CASE REPORT

High-risk percutaneous coronary intervention in a patient with a single coronary artery presenting as STEMI and cardiogenic shock

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Accepted 28 July 2015

SUMMARY

Cardiogenic shock due to ST elevation myocardial infarction in a patient with a single coronary artery involving the sole vessel is a rare presentation. This can be clinically and angiographically challenging. Proper recognition of the topography of diseased vessels and a systematic guarded approach can lead to procedural success. We report a case of an 81-year-old woman who presented with chest pain followed by a near syncope associated with an acute myocardial infarction. Coronary angiography revealed a single proximally occluded right coronary artery and an anomalous left main coronary artery (originating from the proximal right coronary artery) and occluded distal left circumflex artery. The right coronary artery was successfully stented following predilation without compromising the anomalous left main origin. The flow in the chronically occluded left circumflex artery (originating from the anomalous left main) which was depended on the retrograde supply from right coronary artery through collaterals, was also re-established.

BACKGROUND

Single coronary artery (SCA) is a rare coronary artery anomaly, with an estimated incidence of approximately 0.03%.¹ Congenital in nature, most (80%) of the coronary artery anomalies are asymptomatic and incidentally found on coronary angiography. The remainder (20%) of patients can present with life-threatening symptoms such as syncope, arrhythmias and myocardial infarction, which may therefore require a more aggressive approach.² However, the coexistence of acute myocardial infarction and SCA is very rare. Treatment of acute total occlusion of a SCA is a technical challenge, especially when it gives origin to the anomalous left main coronary artery (LMCA). There are further limited data on the coronary interventions in patients presenting with ST elevation myocardial infarction (STEMI) involving the right coronary artery (RCA) as a 'type IIIC SCA anomaly' with cardiogenic shock, as seen in our case.³

CASE PRESENTATION

An 81-year-old woman presented at the emergency department of a tertiary care facility with substernal chest pain followed by a near syncope. The patient's medical history was only significant for hypertension, which was her only risk factor for coronary artery disease. Her physical examination revealed a systolic blood pressure of 76 mm Hg and pulse rate

Figure 1 Admission ECG showing ST elevation in Leads II, III, aVF, V3 to V6.

50 bpm with low-volume distal pulses and prolonged capillary refill time as signs of cardiogenic shock. On cardiac auscultation, an apical soft systolic murmur was present. Chest and neurological examinations were normal. Urgent bedside ECG demonstrated sinus bradycardia of 50 bpm and ST elevation of 2 mm in II, III, aVF, and 1 mm in V3 to V6 leads with 1–3 mm ST depression in the V1 and V2 (figure 1). Other laboratory assessment revealed evidence of myocardial injury, with troponin I >94.00 ng/mL (normal <0.05 ng/mL), creatine kinase 3946 U/L (normal <233 U/L) and creatine kinase MB 286.4 ng/mL (normal <5.0 ng/mL). The patient had a temporary transvenous pacemaker placed immediately and was started on low-dose

Figure 2 Coronary angiogram showing left sinus injection without opacification of any coronary artery (CAU, caudal projection; RAO, right anterior oblique projection).

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To cite: Abdelsalam M, Krishnan M, Banga S, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2015-210345

Video 1 Coronary angiogram showing left sinus injection without opacification of any coronary artery.

dopamine along with norepinephrine infusion; she was transported to our hospital with a diagnosis of STEMI with cardiogenic shock as they did not have a percutaneous coronary intervention (PCI) facility.

As soon as the patient reached our hospital, the catheterisation laboratory was activated under STEMI alert. The patient was shifted to the catheterisation laboratory for coronary angiography and emergent percutaneous intervention.

INVESTIGATIONS

Left heart catheterisation showed mild elevation of left ventricle end-diastolic pressures of 20 mm Hg with no significant aortic valve gradient. Left ventriculography demonstrated severe inferior hypokinesia with mild basal anterior hypokinesia, and an estimated ejection fraction of 40–45%. Coronary angiography showed empty left coronary sinus ([figure 2](#) and [video 1](#)) and RCA as the sole artery originating from right coronary sinus. LMCA originated from the proximal RCA just above the obstruction and traversed across the aortic root ([figures 3 and 4](#), [videos 2 and 3](#)). There was total occlusion of the RCA distal to the origin of the LMCA.

Figure 3 Coronary angiogram showing an anomalous left main coronary artery traversing across the aortic root and proximally occluded LCx (CAU, caudal projection; LAD, left anterior descending artery; LCx, left circumflex artery; LM, left main artery; RAO, right anterior oblique projection).

Figure 4 Coronary angiogram showing proximal total occlusion of the RCA, with the left main coronary artery origin just before the occlusion (CAU, caudal projection; LAD, left anterior descending artery; LAO, left anterior oblique projection; LM, left main artery; RCA, right coronary artery; RI, ramus intermedius artery).

TREATMENT

After heparin and plavix were administered, the RCA was cannulated with the JR 4F guiding catheter. The lesion was crossed with a Balance Middleweight (BMW) wire (Abbott Vascular, Santa Clara, California, USA), and predilation was carried out with a 2×10 mm balloon at 4 atm. This was followed by deployment of the 3.5×28 mm bare metal stent (BMS) at 14 atm. This was further postdilated with a non-compliant balloon at 16 atm. Postdeployment angiography showed Thrombolysis In Myocardial Infarction (TIMI) 3 flow in the RCA. During the RCA intervention, it was ensured that the JR 4F guiding catheter should be coaxial to the RCA and stable enough to prevent dissection or proximal thrombus shift from the thrombus-loaded RCA. Poststenting angiography revealed brisk retrograde filling of the distal left circumflex from right-sided injection, with further filling of few distal branches off the distal left anterior descending artery too ([figure 5](#) and [video 4](#)). A check coronary angiography with RCA injection showed adequate flow in RCA and distal left circumflex coronary artery.

Video 2 Coronary angiogram showing an anomalous left main coronary artery traversing across the aortic root and proximally occluded left circumflex artery.

Video 3 Coronary angiogram showing proximal total occlusion of the right coronary artery, with the left main coronary artery origin just before the occlusion.

Video 4 Coronary angiogram showing postpercutaneous coronary intervention of the right coronary artery with retrograde filling of the distal left circumflex artery through collaterals.

OUTCOME AND FOLLOW-UP

The procedure was successful and the patient had a post-PCI uneventful recovery. She did not require presser support, maintaining systolic blood pressures above 110 mm Hg postprocedure. An elective postprocedure echocardiogram revealed severe hypokinesia of the inferior and posterior walls with mild hypokinesia of the lateral wall with a left ventricular ejection fraction of 40% identifying an underlying myocardial damage prior to intervention. Two days later, the patient was discharged home in a stable condition. In view of her angiogram showing a course between the aorta and the pulmonary artery, the patient was advised to have a CT angiography or cardiac MRI; which she declined. She is presently on optimal medical management with regular follow-ups.

DISCUSSION

Coronary artery anomalies are most commonly asymptomatic and incidentally discovered on coronary angiography. One of

the rarest anomalies encountered is the isolated SCA anomaly.¹ SCA anomalies are classified by Lipton *et al*³ based on the location of the origin of the SCA, the anatomical perfusion distribution of the artery, and the location relative to the ascending aorta and the pulmonary artery. Our case illustrates an example of an SCA arising from the right sinus of Valsalva with the LMCA arising from the proximal RCA that traversed the aorta near the aortic root. Coronary angiography is the gold standard to evaluate coronary artery disease, though SCA anomalies can be further evaluated by multislice CT.⁴ In our patient, we diagnosed the SCA by coronary angiography. Most patients with SCA anomalies are managed with a conservative approach, unless coronary compromise is present, as in the case of our patient, where appropriate revascularisation was necessary.

Although the risk of restenosis is higher with BMS than drug-eluting stents (DES),⁵ there were two reasons for choosing BMS over DES in our patient. First, there were doubts about compliance with antiplatelet therapy in our elderly patient. Second, we anticipated the need for surgery to treat the abnormal course of anomalous left main in near future which might cause anginal symptoms due to pressure effects by the great vessels. According to American College of Cardiology (ACC), it is a class III indication to use DES in patients with poor compliance or any anticipated surgery.⁶ Most of these abnormalities can have life-threatening consequences due to the variant course of these anomalous coronaries between the great vessels, which can be causes of extraluminal compression affecting intracoronary haemodynamics. Sporadic case reports have been published on patients presenting with sudden cardiac deaths following myocardial infarction with anomalous arteries arising from the contralateral sinus with coursing between the great vessels.⁷ In patients with STEMI, a more aggressive therapy including GPIIb/IIIa inhibitors can be taken into consideration to reduce the risk of slow flow. We chose to avoid upfront loading GPIIb/IIIa inhibitors (class IIb indication as per ACC guidelines) since it is a relative contraindication in view of haemorrhagic complications in elderly patients, but we could have started periprocedural infusion if we had less than TIMI 3 flows during angioplasty (class IIa indication).⁶ The case went smoothly and we achieved TIMI 3 flow in the RCA.

Coronary interventions in patients with anomalous vessels have rarely been reported.⁸ These interventions carry a high procedural risk because any complication in a sole arterial supply to the myocardium, like dissection or slow flow, may

Figure 5 Coronary angiogram showing postpercutaneous coronary intervention of the RCA with retrograde filling of the distal LCx through collaterals (CAU, caudal projection; LAD, left anterior descending artery; LAO, left anterior oblique projection; LCx, left circumflex artery; RCA, right coronary artery).

lead to a life-threatening eventuality. The presence of an anomalous coronary artery in a patient may affect the door-to-balloon times by prolonging the puncture-to-balloon time, thus jeopardising clinical outcomes. The risk becomes much higher when the patient presents with an acute coronary syndrome especially with STEMI, as seen in our case. Technical problems do occur, hence proper strategy to treat patients with SCA include proper selection of guide and proper techniques of intervention during procedure does affect the outcome.

Owing to the rarity of this type of pathology, there are not enough studies to suggest specific protocols targeting their sub-acute and chronic management. However, the present standard

of care is similar to the primary PCI with a normal coronary anatomy. So if we are using BMS, at least 1 month of dual anti-platelet therapy is recommended or 12 months for DES; preferably 1 year for both, if no contraindication exists.⁶ No follow-up imaging is required unless there is a chance of interarterial impingement of coronary artery between great vessels is demonstrated on stress test and CT/MRI angiography.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

Learning points

- ▶ A single coronary artery anomaly is a rare entity, with incidental finding during catheterisation.
- ▶ Single coronary artery atheromatous lesions have been reported to have been stented.
- ▶ A simple non-selective angiography, when unable to cannulate the coronary ostium, can be performed to avoid wasted time in the emergency setting as we have done in our case.
- ▶ A single coronary artery anomaly has a rare presentation of ST elevation myocardial infarction (STEMI). Complicated STEMI with cardiogenic shock is commonly seen with this anomaly.
- ▶ Percutaneous intervention in patients with STEMI with a single coronary artery has a high risk and is technically challenging.

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