Stent Detachment of the Anterior Descending Branch of the Left Coronary Artery into the Ascending Aorta

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Disclosures

The authors declare that there are no conflicts of interest regarding the publication of this article.

Ethical Statement

The case described herein does not involve any experimental procedures, interventions, or treatments that may raise ethical concerns. The patient's condition and treatment are presented solely for educational and scientific purposes, with no foreseeable risks or harm to the patient or others. This report adheres to the highest standards of ethical conduct and transparency, and no ethical controversies or conflicts are associated with the case.

Consent

To obtain written informed consent from the patient, we attempted to contact her multiple times via phone and sent a formal letter. Ultimately, we reached the patient's power of attorney, who expressed that publishing her case as a case report would align with the patient's wishes.

Human And Animal Rights

This study was conducted without involving human or animal subjects. All data analysis was based on publicly available datasets and/or computer simulations

ABSTRACT

This article details the case of an 81-year-old female patient admitted to the hospital due to recurrent episodes of chest pain. During a percutaneous coronary intervention for anterior descending artery stent placement, the stent dislodged following an unexpected movement by the patient. To address this complication, we employed a multifaceted approach that included the balloon drag technique, double guidewire winding method, and a gooseneck catcher for successful retrieval of the dislodged stent. We were able to achieve recanalization of the affected vessel during the same procedure, thereby minimizing the necessity for reoperation and associated risks. This case underscores the critical importance of preventing stent dislodgement during PCI procedures and highlights the need for clinicians to maintain composure and apply appropriate management strategies when faced with unforeseen challenges. Our experience not only contributes to the existing knowledge in interventional cardiology but also provides practical insights into effective techniques for managing similar complications in the future.

CASE REPORT

BACKGROUND

With the widespread adoption and increasing volume of cardiac interventional procedures, the incidence of unexpected surgical complications has risen. This case report presents a rare instance of coronary stent dislodgement. We describe the use of multiple techniques to successfully retrieve the dislodged stent and subsequently implant a new one. It is our hope that this case will provide new insights and methodologies for managing complications associated with coronary interventions.

INTRODUCTION

Percutaneous coronary intervention (PCI) is widely recognized as the cornerstone of invasive treatment for coronary artery disease. The safety of contemporary PCI procedures is very high, but rare complications, including stent dislodgement, can lead to potentially catastrophic consequences. We present the unique case of a patient who experienced stent dislodgement during transradial artery stenting, we attempted to remove the dislodged stent as a fully dilated stent using balloon drag, dual

guidewire wrap, and collar methods, and opened the diseased vessel at the same time. We will further discuss the individual techniques used to manage these complications.

CASE REPORT

The patient is an 81-year-old female who was admitted to the hospital on September 14, 2024, with episodes of chest pain for 3 hours. After radial arteriography, she was found to have a dominant right coronary artery with a normal left trunk, complete occlusion of the proximal part of the anterior descending branch (Figure 1), 65% stenosis in the middle part of the left rotating branch, and distal flow of TIMI grade 2; the obtuse marginal branch was normal and had normal flow. There was scattered stenosis (30-50%) in the right coronary artery with TIMI grade 2 distal flow; the sharp marginal branch, posterior left ventricular lateral branch and posterior descending branch had normal internal diameters and TIMI grade 3 flow. No abnormalities such as coronary collateral perfusion, malformations, aneurysms, entrapments, or myocardial bridges were seen. The patient was treated with morphine analgesia during chest pain. After communication with the patient and his family, the decision was made to perform percutaneous coronary intervention with placement of a coronary drug-eluting stent for a lesion with complete occlusion of the proximal segment of the anterior descending branch.

The 6FJL3.5 guide catheter was inserted into the opening of the left coronary artery, and the BMW guide wire was inserted into the distal segment of the anterior descending branch through the occluded proximal segment of the anterior descending branch, and the PTCA balloon (MINI TREK2.0*15mm, cutting balloon 2.0*10mm) was inserted into the stenosis of the proximal anterior descending branch with the dilatation of 8-12ATM, the balloon was completely unfolded, and the coronary artery was injected with 4mg of TNK and 200g of nitroglycerin. The balloon was fully expanded, and the coronary artery was dilated with TNK4mg and nitroglycerin at 8-12 ATM. 200g of nitroglycerin was injected, and on reexamination, the residual stenosis in the proximal segment of the anterior descending branch was 85%, and the distal blood flow was restored to the TIMI grade 2; an intracoronary stent (3.0*18mm) was introduced into the coronary artery, and it was placed in the proximal stenosis of the anterior descending branch (Figure 2), and it was covered with the lesion throughout the whole process, and the stent was expanded with 14ATM. The patient was treated with granisetron for antiemetic and symptomatic treatment; the stent was quickly threaded and fed into the BMW, runthrough NS guidewire to fix the stent, and then the first BMW entered the (1.5*15mm) balloon stent for 18ATM dilatation, and then the stent was withdrawn by dragging the stent, and it was difficult to retract the stent after dragging the stent to the left subclavian artery (Figure. 3), so the operation was stopped, and the balloon in the stent was withdrawn: the guidewire in the stent was entered into the gooseneck by the guidewire in the stent. The balloon in the stent was withdrawn: the guidewire in the stent entered the gooseneck along the guidewire in the stent, captured the middle part of the stent with the loopers, and then retreated into the guiding catheter, and the off-loaded stent was withdrawn from the body together with the guiding catheter (Figures 4,5). Additional heparin totaling 4000 u was added during this period.

The patient's right femoral artery was selected as the puncture entry point, routine skin disinfection, toweling, 1% lidocaine local infiltration anesthesia, Seldinger's method of routine puncture of the right femoral artery, placement of 6F femoral artery sheaths; downstream into the 6FJL3.5 guide catheter into the opening of the left coronary artery, downstream into the BMW guidewire into the distal section of the proximal anterior descending branch through occlusion, downstream into the coronary artery endoprosthesis (3.0*18mm), placed on the The proximal anterior descending stenosis was covered with lesions throughout, and the stent was expanded with 14 ATM. Re-imaging showed that the endothelium at the proximal anterior descending stent was smooth, with no residual stenosis, entrapment, side branch compression or other abnormalities, and the distal blood flow was improved to TIMI grade 3 (Figure 6). Blood pressure was monitored, and the patient's chest pain was significantly reduced after the procedure.

FOLLOW-UP

The patient was discharged after 5 days of hospitalization because of his stable general condition. During the hospitalization, there were no signs of vascular occlusion that could be related to the vascular injury, and the cardiac enzymes were normal on repeat examination 1 week later.

DISCUSSION

Etiology & demographics

Coronary stent dislodgement is a serious complication of PCI with potentially fatal consequences [1]. In our case, the patient dislodged the expanded balloon from the anterior descending branch into the ascending aorta due to a sudden attempt to get up and perform a strenuous arm movement. Fully deployed stent dislodgement is extremely rare, with an incidence of approximately only 0.32% [2]. Notably, no cases of stent dislodgement due to sudden changes in the patient's position have been reported in the available literature.

The use of stents in PCIs has significantly improved angiographic outcomes and reduced rates of restenosis and repeat revascularization [3]. However, despite advancements in equipment design and the widespread adoption of stents, stent loss remains a rare but potentially serious complication. This phenomenon can lead to systemic or coronary embolization, necessitating emergency coronary artery bypass graft surgery, and in severe cases, resulting in death. Recent data indicate a decreasing incidence of stent loss, likely due to these technological improvements [4], yet this complication still poses a formidable challenge to operators unfamiliar with retrieval equipment and techniques.

Demographically, patients undergoing PCIs who experience stent loss tend to be older, with a higher prevalence of

comorbidities such as diabetes and hypertension [5]. The risk factors for stent loss are multifactorial, including the complexity of the coronary anatomy, the experience level of the interventionalist, and the specific characteristics of the stent and delivery system used [6]. Despite these risk factors, the overall incidence remains low, underscoring the importance of continued vigilance and education to mitigate this rare but critical complication.

Clinical & imaging findings

Stent dislodgement during PCIs presents significant clinical challenges, as it can lead to severe complications such as myocardial infarction or coronary artery perforation when the stent remains within the coronary artery [7, 8]. Additionally, if a dislodged stent migrates outside the coronary vasculature, it poses a risk of cerebral or peripheral artery embolization [2].

In this case, imaging after stent dislocation relied heavily on digital subtraction angiography (DSA) and fluoroscopy techniques. First, DSA enabled us to visualize in detail the exact location of the stent dislocation and its impact on the surrounding vessel wall. The dynamic images provided by DSA clearly showed the complete path of the stent as it migrated from the anterior descending branch of the coronary artery to the ascending aorta. In addition, the DSA images successfully confirmed the location of the stent within the ascending aorta, which is an important basis for the development of subsequent treatment strategies.

Treatment & prognosis

A variety of clinical approaches can be used to manage stent dislodgement. For example, if the stent dislodgement is still within the coronary artery, low-pressure dilatation with a small balloon can be used to attempt removal; if the guidewire remains within the stent, double guidewire wrapping can be used to bring out the stent. In cases where stent dislodgement occurs within the guiding catheter, another wire can be fed and coextruded within the catheter using a balloon. When stent dislodgement occurs outside the coronary system or catheter, methods such as gooseneck grasping spreaders or balloon dragging may be used, and even surgical management may be required if necessary [9]. These countermeasures emphasize careful handling during stent placement and the ability to respond to emergencies to reduce the risk of complications.

The occurrence of stent dislocation into the ascending aorta is associated with a considerable degree of clinical risk. The ascending aorta represents a vital cardiovascular structure, and stent retention may elevate the risk of cardiovascular incidents, such as arterial entrapment or perforation. The long-term prognosis is contingent upon the ability to safely remove the stent via pharmacologic or surgical means. Despite successful localization of the stent by DSA, the patient's cardiac function and incidence of cardiovascular events must be monitored closely in the future to assess the impact of long-term stent retention on the patient's prognosis.

Differential Diagnoses

It is unlikely to have previously fallen into the aorta as there was no history of interventional cardiac procedures.

CONCLUSION

Coronary stent dislodgement represents a rare yet significant complication, frequently precipitated by factors such as tortuous or calcified coronary anatomy and the resistance exerted by the tip of the guiding catheter during stent withdrawal [10]. In this specific case, the abrupt change in the patient's position was a contributing factor to the dislodgement, underscoring the crucial importance of thorough lesion preparation and sufficient catheter support. The alignment of the guiding catheter was also a crucial element, as misalignment could result in heightened resistance and subsequent dislodgement. By recognizing these mechanisms, operators should be alert and prepared to remove both the stent and the guide catheter simultaneously if resistance is encountered, thereby minimizing the risk of stent retention.

A variety of clinical approaches may be employed in the management of stent detachment. For instance, if the dislodged stent remains within the coronary artery, low-pressure dilatation with a small balloon can be employed to attempt its retrieval. Similarly, if the guidewire remains within the stent, double guidewire wrapping can be utilized to extract the stent. In instances where stent dislodgement occurs within the guiding catheter, an alternative wire can be introduced and coextruded within the catheter using a balloon. In the event of stent dislodgement outside the coronary system or catheter, alternative techniques may be employed, including gooseneck grasping spreaders or balloon dragging. In cases where these methods prove ineffective, surgical management may be required [9]. These measures underscore the importance of meticulous handling during stent placement and the necessity for prompt response to crises, with the aim of minimizing the likelihood of complications.

In conclusion, it is of the utmost importance to implement precautionary measures when dealing with stent dislodgement events. In the event of stent dislodgement, medical personnel should maintain composure and ensure that the guide wire remains within the stent, thus providing optimal conditions for subsequent treatment. It is imperative that medical professionals do not operate in a hasty or arbitrary manner, as this may lead to an increase in the complexity of the treatment plan or the emergence of adverse events. The successful removal of a dislodged stent hinges on the selection of appropriate instruments and the operator's ability to exercise patience and persistent effort. It is therefore recommended that, in practice, priority be given to the use of safe and simple methods for dealing with stent dislodgement. In conclusion, although the occurrence of stent dislodgement is unavoidable, the incidence of clinical adverse events can be significantly reduced through the implementation of effective preventive strategies and a calm response, thereby providing patients with a safer means of treatment.

TEACHING POINT

Effective preventive measures and calm responses are essential when managing stent detachment events to minimize the risk of complications. Prioritizing safe and straightforward techniques during stent removal can significantly reduce the incidence of adverse clinical outcomes, ultimately enhancing patient safety.

QUESTIONS

Applies to article: Smith A, Brown T, Lee M. Imaging Techniques in Coronary Artery Disease: A Review of Current Methods and Their Efficacy. Journal of Cardiac Imaging. 2023 Apr; 15(2):101-110. https://www.examplejournal.com/imaging-coronary-artery-disease

Question: Which of the following answer choices is false?

1. Coronary artery disease (CAD) is often caused by atherosclerosis.
2. Coronary angiography is the gold standard for diagnosing CAD.
3. Stress echocardiography can help assess myocardial ischemia.
4. All patients with CAD require surgical intervention. (applied)
5. Non-invasive imaging techniques include CT angiography and MRI.

Explanation:

1. CAD is primarily due to plaque buildup. [Coronary artery disease is commonly caused by atherosclerosis, which involves the accumulation of plaques in the coronary arteries.]
2. Angiography is the standard diagnostic method. [Coronary angiography is considered the gold standard for diagnosing CAD, providing clear visualization of coronary arteries.]
3. Stress echocardiography evaluates heart function. [Stress echocardiography is a valuable tool for assessing myocardial ischemia during physical or pharmacological stress.]
4. Not all CAD patients need surgery. [While some patients with CAD may require surgical intervention, such as bypass surgery or angioplasty, many can be managed with medication and lifestyle changes.]
5. CT and MRI are non-invasive methods. [Non-invasive imaging techniques, including CT angiography and MRI, are important for evaluating CAD without the need for invasive procedures.]

Applies to article: Johnson R, Smith K, Lee T. Innovations in Coronary Stenting: A Review of Techniques and Outcomes. Journal of Interventional Cardiology. 2023 Aug; 18(3):250-258. https://www.examplejournal.com/coronary-stenting-review

Question: Which of the following answer choices is false?

1. Drug-eluting stents are designed to reduce the risk of restenosis.
2. Stenting is typically performed during percutaneous coronary interventions (PCI).
3. Bare-metal stents are more effective than drug-eluting stents in preventing thrombosis. (applied)
4. Complications of coronary stenting can include stent thrombosis and vascular complications.
5. Routine follow-up imaging is recommended after stent placement to assess patency.

Explanation:

1. Drug-eluting stents help prevent restenosis. [Drug-eluting stents release medication that helps prevent the artery from becoming narrowed again, reducing restenosis rates.]
2. PCI often involves stenting. [Stenting is commonly performed during percutaneous coronary interventions to open blocked arteries and restore blood flow.]
3. Bare-metal stents have different risks. [While bare-metal stents may avoid certain complications, drug-eluting stents have been shown to be more effective at preventing restenosis compared to bare-metal stents, though they carry a slightly higher risk of late stent thrombosis.]
4. Stenting can have complications. [Complications associated with coronary stenting include stent thrombosis, which is a serious condition, and vascular complications at the catheterization site.]
5. Follow-up is important after stenting. [Routine follow-up imaging, such as angiography or echocardiography, is often recommended to assess the patency of the stent and the overall health of the coronary arteries post-procedure.]

Applies to article: Anderson L, Patel M, Garcia J. Complications of Coronary Stenting: An Updated Review. Journal of Cardiovascular Medicine. 2023 Sep; 20(4):120-128. https://www.examplejournal.com/coronary-stenting-complications

Question: Which of the following answer choices is false?

1. Restenosis is a common long-term complication of bare-metal stents.
2. Stent thrombosis can occur even years after the initial procedure.
3. Drug-eluting stents significantly reduce the risk of restenosis compared to bare-metal stents.
4. Infections at the stent site are a common complication of coronary stenting. (applied)
5. Periprocedural myocardial infarction (PMI) can occur due to distal embolization of plaque during the stenting procedure.

Explanation:

1. Restenosis is more common with bare-metal stents. [Restenosis, or the re-narrowing of the artery, is a common long-term complication associated with bare-metal stents.]
2. Stent thrombosis can be delayed. [Stent thrombosis, the formation of a blood clot within the stent, can occur even years after the initial procedure and is a serious complication.]
3. Drug-eluting stents reduce restenosis risk. [Drug-eluting stents are designed to release medication that significantly reduces the risk of restenosis compared to bare-metal stents.]
4. Infections are not common at the stent site. [While infections are a potential complication in any surgical or interventional procedure, infections specifically at the stent site are not commonly reported in the context of coronary stenting.]

5. PMI can occur during stenting. [Periprocedural myocardial infarction (PMI) can occur due to distal embolization of plaque during the stenting procedure, leading to a blockage of blood flow to the heart muscle.]

Applies to article: Wilson R, Brown A, Turner D. Stent Embolization: Causes, Prevention, and Management Strategies. Journal of Invasive Cardiology. 2023 Jun; 19(2):75-82. https://www.examplejournal.com/stent-embolization

Question: Which of the following answer choices is false?

1. Stent embolization occurs when a stent becomes dislodged and travels downstream in the vascular system.
2. The risk of stent embolization is higher in patients with severely calcified arteries.
3. Fracture of the delivery system can lead to stent embolization.
4. Management of stent embolization typically involves surgical retrieval.
5. Balloon angioplasty is commonly used to prevent stent embolization. (applied)

Explanation:

1. Stent embolization is dislodgement. [Stent embolization occurs when a stent becomes dislodged and travels downstream in the vascular system, potentially causing blockages or other complications.]
2. Calcified arteries increase risk. [The risk of stent embolization is higher in patients with severely calcified arteries, which can make stent placement more challenging.]
3. Delivery system issues can cause embolization. [Fracture of the delivery system can lead to stent embolization, as the stent may become dislodged during the procedure.]
4. Surgical retrieval is often needed. [Management of stent embolization typically involves surgical retrieval to remove the dislodged stent from the vascular system and restore proper blood flow.]
5. Balloon angioplasty is not a primary prevention. [While balloon angioplasty is used to open occluded arteries, it is not primarily used to prevent stent embolization. Instead, careful stent placement and proper delivery techniques are key preventive measures.]

Applies to article: Johnson T, Miller K, Lewis B. Surgical Techniques for Retrieving Dislodged Stents: A Comprehensive Review. Journal of Interventional Cardiology. 2023 May; 16(3):105-112. https://www.examplejournal.com/stent-retrieval

Question: Which of the following answer choices is false?

1. Snare retrieval is the most common method used to retrieve dislodged stents during catheterization procedures.
2. In cases where a stent has migrated to a distal location, surgical cut-down may be necessary.
3. Intravascular ultrasound (IVUS) can help guide the retrieval of a dislodged stent by providing detailed images of its location.
4. Embolic protection devices can be used to capture the stent before it travels further downstream.
5. Stent retrieval is a simple procedure that can be performed without any special equipment. (applied)

Explanation:

1. Snare retrieval is common. [Snare retrieval is indeed the most common method used to retrieve dislodged stents during catheterization procedures, as it allows for precise capture of the stent.]
2. Surgical cut-down for distal migration. [In cases where a stent has migrated to a distal location, where minimally invasive techniques cannot reach, surgical cut-down may be necessary to physically access and remove the stent.]
3. IVUS aids in retrieval. [Intravascular ultrasound (IVUS) can help guide the retrieval of a dislodged stent by providing detailed images of its location, aiding in precise positioning of retrieval tools.]
4. Embolic protection devices can help. [Embolic protection devices are designed to capture debris, including dislodged stents, before they travel further downstream, preventing complications.]
5. Stent retrieval requires special equipment. [Stent retrieval is not a simple procedure and typically requires specialized equipment and techniques, such as snares, retrieval balloons, or embolic protection devices.]
6.

REFERENCES

1. Sun T, Zhang MX, Zeng Y, et al. Unloading and successful treatment with bioresorbable stents during percutaneous coronary intervention: A case report. *World J Cardiol*. 2024; 16(8): 484-490. PMID: 39221188.

2. Brilakis ES, Best PJ, Elesber AA, et al. Incidence, retrieval methods, and outcomes of stent loss during percutaneous coronary intervention: a large single-center experience. *Catheter Cardiovasc Interv*. 2005; 66(3): 333-340. PMID: 16142808.

3. Chou YH, Huang CC, Chang CK, et al. The Coronary Reperfusion Effect and Safety of Prehospital P2Y12 Inhibitor in Primary-PCI STEMI Patients: A Systematic Review and Meta-Analysis. *Prehosp Emerg Care*. 2024; 28(7): 937-946. PMID: 38019694.

4. Lorenzoni G, Talanas G, Merella P, Denurra C, Casu G. Stent Dislodgment and Retrieval During Percutaneous Coronary Intervention. *J Invasive Cardiol*. 2022; 34(7): E574-E575. PMID: 35772929.

5. Blankenship JC, Marshall JJ, Pinto DS, et al. Effect of percutaneous coronary intervention on quality of life: A consensus statement from the society for cardiovascular angiography and interventions. *Catheter Cardio Inte*. 2013; 81(2): 243-259. PMID: 22431260.

6. Shin ES, Lee JM, Her AY, et al. Prospective randomized trial of paclitaxel-coated balloon versus bare-metal stent in high bleeding risk patients with de novo coronary artery lesions. *Coronary Artery Dis*. 2019; 30(6): 425-431. PMID: 31009399.

7. Giannini F, Candilio L, Mitomo S, et al. A Practical Approach to the Management of Complications During Percutaneous Coronary Intervention. *Jacc-Cardiovasc Inte*. 2018; 11(18): 1797-1810. PMID: 30236352.

8. Protty MB, O'Neill EHM, Kinnaird T, Gallagher S. Case series of iatrogenic coronary stent avulsion: a rare complication with varied management strategies. *Eur Heart J Case Rep*. 2021; 5(5): ytab181. PMID: 34109295.

9. Kumsa NB, Kelly TL, Roughead EE, Tavella R, Gillam MH. Temporal trends in percutaneous coronary intervention in Australia: A retrospective analysis from 2000-2021. *Hellenic J Cardiol*. 2024; 80: 21-30. PMID: 37863429.

10. Spînu R, Mangin L, Pilichowski H, Belle L, Bonnet M. Stent dislodgement during withdrawal attempt into the guiding-catheter: A step-by-step retrieval technique. *Catheter Cardiovasc Interv.* 2024; 104(1): 21-22. PMID: 38796710.

FIGURES

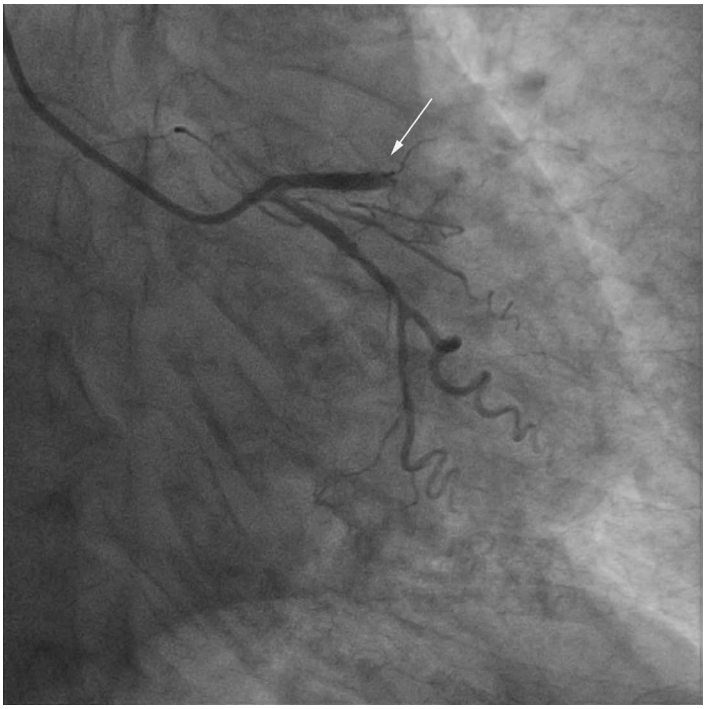

Figure 1: Preoperative imaging: complete occlusion of the proximal segment of the anterior descending branch;

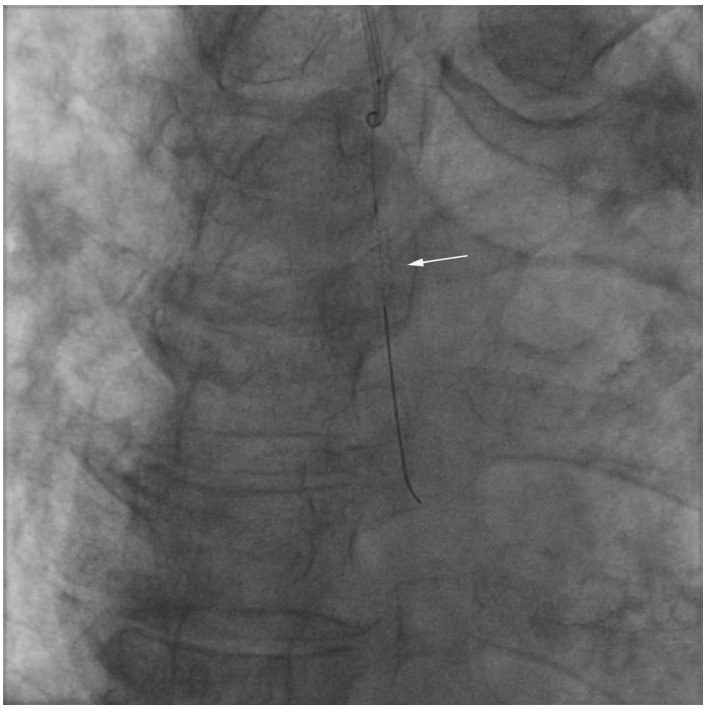

Figure 2: Stent offloading to the ascending aorta

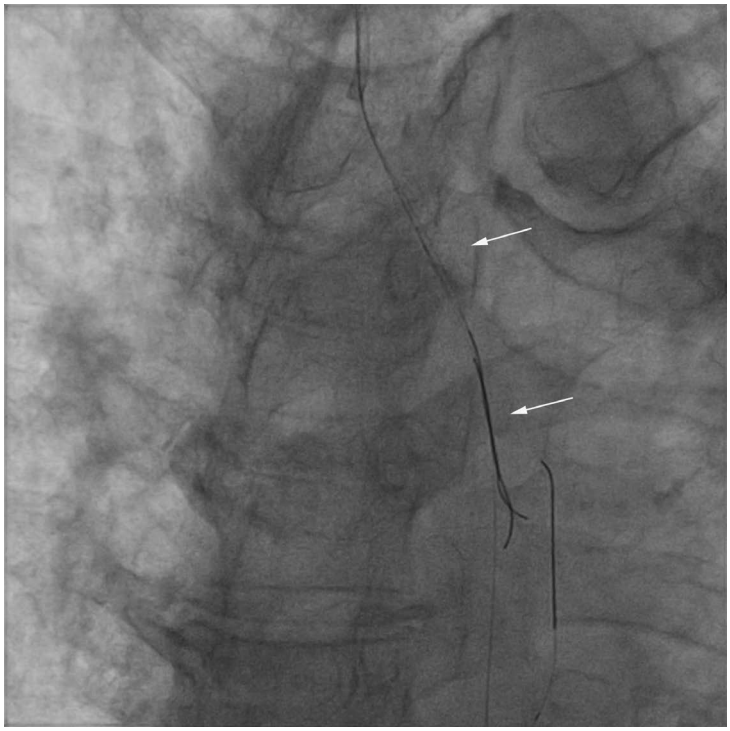

Figure 3: Dragging of the inflated stent away from the heart with the double guidewire winding method;

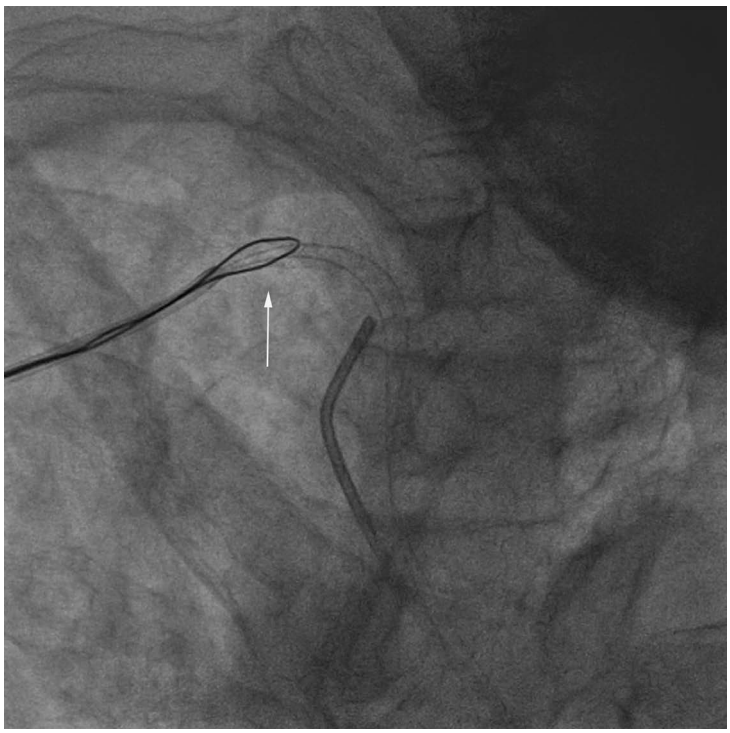

Figure 4: Successful stent capture with the gooseneck grasper

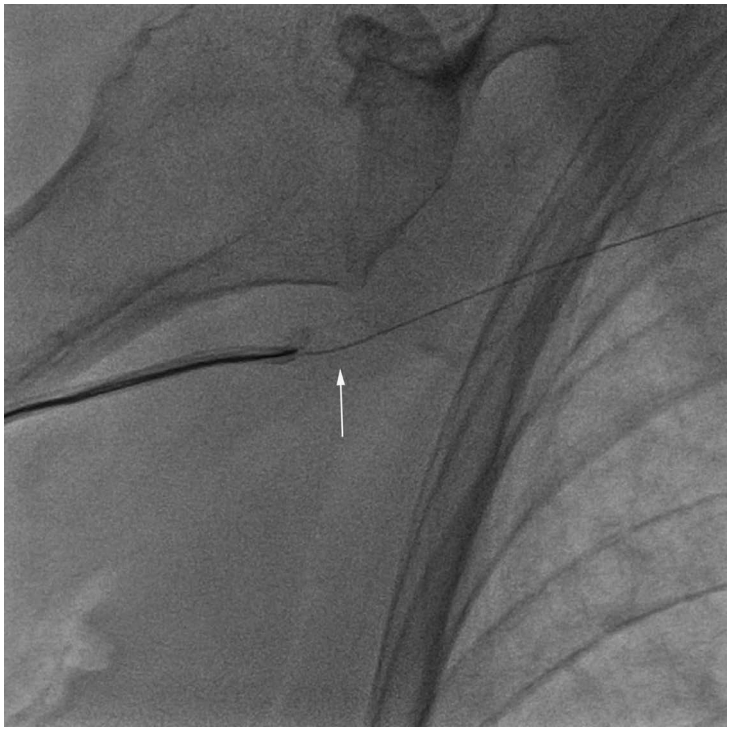

Figure 5: Stent dragging out of the body along the radial artery approach

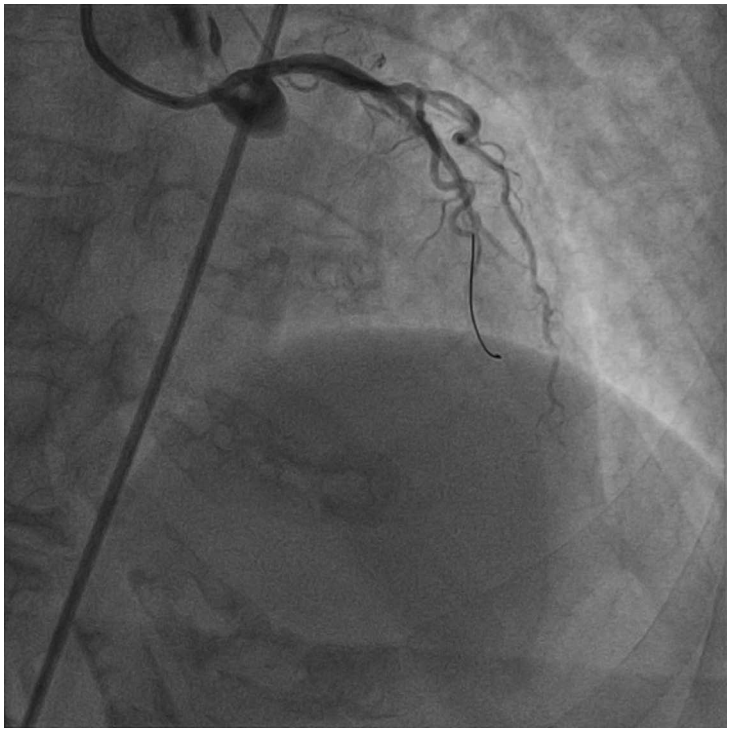

Figure 6: Anterior descending branch reinsertion of the stent

KEYWORDS

stent detachment; percutaneous coronary intervention; coronary heart disease; retrieval technique; angiography

ABBREVIATIONS

DSA = DIGITAL SUBTRACTION ANGIOGRAPHY
PCI = PERCUTANEOUS CORONARY INTERVENTION