ABSTRACT

We present a case of iatrogenic aortocoronary dissection sustained during routine percutaneous coronary intervention for stable angina. Careful wiring of the true lumen and stent implantation to seal off the dissection flap prevented immediate complications, and computed tomography aortography guided a conservative approach to manage the residual aortic dissection. (Level of Difficulty: Intermediate.) (J Am Coll Cardiol Case Rep 2021;3:1-5) © 2021 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

A 78-year-old man, previously fit and well, presented with exertional chest pain consistent with stable angina. He was treated with optimal medical therapy including aspirin, atorvastatin, bisoprolol, and isosorbide mononitrate, but his symptoms persisted, and he underwent diagnostic angiography at another center. His past medical history consisted of hypertension with no other risk factors for coronary artery disease. Diagnostic angiography demonstrated severe stenosis in the dominant, proximal right coronary artery (RCA) beyond a “shepherd’s crook”-type take-off and a proximal course (Figure 1A). Transthoracic echocardiography at another center showed a structurally normal heart. Given his ongoing symptoms and severe stenosis on diagnostic angiography, he chose elective percutaneous coronary intervention (PCI) to the RCA.

LEARNING OBJECTIVES

- To understand the risk factors for aortocoronary dissection.
- To understand the immediate management of aortocoronary dissection.
- To understand the need for multimodality imaging to assess the need for immediate surgery.
- To understand the importance of multidisciplinary heart team discussion, to ensure appropriate decision making in complex cases.

QUESTION 1: WHAT IS AN APPROPRIATE PCI STRATEGY, AND WHAT ARE THE CHALLENGES OF THIS CASE?

There are numerous approaches to treating this lesion. A previous diagnostic angiogram had already
demonstrated a shepherd’s crook tortuosity in the proximal RCA with severe intimal calcification. This finding suggested that delivery of balloons and stents would be more challenging. Anticipating this situation, an Amplatz (Medtronic, Minneapolis, Minnesota) left 0.75 guide catheter was selected because it provides better passive support than a Judkins (Medtronic) right 4.0 catheter, which was the standard RCA guide catheter at Royal Papworth Hospital, Cambridge, United Kingdom. Alternative strategies included using a less supportive guide, but with the use of buddy wire support, or guide catheter extension to deliver equipment. Access was obtained from the right radial artery with a 6-F sheath. An Amplatz left 0.75 guide catheter was selected on the basis of the tortuosity of the proximal RCA, to ensure good passive guide support. Although there was no particular difficulty in engagement, the initial test injection demonstrated catheter-induced dissection of the aorta, just below the RCA ostium (Figure 1B). A nonselective injection demonstrated residual flow in the dissected RCA (Figures 1C and 1D).

**QUESTION 2: WHAT IS THE IMMEDIATE MANAGEMENT OF THIS COMPLICATION?**

Several steps should be taken immediately. First, a rapid reassessment of the patient’s clinical state, including vital signs, and neurological state should be undertaken. Second, passing a coronary wire into the true lumen, to maintain access to the vessel and for sealing the dissection flap, should be attempted. Third, urgent bedside transthoracic echocardiography should be performed to assess for the presence of a developing pericardial effusion likely to cause cardiac tamponade or acute aortic regurgitation. Requesting an urgent consultation from a cardiac surgeon in the catheter laboratory is helpful, where this is available. These complications are uncommon, and so it is sensible to request assistance from an experienced cardiologist.

**FIGURE 1 Angiographic Images of Dissection and Subsequent PCI**

(A) The baseline diagnostic angiogram demonstrates shepherd’s crook anatomy before the lesion (white arrow). (B) Initial engagement and test injection produced an aortocoronary dissection (orange arrow). (C) Nonselective angiography showed that the dissection was inferior to the right coronary artery ostium, but initially flow down the vessel was maintained. (D) An enlarged image of the dissected ostium is shown with the false lumen (yellow arrow) and the true lumen (blue arrow). (E) A Balance Middle Weight Universal wire (Abbott Vascular, Santa Clara, California) was placed in the false lumen as a marker (purple arrow), and a Sion Blue (Asahi Intecc, Tokyo, Japan) wire was passed to the distal right coronary artery to allow ballooning of the lesion. (F) An Xience Sierra drug-eluting stent (Abbott Vascular) (green arrow) was selected to cover the lesion and also to seal the dissection flap. (G) and (H) After post-dilation Thrombolysis In Myocardial Infarction flow grade 3 was restored in the right coronary artery, with symptomatic, electrical, and hemodynamic improvement. PCI = percutaneous coronary intervention.
Severe chest pain immediately developed, and the electrocardiogram showed marked inferior ST-segment elevation. The patient’s blood pressure was initially stable at 130/70 mm Hg. Hand-held transthoracic echocardiography showed no evidence of pericardial effusion. Initial attempts to wire the RCA with a work-horse Balance Middle Weight Universal II wire (Abbott Vascular, Santa Clara, California) were unsuccessful and repeatedly found the dissection plane. The abluminal wire was used as a marker, however, and a Sion Blue (Asahi Intecc, Tokyo, Japan) wire was eventually passed beyond the stenosis into the posterior descending artery.

**QUESTION 3: WHAT IS THE NEXT STEP IN MANAGEMENT OF THIS AORTOCORONARY DISSECTION?**

Because the patient was hemodynamically stable, we decided to attempt to seal the dissection flap by stenting the RCA back to the origin. Case series of iatrogenic aortocoronary dissection are limited, but most patients are treated conservatively, or with PCI to cover the dissection entry point (1,2). Surgical
repair is associated with significant mortality and morbidity, although in patients in Dunning class 3 (extending >40 mm in the ascending aorta), this approach should be considered (3).

Given the location of the lesion, this meant also attempting to stent the target lesion simultaneously. The stenosis was pre-dilated with 2.5 × 15 mm and 3.0 × 20 mm semicompliant balloons. At this stage, flow was lost in the RCA, and the patient became hypotensive, with a blood pressure of 70/40 mm Hg. Transthoracic echocardiography performed at this stage showed a false lumen but no pericardial effusion or acute aortic valvular regurgitation. Initial attempts to deliver a 3.0 × 38 mm Xience Sierra drug-eluting stent (Abbott Vascular) were unsuccessful because of the tortuosity and calcification in the proximal artery. To overcome this obstacle, a 6-F Guideliner guide extension catheter (Teleflex, Wayne, Pennsylvania) was used to facilitate delivery of the stent, which was deployed at 16 atm. This covered both the target lesion and the ostium of the RCA, with the intention of sealing the dissection plane, and it restored Thrombolysis In Myocardial Infarction (TIMI) flow grade 3. Stent expansion was optimized further with a 3.5 × 20 mm noncompliant balloon deployed at 18 atm. At the conclusion of the case, there was TIMI flow grade 3 in the RCA, the pain had resolved, and ST segments had normalized. There was, however, still marked residual dissection in the aorta. The dissection and subsequent PCI procedure are shown in Figures 1A to 1H and Video 1.

**QUESTION 4: HOW SHOULD THE PATIENT BE MANAGED AFTER THE PCI IS COMPLETE?**

Definitive cross-sectional imaging to establish the involvement of the major branches arising from the aorta should be urgently obtained. Furthermore, although this is not a spontaneous dissection, careful blood pressure control to prevent extension of the dissection is essential. We therefore transferred the patient directly from the catheter laboratory to the computed tomography (CT) scanner.

CT aortography demonstrated a large aortic dissection from below the RCA in the right coronary cusp to the innominate vessel (which was not obstructed and arose from the true lumen). The dissection plane was mostly thrombosed, but some contrast material was seen in the flap (Figures 2A and 2B). The dissection plane was >40 mm, a finding implying that the dissection was Dunning class 3. The patient was transferred directly to the intensive care unit pending an urgent discussion with the multidisciplinary heart team. Blood pressure was managed overnight with intravenous hydralazine and labetalol infusions.

**QUESTION 5: HOW SHOULD THE RESIDUAL LARGE IATROGENIC AORTIC DISSECTION BE MANAGED AT THIS STAGE?**

There is no randomized evidence to guide decision making, and even observational data are scant. Most iatrogenic aortocoronary dissections occur in the coronary artery and can be sealed with stenting, or they are retrograde dissections and are likely to resolve spontaneously. This contrasts with spontaneous Stanford type A aortic dissection, which is usually anterograde, but it carries a better prognosis if retrograde (4). The patient had no pericardial effusion, acute aortic regurgitation, involvement of innominate artery, or symptoms.

Given these findings, the heart team decision was to continue with a conservative approach at that stage, with ongoing blood pressure control and repeat cross-sectional imaging the following day.

Further CT after 24 h showed almost complete resolution of the dissection with just a small cuff of soft tissue thickening (Figures 2C and 2D). This finding suggests that the flap had been successfully sealed by the coronary stent, as expected. No further intervention was performed, and he was discharged home safely after an otherwise uncomplicated recovery.

**QUESTION 6: WHY DID THIS COMPLICATION OCCUR?**

The patient and his family wanted to understand why this complication had occurred when they had anticipated a straightforward elective day-case procedure. The selection of a more aggressive guide catheter was most likely responsible for the complication, together with risk factors of advancing age and hypertension. Gentle handling of the guide catheter and respect for the risks associated with PCI, even in the elective setting, are important. Informed consent must include detailing risks at the outset, even when these risks are low.

**QUESTION 7: WHAT SHOULD THE LONG-TERM MANAGEMENT AND OUTCOME BE FOR THIS PATIENT?**

Limited observational data suggest a very low risk of recurrence of the dissection after the acute event (5). It is unlikely that the patient has an underlying structural weakness in the aortic root, as could be suspected in cases of spontaneous dissection.
Furthermore, the entry point is covered with metalwork. This is despite the use of antiplatelet therapy to prevent stent thrombosis.

A follow-up CT aortogram in 1 year was recommended, and he was discharged with a usual post-PCI treatment regimen, including aspirin and clopidogrel for 6 months, with lifelong aspirin, and close attention to blood pressure control.

**CONCLUSIONS**

Guide catheter-induced aortocoronary dissection is a recognized complication of PCI, and operators should remain vigilant in patients with risk factors. Iatrogenic coronary dissection should usually be managed by immediate stent implantation when possible, and cross-sectional imaging is essential to decide whether cardiac surgery or a conservative strategy is most appropriate for the ascending aorta.

**AUTHOR DISCLOSURES**

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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**KEY WORDS** complication, dissection, percutaneous coronary intervention

**APPENDIX** For a supplemental video, please see the online version of this article.

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