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Editorial

Guidewire-induced iatrogenic coronary arteriovenous fistula: An accidental meeting

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Most coronary arteriovenous fistulae are congenital. They drain into cardiac chambers, coronary sinus, or pulmonary artery. Coronary arteriovenous fistulae may be secondary to other conditions such as cardiac trauma, endomyocardial biopsies, aortic valve replacement, and coronary perforation complicating percutaneous coronary intervention (PCI). Coronary perforation is a rare but devastating complication of PCI with potentially fatal outcome. The reported incidence of coronary perforations ranges from 0.1% to 3.0% [1]. Women and the elderly appear to be at higher risk of perforation [2]. Ellis et al. [2] classified coronary perforation into type I: extraluminal crater without extravasation; type II: pericardial or myocardial blush without a ≥1-mm exit hole; and type III: frank streaming of contrast through a ≥1-mm exit hole, and cavity spilling (i.e. coronary arteriovenous fistula): perforation into an anatomic cavity chamber, coronary sinus, etc. The incidence of cavity spilling was 0.02% [2].

Chronic total occlusion remains one of the more difficult challenges for coronary interventionists. Recent developments in the treatment of chronic total occlusion involve the use of tapered hydrophilic or very stiff guidewires. However, it is a trade-off for a higher risk of coronary perforation. A recent study [3] has shown a high coronary perforation rate (7.4%) in patients with unsuccessful PCI for chronic total occlusion. Recently, a retrograde approach for chronic total occlusion of coronary artery through a collateral channel has been introduced. Cavity spilling from the septal artery into the right or left ventricle rarely occurs as a complication of the retrograde approach through a septal channel. In the present case report [4], Park et al. showed coronary arteriovenous fistula induced by penetration of a guidewire for chronic total occlusion followed by balloon inflation. All of the major epicardial coronary arteries have an adjacent companion vein. However, the distance between coronary arteries and veins are variable. Percutaneous in situ coronary venous arterializations (PICVA) is the concept to use the in situ coronary vein as the coronary artery for the treatment of chronic total occlusion [5]. The TransAccess catheter (TransVascular, Menlo Park, CA, USA) with a 24-gauge nitinol needle and phased array ultrasound elements was used to make a connection between the coronary artery and the companion vein. In a previous study, PICVA was attempted in 11 patients. In 6 patients, the adjacent vein could not be adequately targeted for successful needle and wire delivery because of variations in anatomy [5]. Thus it would be extremely rare for a guidewire to penetrate from the coronary artery to the companion vein.

Prolonged balloon inflation, reversal anticoagulation, discontinuation of IIb/IIIa inhibitors if used, and platelet transfusion if needed may be performed to seal coronary perforation. Guidewire-induced coronary artery perforation may be treated with transcatheter delivery of autologous clots, microcoils, gelatin sponges, polyvinyl alcohol, microfibrillar collagen, thrombin, and subcutaneous tissue [6]. The conventional management often fails to seal perforation especially when it is severe (i.e. type III) [1,2]. Before polytetrafluoroethylene (PTFE)-covered stents were available, type III perforations were associated with a high incidence of major adverse events (death, 19%; emergency bypass surgery, 63%; Q-wave myocardial infarction, 15%; cardiac tamponade, 63%) [2]. Covered stents are a unique tool to seal perforation. Briguori et al. [7] demonstrated a high successful rate (91%) for sealing type III coronary perforation with PTFE-covered stents. In their study, clinical outcomes were compared between patients treated with and without PTFE-covered stents for coronary perforation that could not be sealed by conventional management. The PTFE-covered stent group had a lower incidence of non-Q-wave myocardial infarction (0% vs. 47%, $p = 0.005$), cardiac tamponade (8% vs. 82%, $p < 0.001$), blood transfusion (18% vs. 88%, $p < 0.001$), and bypass surgery (18% vs. 88%, $p < 0.01$) [7].

Potential complications of congenital coronary arteriovenous fistulae include pulmonary hypertension and congestive heart failure if a large left-to-right shunt exists, bacterial endocarditis, rupture or thrombosis of the fistula or an associated arterial aneurysm, and myocardial ischemia distal to the fistula due to decreased coronary blood flow. The natural history of patients with an acquired coronary artery fistula is highly variable. It depends on the magnitude of the shunt through the coronary arteriovenous fistulae. Previous case reports demonstrated a benign clinical course of iatrogenic coronary arteriovenous fistulae. Youssef et al. [8] showed spontaneous disappearance of an iatrogenic coronary arteriovenous fistula from a septal artery to the right ventricle. A case report demonstrated disappearance of an iatrogenic coronary arteriovenous fistula due to neointimal hyperplasia in the bare metal stent [9]. Iatrogenic coronary arteriovenous fistulae may be

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managed medically without percutaneous or surgical intervention, if patients are hemodynamically stable. In the present case [4], it might have been possible to manage the coronary arteriovenous fistula medically, especially unless the 2.0-mm balloon had been inflated.

Iatrogenic coronary arteriovenous fistulae with a large shunt may result in congestive heart failure and/or angina, especially if the patient has reduced left ventricular function [10,11]. Elghoul et al. [12] demonstrated usefulness of PTFE-covered stent to seal an iatrogenic coronary arteriovenous fistula after stenting. Another case report showed a case of an iatrogenic coronary arteriovenous fistula that was treated by coil embolization [10].

Iatrogenic coronary arteriovenous fistula is a rate complication of PCI. Many coronary interventionists may have little experience. Thus it is important to know how to treat it in advance from case reports.

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