Hybrid management of a ruptured right subclavian artery aneurysm dissection

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ABSTRACT

Aberrant right subclavian artery is the most common congenital malformation of the aortic arch (0.4%-2.0%). Aneurysms of aberrant subclavian arteries are extremely rare. This results in little experience with their treatment. We describe a case of a patient who presented to the emergency department with a dissection of an aberrant right subclavian artery that later progressed to rupture. Besides hemodynamic instability, this caused an acute superior vena cava syndrome, making airway control difficult. In the operating room, we obtained proximal control through thoracic endovascular aortic repair; median sternotomy was performed for distal control and evacuation of massive hemomediastinum. (J Vasc Surg Cases and Innovative Techniques 2017;3:198-200.)

Aberrant right subclavian artery is a rare malformation, but it is the most common congenital malformation of the arch. We present an interesting case of a patient with a ruptured aneurysm of an aberrant right subclavian artery. She presented in extremis, requiring thoracic endovascular aortic repair (TEVAR) and sternotomy. The patient consented to the presentation of this case.

CASE REPORT

We present the case of a 74-year-old woman known to have arterial hypertension, osteoporosis, and previous right hip arthroplasty. At presentation, she was asymptomatic and unaware of her arterial malformation. She presented to our emergency department for right arm weakness of 4 hours' duration. Her blood pressure and heart rate were normal. On physical examination, her right arm was noted to be pulseless, pale, and cold. Because of this, computed tomography (CT) angiography of the chest, neck, and head was done. The results of the CT scan (Fig 1) revealed an aberrant right subclavian artery arising from the distal aortic arch, coursing behind trachea and esophagus. The subclavian artery was noted to be aneurysmal from its origin for a length of 8 cm with a maximum diameter of 4 cm, with a dissection. The right vertebral artery was occluded, but a patent left vertebral artery was identified.

The patient rapidly deteriorated, and a fast (within minutes) swelling of her face and neck was noted. Anaphylaxis after the intravenous administration of contrast material was considered, but because of CT findings and rapid deterioration, subclavian aneurysm rupture was diagnosed. This resulted in acute superior vena cava (SVC) syndrome and hemodynamic instability. She had a respiratory arrest, and chest compressions were started. After two cycles of cardiopulmonary resuscitation, she returned to spontaneous circulation, and fiberoptic intubation was performed. The patient was then transferred to the operating room. During the transfer to the operating room, the patient arrested twice, but circulation was restored with short courses of cardiopulmonary resuscitation. Massive transfusion protocol was initiated once the patient arrived in the operating room.

Her right femoral artery was percutaneously punctured and a 5F sheath inserted with a pigtail. We performed a femoral cutdown of her left common femoral artery. Through here, a stiff guidewire was crossed through the aortic arch, and then a Zenith TX2 (Cook Medical, Bloomington, Ind) thoracoabdominal endovascular graft (34 × 127 mm) was introduced transfemorally. It was deployed to completely cover the aberrant right subclavian artery ostium and partially cover the left subclavian artery (Figs 2 and 3). It was balloon dilated with a Coda balloon (Cook Medical) several times. Completion angiography revealed extravasation of contrast material from the distal end of the right subclavian artery. Consideration was given to supraclavicular incision for distal ligation of the right subclavian artery and decompression of the hematoma. In view of the massive neck swelling, a faster and more direct approach was chosen.

A median sternotomy with right cervical extension was performed to control the proximal end of the right subclavian artery. On opening of the chest, 1.5 L of blood was suctioned from the mediastinum and right pleural space. The swelling of her face and neck immediately improved. Her aortic arch was mobilized, but access to the right subclavian artery was difficult because of its aberrant course behind the esophagus. The tear in the aneurysm was identified, and the whole artery was suture ligated distal to the tear. This maneuver achieved proper hemostasis, and the chest was closed after insertion of mediastinal and pleural drains. The right arm was not revascularized as it was thought to be viable (good capillary refill). Thought was

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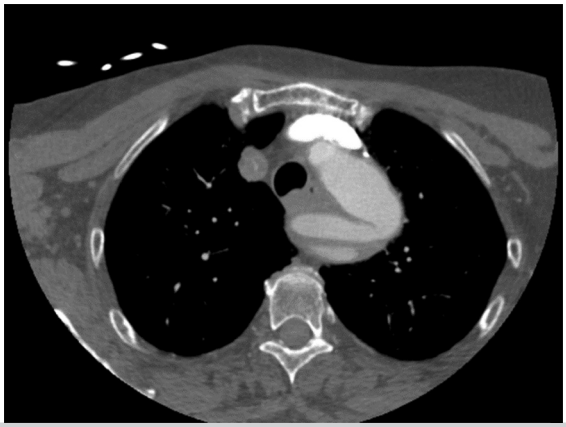

Fig 1. Computed tomography (CT) scan showing aberrant takeoff of the dissected aneurysmatic right subclavian artery.

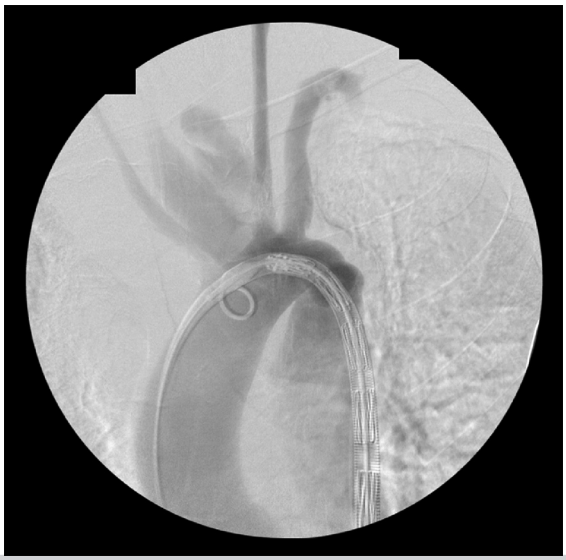

Fig 2. Intraoperative angiogram obtained before deployment of the endovascular graft shows (*left to right*) the right carotid artery, the dissected aneurysmatic right subclavian artery with extravasation of contrast material, the left carotid artery, and the left subclavian artery.

given to carotid to subclavian bypass on the right, but this was abandoned owing to the critical condition of the patient. Thus, she was transferred to the intensive care unit for further resuscitation.

During the postoperative period, a right occipital stroke was seen on CT scan with a left side hemineglect. This was thought to be secondary to the right vertebral artery occlusion seen on the preoperative CT scan. She was extubated on postoperative day 3 and quickly recovered. She was discharged from the hospital to a neurologic rehabilitation facility with mild neurologic sequelae.

DISCUSSION

Aberrant right subclavian artery is the most common congenital malformation of the aortic arch and is seen in 0.4% to 2.0% of the population.[1,2] Diverticulum of Kommerell is present in approximately 60% of these patients, and most of the symptoms with which aberrant subclavian arteries are manifested (dysphagia, dysphonia, and thoracic pain) are attributed to it. These diverticula are outpouchings at the origin of the aberrant subclavian arteries.

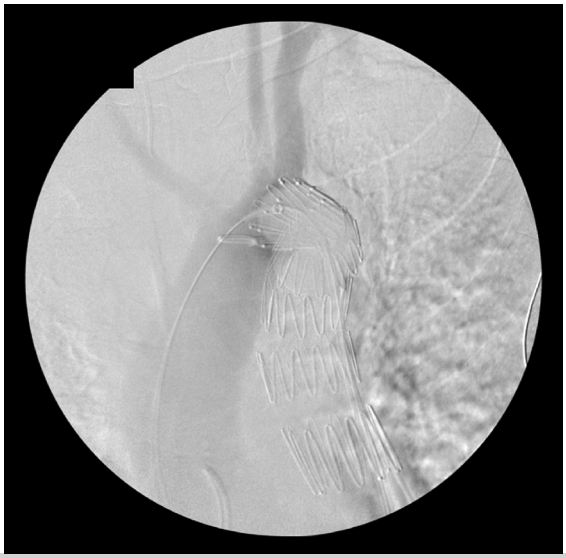

Fig 3. Intraoperative angiogram after deployment of the endovascular stent. The aberrant right subclavian artery is no longer visible because its origin has been covered with the stent.

Aneurysms of the subclavian arteries are rare, as made evident by a case series at the Mayo Clinic that found 31 patients in 20 years.[3] Little experience exists for treatment of ruptured subclavian aneurysms, and the conventional approach is open surgical repair.[4,5] Because of the difficult anatomy involved in aberrant subclavian aneurysms, endovascular techniques have emerged as a safe and reliable alternative.[6,7] TEVAR is used to exclude the aberrant subclavian artery from the aorta, and a posterior distal control is done as an open procedure (carotid-subclavian bypass with subclavian artery ligation proximally to the anastomosis).

We searched the literature for publications regarding ruptured aberrant subclavian artery aneurysms through PubMed. Using the search terms “aneurysm” and “aberrant right subclavian artery,” and “rupture,” we found 24 entries. Of these, only two referred to ruptured aneurysms,[8,9] and only one of these underwent repair. Twelve articles described hybrid or endovascular treatments for aberrant right subclavian artery aneurysms,[1,5,6,10-15] and the other 10 were unrelated to our topic. By exploring the bibliography of these papers, three others relevant to our research were found.[4,7,16]

After review of this literature, we can say that rupture of an aberrant right subclavian aneurysm is a rare occurrence. None of the reviewed publications included a

case presenting with initial symptoms of right arm ischemia due to aneurysmal dissection and later rupture. All the papers found described hybrid or endovascular treatment with good postoperative results.

In this case, the patient presented in extremis with multiple cardiac arrests and acute SVC syndrome. The fastest way to control the bleeding was deemed to be TEVAR exclusion of the aberrant subclavian ostium with later sternotomy for control of the distal end of the ruptured aneurysm. Initial open approach through a median sternotomy only was considered, but fast access to the right subclavian artery was deemed difficult because of the large hematoma and the deep location in the chest of the artery. Also, consideration was given to an endovascular plug from the right subclavian artery or supraclavicular control and ligation of the right subclavian artery, but we thought a sternotomy was necessary for mediastinal decompression to treat the SVC syndrome. For cases in which the aneurysm has a healthy segment of proximal artery, a subclavian artery covered stent could be a good alternative. Results in this case were deemed good, with little postoperative morbidity.

From our experience and the literature review, we think that the hybrid approach is a feasible alternative to conventional open surgical management in patients with aberrant right subclavian artery ruptured aneurysms. Proximal exclusion of the bleeding source through the TEVAR portion of the operation is fast and effective in restoring hemodynamic stability. As evidenced by our case, it is not enough to exclude the proximal portion, and distal control must be achieved. Less invasive approaches to median sternotomy are feasible, but in this case, we considered it was the best option to effectively drain the large mediastinal hematoma and to achieve distal control.

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