Retroperitoneal Bleeding and Arteriovenous Fistula after Percutaneous Coronary Intervention Successfully Treated with Intravascular Ultrasound-guided Covered Stent Implantation

Satoshi Mogi¹, Yuichiro Maekawa², Keiichi Fukuda² and Shigetaka Noma¹

Abstract

The major puncture-site complications of the transfemoral approach are retroperitoneal bleeding (RPB), arteriovenous (AV) fistula, and arterial pseudoaneurysm. Although the management of RPB and AV fistula depends on individual cases, our experience shows that the use of a covered stent with intravascular ultrasound (IVUS) guidance can successfully manage percutaneous coronary intervention-associated RPB and AV fistula. IVUS guidance can therefore make it easy to use an optimal-size covered stent.

Key words: retroperitoneal bleeding, arteriovenous fistula, percutaneous coronary intervention, covered stent, intravascular ultrasound


Introduction

The complication of bleeding after percutaneous coronary intervention (PCI) is associated with both short-term and long-term mortality (1-3). The major puncture-site complications of the transfemoral approach are retroperitoneal bleeding (RPB), arteriovenous (AV) fistula, and arterial pseudoaneurysm. RPB is a rare but life-threatening complication (4). AV fistula occasionally requires surgical treatment. Although the management of RPB and AV fistula depends on individual cases, our case shows one of the “bail-out” procedures for these PCI-associated complications.

Case Report

A 50-year-old man with hypertension and dyslipidemia was admitted to our hospital because of effort angina. Coronary angiogram revealed significant stenosis of the distal right coronary artery (RCA). After he had been given aspirin, clopidogrel, statin, and a β-blocker, he underwent PCI for severe stenosis of the distal RCA. An 8-Fr femoral sheath was inserted into his left femoral artery with difficulty. Femoral angiography was performed and no significant findings were observed. He received unfractionated heparin (8,000 units), and the activated clotting time (ACT) was maintained at 250-300 seconds every 30 minutes through the administration of 1,000-2,000 units of heparin. The diseased RCA was successfully treated by the implantation of two drug-eluting stents. Hemostasis was obtained by using an 8-Fr Angioseal vascular closure device (St. Jude Medical, St. Paul, MN, USA) without hematoma. Three hours later, his systolic blood pressure decreased to 70 mmHg, and he complained of discomfort. Abdominal computed tomography (CT) was performed, which showed a retroperitoneal hematoma and AV fistula (Figure A, B). Four units of packed red blood cells were transfused, and he underwent peripheral vascular angiography again. The ACT was 100 seconds because 10 mg of protamine sulfate was administered. A 6-Fr sheath was inserted into his right femoral artery, and angiography revealed active extravasation from an inferior epigastric artery (IEA) and femoral vein although arteriography showed only the artery, indicating an AV fistula (Figure C). Surgical repair was planned; however, percutaneous repair for the rupture of the IEA and AV fistula was performed because his vital signs...
Figure. A: Abdominal CT showed a retroperitoneal hematoma (white arrow). B: Peripheral CT angiography showed the left femoral vein, indicating arteriovenous fistula (white arrow). C: Femoral angiography of the left anterior oblique projection showing bleeding from the inferior epigastric artery (white arrow) and femoral vein, indicating arteriovenous fistula (black arrow). D: IVUS image of the inferior epigastric artery. The vessel diameter was around 3 mm. E: Balloon tamponade was performed. A guidewire was advanced into the inferior epigastric artery and a balloon was inflated. F: A covered stent (2.8×16 mm) was implanted. G: The final femoral angiogram showed no bleeding from the inferior epigastric artery and no femoral vein.

deteriorated. We introduced a 6-Fr internal mammary artery guiding catheter into the left common iliac artery and advanced a 0.014 floppy wire into the IEA. We checked the vessel diameter by using intravascular ultrasound (IVUS) (Figure D) and inflated a 2.0×20 mm balloon for 15 minutes. Fifteen minutes later, extravasation was still observed; therefore, a longer balloon (2.0×40 mm) was inflated for an additional 20 minutes (Figure E). However, the bleeding did not stop after the two balloon inflations. We thus deployed a 2.8×16 mm covered stent (Abbott Vascular, Abbott Park, USA) at the rupture site with IVUS guidance (Figure F). After the stent implantation, an angiogram was performed,
which showed no bleeding from the IEA and no femoral vein (Figure G). The patient was discharged from the hospital five days after the procedure. Three months later, abdominal CT revealed the patency of the left IEA and the absence of AV fistula.

**Discussion**

RPB is one of the life-threatening complications that occur after transfemoral cardiac catheterization, including PCI. The incidence of RPB after PCI was reported to be 0.4%, and the in-hospital mortality in cases of RPB was 6.6% (4). A previous study demonstrated that the independent predictors of RPB after PCI were female sex, low body surface area, high femoral artery puncture, excessive anticoagulation, and the use of large catheters (4). More recently, a large multicenter registry reported that the use of a vascular closure device was associated with an increased risk for the development of RPB. This association was significant for AngioSeal; however, there was no significant trend with Perclose (Abbott Laboratories, Abbott Park, USA). In addition, unintentional puncture of the IEA is one of the causes of RPB. The IEA branches from the distal external iliac artery and descends from the anterior side of the femoral artery, and turns to the cranial side to supply the lower abdominal wall in most anatomical variables. This U-shaped vessel course promotes the risk of unintentional puncture. Sherev et al. have shown that the bottom of the “U-shaped curve” is a better landmark than the origin of the IEA for the retroperitoneal space, and vascular access above this angiographic landmark is associated with an increased risk of RPB (5). Bleeding from the IEA can track from below the inguinal ligament and communicates with the retroperitoneal space. In our case, AV fistula also occurred. The femoral artery lies anterior to the superficial femoral vein; therefore, unintentional puncture of both the IEA and the femoral vein resulted in RPB and AV fistula. Early recognition of vascular injury may therefore help to avoid major bleeding complications. After femoral access is achieved, a femoral angiogram should be performed before PCI; however, in this case, IEA injury was not recognized, although a femoral angiogram was performed. A previous report suggested that balloon tamponade or covered stent placement for IEA injury is a feasible and safe procedure (6). Our case was consistent with previous cases, and the IVUS guidance made it easy to use an optimal-size covered stent. The use of a covered stent has resulted in long-term favorable outcomes in the management of acute coronary perforation (7). Likewise, our follow-up CT showed no restenosis of the covered stent. Our procedure with IVUS guidance may contribute to a favorable result. To the best of our knowledge, this is the first report to show that the use of a covered stent with IVUS guidance can successfully manage PCI-associated RPB and AV fistula.

**The authors state that they have no Conflict of Interest (COI).**

**References**