

Isolated aortic dissection during coronary intervention: rare but challenging

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Abstract Catheter-induced aortic dissection without involvement of the coronary arteries is an extremely rare complication of percutaneous coronary intervention. Management strategies vary depending on clinical scenarios, however, the choice of strategy prompt recognition and early aggressive management is key to patient outcomes.

Keywords Isolated aortic dissection · Percutaneous coronary intervention · Catheter-induced aortic dissection

Introduction

Dissection of coronary ostium with retrograde extension into ascending aorta (coronary-aortic) has been reported during percutaneous coronary intervention (PCI). On the other hand, catheter-induced isolated ascending aortic dissection (AAD) is an extremely rare complication of PCI [1]. We report a case of isolated catheter related aortic dissection in a patient undergoing routine percutaneous coronary intervention. Further, we also discuss management of this rare but life-threatening complication of cardiac catheterization.

Case presentation

A 53-year-old woman with past medical history of hypertension, diabetes mellitus, and tobacco and cocaine abuse presented to our hospital with substernal chest pain and shortness of breath. She was hemodynamically stable on admission and physical exam was unremarkable. Baseline electrocardiogram (EKG) was normal, however, cardiac enzymes were elevated with a peak troponin of 5.02 ng/mL (Normal < 0.04 ng/mL). She was treated for acute coronary syndrome with aspirin, statin, calcium channel blockers (due to suspicion of cocaine use) and intravenous unfractionated heparin. Transthoracic echocardiogram performed before the heart catheterization revealed normal left ventricular size and function, normal-sized aortic root and ascending aorta.

Diagnostic coronary angiography was performed from right common femoral artery access. 6 French (F) Judkin's left, 6F Judkin's right and 3DRC catheters were used for angiography. The left main coronary artery had a normal origin with mild plaque disease. Left anterior descending artery (LAD) was normal, however, dye hang up was seen in the diagonal branch suggestive of thrombotic occlusion and was considered the culprit vessel (Fig. 1). The left circumflex artery was dominant and showed a distal 30 % stenosis and mild diffuse plaque. Right coronary artery (RCA) was a small non-dominant vessel. After conclusion of diagnostic angiography, it was elected to proceed with percutaneous coronary intervention (PCI) of the diagonal artery. A 7 Fr XB 3.5 guide catheter was advanced to the aortic root over a J-tipped guide wire and attempts to coaxially engage the left main ostium were performed. A non-selective injection of small amount of contrast to help guide engagement was performed and this revealed contrast staining in the aortic root (Fig. 2). No further contrast

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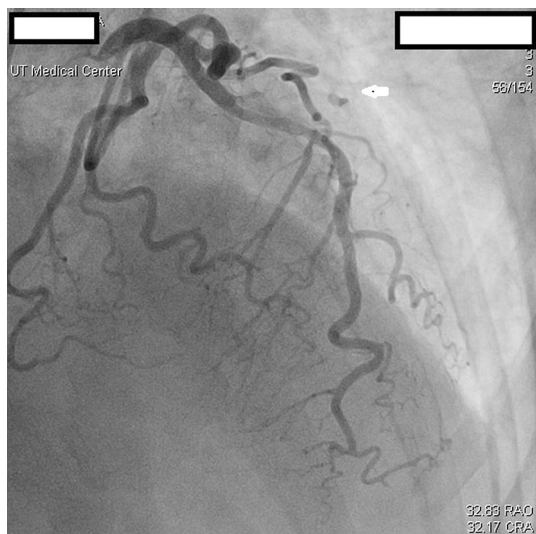


Fig. 1 RAO cranial view showing dye hang up (*white arrow*) in the diagonal branch suggestive of thrombotic occlusion

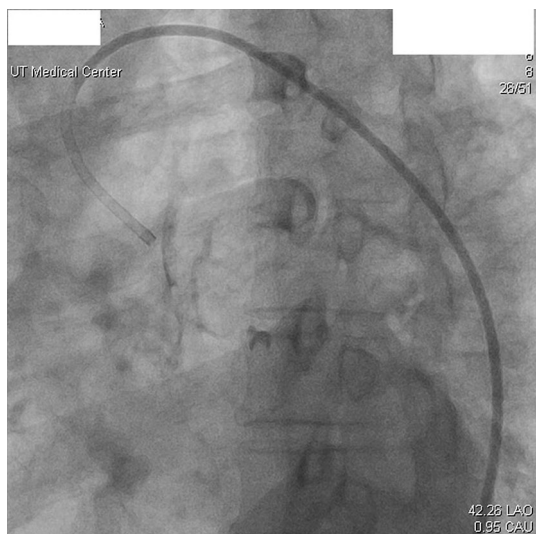


Fig. 2 Contrast staining in the aortic root due to dissection

injections were performed due to high suspicion of ascending aortic dissection. The dye staining appeared to extend more than 4 cm above the sinus of valsalva indicative of extensive aortic involvement [2]. The patient complained of chest pain, however, remained electrically and hemodynamically stable, and PCI was aborted. Intravenous esmolol was started to aggressively control blood pressure and heparin used during PCI was reversed with protamine. Urgent transthoracic echocardiogram performed in catheterization laboratory was negative for a pericardial effusion and color flow imaging did not reveal intimal tear in the root. Urgent computerized tomographic angiography (CTA) scan of the chest and abdomen

revealed a circumferential, mediastinal hematoma surrounding the ascending aorta, aortic arch and great vessels with extra luminal contrast at the root of the ascending aorta (Fig. 3). Also, noted was compression of the main pulmonary trunk (Fig. 4) and to a lesser extent the RCA secondary to the hematoma. In light of these findings, patient was referred for emergent surgical repair of the ascending aortic dissection. The patient was placed on a cardiopulmonary bypass support and direct aortic cannulation was not done due to ascending aorta dissection. Cardiopulmonary bypass was achieved by cannulating the innominate artery and the right atrial appendage with retrograde cardioplegia for the duration of the procedure. During surgical exploration of aorta the dissection flap was noted in the aortic root in the proximity of the left main coronary ostium. However, this dissection did not propagate distally into the left main artery. Also aortic hematoma had compressed the right coronary orifice. The right ventricular function was reduced preoperatively and a significant-sized pericardial effusion was noted. The dissection was surgically repaired using interrupted 4-0 Prolene sutures and the intimal defect was closed with a more superficial 5-0 running Prolene suture. Drainage of the pericardial hematoma was also performed and the right ventricular function improved to normal and the patient was easily weaned off cardiopulmonary bypass. Initial plans of a bypass graft to the diagonal branch were abandoned due to intramyocardial course of the vessel. The patient had an uneventful recovery and was discharged on postoperative day 5. She continues to do well on 3-month follow-up examination and a CT scan done in follow-up

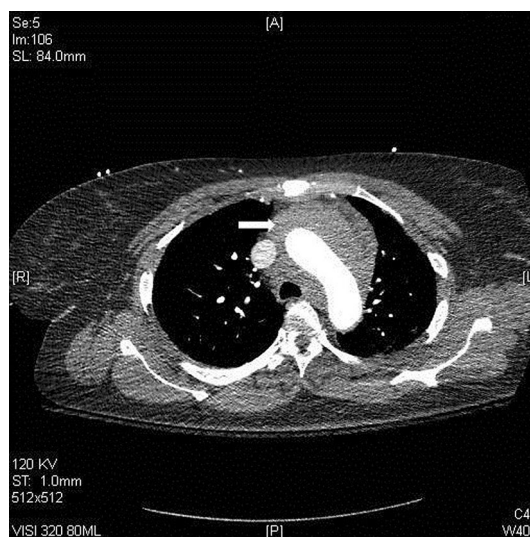


Fig. 3 Computerized Tomographic angiography (CTA) scan of the chest showing a circumferential, mediastinal hematoma (*arrow*) surrounding the aorta at the level of the aortic arch

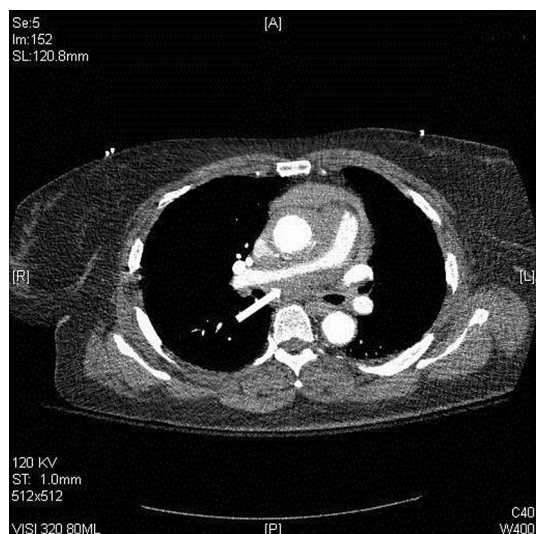


Fig. 4 CTA chest showing the hematoma compressing the main pulmonary trunk (*arrow*)

showed resolution of the hematoma with no residual dissection (Fig. 5).

Discussion

Dissection of the ascending aorta during cardiac catheterization has been reported with an incidence ranging from 0.01–0.1 % in literature [3]. Coronary artery dissection extending retrograde towards the sinuses of valsalva and the ascending aorta is much more commonly encountered

than an isolated AAD. Dunning et al. have proposed a classification to better classify the combination of coronary artery–ascending aorta dissections [2]. Class 1 is defined as a focal dissection restricted to the coronary cusp and Class 2 extends up the aorta but < 40 mm, Class 3 is the most extensive dissection extending from the coronary cusp up the ascending aorta >40 mm [2]. Class 3 dissections tend to have worse outcomes as expected from extensive aortic involvement [2]. Right coronary artery is more commonly involved in retrograde dissection than the left coronary system [2]. Emergent setting of the procedure has also been associated with a higher risk of dissection by about 10-fold compared to an elective setting [4].

A 10-year retrospective study found the incidence of 0.12 % in interventional procedures as compared to 0.01 % in the diagnostic procedures [1]. Some of the identified risk factors include use of unconventional catheters (especially Amplatz catheters), larger catheter size, deep coronary engagement, and forceful and/or non-selective contrast injection [1, 2]. Besides guide catheters, other devices used during coronary intervention including wires, balloon, and support devices (Intra-aortic balloon pump, guideliners) have also been reported to cause dissection [5]. In our patient, guide catheter-induced localized aortic dissection was iatrogenic and larger catheter size and over aggressive manipulation may have been contributory factors. Noguchi et al. have described a similar case of isolated AAD without coronary involvement occurring during PCI for acute myocardial infarction [5]. Aggressive guide catheter manipulation during radial approach was the causative factor in their case with the intimal tear starting in the

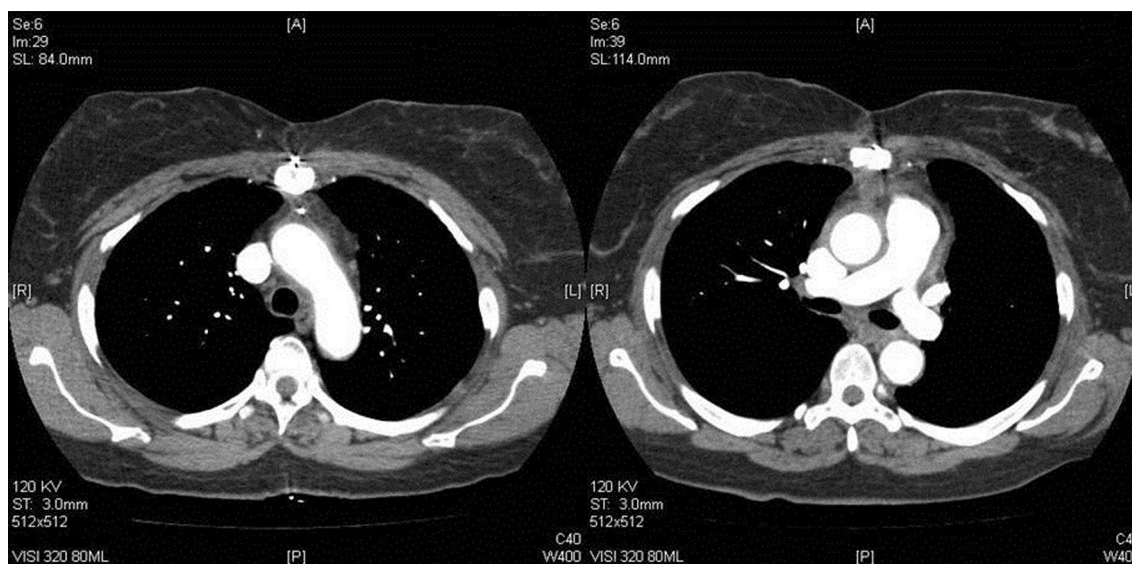


Fig. 5 CTA chest in follow-up showing resolution of the hematoma at the aortic arch level and around the pulmonary artery

brachiocephalic artery. Emergent surgical aortic reconstruction with a Dacron graft was performed. In yet another case, authors report a case of isolated dissection of aortic sinus of Valsalva caused by a stiff coronary guidewire [6]. Similar to our case, immediate surgical management with repair of the dissection using Prolene sutures was successful.

Coronary aortic dissection has been successfully treated using both percutaneous intervention and surgical approaches. In cases of retrograde propagation from the coronary artery, sealing the entry site of dissection with stents along with close surveillance is often times successful [7, 8]. However, extensive retrograde coronary aortic and isolated AAD resembles spontaneous ascending aortic dissection (type A) and thus surgical management is favored [8]. Aggressive blood pressure control, reversal of anticoagulation and early surgical intervention remain critical for successful outcome as in our case. In addition, pericardial effusion and its hemodynamic consequences may lead to rapid clinical deterioration in these cases. In our case, early surgical treatment proved prudent as aortic hematoma had rapidly expanded and led to wall motion abnormalities in the region of right coronary distribution, which was likely compressed by the surrounding hematoma.

Our report illustrates an extremely rare clinical scenario of isolated iatrogenic AAD during cardiac interventional procedure. Surgical treatment continues to remain favored treatment modality for this life-threatening complication. While guiding catheters are undoubtedly important for successful PCI, however, careful manipulation of catheters while engaging coronary arteries cannot be overemphasized.

Acknowledgments None.

Compliance with ethical standards

No research involving human or animal participants was involved. No consent was required as no research was conducted.

Conflict of interest The authors report no financial relationships or conflicts of interest regarding the content herein.

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