



Guidewire-Induced Coronary Artery Perforation Complicated by Cardiac Tamponade Following Percutaneous Coronary Intervention: A Case Report and Literature Review

Rita Balech¹, Anthony Saadeh², Tia Khadra^{3ID*}, Nada Saleh², Dina Badran², Robert Hobeika⁴

¹Department of Cardiology, Faculty of Medicine, Lebanese University, Beirut, Lebanon

²Department of Internal Medicine, Faculty of Medicine, Lebanese University, Beirut, Lebanon

³Faculty of Medicine, Lebanese University, Beirut, Lebanon

⁴Department of Cardiology, Lebanese Hospital Geitaoui, Beirut CHU, Beirut, Lebanon

Corresponding Author: Tia Khadra [ORCID](#)

Address: Faculty of Medicine, Lebanese University, Beirut, Lebanon; Email: tia.khadra@st.ul.edu.lb

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Abstract

Percutaneous coronary intervention (PCI) carries many complications, one of which is coronary artery perforation (CAP). It is a rare complication, but its incidence is increasing as the complexity of PCI increases. We present a case of cardiac tamponade following PCI secondary to CAP caused by a guidewire. This case highlights the importance of considering rare complications and managing them appropriately.

Keywords

Coronary Artery Perforation, Percutaneous Coronary Intervention, Cardiac Tamponade, Guidewire-Induced Perforation, Ellis Classification

Introduction

Percutaneous coronary intervention (PCI) carries many complications, one of which is coronary artery perforation (CAP). It is a rare complication, but its incidence is increasing as the complexity of PCI increases [1,2]. It is estimated that CAP occurs in 0.2-0.4% of PCI cases [3]. There are many causes of perforation, ranging from guidewire manipulation, balloon expansion, and stent deployment to the use of debulking devices [4]. Pericardial effusion and hypotension are common consequences of CAP, with additional complications including arrhythmias, stroke, major vessel occlusion, cardiac tamponade, and

myocardial infarction, potentially causing cardiogenic shock and death in the most severe cases [5]. We present a case of cardiac tamponade following PCI secondary to CAP caused by a guidewire.

Case Presentation

A 70-year-old woman with a past medical history significant for coronary artery disease, status post percutaneous transluminal coronary angioplasty with single stent implantation one year prior, and hypothyroidism was admitted for elective coronary angiography. Baseline laboratory investigations and vital signs were within normal limits prior to

Case Report

the procedure.

Coronary angiography revealed an ectopic origin of the circumflex artery from the ostium of the right coronary artery, with a severe (70%) calcified stenosis of the first circumflex segment (CX1). Percutaneous coronary intervention was therefore indicated and successfully performed with stent deployment.

At the conclusion of the angioplasty, the patient developed acute hypotension associated with chest discomfort. Angiographic imaging demonstrated contrast stagnation within the myocardium, consistent with distal coronary perforation caused by the microguide (**Fig-1**). An emergent transthoracic echocardiogram revealed a moderate hemopericardium.

Immediate management included administration of protamine to reverse the effects of heparin and inflation of a 1.5 mm balloon proximal to the site of perforation

to achieve hemostasis. Laboratory evaluation showed a decrease in hemoglobin from 13 g/dL to 10 g/dL, leukocytosis with the white blood cell count increasing from 8,000/ μ L to 10,000/ μ L, serum creatinine of 0.73 mg/dL, an elevated troponin level of 321 ng/L, C-reactive protein of 10 mg/L, and procalcitonin of 0.05 ng/mL.

The patient was urgently transferred to the operating room for pericardial drainage and subsequently admitted to the coronary care unit for close monitoring. She received a packed red blood cell transfusion, intravenous fluid resuscitation, vasopressor support for borderline hypotension (systolic blood pressure 90-100 mmHg), and empiric intravenous antibiotics.

Her hemodynamic status gradually stabilized, vasopressors were discontinued, and she demonstrated sustained clinical improvement. The patient was ultimately discharged home in stable condition.

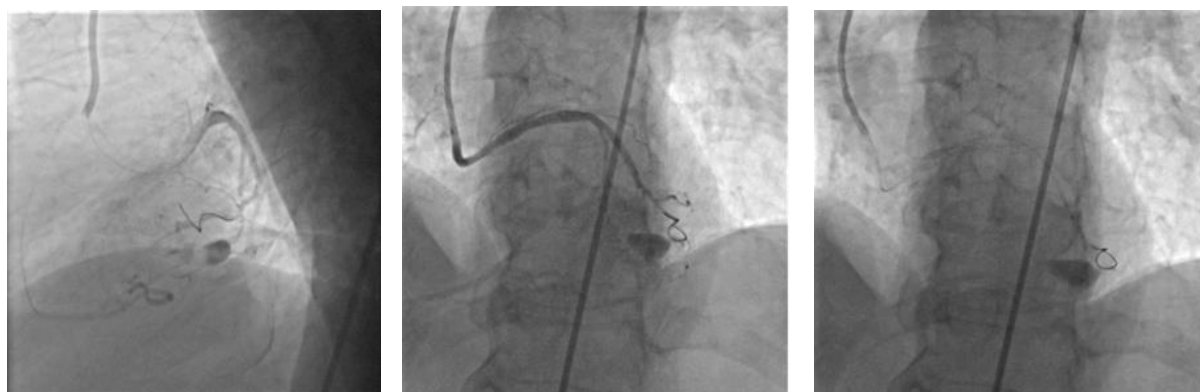


Fig-1: Angiography

Contrast Stagnation within the Myocardium

Discussion

CAP is a rare and serious complication of PCI [1]. Risk factors include female sex and older age; these two factors tend to be associated with narrower coronary arteries [6]. Other risk factors include the type and location of the lesion, use of clopidogrel, lower baseline glomerular filtration rate, hypertension, prior coronary artery bypass grafting (CABG), history of congestive heart failure, and multivessel coronary artery disease [6].

Almost 21-25% of CAP cases are missed during the procedure but are detected afterward as cardiac

tamponade. A fatal outcome of CAP directly correlates with the development of tamponade and concurrent arrhythmias, with a high need for emergency pericardiocentesis [7]. Current data suggest that guidewire-induced CAP is complicated by cardiac tamponade in nearly half of these patients as an insidious subacute presentation [4], and patients should be observed for delayed cardiac tamponade for at least 24 hours [5]. It can also occur up to 8 days after PCI [8].

Symptoms suggestive of tamponade include hypotension, dyspnea, and chest pain. Signs include bradycardia and distended neck veins [6]. Emergent

Case Report

echocardiography should be performed to establish the diagnosis, and right heart catheterization, if performed, will show equalization of diastolic pressures [6].

The severity of CAP is estimated according to the Ellis classification based on the angiographic appearance of the perforated coronary artery: type I, extraluminal crater without extravasation; type II, pericardial or myocardial blush without contrast jet extravasation; and type III, extravasation through a frank (≥ 1 mm diameter) perforation with contrast streaming and cavity spilling [9]. The incidence and mortality of pericardial tamponade are closely associated with the Ellis classification, increasing with the classification type [10].

There are a variety of approaches to treat CAP. These include simple observation with repeated echocardiography for mild cases, prolonged balloon inflation to cease blood flow to the perforation site, or, for more severe cases, the use of polytetrafluoroethylene-covered graft stents for definitive treatment [3].

In this case, the 70-year-old woman with known coronary artery disease (CAD), prior percutaneous angioplasty with stenting one year earlier, and hypothyroidism underwent coronary angiography, which showed an ectopic coronary anatomy with 70% calcified stenosis in the CX1 (first obtuse marginal) branch. Balloon angioplasty with stenting was attempted, but the distal microguidewire caused perforation. This led to myocardial contrast stasis, hypotension, chest pain, and moderate hemopericardium on echocardiography (Ellis type II perforation, pericardial blush with no frank extravasation) [11]. The contributing factors in this scenario include older age, female sex, potentially multivessel CAD, and calcified lesions, which increase the likelihood of guidewire-related injury in tortuous or ectopic anatomy [11,12].

Heparin reversal with protamine was performed to manage the distal guidewire perforation, as recommended to avoid excessive bleeding while lowering the risk of stent thrombosis [12]. Then, prolonged inflation of a 1.5 mm balloon was performed

proximal to the site (2-6 atm for 10-20 min) to seal the leak and minimize additional pericardial fluid [2]. Emergent pericardial drainage performed in the operating room relieved the tamponade physiology and prevented impending hemodynamic collapse. From the operating room, the patient was transferred to the coronary care unit (CCU) for intravenous fluid and antibiotic administration and vasopressor support for hemodynamic stabilization. In approximately 50% of guidewire perforation cases, conservative measures can be used to achieve the same effect [12].

Conclusion

Coronary artery perforation is a rare but serious complication of percutaneous coronary intervention, especially in elderly women with calcified lesions and complex or ectopic coronary anatomy. This case highlights a guidewire-induced distal coronary perforation (Ellis type II) complicated by acute hemopericardium and hemodynamic instability. The key to achieving a favorable outcome remains early recognition, immediate echocardiographic assessment, prompt anticoagulation reversal, prolonged balloon inflation, and timely surgical pericardial drainage. Early diagnosis and coordinated intervention are pivotal for improving survival and recovery following coronary artery perforation.

Conflict of Interest

The authors have read and approved the final version of the manuscript. The authors declare no conflicts of interest.

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Case Report

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