Editorial Team

EDITORIAL

On behalf of the editorial board of The Interventionalist Journal (TIJ), I would like to extend my deepest appreciation to the founder team, who had built the foundation of this journal.

The aim of The Interventionalist Journal is to provide and served as a platform for all clinicians who are doing minimally invasive procedures to share their findings, expertise, innovations and experiences at the regional and international significance. We envisaged being providing a high-standard and evidence-based platform for publishing high impact publications.

I am humbly inviting each of you to actively participate and contribute to The Interventionalist Journalas an author, reviewer, and reader.The Interventionalist Journal has a strong starting point and I am confident that, we can eventually venture into new heights.

Sincerely,
Ezamin Abdul Rahim
MD, MMed Rad
Editor-in-Chief
The Interventionalist Journal

THE INTERVENTIONALIST JOURNAL

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EMBOLIZATION FOR THE TREATMENT OF DELAYED HEMATURIA RENAL ARTERY PSEUDOANEURYSM FOLLOWING BLUNT TRAUMA

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ABSTRACT:

Background: The occurrence of a renal artery pseudoaneurysm after blunt renal trauma is an infrequent complication. The occurrence of delayed bleeding is typically observed within 2 to 3 weeks following an injury. It is commonly attributed to the presence of an arteriovenous malformation (AVM) or pseudoaneurysm. They are frequently observed in cases of severe injuries or trauma that penetrates the body. The application of angiographic catheterization is efficacious in detecting pseudoaneurysms in the renal artery. The management of renal pseudoaneurysms necessitates the consideration of distinct clinical associations, including the location and size of the lesion as well as the presence of symptoms.

Objective: This study aims to describe in detail how angiographic catheterization and embolization were used to treat a patient with a post-traumatic pseudoaneurysm of the renal artery.

Materials and Methods: Conducting a literature review and medical records.

Results: A case of renal artery pseudoaneurysm is presented. A male individual aged 33 sought medical attention at the emergency department following a motorcycle collision and exhibited symptoms of pain in the right flank region. The individual underwent a medical intervention involving the placement of a double J stent. After nearly fourteen days, the individual reported experiencing hematuria. The abdominal CT scan revealed a renal injury on the right side with an AAST grade of 4, while the renal CTA demonstrated the presence of a pseudoaneurysm. With the help of an angiographic catheterization, a false aneurysm was found at the right renal pole. The procedure of selective embolization utilizing coils was performed on the renal arteries located at the lower and middle poles of the right kidney.

Conclusion: The occurrence of renal artery pseudoaneurysms is infrequent; however, it is a grave complication that may arise from renal trauma. The accurate diagnosis and effective management of pseudoaneurysms are of paramount importance due to their potential to cause severe and potentially fatal complications if left untreated. The diagnostic process for pseudoaneurysms heavily relies on the involvement of the general radiologist. Interventional radiology procedures have less morbidity and mortality compared to surgical procedures.

Keywords: angiographic catheterization, embolization, and pseudoaneurysm.

INTRODUCTION

Trauma to the kidneys can lead to harm caused upon either the renal parenchyma or the renal vasculature, which may result in rupture or damage to the collecting system[1]. Renal trauma is observed with a higher frequency in the male population, accounting for approximately 72-93% of cases. Moreover, it is more commonly reported in individuals aged between 31-38 years[2]. Delayed bleeding, which typically manifests 2-3 weeks post-injury, is commonly attributed to the presence of an arteriovenous malformation or a pseudoaneurysm[3].

OBJECTIVES

This paper aims to describe a case of angiographic catheterization and embolization in a patient with renal artery pseudoaneurysm.

METHODS

This paper is conducting a literature review and medical records.

CASE REPORT

A male patient, aged 33, presented to the emergency department following blunt trauma resulting from a motorcycle accident. The patient was diagnosed with blunt abdominal trauma. The urologist did the insertion of a stent for urine drainage. Almost two weeks after the injury, the patient complained of hematuria, and the patient underwent abdominal CT, and the result was renal injury scale AAST 4. Two days later, the patient underwent renal CTA, and the result was a pseudoaneurysm in the middle and lower pole right kidney. Then patients were referred to our hospital; the patient underwent an angiographic catheterization**.** It showed a pseudoaneurysm at the right middle and lower pole renal artery. Embolization of the right middle and lower pole aneurysm was performed using coil sizes 3mm x 5cm and 2mm x 3cm. Post embolization run showed total occlusion of the pseudoaneurysm.

DISCUSSION

A true aneurysm is an expansion of the vascular wall in the shape of a ball, while a pseudoaneurysm is caused by the tissues that surround the arteries[5]**.** Pseudoaneurysms are a type of aneurysm that are not true aneurysms but rather occur at the location of arterial injury. This leads to the formation of a hematoma that is confined to the local area and is characterized by turbulent blood flow. Unlike aneurysms, pseudoaneurysms are not able to penetrate the vessel wall. Pseudoaneurysms are unlike true aneurysms in that they do not penetrate any layer of the vessel wall. A wall forms from fibrin that are ultimately weaker than a true aneurysm[6].

Renal artery pseudoaneurysms are predominantly related to medical management. The most common causes are open and endoscopic surgery, percutaneous renal surgery, and a kidney biopsy. The occurrence of a renal artery pseudoaneurysm due to traumatic events is infrequent. Pseudoaneurysms arising from renal

trauma are attributed to the impact of deceleration forces on the arterial system[7].

The conventional angiography technique is widely accepted as the benchmark method for diagnosing pseudoaneurysms. But non-invasive imaging methods like ultrasound, magnetic resonance angiography (MRA), and computed tomography angiography (CTA) are good ways to find pseudoaneurysms. In contemporary times, there has been a greater utilization of percutaneous endovascular and surgical methods in managing arterial ailments. In recent times, interventional radiology has undergone significant advancements and has superseded surgical interventions[8].

The use of embolization has been proven to be effective in the treatment of pseudoaneurysm therapy. Two primary techniques are commonly utilized in clinical practice, namely embolization and stent deployment. The optimal course of treatment is contingent upon the dimensions of the neck region and the supplementary provisions of the terminal organ[8].

The choice of embolization material depends on several things, such as the presence of pseudoaneurysms and/or active bleeding, the presence of collateral vessels, the location of the feeding artery, and the clinical status of the patient[9]**.** Sarmuk *et al.* (2021) chose endovascular embolization with Boston Scientific's "Guglielmi Detachable Coil" (GDC) in their case report. These coils were carefully inserted at the terminal artery, targeting the area of leakage. A short section of uncoated stainless steel connects the coil to the Teflon-coated delivery wire. The objective of this intervention was to induce thrombosis, thereby effectively occluding the pseudoaneurysm. The other researchers used a Boston Scientific 6F double-curve guiding catheter, an Excelsior-14 microcatheter, and a platinum-tip steerable guidewire (specifically, the Transcend model from Boston Scientific). The renal aneurysm was treated by inserting a microcatheter tip and subsequently filling the cavity with multiple Guglielmi Detachable Coils[10].

After the embolization procedure, embolize the right middle pole and right lower pole using coil sizes of 3mm x 5cm and 2mm x 3cm. The post-embolization run showed total occlusion of the pseudoaneurysm. After the embolization procedure, the patient was observed; within 24 hours of observation, there were no more complaints of hematuria, and the right-side pain was reduced.

The literature reports that percutaneous embolization is a safe and cost-effective alternative to surgical exploration for the treatment of traumatic renal pseudoaneurysms[11]. Additionally, it is considered a less complex procedure. The potential adverse effects of renal artery embolization encompass postembolization syndromes such as nausea, vomiting, fever, leukocytosis, and abdominal pain resulting from the damage to the renal parenchyma. Additionally, there is a risk of hematoma at the catheter insertion site, renal failure, and temporary arterial hypertension[12].

CONCLUSION

The occurrence of a renal artery pseudoaneurysm is infrequent, yet it represents a significant and consequential complication arising from renal trauma as in this case. Renal artery embolization is a minimally invasive procedure utilized for the diagnosis and treatment of renal artery pseudoaneurysms. Pseudoaneurysm examination via CT is only diagnostic, but if using catheter angiography, it can also be directly treated with an embolization procedure guided by an angiographic catheterization. By using an angiographic catheter, an interventional radiologist can quickly make a diagnosis and start treatment to avoid potential problems like haematuria, anemia or haemodynamically unstable, and renal failure.

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FIGURE LEGENDS:

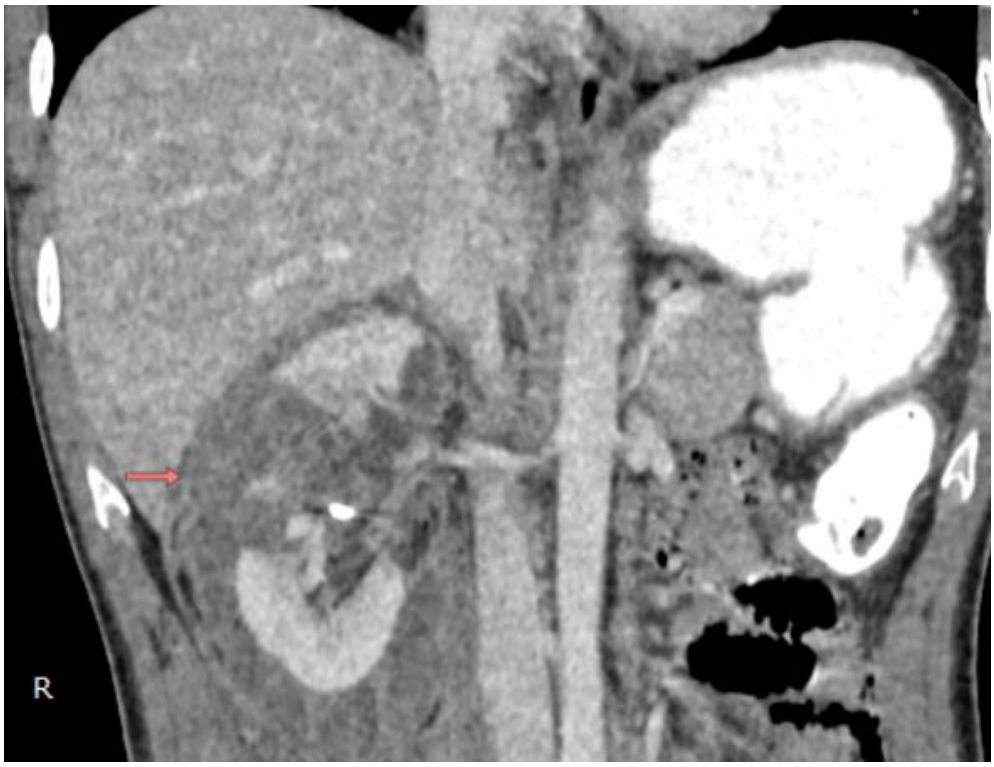

Figure 1: Soft tissue window of abdominal CT scan showed right renal injury AAST grade 4

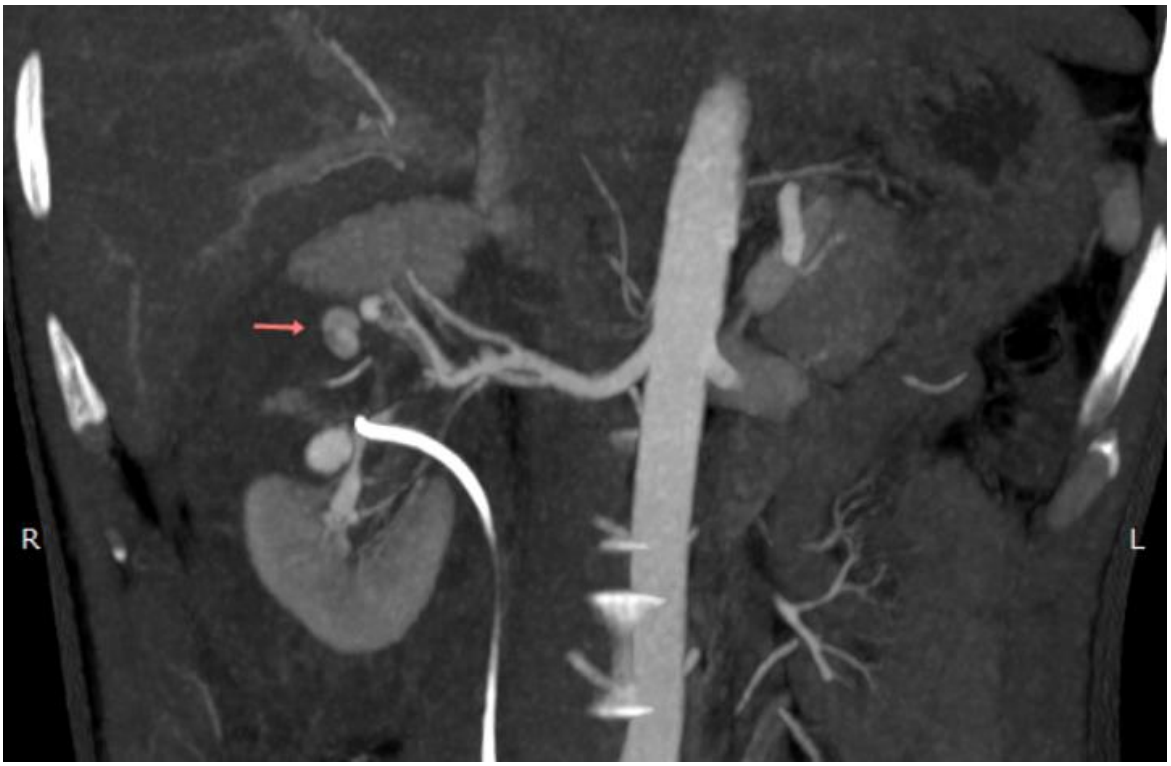

Figure 2: Angio window of renal CTA showed middle pole pseudoaneurysm

Figure 3: Angio window of renal CTA showed lower pole pseudoaneurysm.

Figure 4: Angiography pre-embolization.

Figure 5: Angiography post-embolization.

MANAGEMENT OF ON TABLE RUPTURED OF BRACHIOCEPHALIC ARTERY PSEUDOANEURYSM

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ABSTRACT:
Pseudoaneurysms are abnormal outpouching or dilatation of arteries bound only by the tunica adventitia, the outermost layer of the arterial wall. The presence of a pseudoaneurysm is like a ticking bomb that can rupture at times, causing dire consequences for the patient. The brachiocephalic trunk is an uncommon location for such pseudoaneurysms. Rarely, it is caused by an iatrogenic injury during tracheostomy. We report an interesting case of a 59-year-old male patient who presented with fresh blood spurting from the surgical wound at the right upper anterior chest wall two weeks post-traumatic tracheostomy. The CT thoracic angiogram was performed, establishing the diagnosis; hence, the decision was made for endovascular treatment. However, this pseudoaneurysm ruptured during the manipulation, leading to an immediate threatening situation. The bleeding was controlled with high-pressure balloon tamponade, followed by the deployment of a self-expandable covered stent across the pseudoaneurysm sac. We will discuss the diagnosis and management plan for this situation as well as the review of the literature.

Keywords: Brachiocephalic artery pseudoaneurysm, ruptured aneurysm, aneurysm stenting

INTRODUCTION

Brachiocephalic artery pseudoaneurysm is an uncommon condition (1–3). The acute presentation of a ruptured brachiocephalic artery pseudoaneurysm is usually dramatic and life-threatening. The patient can develop massive hemothorax and hemorrhagic shock(4). Sometimes, the patients may present with delayed manifestation, which is usually non-specific, varying from mild respiratory distress to severe airway obstruction, dysphagia, hemoptysis, hematemesis, bruits, or cardiac failure(5). The usual cause of brachiocephalic artery pseudoaneurysm is chest trauma, late complication of thoracic aortic surgery, or catheterization of central venous puncture(1–3,6). However, as in our patient, a rare case of brachiocephalic artery pseudoaneurysm occurred secondary to iatrogenic injury during tracheostomy surgery(7).

CASE PRESENTATION

Our patient is a 59-year-old male who presented to the emergency department with fresh blood spurting from a surgical wound at the right upper anterior chest wall. He had a history of traumatic brain injury two months ago which required tracheostomy insertion. He is recovered with the dependent activity of daily living status. During the tracheostomy placement, the brachiocephalic artery was accidentally injured. A mini sternotomy was done by the cardiothoracic surgeon, followed by wound exploration and primary vascular repair of the brachiocephalic artery. Hemostasis was secured. The patient was well and the tracheostomy was removed prior to discharge. However, two weeks later, his family member noted blood-soaked dressing at the operation site. Spurting of fresh blood was noted upon removal of the dressing. Compression was done, and the patient was brought to the hospital. On arrival at the emergency department, the patient was noticed to have a large hematoma over the right side of the neck (Figure 1). The bleeding from the operation site was managed by compression application and tight dressing and the patient was intubated for airways protection.

The patient underwent computed tomography (CT) angiogram, which showed a saccular aneurysmal dilatation arising from the brachiocephalic artery measuring 1.1cm x 1.4cm x 2.3cm (AP x W x CC) with the aneurysmal neck measuring 0.3cm (Figure 2). After stabilizing the patient's vitals and further discussion with the vascular surgeon, he was brought to the interventional angiography suite for arterial stenting. A right common femoral artery access was gained, and an 11Fr vascular sheath was inserted. Firstly, a selective brachiocephalic angiogram was performed using the 5Fr Vertebral catheter to delineate the location and morphology of the pseudoaneurysm and the distance from the origin of the brachiocephalic artery and its branches (Figures 3 and 4).

However, spontaneous pseudoaneurysm rupture occurred during the brachiocephalic artery's selective angiogram, evidenced by contrast extravasation from the pseudoaneurysm (Figure 5). It caused expansion of the right neck hematoma. The patient's blood pressure dropped as low as 50/30 mmHg, and he developed fast atrial fibrillation. The anesthesiology and surgical team immediately performed fluid and packed cells resuscitation to stabilize the patient's condition. We performed a balloon tamponade at the rupture site using a 10mm x 60cm Conquest high-pressure balloon (*Becton, Dickinson and Company, New Jersey, USA*) for 3 minutes each cycle to up to 3 cycles (Figure 6). An ultrasound Doppler of the right common carotid artery was performed to ensure total vessel occlusion. Post tamponade selective angiogram showed complete resolution of the contrast extravasation from the pseudoaneurysm. The patient's vitals stabilize during the mid-tamponade period.

Subsequently, a self-expandable covered stent size of 12mm x 40mm was deployed across the perforation site in the brachiocephalic artery. Care was taken to preserve the origin of the right common carotid and right subclavian artery (Figure 7). Selective angiogram post stent

deployment showed a normal flow of the brachiocephalic artery with preserved right common carotid and right subclavian artery (Figure 8). No extravasation noted. The patient was transferred to the intensive care unit at the end of the procedure. He was put on dual antiplatelet therapy of Tab Aspirin and Tab Clopidogrel as per institution protocol.

DISCUSSION:

Brachiocephalic artery pseudoaneurysms account for only 3% of all aneurysms in the supra-aortic vessels (8,9). Ruptured brachiocephalic pseudoaneurysm has serious complications such as respiratory distress, facial and upper limb swelling, and even lead to hypovolemic shock(10). Treatment option for this aneurysm includes open surgical or less invasive procedure such as an endovascular graft stent(11,12). One of the risk factors that cause injury to the brachiocephalic artery during surgical tracheostomy is the high-riding brachiocephalic artery(13). A high-riding brachiocephalic artery, as in our patient, is a rare variant, with only a handful of cases has been reported (14). A high-riding brachiocephalic artery passes much more superiorly than the usual normal location. This poses a significant risk of injury during performing any non-image-guided surgical procedure of the neck, including surgical tracheostomy. In most cases, patients with a high-riding brachiocephalic artery may be asymptomatic; however, some may present with painless anterior neck mass(15).

Computed Tomography Angiogram (CTA) is the most sensitive imaging to confirm the diagnosis of pseudoaneurysm. CT Angiogram is useful in delineating the size and exact location of the pseudoaneurysm as well as the location of the neck of the pseudoaneurysm. Apart from that, it can show any vessel abnormality and variant, such as a high-riding brachiocephalic artery. This is important for the vascular surgeon and interventional radiologist for preoperative planning. Based on the CTA findings, we planned the sizing of the stent and possible deployment site. MIP and MPR reformation of the CTA images allows the study of the aneurysm morphology and accurately identifies the origin of the nearby vessels, which helped in anticipating and preventing accidental closure of the adjacent branches during stent placement.

In our patient, there was a rupture of the pseudoaneurysm that occurred during catheter manipulation prior to the selective angiogram. It led to expanding hematoma, leading to acute hypotension and fast atrial fibrillation episodes. This feature indicates that the patient was going into hemorrhagic shock. The decision to deploy balloon tamponade was made instantaneously to occlude the bleeder temporarily to allow for stabilization. Balloon tamponade aims to halt the blood flow from the artery into the pseudoaneurysm and prevent leaks outside through the side of the rupture. It gives time for the coagulation pathway activation and thrombus formation to occur inside the aneurysm sac to seal the bleeding. This is provided that the patient's coagulation profile and platelet count are at an optimum level, as in our patient. However, this tamponade should not be prolonged as it could lead to ischemic stroke formation due to lack of cerebral supply. Intermittent periods of balloon deflation can help in preventing this.

Treatment options for brachiocephalic artery pseudoaneurysm can be divided into three categories: endovascular procedures, surgical repair, or hybrid surgery. A retrospective study was conducted in 2019, discussing the experience for the treatment of traumatic innominate arterial injury(16). In this study, endovascular repair was performed by digital subtraction angiography. After the location and severity of the injured innominate artery were confirmed by angiography, an appropriate covered stent was deployed at the injury site. Surgical repair is an open surgery method by exposing the injured innominate artery through a medial approach. The artery was then repaired by using a polytetrafluoroethylene (PTFE) vascular graft. Hybrid surgery is basically a combination of endovascular technique and open surgery. It is a method by which the intra-operative hemorrhage

is controlled by appropriate balloon inflation at the origin of the artery. Then, open surgical repair was performed using a PTFE vascular graft. Endovascular treatment is a less invasive option for vascular repair. It is required only to have a small puncture of the common femoral artery to get an access site. This study shows that endovascular treatment gives more time-saving and less systemic side effects(16). A covered stent, such as the one we used, is the material of choice in treating brachiocephalic artery injury or pseudoaneurysm.

CONCLUSION:

Brachiocephalic artery pseudoaneurysm is rare but possibly fatal if ruptured. A multidisciplinary team discussion is recommended to manage this condition adequately. Endovascular treatment has the advantages of shorter procedural time, minimal trauma, and satisfactory post-procedure recovery, leading to better patient experience.

CONFLICTS OF INTEREST:

The authors have no potential conflicts of interest to report regarding this presentation.

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INFORMED CONSENT:

Consent had been acquired from the patient's guardian for the publication of images and content.

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FIGURE LEGENDS:

Figure 1: Right lateral neck swelling

Figure 2: Pseudoaneurysm of the brachiocephalic artery (Arrow)

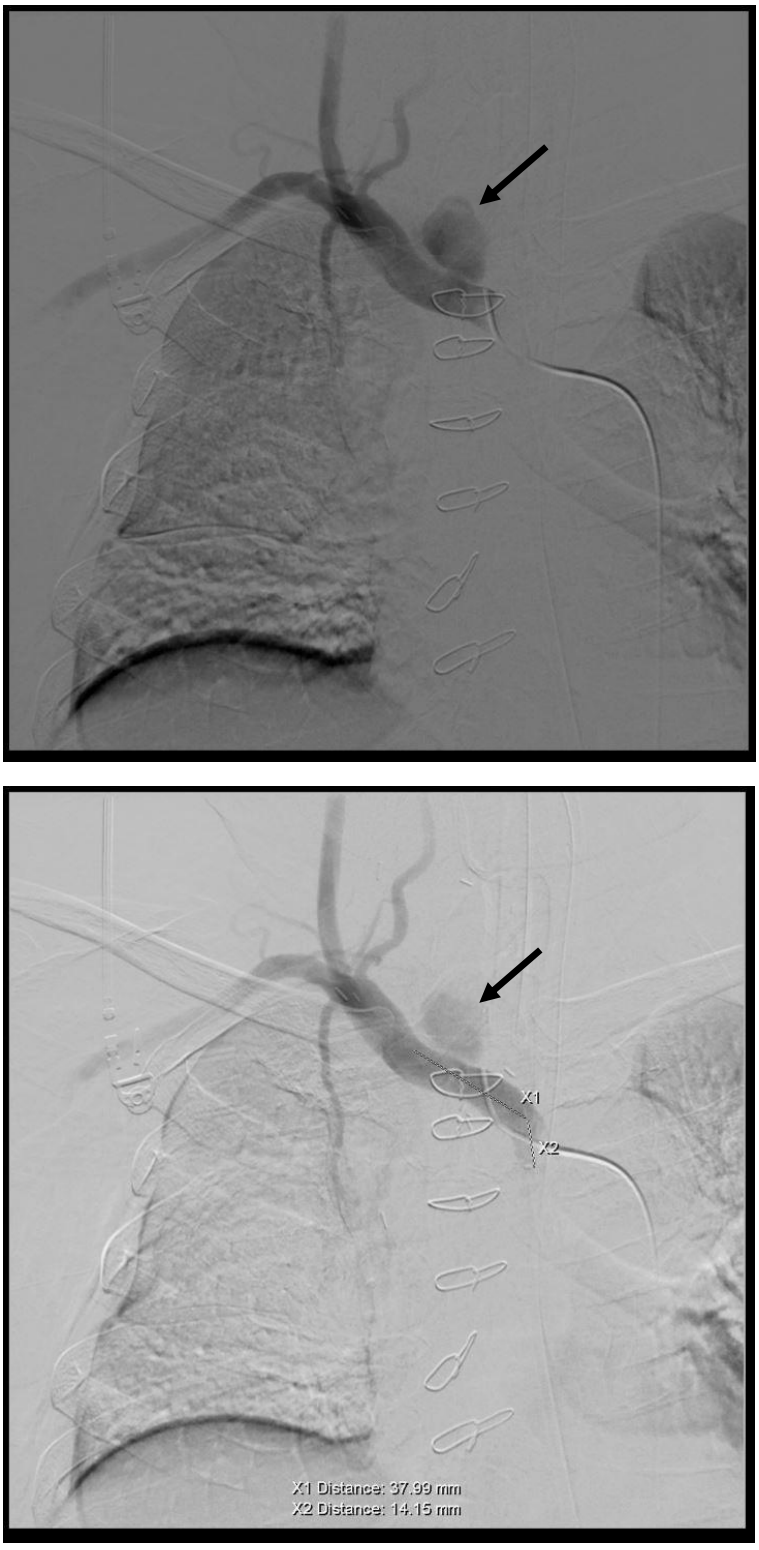

Figure 3: Selective brachiocephalic artery angiogram shows the location of the pseudoaneurysm (Arrow).

Figure 4: Contrast extravasation from the ruptured Brachiocephalic pseudoaneurysm (Arrow)

Figure 5: Deployment of the high-pressure balloon for tamponade effect.

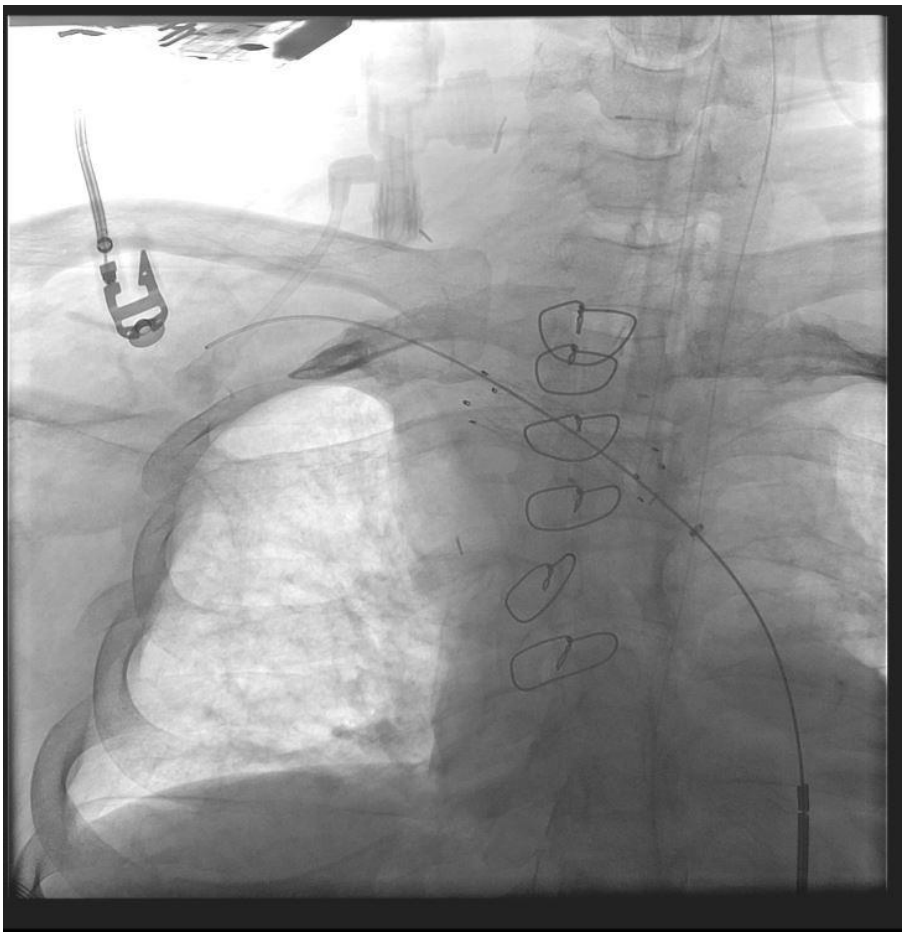

Figure 6: Deployment of the stent.

Figure 7: Post stent deployment angiogram