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)

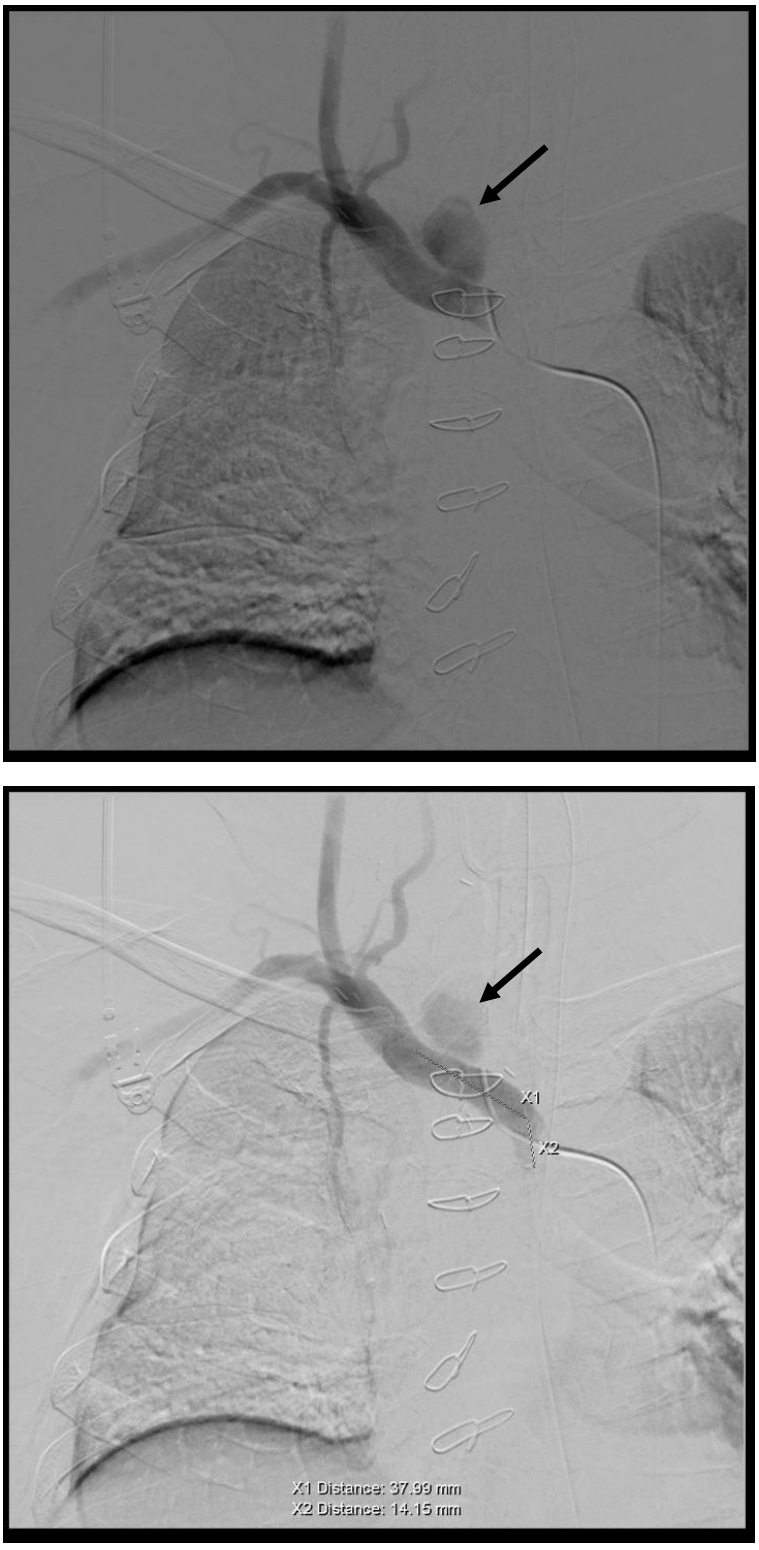

Figure 3: Selective brachiocephalic artery angiogram shows the location of the pseudoaneurysm (Arrow).

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

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

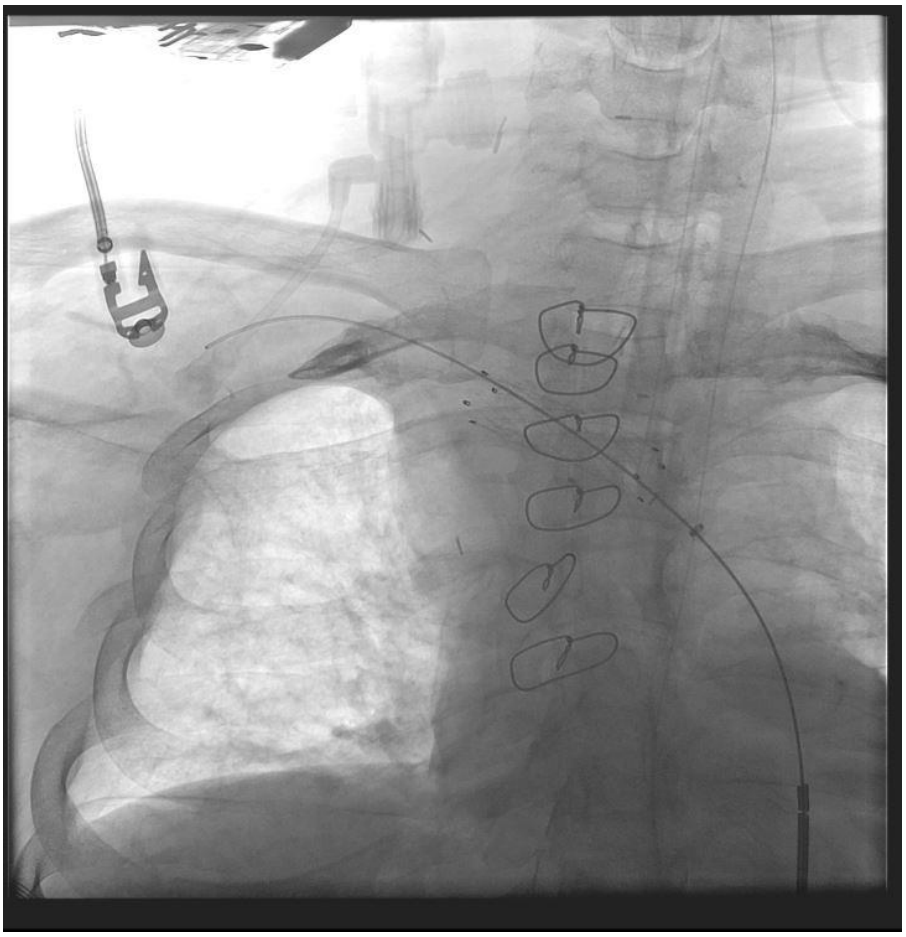

Figure 6: Deployment of the stent.

Figure 7: Post stent deployment angiogram