Cardiogenic shock after coronary artery bypass grafting surgery due to coronary spasm

Choque cardiogénico poscirugía de revascularización de miocardio debido a espasmo coronario

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Case presentation

A 55-year-old female patient with a history of acute myocardial infarction and ischemic cerebrovascular disease diagnosed 4 years prior, as well as hypertension, dyslipidemia, and a 10-year history of rheumatoid arthritis treated with corticosteroids and methotrexate. She was admitted to the emergency department with a diagnosis of acute coronary syndrome without ST-segment elevation (1-day history of chest pain and ST 2-mm depression on electrocardiogram anterior leads) and cardiac enzymes elevation (CPK-MB: 45 U/l), which was stabilized in the emergency department with medical therapy. The patient had an echocardiogram practiced 3 months before the event that showed the left ventricular ejection fraction (LVEF) of 45%, with moderate anterior hypokinesia.

Diagnostic cardiac catheterization was performed 24 h after an emergency admission, which showed severe occlusion of 95% in the left coronary ostium (Fig. 1) and the rest of the coronary arteries without angiographically significant lesions; in addition, hetero-coronary collateral circulation was observed from the

right to anterior descending coronary artery. Two days after catheterization, coronary artery bypass graft surgery was performed with the use of the bilateral internal mammary artery, with the left mammary artery placed toward the marginal artery and the right to the anterior descending artery.

In the immediate post-operative period (2 h after surgery), the patient had frank hemodynamic instability with a cardiac index of 2.0 L/min/m², mean blood pressure of 60 mmHg, and heart rate of 120 beats/min; despite the use of dobutamine at up to 10 mg/kg/min and norepinephrine at up to 0.3 µg/kg/min, the electrocardiogram showed ST-segment depression of up to 3 mm in leads II, III, and aVf, V4, V5, V6, and 2-mm elevation in lead aVR; CPK-MB showed an elevation of 15 U/L. Echocardiography showed an LVEF of 35% with severe diffuse hypokinesia. Immediately afterward, an intra-aortic counterpulsation balloon was inserted by means of the right femoral puncture, whereby transient stabilization was achieved, with the cardiac index improving up to 2.4 L/min/m²; however, electrocardiogram alterations persisted, and emergency cardiac catheterization was, therefore, performed

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Figure 1. **A:** the left coronary angiography showing severe left ostium lesion and anterior descending artery diffuse thinning; **B:** the right coronary artery without obstruction, with collateral circulation to anterior descending artery being observed. CX: circumflex artery; DA: anterior descending artery; TCI: trunk coronary left.

4 h after surgery due to the suspicion of perioperative myocardial infarction due to graft occlusion, and the possibility of angioplasty of the left coronary trunk was also contemplated.

The coronary angiography images showed patency of both bypasses; however, blood flow of the mammary arteries was filiform due to severe spasm of both arteries, with severe spasm of the native coronary arteries also being observed (Fig. 2A and B). In view of these findings, the use of norepinephrine was discontinued and vasodilator therapy with nitroglycerin guided by blood pressure levels was initiated. Forty-eight hours after surgery, the patient had the counterpulsation balloon removed and the use of dobutamine was discontinued, as well as mechanical ventilation. Drug therapy with verapamil was started.

Subsequent evolution was satisfactory; however, a new cardiac catheterization was performed 3 weeks after surgery, which showed permeability and good flow of the coronary bypasses and anastomoses without lesions (Fig. 2C and D). At that moment, LVEF was 40% and, regarding motility, only mild hypokinesia was found in the anteroapical region; the remaining parameters were normal. At present, the patient has had 1 year of follow-up with good clinical evolution, with vasodilator treatment with verapamil, in addition to antiaggregant and lipid-lowering treatment.

Discussion

The presented case is a post-operative coronary spasm that made the patient go into shock but was satisfactorily resolved with the use of aortic counterpulsation balloon and vasodilators. One study analyzed

Figure 2. **A and B:** immediate post-operative period coronary angiography showing severe spasm of coronary bypasses, as well as of native coronary arteries; **C and D:** coronary angiography at the 3rd week of the post-operative period showing adequate flows in the breast grafts, as well as permeable anastomosis and good flow in anterior descending artery and CX. LIMA: left internal mammary artery; RIMA: right internal mammary artery; CX: circumflex artery; DA: anterior descending artery.

the profile of 115 cases of perioperative coronary spasm and concluded that average age was 64 years and that 84% of subjects were males, with the main risk factors being hypertension, history of angina, being a smoker, and having diabetes mellitus¹. It should be noted that the use of double mammary artery was carried out because the patient was younger than 70 years and had a life expectancy of more than 10 years². The pathophysiology of perioperative coronary spasm has not been clarified in detail³.

Post-operative coronary spasm has been associated with coronary artery trauma due to manipulation during surgery, alkalosis, low body temperature, thoracic drainage tubes, and vasospastic factors of platelets damaged during the cardiopulmonary bypass^{4,5}. Incidence during the 1st h ranges from 0.8 to 1.3%³.

Spasm should be suspected when the patient exhibits unexplained hemodynamic instability in the post-operative period. When causes of instability such as cardiac tamponade and tension pneumothorax are excluded, coronary angiography should be considered. Surgical re-exploration is not recommended in these cases⁶.

The indicated treatment is intravenous injection of vasodilators such as isosorbide, adenosine triphosphate, or calcium channel blockers. The best treatment

is reported to be vasodilator intracoronary injections during coronary angiography. Stent implantation in cases of refractory spasms with a focal lesion is also possible, but due to the complications this entail, it is not the most recommended treatment⁶.

In patients with hemodynamic instability, the use of aortic counterpulsation balloon can increase coronary flow, and it was this treatment, together with vasodilators, which finally could help the patient overcome instability⁶. There is a report in literature of three female patients with similar conditions, of whom two died and one managed to survive after the use of aortic counterpulsation balloon and to fully recover⁷. In general, patients' long-term prognosis is good, 5-year survival can be higher than 94%⁸.

Despite being a rare entity, it is important for surgery departments to take it into account as a possible complication in the post-operative period. Early diagnosis and proper treatment can prevent possible consequences and patient death.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical disclosures

Protection of people and animals. The authors declare that no experiments have been carried out on humans or animals for this research.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

References

1. Koshiba K, Hoka S. Clinical characteristics of perioperative coronary spasm: reviews of 115 case reports in Japan. *J Anesth.* 2001;15(2):93-9.
2. Kolh P, Windecker S, Alfonso F, Collet JP, Cremer J, Falk V, et al. Task force on myocardial revascularization of the European Society of Cardiology and the European Association for Cardio-Thoracic Surgery. European Association of Percutaneous Cardiovascular Interventions 2014 ESC/EACTS Guidelines on myocardial revascularization: The task force on myocardial revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Developed with the special contribution of the European Association of Percutaneous Cardiovascular Interventions (EAPCI). *Eur J Cardiothorac Surg.* 2014;46:517-92.
3. Lorusso R, Crudeli E, Lucà F, De Cicco G, Vizzardi E, D'Aloia A, et al. Refractory spasm of coronary arteries and grafted conduits after isolated coronary artery bypass surgery. *Ann Thorac Surg.* 2012;93(2):545-51.
4. Schena S, Wildes T, Beardslee MA, Lasala JM, Damiano RJ Jr, Lawton JS. Successful management of unremitting spasm of the nongrafted right coronary artery after off-pump coronary artery bypass grafting. *J Thorac Cardiovasc Surg.* 2007;133(6):1649-50.
5. Pinho T, Almeida J, Garcia M, Pinho P. Coronary artery spasm following aortic valve replacement. *Interact Cardiovasc Thorac Surg.* 2007;6(3):387-8.
6. Unai S, Hirose H, Cook G, Lee Y, Miura S, Kigawa I, et al. Coronary artery spasm following off-pump coronary artery bypass surgery. *Int Heart J.* 2014;55(5):451-4.
7. Paterson HS, Jones MW, Baird DK, Hughes CF. Lethal postoperative coronary artery spasm. *Ann Thorac Surg.* 1998;65(5):1571-3.
8. Ong P, Athanasiadis A, Borguiya G, Voehringer M, Sechtem U. 3-years follow-up of patients with coronary artery spasm as cause of acute coronary syndrome: the CASPAR (coronary artery spasm in patients with acute coronary syndrome) study follow-up. *J Am Coll Cardiol.* 2011;57(2):147.