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CASE REPORT

Coronary and Right Ventricular Perforations: Frying pan and the Fire.

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Abstract

Background: Pericardiocentesis is a challenging procedure, particularly in the setting of acute cardiac tamponade (CT) following coronary perforation during percutaneous intervention (PCI).

Case Presentation: In the case presented here, an ad hoc PCI procedure was performed on the Left Anterior Descending (LAD) artery, which resulted in coronary artery perforation and subsequent acute cardiac tamponade. Emergency pericardiocentesis was promptly performed; however, an additional complication of right ventricular (RV) perforation occurred, necessitating specialized management.

Management & Results: The coronary perforation was successfully managed using a covered stent, while the RV perforations were addressed through the deployment of a Patent Ductus Arteriosus occluder device and subsequent surgical patch repair.

Conclusion: This case emphasizes the critical importance of having the necessary equipment, involving multiple modalities, and possessing expertise in order to effectively manage complications arising from cardiac catheterization procedures. The availability of appropriate hardware and a multidisciplinary approach can significantly contribute to life-saving interventions in such situations.

Keywords

Coronary Perforation, Right Ventricular Perforation, Coronary Intervention complications, Occluder Device.

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Introduction

Coronary artery perforation (CAP) is a potentially life-threatening complication of percutaneous coronary intervention (PCI), with reported incidences ranging from 0.1% to 3%. It can lead to serious consequences such as cardiac tamponade (CT), myocardial infarction (MI), cardiac arrest, and even death[1].

Iatrogenic cardiac perforation is considered one of the most dreaded complications, as it is associated with adverse outcomes including CT and death. Performing pericardiocentesis is particularly challenging, especially in cases of acute CT occurring in the context of CAP[2].

In the presented case, ad hoc PCI to the left anterior descending artery (LAD) resulted in perforation, which was initially managed with a covered stent and pericardiocentesis[3]. However, subsequent complications arose, including the inadvertent placement of a sheath into the right ventricular (RV) cavity and perforation of the RV apex[4]. These complications were successfully addressed through percutaneous device closure and surgical patch repair, respectively.

Case Presentation

A 59-year-old woman with a delayed presentation of anterior wall myocardial infarction (MI) was referred to our outpatient clinic. She remained hemodynamically stable, but initial assessments revealed an ejection fraction (EF) of 40%. The patient had a history of poorly controlled diabetes mellitus for 13 years and non-compliance with oral antidiabetic medications.

Coronary angiography demonstrated calcified left anterior descending (LAD) artery and diffuse severe disease from the left main stem (LMS) to the mid LAD, along with mild disease in the left circumflex (LCx) and right coronary arteries. Subsequently, PCI was performed on the LMS and LAD (Figure 1 and 2). Following predilatation, a dissection occurred in the proximal to mid LAD. A Resolute Onyx 2.5x38 mm stent was deployed at 12 atm in the proximal to mid LAD, while a Resolute Onyx 3.0x38 mm stent was deployed at 18 atm from the LMS to proximal LAD, effectively jailing the LCx and overlapping the first stent. Postdilatation was performed using a 3.0x15 mm balloon in the mid LAD stent and a 3.75x15 mm balloon in the LMS to proximal LAD stent. However, the mid LAD stent did not achieve optimal apposition, leading to perforation behind the lower half of the stent upon inflation of a 3.75x15 mm balloon (Figure 3).

Management & Result

Balloon tamponade was promptly initiated using a 3.75x15 mm balloon, which was maintained for 10 minutes. During this period, the patient was continuously monitored for chest pain or heaviness, and her ECG, heart rate, and blood pressure were closely observed. Transthoracic echocardiography (TTE) revealed no pericardial effusion. However, repeated angiography after the balloon tamponade showed persistent perforation in the mid LAD. Consequently, preparations were made for potential pericardiocentesis, and a covered stent (2.8x16 mm) was deployed at 15 atm to cover the perforation (Image 4). Despite these interventions, the angiogram still indicated the presence of a perforation, leading to the onset of acute cardiac tamponade (CT).

Supplemental oxygen was administered via a mask, and pericardial blood drainage was attempted using a percutaneous needle guided by fluoroscopy. A guide wire was advanced through the needle hub, after which the needle was removed, and a femoral sheath was advanced over the guidewire. Simultaneously, femoral venous access was established, and autotransfusion of the drained blood was initiated. However, there was no improvement in blood pressure. The pericardial access sheath was connected to a pressure transducer, which displayed right ventricular (RV) pressure tracings. TTE revealed moderate circumferential pericardial effusion and RV collapse. Agitated normal saline (10 mL) was injected through the subxiphoid access sheath, which confirmed opacification of the RV. The patient was sedated, placed on a mechanical ventilator, and started on intravenous saline and dobutamine infusion.

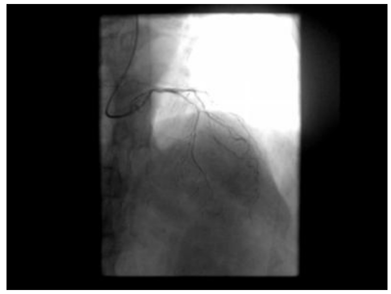

Figure 1: Calcified LAD

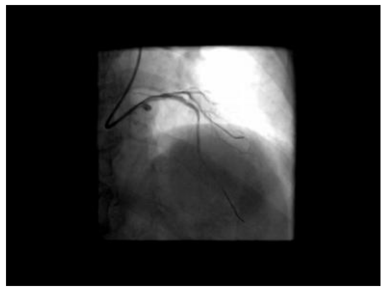

Figure 2: PCI LAD-LMS

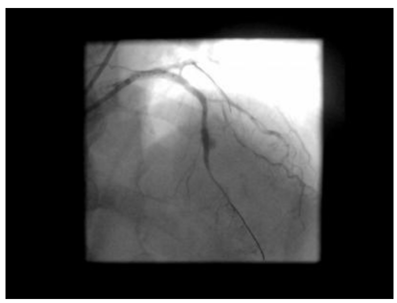

Figure 3: Perforation Following Post Dilatation

Figure 4: RV Gram

Figure 5: PDA device implanted to close RV perforation.

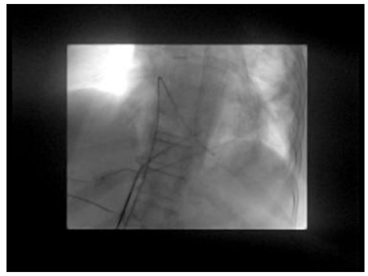

Figure 6: PDA device implanted to close RV perforation

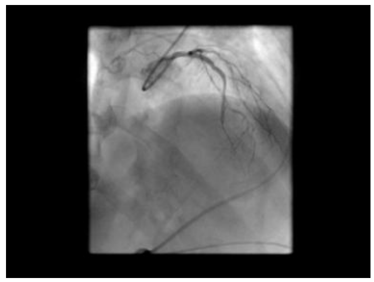

Figure 7: Sealed LAD perforation, also PDA occlude device in SITU

Another femoral sheath was inserted into the pericardial space via the subxiphoid window, and this time the pressure transducer did not reveal RV pressure tracings. Fresh blood was drained and transfused via the femoral vein. A five French pigtail catheter was introduced into the pericardial cavity and left in place using a catheter-over-wire technique for further drainage and autotransfusion via the femoral vein. After the patient's blood pressure improved, a repeat angiogram demonstrated successful sealing of the perforation and TIMI III flow from the LMS to the distal LAD. Collaboration with a structural heart cardiologist and cardiac surgeon was sought. Despite mild residual pericardial effusion still observed on repeated TTE, and persistent blood tapping from the pericardial space, a right ventricular angiogram was performed via transthoracic access to confirm the location of the sheath within the RV cavity. A second RV angiogram, accessed through the femoral vein, revealed dye leakage into the pericardial space (Figure 4).

The transthoracic sheath was upgraded from 6F to 7F femoral sheath, and a Cera TM 6x8 Patent Ductus Arteriosus (PDA) occluder device (LifeTech Scientific) was placed in the RV wall (Figure 5 & 6). Another RV angiogram demonstrated an additional site of oozing at the RV apex (Figure 7).

The patient was continuously infused with saline and dobutamine, while blood auto transfusion was maintained, and she was subsequently transferred to the operating room for patch repair of the RV perforation.

Patient underwent successful surgical repair of RV. Her EF after surgery was 36%. She had uneventful recovery and was discharged on 8th day of her surgery.

Discussion

The complications observed in this case were a consequence of over-dilatation of a calcified vessel using a noncompliant balloon. Despite prolonged balloon tamponade and the deployment of a covered stent, a persistent perforation in the LAD led to acute cardiac tamponade (CT)[5]. Pericardiocentesis is typically performed under the guidance of transthoracic echocardiography (TTE) or fluoroscopy, with an overall reported major complication rate of 3%.

Iatrogenic cardiac perforation is a known complication associated with various procedures, including transseptal puncture, transcatheter aortic valve implantation, and pericardiocentesis[6]. Encountering one life-threatening complication while attempting to manage another is undeniably a nightmare scenario[1,6]. Surgical repair is generally considered the first-line approach for managing RV perforation. However, there have been reported cases in the literature where iatrogenic cardiac perforations were successfully closed using percutaneous closure devices such as occluder devices, glues, and Angio-Seal. Having the necessary equipment readily available to address emergency situations is of utmost importance.

Conclusion

In conclusion, this case highlights the potential risks and challenges associated with iatrogenic cardiac perforation during percutaneous interventions. Despite the complications encountered, including acute CT and RV perforation, a multidisciplinary approach involving percutaneous closure devices and surgical repair was successfully employed. It underscores the significance of being prepared with the appropriate tools and expertise to manage such critical situations effectively. Further studies and advancements in techniques and technologies are warranted to improve the prevention and management of iatrogenic cardiac perforations and their associated complications.

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