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Iatrogenic left main and right coronary ostial occlusion following surgical aortic valve replacement

Oclusão ostial iatrogênica do tronco da coronária
esquerda e da coronária direita após substituição
cirúrgica da válvula aórtica

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ABSTRACT – Surgical aortic valve replacement is the gold standard for treatment of severe symptomatic aortic stenosis. Complications directly related to surgical procedure are relatively infrequent. Coronary ostial stenosis is a rare but potentially life-threatening complication, whose exact pathogenetic mechanism is not known, but a few hypotheses have been proposed. We present a case of a recurrent acute coronary syndrome during the first 12 months after simultaneous surgical aortic valve replacement and coronary artery bypass grafting, as a result of bilateral coronary ostial stenosis by prosthetic aortic valve. When this complication is suspected, especially in unstable patients, prompt diagnostic confirmation and early revascularization therapy are crucial. In this clinical setting, percutaneous intervention of coronary bypass emerged as the best revascularization option.

Keywords: Thoracic surgery; Coronary stenosis; Acute coronary syndrome; Iatrogenic disease

RESUMO – A substituição cirúrgica da válvula aórtica é o padrão-ouro para o tratamento da estenose aórtica sintomática grave. Complicações diretamente relacionadas ao procedimento cirúrgico são relativamente pouco frequentes. A estenose ostial da artéria coronária é uma complicação rara, mas potencialmente fatal, cujo exato mecanismo patogénico é desconhecido, embora algumas hipóteses já tenham sido propostas. Apresentamos um caso de síndrome coronariana aguda recorrente nos primeiros 12 meses após substituição cirúrgica da válvula aórtica realizada simultaneamente com cirurgia de revascularização do miocárdio, resultante da estenose ostial coronariana bilateral por válvula aórtica protética. Quando houver suspeita dessa complicação, principalmente em pacientes instáveis, a pronta confirmação diagnóstica e a revascularização precoce são cruciais. Nesse cenário clínico, a intervenção coronária percutânea foi considerada a melhor opção de revascularização.

Descritores: Cirurgia torácica; Estenose coronária; Síndrome coronariana aguda; Doença iatrogênica

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INTRODUCTION

Iatrogenic coronary ostial stenosis (ICOS) is a rare but potentially life-threatening complication of surgical aortic valve replacement (SAVR). It was first described by Roberts and Morrow in 1967,¹ and has been reported to occur in 1% to 5% of all patients undergoing this procedure.²⁻⁵ The most likely pathophysiological mechanism proposed is post-traumatic fibrous intimal proliferation, caused by coronary ostia cannulation for direct cardioplegia during the operation.⁶ Symptoms of ICOS, which usually develop within 3 to 6 months of surgery, can be rapidly progressive, so prompt clinical recognition and early treatment is required.

CASE REPORT

A 83-year-old female patient, with no cardiovascular risk factors, was referred for severe symptomatic aortic stenosis, with new onset of shortness of breath. A preoperative transthoracic echocardiogram (TTE) showed peak and mean aortic gradients of

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75 and 45mmHg, respectively; aortic valve area estimated in 0.6cm² and well-preserved left ventricle ejection fraction (LVEF). Coronary angiography revealed 50% ostial stenosis of left main coronary artery (LMCA) and 60% distal stenosis of dominant right coronary artery (RCA). In April 2018, she underwent uncomplicated cardiac surgery with insertion of a 19-mm PERIMOUNT bioprosthetic aortic valve, and simultaneously one-vessel coronary artery bypass grafting with a saphenous vein graft (SVG) to the left anterior descending (LAD) coronary artery (internal mammary artery was very thin). Cardiopulmonary bypass (CPB) was established and, during surgery, cardioplegic solution was administered from each coronary ostium via a selective coronary artery cannula. Withdrawal from CPB was uneventful and early postoperative recovery was

unremarkable. She was discharged home after 8 days on medical therapy: aspirin 100mg o.d., furosemide 60mg o.d., bisoprolol 5mg o.d. and atorvastatin 10mg o.d. Four months later, she was readmitted in the emergency department after syncope preceded by oppressive chest pain. The 12-lead electrocardiogram showed complete atrioventricular block, ST-segment elevation in DII, DIII and aVF, and ST-segment depression in DI and aVL (Figure 1). Due to diagnosis of inferior myocardial infarction, she underwent emergent coronary angiography that revealed bioprosthetic aortic valve involving the origin of LMCA and RCA conditioning their ostial occlusion, and SVG-LAD with 90% ostial stenosis (Figure 2). Several unsuccessful attempts have been made to advance the guide wire into RCA, and an initial conservative approach with optimization of medical therapy

Figure 1. 12-lead electrocardiogram on admission reveal complete atrioventricular block, ST-segment elevation in DII, DIII and aVF and ST-segment depression in DI and aVL.

Figure 2. Diagnostic coronary angiogram shows bioprosthetic aortic valve involving the origin of left main coronary artery (A) and right coronary artery (B) and severe ostial stenosis of saphenous vein graft/left anterior descending (C).

was adopted. Echocardiographic evaluation showed aortic bioprosthesis without signs of dysfunction, severe mitral insufficiency due to anterior leaflet prolapse, normal LVEF with akinesia of the middle and basal segments of the inferior wall and septum, and dilated right ventricle (RV) with significant systolic dysfunction. Posteriorly she developed hypotension and extreme bradycardia with transient need for a transvenous temporary pacemaker, which was withdrawn after recovery of her own sinus rhythm in 4 days. Because of recurrent angina associated with electrocardiographic changes compatible with ischemia, it was decided to perform ostial SVG-LAD angioplasty, with direct implantation of a 3.5x12mm Onyx drug-eluting stent, with good final angiographic result (Figure 3). She was discharged from hospital after 18 days without acute complications. At 5 months of follow-up, she was clinically stable, at New York Heart Association (NYHA) class II heart failure and with Canadian Cardiovascular Society (CCS) class II angina, and the echocardiographic reassessment was similar to the last one. She was again readmitted, 1 year after angioplasty, for non-ST segment elevation acute myocardial infarction and cardiogenic shock. Emergent coronary angiography showed SVG-LAD with severe in-stent stenosis and remaining coronary anatomy was overlapping. The graft lesion was successfully treated using a 3.0mm AngioSculpt balloon with complete restoration of flow. After the procedure, unfavorable evolution with pulseless electrical activity cardiac arrest, recovered after eight cycles of Advanced Life Support, and initiation of high doses of norepinephrine and dobutamine. Echocardiographic evaluation showed aortic bioprosthesis without signs of dysfunction, severe biventricular systolic dysfunction (LVEF 25%), severe mitral and tricuspid insufficiency, mild pericardial effusion under the right cavities and no signs of mechanical complications. Despite the supportive care measures, the patient developed refractory cardiogenic shock and died after 2 days.

Figure 3. Post-procedure coronary angiogram shows successful revascularization of the saphenous vein graft/left anterior descending with stent implantation (A and B).

DISCUSSION

Although the pathophysiological mechanism of coronary ostial stenosis after SAVR is not well understood, various mechanisms could have mutually influenced this case according to previous studies. Roberts and Morrow examined the postoperative pathological findings at necropsy in patients with SAVR and reported intimal fibrous thickening in the aortic root and proximal coronary artery.¹ In particular, the selective antegrade ostial cannulation for administration of the cardioplegic solution during surgery may produce microinjuries and local hyperplastic reaction due to perfusion pressure of cardioplegic fluid and over-dilation of the vessel by the tip of the catheter.⁶⁻⁸ Tukiji et al. reported that immunological reaction to the heterograft in patients with implanted bioprosthesis was a potential mechanism of ICOS and should be considered in cases of bilateral ostial coronary arteries stenosis revealed several months following the surgical procedure.⁷ There may also be a genetic predisposition for developing this complication, since 70% of affected patients as compared to 10% to 15% in a control group had an epsilon 4 allele apolipoprotein E genotype.⁹ Other mechanisms suggested are direct obstruction by the prosthetic valve and its components, prosthetic oversizing and improper positioning causing turbulence from the disc occluder moving in front of the ostium, and abnormally low ostia. Coronary ostial stenosis after SAVR may trigger several myocardial ischemic conditions. High clinical suspicion is crucial, hence evaluation through coronary artery angiography, and intravascular imaging if possible, is vital for timely management. The most peculiar aspect of our case was the relatively atypical presentation, due to the simultaneous involvement of both coronary ostia by the prosthesis. Contrary to what one would expect, this bilateral ostial compromise did not become an immediately fatal event. Although it was not possible to revascularize the culprit RCA, due to technical reasons, patent LAD graft was life-saving at an early stage. Because of recurrent ischemia with symptoms and electrical instability, which required a prompt intervention, angioplasty of the graft lesion was chosen as the best revascularization option. In the second ischemic event she was with a severe cardiogenic shock upon admission and did not survive, despite the revascularization of severe graft in-stent restenosis.

There is a reasonable body of evidence that ICOS may occur after SAVR. This complication may be life threatening if not promptly recognized, and should be avoided by limiting the manipulation of the ostia of coronary vessels as much as possible during the surgical procedure. This case illustrates the importance of having a high index of diagnostic suspicion if signs of myocardial ischemia occur soon after surgery, so that immediate reperfusion strategies can be implemented.

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None.

CONFLICTS OF INTEREST

The authors declare there are no conflicts of interest.

CONTRIBUTION OF AUTHORS

Conception and design of the study: AN; data collection: AN, PA e CXR; data interpretation: AN, PA e CXR; text writing: AN, PD e TP; approval of the final version to be published: AN, PA, CXR, TP, PD e MJM.

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