Iatrogenic left main and proximal right coronary artery stenoses after aortic valve replacement

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Abstract

Iatrogenic left main coronary artery stenosis after aortic valve replacement is an infrequent but potentially life-threatening complication. A 44-year-old woman who had normal coronary arteries documented by preoperative coronary angiogram, and who developed severe stenosis of the left main coronary artery and subtotal occlusion of the proximal right coronary artery after aortic and mitral valve replacements is presented. Coronary lesions were clinically manifested 4 months after the first operation. Accurate diagnosis was confirmed by repeat coronary angiography. She underwent successful coronary artery bypass grafting. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

Iatrogenic left main coronary artery (LMCA) stenosis after aortic valve replacement (AVR) is an infrequent but life-threatening complication because of coronary perfusion related trauma to the vessel wall with cannulation of the coronary ostia [1–4]. It was first described by Roberts and Morrow [5] in 1967.

The insertion of perfusion cannula and direct coronary perfusion for myocardial protection during AVR may produce immediate traumatic lesions and late stenosis of the coronary arteries, by causing grave consequences, including sudden death [1–3]. This complication still occurs despite the use of more advanced catheter materials and modern surgical preservation techniques [4]. Prompt clinical recognition and early treatment may be life-saving.

We present a case of severe LMCA stenosis and subtotal occlusion of the proximal right coronary artery after aortic and mitral valve replacement, who had normal coronary arteries documented by preoperative coronary angiogram.

2. Case report

A 44-year-old woman was referred to another center because of increasing exertional dyspnea and palpitation for 2 months. She had atrial fibrillation. Physical examination and cardiac catheterization revealed severe mitral valve stenosis (mitral valve area: 0.76 cm², diastolic gradient 20 mmHg), grade II mitral valve regurgitation, severe calcific aortic valve stenosis (peak systolic gradient: 65 mmHg, aortic valve area: 0.91 cm²), and severe pulmonary hypertension (systolic pressure of 60 mmHg). Preoperative coronary angiogram was normal. In February 1999, she underwent mitral and aortic valve replacements with Medtronic-Hall mechanical prostheses (Medtronic Inc., Minneapolis, MN, USA) (31 and 21 mm in size, respectively) at the same hospital. She had undergone operation with antegrade delivery of cold blood cardioplegia and direct cannulation of both coronary ostia. Malleable coronary perfusion cannula of size 11F (3.5 mm, Stöckert) had been used. The patient had complete recovery. She was discharged by oral anticoagulant prescription.

Four months later, she admitted to our hospital with a 3-day history of increasing severe chest pain and dyspnea on exertion. On admission, blood pressure was 130/70 mmHg and pulse rate 65 beats/min and irregular. Resting electrocardiogram showed ST depression of 2 mm and T-wave inversion in precordial leads, II, III, and aVF. Physical examination revealed normal prosthetic valve sounds, rales on the base of the lungs, and grade 2/6 systolic ejection murmur at the right second intercostal space by auscultation. There was no pedal edema. An echocardiographic study showed good function of the prosthetic valves. Left ventricular ejection fraction was 66% and the septum was mildly hypokinetic. Her repeat coronary angiogram showed severe (50%) ostial stenosis of the left main coronary artery.
and 95% stenosis of the proximal right coronary artery (RCA) (Figs. 1 and 2).

The patient underwent emergency reoperation. A redo median sternotomy was performed, recent multiple adhesions were divided. Cardiopulmonary bypass was instituted by cannulating the right axillary artery and the right atrium with antegrade aortic root and retrograde coronary sinus perfusion with cold blood cardioplegia. The patient underwent double coronary artery bypass grafting (CABG) with use of saphenous vein graft to the RCA and the left internal mammary artery to the left anterior descending coronary artery. The postoperative course was uneventful and the patient was discharged on the ninth postoperative day. At her recent follow-up, 3.5 years after the second operation, she was symptom free.

3. Discussion

The true incidence of iatrogenic stenosis of the proximal coronary arteries is not known, but it has been reported in 1–5% of patients undergoing AVR in previous reports [1,2,4,6]. However, its probable incidence is likely to be higher, one assumes that certain unexplained sudden deaths after AVR may also be due to iatrogenic coronary ostial occlusion [1,2].

Coronary ostial stenosis developing after AVR is a probably well-known complication for older surgeons, although for younger surgeons it may be not as well-known as it has become rather unusual. The causative mechanism is probably mechanical trauma to the vessel wall due to direct cannulation of the coronary ostia, continuous perfusion of the coronary arteries under high pressure, and withdrawal and repeated cannulations caused intimal disruption or avulsion [1–8].

It may also occur in association with widespread intimal thickening in the aortic root, presumably as a reaction to turbulence around aortic ball valve prostheses [8]. Roberts and Morrow [5] described intimal thickening in the aortic root due to turbulent flow patterns, including the coronary ostia, in 14 patients who underwent AVR by a ball valve prosthesis. Bjork et al. [8] have encountered this process in two patients (0.4%), who underwent AVR with the Bjork–Shiley tilting disc valve prosthesis. Cheung et al. [3] reported that cause of LMCA ostial stenosis after AVR was probably related to the over-sizing and orientation of the prosthesis.

Trimble et al. [7] suggested a cause-and-effect relationship between late coronary stenosis and coronary cannulation. They showed that high coronary perfusion pressures were responsible for the coronary lesions after AVR.

Intimal ischemia and narrowing of the coronary arteries may also be explained by occlusion of vaso vasorum due to prolonged distention of the vessel wall. Occasionally, a purse string suture that placed around the coronary orifice to secure perfusion cannula, may cause ostial stenosis [1,2].

Fig. 1. Coronary angiogram showing severe stenosis of the left main coronary artery.
As a predisposing factor for development of such lesions after AVR, Winkelman et al. [4] suggested that patients with the α4 allele might be genetically predisposed for pathologically increased response of proliferative repair mechanisms after arterial injury.

This complication may occur in both proximal coronary arteries with predominance of the left coronary artery. Coronary ostia and adjacent segments are mostly involved [2–4,9]. Intimal proliferation may also occur a few millimeters beyond the coronary ostia [1].

Pennington et al. [6] showed that left coronary arterial injuries occurred distal to the coronary orifices in four of seven patients with coronary arterial stenoses. In our study, the lesion located distal to the orifice of the RCA.

A classic presentation is recent onset of severe angina, ventricular arrhythmias, congestive heart failure, and occasionally sudden death after the operation by a period of several months [1–3,7]. In our case, clinical presentation occurred 4 months after the first operation.

Repeated coronary angiography should be performed for the definitive diagnosis. This complication requires early CABG because of the potential risk of sudden death.

The conventional surgical treatment of isolated critical stenosis of the LMCA leads to the definitive occlusion of the vessel. Direct surgical angioplasty may be alternative surgical strategy in patients with iatrogenic LMCA stenosis [10].

Various measures to prevent the development of iatrogenic LMCA stenosis during coronary arterial perfusion should be undertaken. All manipulations around and inside the coronary ostia should be avoided. A soft hand when inserting the cannula and holding it in place is the main advice to be given the young surgeons. However, continuous or interrupted retrograde cardioplegia delivery should be made as a means to avoid this type of problem described here.

References


