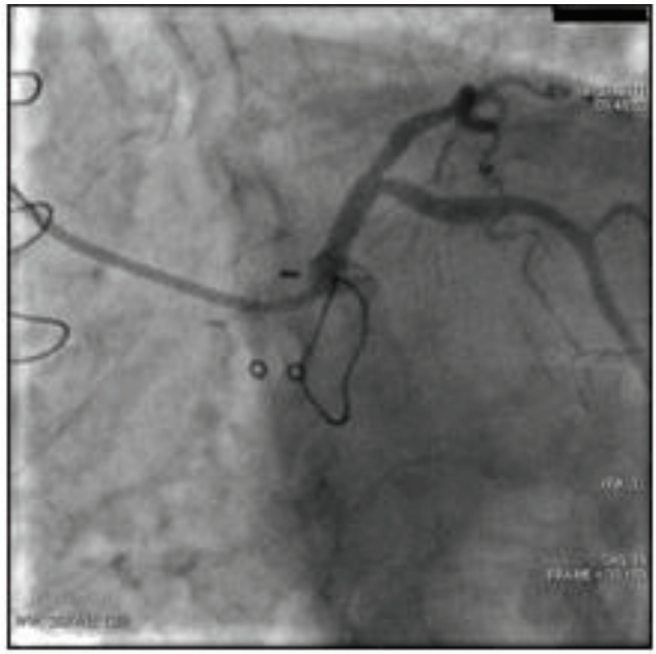

Figure 3. TIMI III flow after direct stenting of the left main coronary ostium with an Endeavor Resolute Zotarolimus-Eluting Stent (4.0 × 12 mm).

the risk of redo surgery, and the patient underwent uneventful direct stenting of the LMCA lesion with placement of an Endeavor Resolute Zotarolimus-Eluting Stent (4.0 × 12 mm; Medtronic, Minneapolis, MN, USA). An angiography examination showed very good results with a flow value of 3 in the Thrombosis in Myocardial Infarction (TIMI) classification (Figure 3). Integrilin (eptifibatide) was administered for 12 hours, and clopidogrel was prescribed for 12 months, along with aspirin and a statin. The patient was discharged from the hospital the next morning. Two years after the percutaneous intervention, she remains asymptomatic at examinations in the outpatient clinic.

## DISCUSSION

Although coronary ostial stenosis after AVR can occur in the right coronary artery or the LMCA, the condition occurs more often in the left coronary system. Patients with iatrogenic coronary ostial stenosis typically present within 6 months of AV surgery with symptoms of myocardial ischemia, infarction, left ventricular failure, arrhythmia, or sudden death. The most probable mechanism is injury to the coronary ostia caused by catheters used for antegrade cardioplegia delivered via the coronary ostia [Funada 2006]. Development of coronary ostial stenosis also has been postulated to be the result of an immunologic reaction to heterografts; however, its occurrence after mechanical-valve implantation makes that less likely [Chavanon 2005]. Turbulent flow around prosthetic valves can provoke intimal thickening and fibrous proliferation near the aortic root, which can be a mechanism of coronary ostial stenosis.

A genetic predisposition may also be present, and the apolipoprotein E ε4 allele has been suggested to predispose patients to a pathologically increased proliferative repair response after arterial injury [Winkelmann 1993]. Our patient had undergone selective ostial administration of cardioplegic fluid, and that was probably the pathophysiological mechanism for the postoperative coronary ostial stenosis. The option to reduce the incidence of coronary ostial stenosis might be retrograde administration of cardioplegic solution through the coronary sinus, where rupture is far less common than is ostial stenosis.

Reperfusion should be performed immediately after a diagnosis of coronary ostial stenosis.

Presentation of a new coronary stenosis usually occurs within the first months of surgery, when pericardial adhesions are most dense and there is residual inflammation of tissues. That leads to an increased risk of major vessel injury due to difficulties in identifying structures during the operation. In addition, in the short interval between AVR and repeat thoracotomy, left ventricular hypertrophy is unlikely to have fully regressed, limiting myocardial preservation during bypass [Chavanon 2002]. These factors lead to a high risk of perioperative myocardial infarction and cardiac failure.

With the results of contemporary randomized controlled trials, such as SYNergy between percutaneous coronary intervention with TAXus and cardiac surgery (SYNTAX), percutaneous therapy for LMCA stenosis is gaining wider acceptance as a feasible alternative to conventional surgery. The registries describing LMCA angioplasty with drug-eluting stents have reported excellent immediate and midterm outcomes, with a low need for revascularization due to restenosis: 1 of 147 patients (0.9%) at a mean of 886 ± 308 days [Chieffo 2007].

The alternative minimally invasive approach for patients with an LMCA lesion might be minimally invasive direct coronary artery bypass (MIDCAB) without cardiopulmonary bypass. After completion of grafting of the left internal thoracic artery to the left anterior descending artery, a radial artery or saphenous vein graft is anastomosed to the obtuse marginal branch. Extending the left anterior small thoracotomy 3 or 4 cm laterally allows an approach to the obtuse marginal branch without rotating the beating heart [Takahashi 2000], but technical difficulties may restrict the surgical indications, despite the advantages. Furthermore, there may be insufficient time and no possibility to transport a patient to the cardiac surgery clinic. Patients also often do not agree to redo surgery, even with a less invasive method like the present strategy. After the heart team's decision to perform a percutaneous coronary intervention with implantation of a drug-eluting stent, we decided to avoid the risk of reoperation because of the typically very good immediate and short-term results after stenting the LMCA ostium [Seung 2008]. We implanted a drug-eluting stent because of the lower rates of restenosis compared with bare-metal stents in aorto-ostial lesions [Seung 2008].

To date, use of a drug-eluting stent at the LMCA for iatrogenic coronary ostial stenosis has not been reported. The major advantages of percutaneous intervention in this setting are its immediate availability and low perioperative risk.

In conclusion, the occurrence of unstable angina, left ventricular heart failure, and ventricular arrhythmias may be indications of such complications as coronary ostial stenosis and may require a rapid diagnosis.

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