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Acute coronary occlusion after surgical replacement of the aortic valve treated with emergency off-pump coronary artery bypass grafting

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Abstract

Acute coronary occlusion after surgical replacement of the aortic valve is a rare but potentially fatal event. Due to its rarity, there is no univocal treatment with the percutaneous approach being the most commonly used for its promptness and ease of use. Only a few cases have been treated with coronary artery bypass grafting (CABG) and, to the best of our knowledge, none has been reported with the use of off-pump CABG (OPCABG). Here we describe the case of acute coronary occlusion of the circumflex artery immediately after surgical replacement of the aortic valve in a 79-year-old patient. The occlusion was promptly diagnosed and treated with interval emergency balloon angioplasty followed by OPCABG of the circumflex artery. The patient made a full recovery and was discharged home 12 days after the surgery.

KEYWORDS

aorta and great vessels, coronary artery disease

1 | INTRODUCTION

Acute coronary artery obstruction during aortic valve replacement is a possibly fatal complication of this type of surgery.¹ Case reports of this phenomena are rare and mostly relate to coronary artery stenosis in the months following surgical intervention.² Acute events such as plaque rupture, embolization and coronary spasm leading to acute myocardial ischaemia intraoperatively or in the immediate postoperative period, with subsequent cardiovascular failure are also described.³ A high index of suspicion, with prompt investigation and management are required to prevent mortality. Here we describe a near-fatal case of coronary artery occlusion during a surgical procedure of aortic valve replacement with its investigation and immediate management.

2 | CASE PRESENTATION

A 79-year-old male patient was referred to our hospital with symptoms of shortness of breath on exertion, but no angina or syncope. A transthoracic echocardiogram demonstrated severe aortic stenosis and a moderately impaired left ventricle, and the patient was referred for surgical replacement of the aortic valve (SAVR). His previous medical history included coronary artery disease with a previous anterior myocardial infarction managed with primary percutaneous coronary intervention (PCI) to the left anterior descending artery (LAD). A coronary angiogram was performed 3 months before surgical intervention showing the patency of the previous LAD stent and a moderate stenosis of the AV branch of the left circumflex (Figure 1). The fractional flow reserve (FFR) was 0.86 suggesting this a nonsignificant flow limiting stenosis. The surgical

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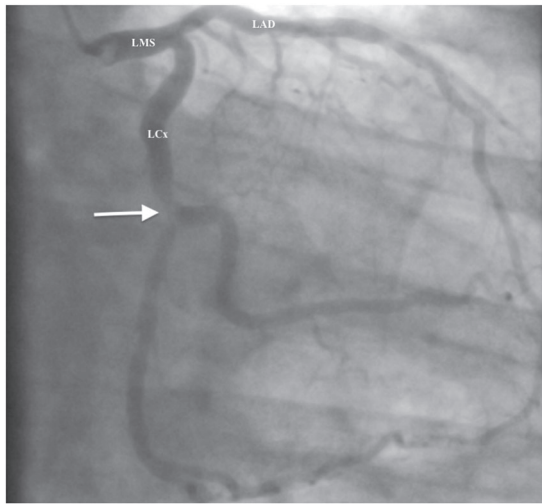


FIGURE 1 Preoperative coronary angiogram showing a moderate plaque on the circumflex artery (arrow). LAD, left anterior descending, LCx, left circumflex; LMS, left main stem

intervention proceeded via median sternotomy. A severely calcified aortic valve was found, and it was replaced with a 23 mm biological prosthesis using single non pledgeted sutures in an infra-annular fashion. Although the valve appeared severely calcified, there were no technical complications during the procedure and the total cross clamp time was 59 min. Once the cross-clamp was removed, the electrocardiography (ECG) demonstrated a complete heart block. This was managed by VVI pacing with temporary pacing wires and allowed the weaning from cardiopulmonary bypass (CPB) with minimal inotropic support. Immediately after weaning CPB, significant ST elevation was noted in all ECG leads, although no new areas of dyskinesia or akinesia were found at the intraoperative transesophageal echocardiogram and it was assumed that these ECG changes may have been related to a possible air embolus. The ECG changes persisted despite further attempt to deairing the heart and therefore CPB was reinstated and a single retrograde shot of retrograde cardioplegia was given in the attempt to remove possible air

emboli from the coronaries. The CPB was weaned for the second time and the ECG changes progressively resolved. Protamine was given and decannulation and hemostasis completed. Few minutes following sternal closure a new evidence of severe ST elevation in the inferior/posterior leads was seen and quickly deteriorated into ventricular tachycardia requiring DC cardioversion. An intra-aortic balloon pump was inserted into the right common femoral artery and the patient was stabilized allowing safe transfer to the Cath-lab. An emergency coronary angiogram demonstrated a new total occlusion of the circumflex artery just before the 1st obtuse marginal artery. (Figure 2A). We thought that this was due to an embolic event, while a thrombotic cause was excluded as the patient was fully heparinized when the ECG changes initially occurred. Interval emergency management was completed via a balloon angioplasty thereby achieving TIMI 3 flow (Figure 2B): this angioplasty, although incomplete, allowed us to stabilize the patient to finalize the revascularization via coronary artery bypass grafting. We intentionally decided not to use coronary stents to avoid the broad antiplatelets treatments associated with the use of stents.

The patient was immediately taken back to theatre and an Off-pump coronary artery bypass grafting was performed with a segment of saphenous vein grafted to the distal portion of the left circumflex artery. This resulted in prompt resolution of the ischemic changes. The patient was progressively weaned from the IABP and the inotropes and made full recovery. His postoperative convalescence was complicated by hospital acquired pneumonia and acute kidney injury, but after resolution of these complications he was discharged home after 12 days.

3 | DISCUSSION

Myocardial infarction with nonobstructive coronary artery is seen in 6%–15% of troponin positive acute coronary syndrome, the causes include embolism, plaque rupture with spontaneous recanalization, spasm, and flush occlusion of small calibre epicardial artery.⁴ The causes of emboli are mainly three. The direct coronary embolism,

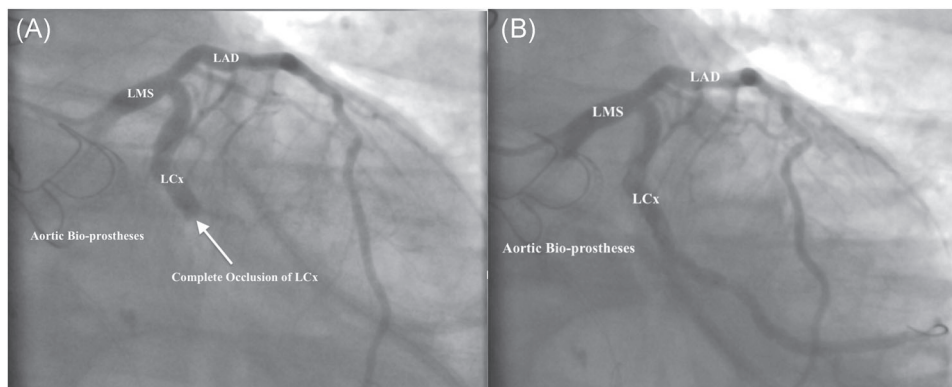


FIGURE 2 (A) Immediate postoperative coronary angiogram showing a complete occlusion of the circumflex artery. (B) reestablished TIMI 3 flow in the LCx branch after balloon dilatation. LAD, left anterior descending, LCx, left circumflex; LMS, left main stem

where emboli enter the coronary circulation via the systemic circulation or from within the left ventricle and it is mostly caused by atrial fibrillation, atrial myxomas, ventricular thrombus, or calcific emboli from calcific aortic stenosis. Another cause is represented by paradoxical coronary embolism: in this case the emboli enter the coronary circulation after passing from the venous circulation via a septal defect or a patent foramen ovale. Another important cause is the iatrogenic embolism that is associated with an interventional procedure, usually cardiac surgery, or PCI.

Coronary artery stenosis can occur acutely after aortic valve replacement due to inadequate positioning of the valve prosthesis.⁴ A postmortem autopsy report showed that 3.4% of deaths after SAVR were at least partly attributed to encroachment on one or both coronary ostia⁵ with causes of ostial compromise related to the valve sutures, the valve sewing ring, and the aortotomy suture line.⁵ Late coronary artery embolism following surgical aortic valve replacement is a rare event mostly related to a subtherapeutic anticoagulation leading to coronary embolic events that are treated with PCI.^{6,7}

There are only few case reports concerning coronary stenosis as acute complication after SAVR.^{1,3,6,8-10} A case similar to ours was recently reported by Sadek et al.⁸ with an acute left main stem occlusion following aortic valve replacement and mitral valve repair in a 41-year-old man with angio-graphically normal coronaries: even in that case the ischemia became evident after the protamine infusion and needed an emergency coronary artery thrombus aspiration. The source of the emboli was unknown. In another similar case, Sanchez-Recalde et al.,⁹ described a total right coronary occlusion after a SAVR in a patient with porcelain aorta. This case emphasizes the dangers of operating on patients with severe atherosclerosis affecting the ascending aorta.

In our case the aortic root was not calcified or atherosclerotic and although the preoperative assessment showed a visually stenosed obtuse marginal coronary artery, we were reassured by the FFR that intraoperative coronary intervention was not required. The precise embolic source was unknown, and it may have been secondary to calcific emboli leading a blockage in the previously stenosed location or most likely to an acute intraoperative coronary plaque rupture. Importantly the patient was stabilized with an intra-aortic balloon pump and was promptly transferred for a coronary angiogram allowing for a rapid diagnosis and management. In most of the previously reported cases of acute coronary emboli after SAVR, the management was a form of PCI (embolic aspiration or angioplasty/stent).^{3,6,8,9} Here we elected for aortocoronary bypass with vein graft immediately after the balloon angioplasty. Stenting was avoided due to the potential postoperative bleeding risk with antiplatelets. This proved to be a very effective treatment of the complication resulting in an immediate improvement of the ischemic signs on the ECG and prompting a rapid and progressive stabilization of the cardiovascular conditions. Moreover, the beating heart technique allowed us to avoid a second run of CPB

and a further cardioplegic arrest that might have represented further injuries to the already damaged myocardium. In a previously reported case of acute coronary occlusion,¹⁰ the surgeon conducted an on-pump single coronary bypass graft to the LAD in an 80-year-old lady to overcome the occlusion and even in that case the CABG was a resolute treatment.

In conclusion a prompt investigation with coronary angiogram and temporary restoration of flow with angioplasty proved to be the critical step to identify and manage the problem. Full restoration of the coronary perfusion which followed with CABG is a safe and effective procedure to perform in case of an acute coronary occlusion after SAVR. This resulted in a quick restoration of the myocardial perfusion and function and permitted a prompt recovery after a severe and potentially fatal complication.

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

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