

## Post-valvular surgery multi-vessel coronary artery spasm – A literature review



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### ABSTRACT

Coronary artery spasm (CAS) refers to the spontaneous or stimuli-induced transient, often localized and intense subtotal or total constriction/occlusion of the epicardial coronary artery, usually concomitant with *angina pectoris* with associated elevation of the ST segment on electrocardiogram (ECG).

In this article, we present a literature review on post-valvular surgery CAS and report the clinical case of a 77 year-old man who experienced severe early post-aortic surgery chest pain and hemodynamic instability. Emergent coronary angiography revealed severe occlusion of multiple branches of both coronary arteries. The CAS was alleviated with intracoronary infusion of nitroglycerin.

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### 1. Introduction

Coronary artery spasm (CAS) refers to the spontaneous or stimuli-induced transient, often localized and intense subtotal constriction or total occlusion of the epicardial coronary artery, often concomitant with *angina pectoris* with resultant ST segment alteration on the electrocardiogram (ECG). Postoperative, or more specifically, post-valvular surgery CAS is a multi-factorial, infrequent but lethal complication of open heart surgery, with documented implication in perioperative cases of *angina pectoris*, acute myocardial infarction and their associated hemodynamic instability [1,2].

With a multi-factorial mechanistic underlining, there is no universal prophylactic or definitive treatment, thus the adoption of diverse therapeutic approaches in preventing and/or alleviating post-valvular surgery CAS, including cardiorespiratory inotropic support, intracoronary or intravenous administration of nitrates, non-steroidal anti-inflammatory drugs, calcium pump blockers, phosphodiesterase inhibitors and adenosine triphosphate (ATP), as well as initiation of intra-aortic balloon pump (IABP) [2–5].

In the light of the undefined incidence of post-valvular surgery CAS, its critical role in the pathogenesis of perioperative coronary artery disease (CAD), or so called ischemic heart disease (IHD), and post-valvular surgery mortality, as well as the dearth of a documented globally-consensual therapy guideline, we herein review current

literature on this subject (Table 1) and report a clinical case of multi-vessel CAS after aortic valve replacement in our facility.

### 2. Case report

A 77-year-old man, known tobacco smoker with a history of hypertension, aortic aneurysm of unspecified site without mention of rupture, severe aortic valve insufficiency and coronary atherosclerosis of the native coronary artery, underwent replacement of the ascending aorta, aortic valve annuloplasty with reconstruction of the sinotubular junction (Florida sleeve technique) and coronary artery vein graft on obtuse marginal branch at our facility. Preoperative coronary angiography showed no abnormal lesions (Fig. 1). There was intraoperative confirmation that the aortic valve and the free tricuspid edges were not thickened with fibro-calcified lesions. Aortic root remodelling plus myocardial revascularization was successfully performed. Immediate postoperative period in the critical care unit was uneventful with the patient showing regular sinus rhythm, no ischemic changes with good left ventricular contractility (Fig. 2).

Several hours later, in the night of the postoperative day 1 (1PO), the intensive care unit critical (ICU) ECG alarm was triggered. ECG findings included a recurring transient 2.5 mm ST segment elevation in the anterior leads V3, V4 with similar elevation in the inferior leads II, III, aVF (Fig. 3) which initially was non-responsive to intravenous vasodilators therapy. In addition, there was hemodynamic instability but no ventricular arrhythmia, prompting the diagnosis of postoperative vasospastic syndrome. We noted however that patient presented with no excruciating chest pain with progressive dyspnoea, as is classically

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**Table 1**  
Review of current English language literature on post-valvular surgery coronary artery spasm.

No.	Author(s)	Year	Diagnosis	Study type	Note
1	Alizadeh-Ghavidel A, et al.	2015	CAS following aortic valve replacement	Case report	Focal RCA lesion, relieved by intracoronary nitrates infusion
2	Pragliola C, et al.	2015	CAS after mitral valve replacement	Case report	Focal RCA lesion, intracoronary injection of nitrates
3	Anselmi A, et al.	2013	CAS after tricuspid valve surgery	Case report	Diffuse CAS, intracoronary injection of nitrates
4	Tzeng SS, et al.	2012	Bead-like CAS	Imaging	Diffuse CAS, treated with nitrates and aspirin
5	Casquero E, et al.	2009	CAS after mitral and tricuspid annuloplasty	Imaging	Diffuse CAS, stabilized with intracoronary nitroglycerine and IABP
6	Pinho T, et al.	2007	CAS following aortic valve replacement	Case report	Focal RCA lesion, relieved with intracoronary administration of isosorbide dinitrate, removal of pericardial drainage tube, and IABP
7	Pragliola C, et al.	2007	CAS after aortic valve replacement	Case report	Diffuse CAS, resolved with intracoronary infusion of nitrates and verapamil
8	Song MH, et al.	2006	Refractory CAS after aortic valve replacement	Case report	Multifocal RCA lesion, refractory to intracoronary infusion of nitrates and calcium antagonists, resolved fully after ATP injection.
9	Minato N, et al.	1995	Perioperative CAS in modified Bentall's operation for annulo-aortic ectasia in Marfan's syndrome	Case report	CAS, refractory to nitrates infusion, resolved by nicardipine (a calcium antagonist)
10	Tsuchida K, et al.	1993	CAS after aortic valve replacement	Case report	Diffuse CAS, refractory to intracoronary administration of isosorbide dinitrate, nitroglycerin, diltiazem methylprednisolone, papaverine, lidocaine, and nifedipine through the nasogastric tube. Treated with inotropic agents, coronary vasodilators, IABP, and deep sedation with pentobarbital.
11	Kinoshita K, et al.	1991	Perioperative CAS	Retrospective cohort study	Diverse. 1 died, 4 others responded to intravenous administration of nitroglycerin and diltiazem ± IABP

expected, nor did patient allude to previous occurrence of similar chest symptom.

Laboratory findings were deranged: elevated C-reactive protein (16.14 mg/L), and urea (30 mg/dL), with low hemoglobin (10.4 g/dL) and platelet ( $120 \times 10^9/L$ ).

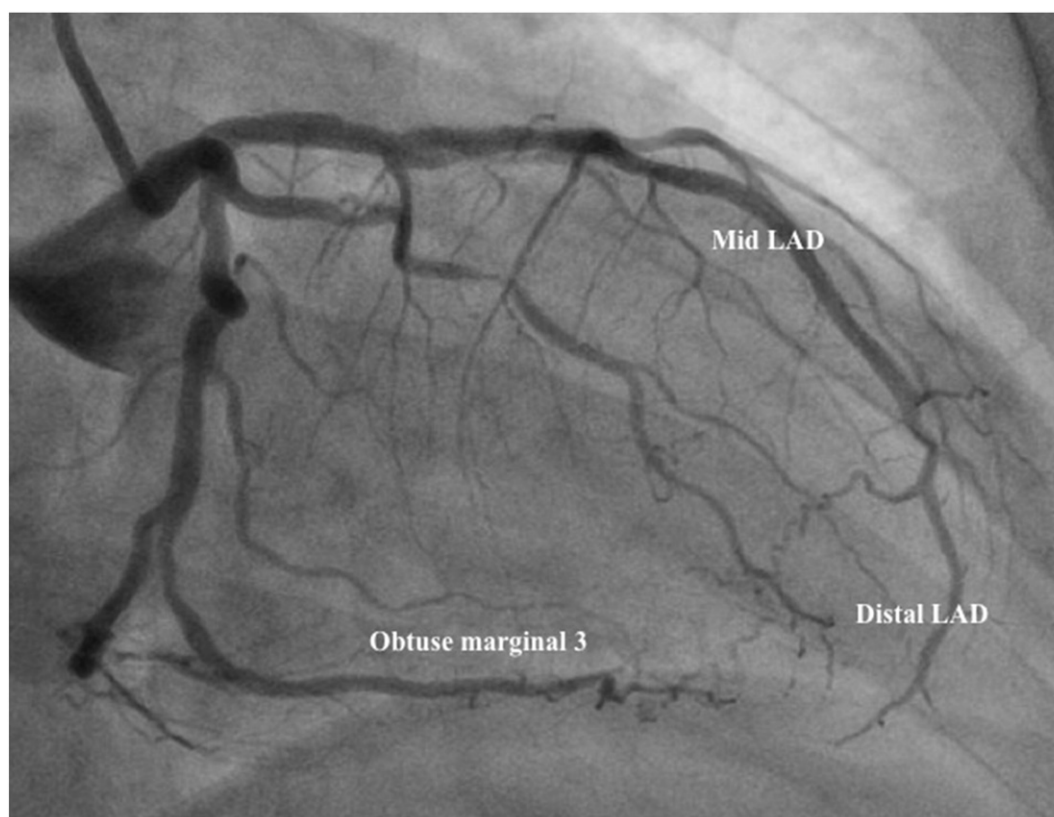
Emergent coronary angiography to probe the cause of the hemodynamic instability confirmed the diagnosis of early post-valvular surgery multi-vessel CAS, showing over 90% spasmic occlusion of the diagonal (D1, D2) branches of the left anterior descending (LAD) artery, and marginal branches (M1, M2, M3) of the circumflex (Cx) artery (Fig. 4).

However, elevated ST segment returned to baseline (Fig. 5) and CAS progressively resolved, after infusion of intracoronary nitroglycerin infusion (Fig. 6). Recovery was uneventful thereafter, and the patient was discharged on the postoperative day 8.

### 3. Methods

#### 3.1. Literature search

The PubMed database was queried for publications related to the use of the post-valvular surgery CAS. Search was limited to human subjects



**Fig. 1.** Preoperative coronary angiography showed narrowing lesion on first obtuse marginal branch of circumflex artery.

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