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TREATMENT OF VASCULAR PERFORATION BLEEDING COMPLICATIONS POST-CORONARY INTERVENTION USING COILS

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ABSTRACT

Background: Perforation of artery causing bleeding is a rare but serious complication of percutaneous coronary intervention (PCI), with potentially life-threatening consequences. Prompt recognition and management are crucial, particularly in high-risk patients or complex procedures. Coils are essential tools for sealing perforated or ruptured vessels, preventing further haemorrhage and stabilising the patient.

Case description: This report highlights three cases of perforated artery managed with coil embolization. The first case involved perforation of a small branch of the internal mammary artery, the second a ruptured aneurysm in the superior mesenteric artery and the third a distal branch perforation of the diagonal artery. All patients presented with significant haemorrhage, requiring urgent intervention. Coil embolization was successfully performed in all cases, achieving haemostasis and preventing further complications.

Conclusion: Coil embolization is a lifesaving technique for managing perforated artery or ruptured aneurysm, emphasising the importance of timely diagnosis, technical expertise and the availability of advanced interventional tools.

KEYWORDS

Coils, coronary artery perforation, bleeding after percutaneous coronary intervention

LEARNING POINTS

- Perforation of artery causing bleeding is a rare but life-threatening complication of percutaneous coronary intervention.
- Coil embolization is a lifesaving technique for distal vessel perforations and aneurysmal ruptures.
- High-risk interventions demand careful planning, expertise and ready access to advanced tools such as coils.

INTRODUCTION/BACKGROUND

Arterial perforation, including coronary artery perforation (CAP), is an uncommon but serious complication of percutaneous coronary intervention (PCI), with an incidence of approximately 0.2–0.5%[1]. Although rare, it poses significant risks to patient survival, particularly during

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complex procedures involving calcified lesions, chronic total occlusions, tortuous vessels or patients on anticoagulation therapy[1]. Distal arterial perforation, often associated with the use of hydrophilic or stiff guidewires, accounts for up to 90% of cases and is typically classified as Ellis type V based on the location and severity of the perforation[2]. In such cases, coil embolization is a highly effective treatment, as coils induce thrombus formation and seal the bleeding site. Coils, categorised by material and delivery design, are essential in interventional cardiology for controlling haemorrhage, particularly in emergency scenarios involving pericardial bleeding[3]. This case series presents three patients with life-threatening bleeding – two due to coronary or other vessel perforations and one from a ruptured aneurysm – all successfully treated with coil embolization after PCI via the right radial artery.

CASE DESCRIPTION

Case 1: A 66-year-old female patient presented to the hospital with a diagnosis of acute coronary syndrome. Her medical history included hypertension and type II diabetes mellitus, for which she was receiving treatment. The patient was on antithrombotic therapy, including aspirin 162 mg, ticagrelor 180 mg and enoxaparin sodium 0.6 ml.

She underwent coronary angiography and PCI via the right radial artery, which revealed 80% stenosis in segments 1 and 3 of the right coronary artery. Two stents were successfully deployed, with favourable results. A 0.035 hydrophilic guidewire (Terumo®) was used for catheterisation during the procedure.

Following the intervention, the patient was transferred to the intensive care unit for monitoring. Eight hours later, she developed fatigue and dyspnoea, accompanied by pallor. However, she did not report chest pain. Her blood pressure was 120/70 mmHg, with a sinus heart rate of 100 beats per minute. Laboratory tests revealed a significant drop in haemoglobin levels, from 110 g/l pre-procedure to 71 g/l.

A bedside ultrasound showed a large volume of free fluid in the right pleural cavity, with no fluid in the left pleural cavity, pericardium or abdomen. There were no signs of aortic dissection. A chest X-ray (CXR) revealed blunting of the right costophrenic angle and opacification of the lower third of the right lung, consistent with pleural effusion *(Fig. 1)*. Multi-slice computed tomography (MSCT) of the thoracic vasculature identified active bleeding from a small branch of the right internal mammary artery into the right pleural cavity.

The patient received one unit of packed red blood cells (250 ml) and was transferred to the catheterisation laboratory for urgent haemostasis. The perforated artery was successfully sealed using two pushable coils delivered through the right radial artery with the assistance of a Progreat™ micro catheter. The first coil was a VortX™ Diamond-18 (5 × 6 mm) and the second was a Complex Helical™-18 (8 × 12 mm). Follow-up angiography confirmed cessation of bleeding *(Fig. 2 and 3)*. Post-procedure, the patient underwent pleural drainage. She stabilised clinically and was discharged three days later in good condition.

Case 2: A 62-year-old female patient presented to the hospital with a diagnosis of acute coronary syndrome. Her medical history included hypertension and type II diabetes mellitus, both under treatment. The patient was on antithrombotic therapy, including aspirin 162 mg, ticagrelor 180 mg and enoxaparin sodium 0.6 ml.

She underwent coronary angiography and PCI via the right radial artery, which revealed 80% stenosis in segments 1 and 2 of the circumflex artery. A single stent was successfully deployed, resulting in a favourable outcome. The patient was stable and transferred to the general ward for observation.

Twelve hours later, the patient developed fatigue and abdominal pain, accompanied by pallor. She reported no chest pain or dyspnoea. Her blood pressure was 130/70 mmHg, and her heart rate was 95 beats per minute with a sinus rhythm. Laboratory tests showed a significant drop in haemoglobin levels, from 120 g/l pre-procedure to 91 g/l.

Bedside ultrasound revealed free fluid in the abdominal cavity, specifically in the Douglas pouch, with no fluid in the pleural cavities or pericardium *(Fig. 4)*. There were no signs of aortic dissection. A CXR appeared normal. An MSCT of the thoracic and abdominal vasculature identified a ruptured aneurysm with active bleeding in the right branch of the superior mesenteric artery. The aneurysm measured 16 × 11 mm, with a retroperitoneal haematoma of 117 × 50 mm and intra-abdominal blood accumulation measuring 73 mm.

The patient was urgently transferred to the catheterisation laboratory for endovascular management. The ruptured

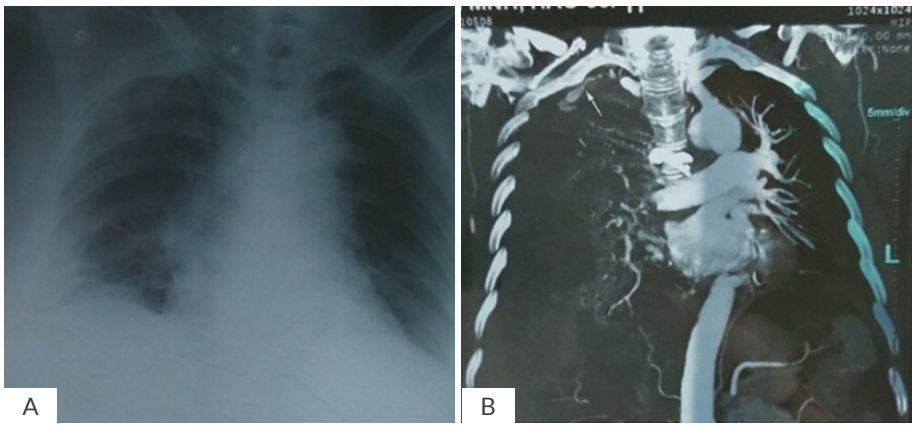


Figure 1. A) Chest X-ray showing blunting of the costophrenic angle and opacity in the lower third of the right lung. B) MSCT revealing the bleeding point in a small branch of the right internal mammary artery (arrow).

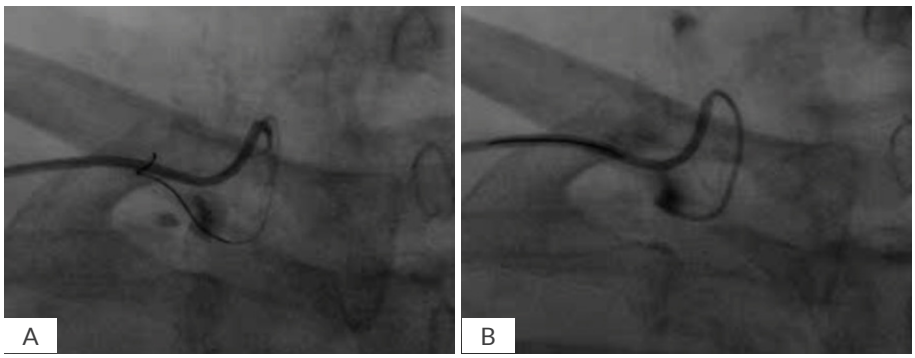


Figure 2. Selective angiography showing the perforated bleeding branch.

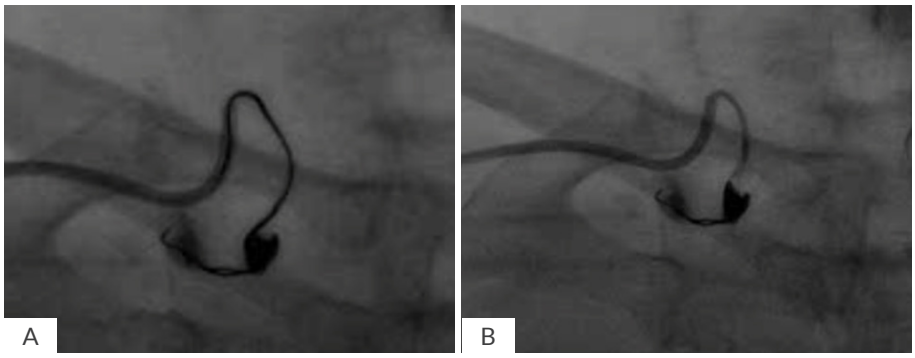


Figure 3. Coil deployment and post-procedure angiography confirming cessation of bleeding.

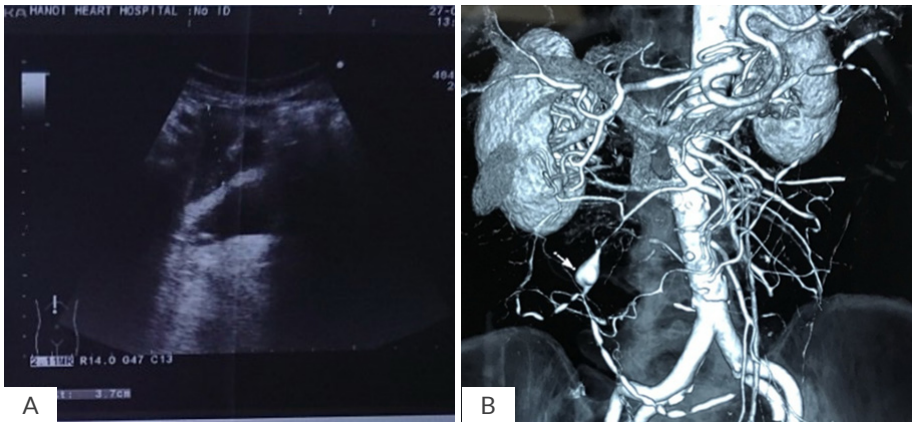


Figure 4. A) Ultrasound image showing abdominal fluid. B) MSCT image of the ruptured aneurysm.

aneurysm was successfully sealed using five pushable coils delivered via the left radial artery with the assistance of a Progreat™ microcatheter. The coils included two VortX Diamond-18 coils (10 × 8 mm) and three Complex Helical-18 coils (9 × 12 mm). Follow-up angiography confirmed the cessation of bleeding.

Following the procedure, the patient received medical management and close monitoring. She stabilised clinically and was discharged in good condition after five days.

Case 3: A 78-year-old male patient presented to the hospital with a diagnosis of acute coronary syndrome. His medical history included hypertension and type II diabetes mellitus, both under treatment. The patient was receiving antithrombotic therapy, including aspirin 162 mg, clopidogrel 600 mg and enoxaparin sodium 0.6 ml.

A coronary angiography revealed 80% stenosis in segments 1 and 2 of the left anterior descending artery (LAD), along with a trifurcation lesion involving a large first diagonal branch (D1). The intervention was performed using two standard guidewires (non-hydrophilic), and a single stent was deployed across the trifurcation (cross-over technique). Post-procedure imaging showed active bleeding from a distal branch of the first diagonal artery (D1) into the pericardial cavity.

The patient developed chest discomfort, dyspnoea, bradycardia and hypotension, indicative of cardiac tamponade. Immediate resuscitation measures were initiated. A balloon was inflated in the proximal LAD to reduce blood flow to the site of bleeding, and a microcatheter was advanced into D1. Two Complex Helical-18 coils (4 × 10 mm) were deployed to seal the perforation. Follow-up angiography confirmed the cessation of bleeding *(Fig. 5)*.

A pericardial drain was placed to remove accumulated blood, and the patient was transferred to the intensive care unit for further monitoring and treatment. He stabilised clinically and was discharged in good condition three days later.

DISCUSSION

Arterial perforation or ruptured aneurysm is a rare but severe complication during percutaneous coronary intervention (PCI), with an incidence ranging from 0.1 to 0.4%[4]. The cases presented in this report underscore

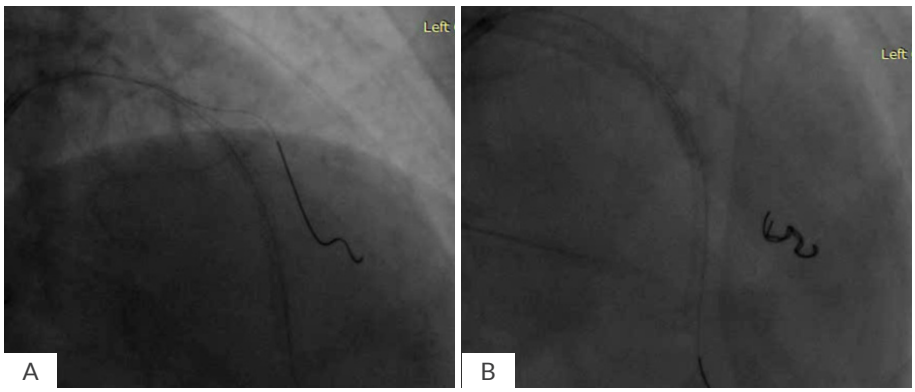


Figure 5. A) Distal branch perforation of D1 after stent placement in LAD segments 1–2. B) Coil embolization sealing the perforation.

the clinical and procedural complexities associated with managing CAP, particularly when distal vessel branches are involved[5]. Despite its rarity, arterial perforation demands prompt recognition and effective management to prevent life-threatening complications such as cardiac tamponade or hemodynamic collapse.

In the third case, a combination of patient-specific and procedural factors likely contributed to the occurrence of CAP. The patient, a 78-year-old male, presented with advanced age, hypertension, and type II diabetes mellitus—known risk factors for vascular fragility. Additionally, the patient was receiving antithrombotic therapy, including aspirin, clopidogrel, and enoxaparin, which increased the risk of bleeding. From a procedural standpoint, the intervention involved stent placement across a bifurcation lesion in the left anterior descending (LAD) artery using two guidewires, a technique inherently associated with increased procedural complexity.

The perforation in the distal branch of the D1 was likely caused by mechanical stress from guidewires or stent expansion at the trifurcation site. This type of perforation, classified as Ellis type V, is particularly challenging due to the small vessel size, limited accessibility, and difficulty achieving hemostasis[6]. Immediate recognition of the complication was critical, as evidenced by the patient's rapid clinical deterioration with symptoms of chest discomfort, dyspnoea, hypotension, and bradycardia, indicative of cardiac tamponade.

The management of CAP in this case highlights the importance of swift, evidence-based interventions. Balloon inflation in the LAD provided temporary haemostasis by reducing blood flow to the perforation site, allowing time for definitive treatment. Coil embolization was subsequently performed using two Complex Helical-18 coils delivered via a microcatheter into the distal D1 branch. This approach effectively sealed the perforation by inducing localized thrombus formation, as confirmed by follow-up angiography. The ability to deploy coils accurately in small, distal vessels underscores the value of advanced imaging techniques, specialized microcatheters, and technical proficiency in managing CAP[3].

The decision to place a pericardial drain was crucial in managing the immediate hemodynamic effects of cardiac tamponade. This intervention prevented further hemodynamic compromise and allowed the patient to stabilize post-procedure. Notably, the patient's clinical recovery and discharge within three days emphasize the effectiveness of the chosen management strategy.

The cases also raise important considerations for procedural planning and risk mitigation in high-risk patients. The use of hydrophilic or stiff guidewires and aggressive stent deployment strategies should be carefully weighed against the potential risk of vascular injury, particularly in patients with predisposing factors such as advanced age or comorbid conditions. Ensuring the availability of specialized equipment, including coils and microcatheters, is essential for all PCI-capable facilities to address complications promptly.

In conclusion, the successful management of perforation or rupture of artery causing bleeding in these cases demonstrates the critical role of timely recognition, multidisciplinary coordination, and the use of advanced interventional techniques. While CAP remains a rare complication, its severity necessitates preparedness and expertise in its management. Further studies are needed to identify optimal strategies for preventing CAP and managing it effectively in diverse clinical settings.

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