Iatrogenic dissection of the right coronary artery during diagnostic coronary angiography, a case report

Abstract

Iatrogenic coronary dissection is a mechanical rupture of a coronary wall during coronary angiography or angioplasty. It is a rare but serious complication that can rapidly lead to the death of the patient. We report the case of a young 35 year old patient with only active smoking as a cardiovascular risk factor who presented during a coronary angiography for a STEMI a conduction disorder and hemodynamic instability revealing an iatrogenic dissection of the right coronary artery. Several predisposing factors for iatrogenic coronary artery dissection have been described in the literature, including female gender and deep intubation of the artery. It mainly involves the right coronary artery due to its specific anatomical characteristics. The diagnosis is made on coronary angiography. Management differs according to the haemodynamic state of the patient and the classification of the coronary dissection. Stenting, coronary artery bypass grafting or even conservative treatment may be proposed.

Keywords

Iatrogenic, coronary artery, dissection

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Introduction

Iatrogenic coronary dissection (IaCD) is one of the most feared complications during coronary catheterisation. Although rare, it remains serious and can rapidly lead to the death of the patient by interruption of the coronary flow. It is defined as an iatrogenic (and not spontaneous) rupture of a coronary wall by a material used during a coronary angiography or angioplasty procedure resulting in extravasation of blood at the level of the subendothelial layers with the constitution of two channels, one true and one false separated by an intimal flap. It mainly involves the right rather than the left network (85% and < 15% respectively) [1]. The dissection line may spread downstream or even upstream, resulting in an associated aortic dissection. The treatment of IaCD is based on early revascularisation by angioplasty or surgical treatment. In this case study, we will discuss the factors leading to the occurrence of IaCD, its various aspects and the different treatments proposed, with a review of the literature. Our study has been reported in line with the SCARE 2020 criteria [2].

Case report

The patient was 35 years old, with active smoking as a modifiable cardiovascular risk factor, and without any particular medical history. He presented to the emergency room 4 hours following the beginning of an infarct-like chest pain. The cardiovascular examination noted a stable hemodynamic state with a blood pressure of 115/75 mmhg and a heart rate of 95 beats per minute. There were no signs of acute ventricular failure, no murmurs or additional sounds suggesting a mechanical complication. The electrocardiogram showed an extended anterior ST-segment elevation of 6 mm, necrotic Q waves in the same territory, mirroring in the inferior leads and complete right bundle branch block. After a loading dose of Clopidogrel and aspirin, the patient was sent directly to the cardiac catheterization laboratory where an emergency coronary angiography was performed, showing a thrombotic occlusion of the proximal anterior interventricular artery, which had undergone active stent angioplasty after dilatation. The right network was not opacified in the acute phase due to the laborious nature of the procedure. The patient was put on double antiplatelet aggregation (Clopidogrel and aspirin) as well as unfractionated heparin and tirofiban for 24h. The biological workup was unremarkable except for a troponin level of 65,525 ng/ml and a C-reactive protein level of 55 mg/l. The metabolic work-up showed no diabetes or dyslipaemia. Trans-thoracic echocardiography showed wall motion akinesia in the territory of the anterior interventricular artery with 34% systolic left ventricular dysfunction. Three days later, a second coronary angiography was performed to opacify the right coronary network. A 5F Judkins Right (JR) 4.0 diagnostic probe was used to intubate the right coronary ostium via a 0.035 guidewire. On opacification of the right coronary ostium, a spiral dissection line was noted with initial intermittent interruption of coronary flow (Figures 1 and 2). The patient presented an infarct chest pain associated with anxiety and agitation. A rapid physical examination on the catheterisation table showed hypotension at 75/45mmhg, bradycardia at 30 beats per minute, and profuse sweating without muffled heart sounds and without murmurs of mitral insufficiency or ventricular septal defect. The electrocardiogram on the monitor showed sinus dysfunction that responded to 1 mg of atropine. After sedation of the patient, angioplasty of the right coronary artery was performed with two active stents (4.0 x 26mm and 3.5 x 30mm), which occluded the false channel openings and restored TIMI 3 flow to the right coronary artery (Figures 3 and 4). After the procedure, the patient experienced an acute heart failure which was controlled after treatment with diuretics and then declared discharged after a few days of monitoring in the intensive care unit and the clinical area.

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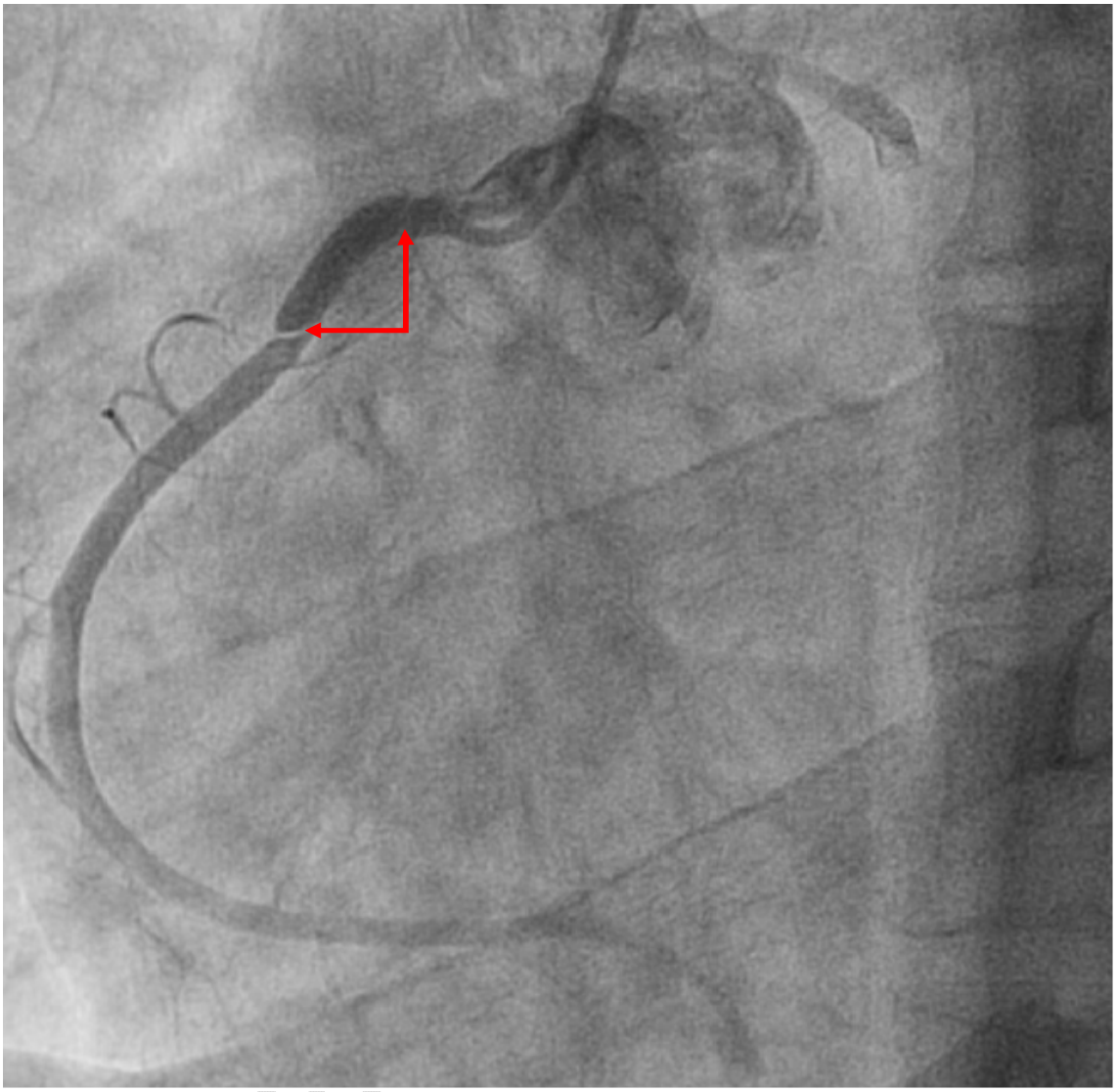

Figure 1: Coronary angiography showing a spiroid iatrogenic dissection (red arrow) of the right coronary artery.

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Figure 2: Coronary angiography showing iatrogenic dissection of the right coronary artery with interruption of coronary flow.

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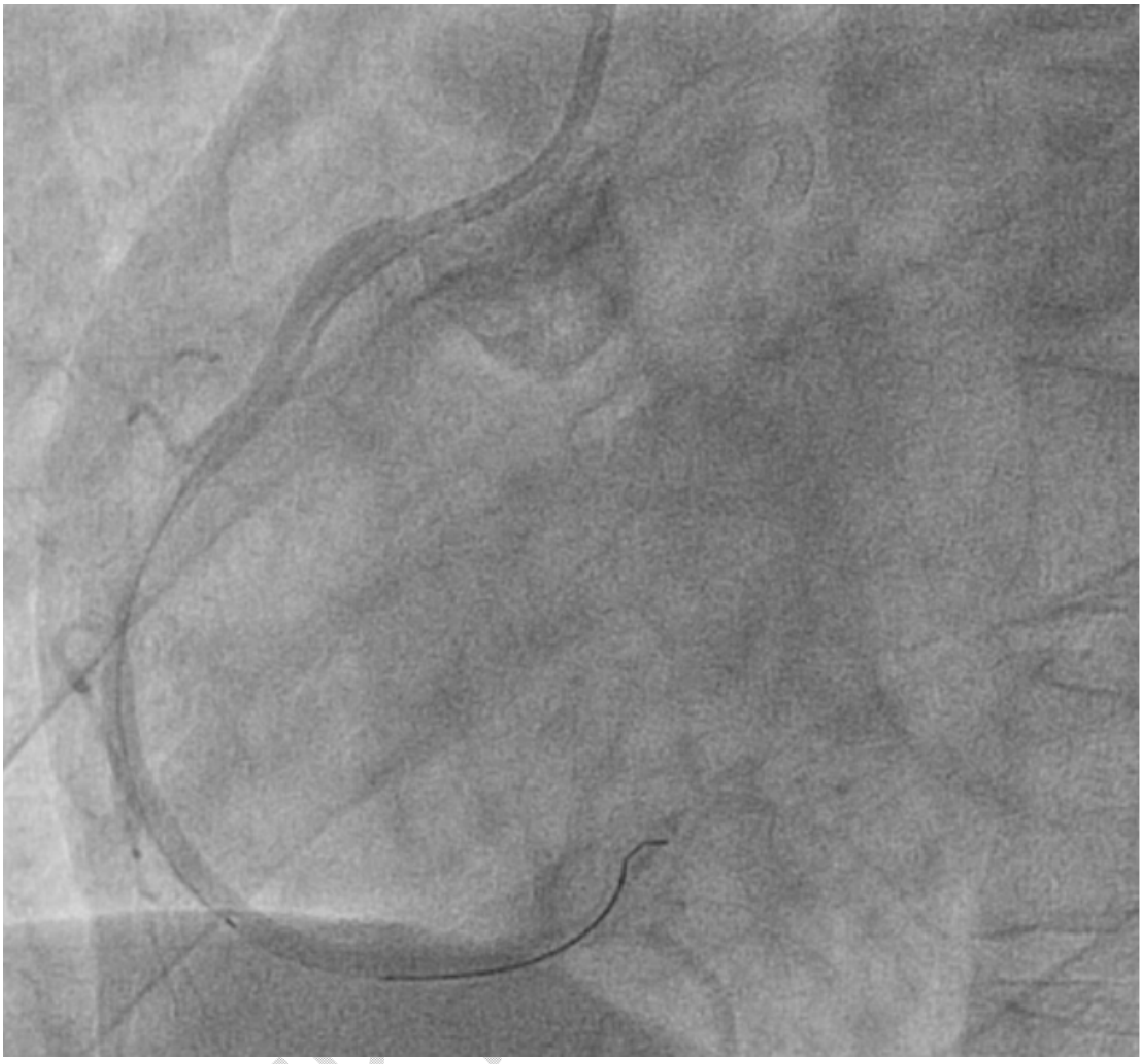

Figure 3: Coronary angiography showing successful passage of the guidewire through the true channel of the iatrogenic coronary dissection of the right coronary artery.

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Figure 4: Final outcome after right coronary artery angioplasty.

Discussion

Iatrogenic coronary artery dissection (IaCD) is a rare complication. Indeed, it occurs in less than 0.1% of diagnostic coronary procedures and angioplasties combined [3]. However, the majority of cases have been described during an angioplasty procedure, especially in cases of chronic total artery occlusion [4]. This is due to the use of large catheters, guidewires and other devices introduced intra-coronary [5]. Other predisposing factors have been reported such as an infiltrated left main coronary artery, the presence of complex lesions, the use of Amplatz catheters, deep intubation and female gender [6] as well as the injection of contrast medium during deep exhalation [7]. This was not consistent with the characteristics of our case, which was male, in whom a JR 4.0 5F catheter was used, during diagnostic coronary angiography with easy, co-axial intubation of the right coronary.

According to Yip et al [1] and a 10-year cohort by Anantharaman Ramasamy [8] of 55,968 patients, the right coronary artery appears to be the most predisposed to IaCD compared to the left main coronary artery (85% Vs < 15% and 50% Vs 45% respectively). Similarly, retrograde extension of the dissection would be more frequent during an IaCD of the right coronary than of the left main coronary artery. This is thought to be due to a higher concentration of smooth muscle cells and a denser matrix of type I collagen fibres in the periosteal wall and sino-tubular junction of the left main coronary artery [9]. Also, the use of EBU and Amplatz left catheters designed for the left network to intubate the right coronary artery increases the risk of IaCD occurrence [10].

The starting point for IaCD is most often an atherosclerotic plaque in the coronary artery. Indeed, ulceration of a plaque by the catheter can provide a portal of entry for the dissection, which will expand under the effect of pulsatile blood flow [11]. There are several classifications of coronary dissection. The most commonly used are the classification of the National Heart, Lung and Blood Institute (NHLBI) (Table 1), which predicts the risk of coronary occlusion [11], the classification of Dunning et al [12] for dissections with retrograde extension (Table 2) and the classification of Eshtehardi (Table 3) et al [13] for left main coronary artery dissections.

The diagnosis of IaCD should be suspected in the presence of any clinical changes in the patient in the coronary angiography room, including the occurrence of chest pain or at most cardiogenic shock. Some patients may be completely asymptomatic [9]. The appearance of ST elevation on monitoring indicates coronary occlusion [9]. Rhythm or conduction disorders may also be present as in our patient. The diagnosis of certainty is made by coronary angiography, which shows a dissection line with a defect in opacification or stagnation of the contrast medium, sometimes with interruption of the coronary flow [4]. The use of intravascular ultrasound (IVUS) can help in the assessment of retrograde extension of IaCDs and stenting [14,15]. Optical coherence tomography (OCT) should be avoided due to the injection of contrast material which may aggravate the dissection [4]. Chest CT remains the gold standard for detecting associated aortic dissection [4].

Management requires personal experience and good psychological skills. Indeed, as long as the operator maintains composure, keeps the catheter stable and handles quickly, most patients will be well managed [16]. The therapeutic strategy depends on the severity of the dissection and the haemodynamic status of the patient. It can be either conservative in benign dissections or involve stenting or surgery. For benign dissections (Type A and B of the

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NHLBI classification), conservative treatment is often appropriate when the angiographic appearance remains unchanged after ten minutes [17]. For type C to F dissections, invasive management should be recommended as they have a poor prognosis [17] as they often result in interruption of coronary flow. For these types of IaCD, stenting to block the entry orifice is required after placement of a non-rigid guidewire in the true lumen [18], guided by careful injections especially if the patient is unstable [19]. In case of stenting, the risk of intra-stent restenosis is drastically higher [20]. Coronary artery bypass grafting should be reserved for stable patients with extension to the root of the aorta and in case of failure to pass the guidewire through the true lumen [19]. The prevention of IaCD requires a good catheterisation technique, the use of appropriate guidewires and catheters, the avoidance of deep intubations and injections when the pressure curve is dampened [5].

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Table 1: Classification of coronary dissections according to the NHLBI

Type	Description
A	Minor radiolucent areas in the lumen without flow alteration or stagnation of the contrast medium
B	Radiolucent luminal flap extending parallel to the vessel wall without alteration of flow or stagnation of contrast medium.
C	Opacification outside the vessel lumen in the form of an "extraluminal cap" with stagnation of the contrast medium
D	Radiolucent spiral opacification defects with stagnation of the contrast medium
E	New and persistent opacification defects in the vessel lumen
F	Injuries with impaired coronary flow or total occlusion

Table 2: Classification of coronary dissections according to Dunning et al.

Type	Description
I	The dissection includes the coronal cusp.
II	Extension to the aortic wall but < 40mm.
III	Extension to the aortic wall greater than 40mm.

Table 3: Classification of coronary dissections according to Eshtehardi et al.

Type	Description
I	Localized dissection.
II	Dissection with extension to the circumflex and anterior interventricular.
III	Dissection with extension to the root of the aorta.

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Conclusion

Iatrogenic coronary artery dissection remains one of the most feared complications of coronary catheterisation which is an invasive and dangerous procedure. Therefore, the indications for coronary angiography and/or angioplasty must be carefully determined in order to avoid any untimely procedure that could lead to this complication.

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