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Hybrid management of thoracic aortic aneurysm in a patient with massive hemoptysis: A case report

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ABSTRACT

INTRODUCTION: Thoracic aortic aneurysm (TAA) is a cardiovascular disorder, associated with high rates of mortality and morbidity. Here, we report a case of massive hemoptysis in a patient with TAA.
PRESENTATION OF CASE: A 49-year-old man presented with massive hemoptysis and true aneurysm of the aortic arch from the origin of the left common carotid artery to the first segment of the descending aorta. We adopted hybrid method for TAA repair. The patient remained in good condition after hybrid management.
DISCUSSION: Although most cases of TAA are asymptomatic, it can present with a wide range of symptoms and complications. Chest pain is the most important symptom of TAA, and its sudden occurrence is a sign of rapid aneurysm expansion, dissection, or rupture. This was a rare case of TAA, as hemoptysis is not a common symptom of TAA.
CONCLUSION: This rare case was managed using the hybrid method which resulted in resolution of hemoptysis without any complications.

1. Introduction

Thoracic aortic aneurysm (TAA) refers to an abnormal widening or ballooning of part of the aorta in the chest. Since this part of the aorta is responsible for the oxygen-rich blood flow from the heart to the vital organs, any damage can cause cardiovascular complications [1]. Since TAA is a silent disease, it is difficult to assess its prevalence and incidence rates. Based on some studies, the annual incidence of TAA is 5.6–10.4 cases per 100 000 patient-years. According to statistics, the incidence rate of TAA is increasing due to the advancing age of communities and the use of imaging technologies [2].

The risk factors and etiology of TAA are diverse. Risk factors, such as older age, smoking, hypertension, atherosclerosis, and genetic disorders (Ehlers-Danlos or Marfan syndromes), can contribute to disease progression and aortic dissection [3,4]. Since TAA progresses slowly over time, most cases are asymptomatic. The initial symptom of this disease is pain in the chest and neck. Due to disease development and the resultant pressure on other organs (e.g., airways), signs such as cough, dyspnea, and hoarseness are developed [5,6]. Clinical management of TAA depends on the symptoms, underlying causes, and location and size of the aneurism [7]. Here, we present the case of a 49-year-old patient who referred to our center with hemoptysis. This work reported in line with the SCARE criteria [8].

2. Case presentation

The patient was a 49-year-old male farmer, who was referred to our center due to hemoptysis during the past 10 days before admission. He had a history of hemoptysis, which initiated suddenly with about 200 cc of blood and then tapered to mild hemoptysis in the following days. besides, he had a history of hoarseness in the past year. However, there was no history of chest pain, fever, or chest trauma.

The patient's medical history was negative for any congenital or acquired systemic diseases. He was not under any special medication, and no item was detected in research for familial problems. He was a heavy smoker with no alcohol dependence.His blood pressure was 125/85 mmHg in both arms, and heart rate was regular at 85 bpm. The remainder of the physical examination was unremarkable. Spiral chest CT angiography revealed a large aneurysm of the aortic arch, starting right after the origin of the left common

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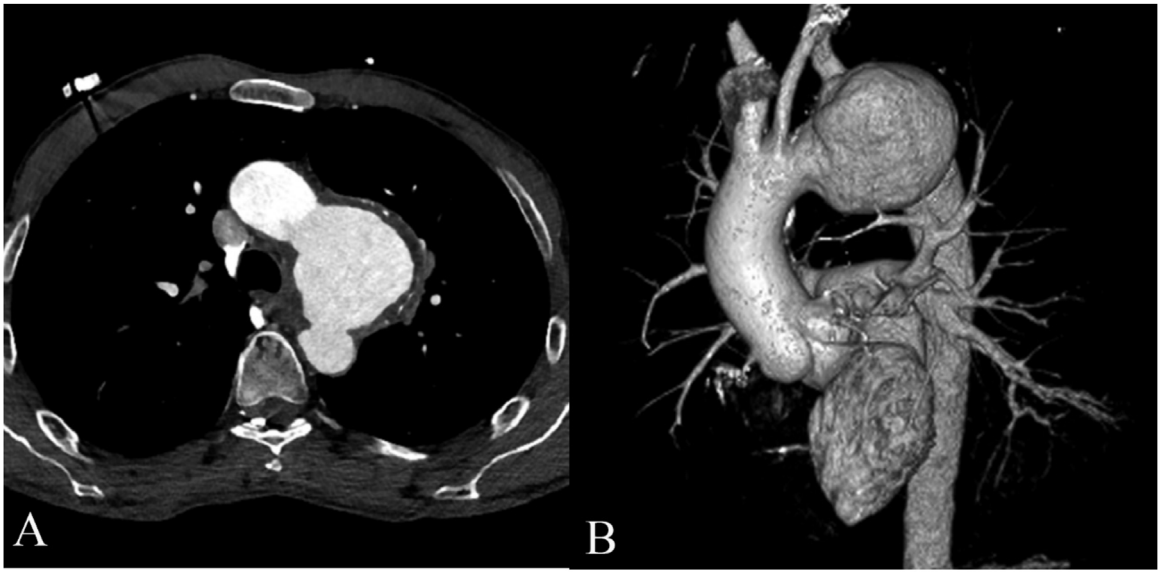

Fig. 1. A) Spiral CT angiography of the aortic aneurysm, B) aneurysm after 3D reconstruction.

carotid artery and extending to the first segment of the descending aorta (Fig. 1A & B). The presence of any connection between the aneurysmal part and airways was carefully sought, and nothing was found.

Emergency treatment was initiated for the patient due to a history of massive hemoptysis in the past few days; accordingly, the hybrid procedure applied. The patient transferred to the operating room. After general anesthesia and intubation with a double-lumen endotracheal tube, a median sternotomy was performed. following the adminstration of 1 mg/kg of heparin, the pericardium opened, and the aortic arch, innominate artery, and left common carotid artery meticulously dissected.

A Dacron Y-graft (size, 16–8) was used for debranching the mentioned branches of the aortic arch. It was beveled proximally and anastomosed to the anterolateral aspect of the ascending aorta. Then, the left common carotid artery suture was ligated proximally, and its distal part was anastomosed to the medial limb of the Dacron Y-graft. The same procedure was applied for the innominate artery. Heparin was reversed by protamine sulphate, while the sternum and wound were closed after hemostasis in a routine process. Cerebral oximetry was in a normal range bilaterally during the procedure.

First, the left subclavian artery (SCA) was closed with an endovascular device, and then, thoracic endovascular aortic repair (TEVAR) was carried out with a covered stent, inserted from the ascending aorta to the proximal part of the descending aorta. In the TEVAR procedure, the common femoral artery (CFA) was cannulated percutaneously, using 2 ProGlide devices (closure devices). First, the left SCA was occluded by an 18-mm PDA occluder. The occluder was positioned between the ostium of SCA and vertebral artery separation.

After occlusion of SCA, a 38-34-209 Zenith Alpha Thoracic proximal component device was inserted through CFA and placed at the arch. Meanwhile, a temporary pacemaker (TPM) lead was inserted through CFV, and its tip was placed at the right ventricular (RV) apex. With a sudden increase in heart rate induced by TPM (about 200 per minute), blood pressure dropped to the mean arterial blood pressure of 50–60 mmHg; this process prevented device movements during deployment at zone 0 of the aortic arch. The stent graft was positioned in the right location, and the grafted part was placed right after the aortic to brachiocephalic arteries and the left common carotid artery bypass graft; this facilitated the longest sealing at zone 0 and normal perfusion of the graft at the same time.

After the best position was determined during rapid RV pacing, the device was deployed as promptly as possible to reduce the risk of device displacement. There was a type 1A endoleak after graft deployment; therefore, we carried out compliant balloon inflation at the proximal grafted part during rapid RV pacing. The final result was satisfactory, without any significant endoleaks. The delivery system was withdrawn, and hemostasis was achieved by closing the Pro Glide sutures. There was no evidence of leakage on the completion aortogram. The patient had no evidence of neurological complications and was discharged within 24 h with stable vital signs and no symptoms. A CT angiography scan was also acquired within 5 days after the hybrid procedure (Fig. 2).

All the described procedures were carried out by an experienced team consisting of three cardiac surgeons (15, 5, and 3 years of experience) as well as two interventional cardiologists (each with 5 years of experience).

3. Discussion

In this case report, a TAA patient with hemoptysis was treated with the hybrid technique. Although most cases of TAA are asymptomatic, it can present with a wide range of symptoms and complications. Chest pain is the most important symptom of TAA, and its sudden occurrence is a sign of rapid aneurysm expansion, dissection, or rupture [9]. The review of the literature showed that there have not been any cases of TAA with hemoptysis, and our study is the first report of this occurrence. TAA can progress slowly over time without any symptoms. If it becomes large enough, it can cause pain in the chest or back and induce pressure on the airway structure [10]. Therefore, one of the possible symptoms of TAA can be hemoptysis [11]. In general, selection of the type of management (conservative or surgical) in patients with TAA depends on many factors, such as symptoms, size of aneurysm, and location of aneurysm. In asymptomatic patients, repair of TAA is not recommended unless the risk of rupture or other complications exceeds the risks associated with repair. Indications for repair in asymptomatic TAA patients depend on the diameter, location, and expansion rate of TAA, as well as the underlying etiology [12,7].

In patients with typical symptoms of TAA or ruptured TAA, surgery is the best approach for increasing the rate of survival.

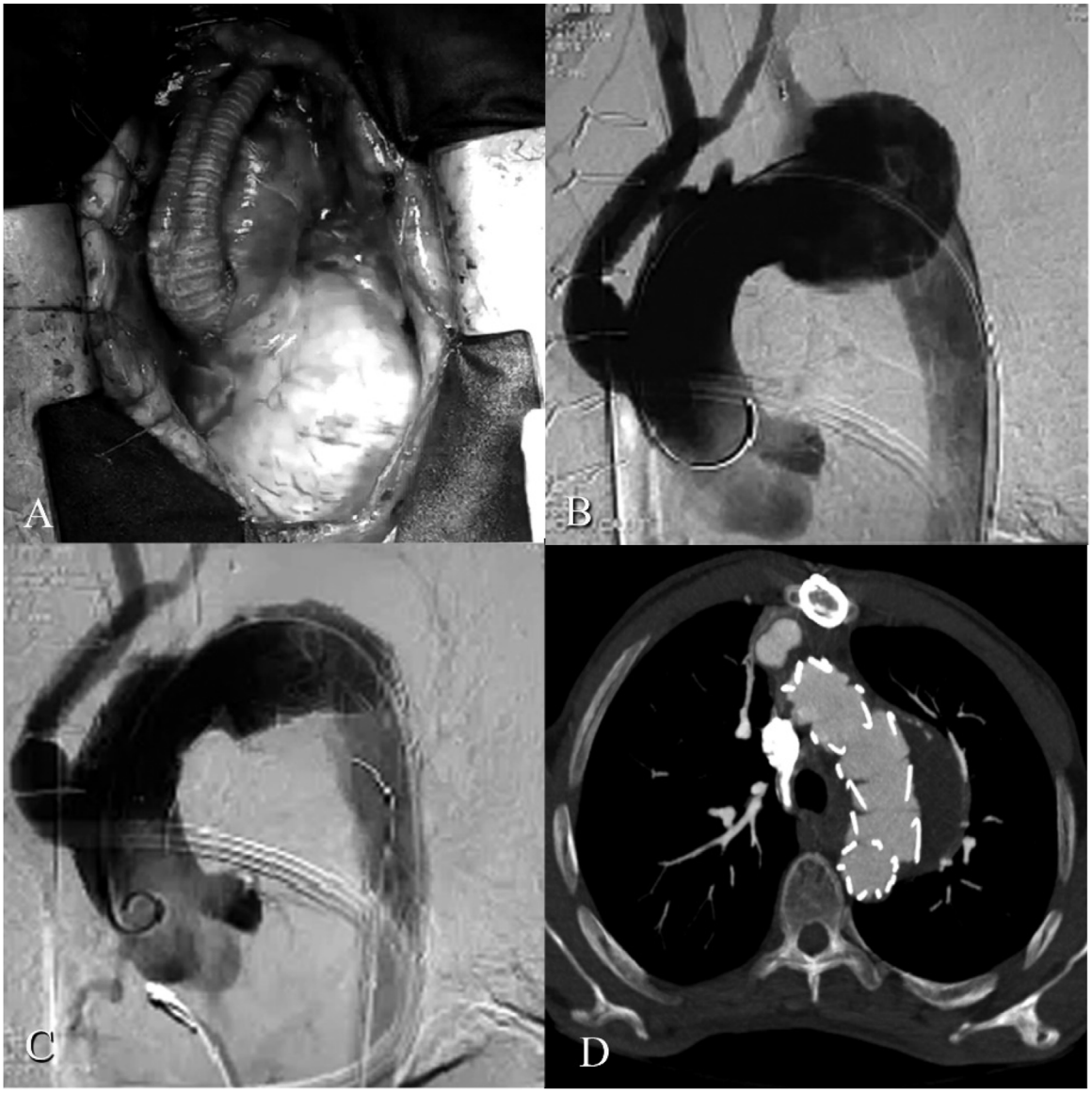

Fig. 2. A) The intraoperative view of the ascending aorta after debranching the innominate and left carotid arteries; B) angiographic image after aortic root injection of the contrast; C) the same angiographic image after stent deployment; D) CT angiography at 5 days after the procedure. The aneurysm sac is thrombosed.

Based on the American College of Cardiology guidelines, all symptomatic TAA patients and those with large aneurysms or high risk of rupture require immediate surgery. Selection of the repair technique (open surgery vs. endovascular repair) depends on different factors, such as etiology (sporadic or genetically-mediated), age, medical comorbidities, location in the descending aorta, and extent of the aneurysm. Today, three surgical procedures are used in patients with an aneurysm, i.e., open surgery, endovascular repair, and hybrid repair. For a long time, the conventional method of TAA management comprised of open surgical resection and reposition by a Dacron graft. This method is associated with very high rates of mortality and morbidity and reduces the survival of patients by increasing the risk of serious complications, such as neurological problems [13]. Nonetheless, this approach remains necessary for the management of a variety of thoracic diseases, such as complications of thoracic aortic stent-graft placement. Thoracic endovascular aortic repair (TEVAR) is one of the alternative methods for TAA management [14]. The first report of TEVAR was published in 1988 by Volodos [15]. The advantages of this method are the minimally invasive approach, avoidance of thoracotomy and aortic clamping, and reduced blood loss and operation time. These advantages are very important in patients with ruptured descending thoracic aortic aneurysm (rDTAA). A part from the high efficiency of TEVAR, there are some concerns about the associated complications. For instance, infection and rupture of the aorta during follow-up can occur in some patients undergoing TEVAR. Also, some studies have reported that aortic interventions are necessary in nearly 8% of TEVAR patients within the first month [16].

The hybrid method includes the aortic arch repair, with debranching and reimplantation or bypass of the aortic arch vessels and TEVAR with endografting of the aortic arch. Many studies have shown the feasibility and efficacy of this procedure in the aortic arch, which is associated with acceptable mortality and morbidity. In addition, the hybrid method has high efficiency for older patients or those with comorbidities. Evidence shows that this technique can be safely adopted with a low aortic reoperation rate and no delayed neurological complications or endoleaks [17].

In our report, the patient had a large aneurysm of the aortic arch at the level of the origin of the left common carotid artery. Since our patient was a symptomatic case of TAA, the preferred

approach was the surgical intervention. However, in this case, the presence of hemoptysis prohibited us from performing a complete surgical approach, which needed high-dose heparin use and long-time cardiopulmonary bypass. This approach could result in massive fatal hemorrhage. Since our patient was a symptomatic emergency case of TAA with massive hemoptysis, we selected the hybrid technique (typically an open approach for the management of the ascending aorta or aortic arch and an endovascular approach for the descending thoracic aorta). The mentioned approach with minor modification of the related guidelines in this unique TAA presentation can be used in similar circumstances.

4. Conclusion

The hybrid approach seems to be advantageous for TAA patients requiring emergency interventions such as this patient with massive hemoptysis.

Patient perspective

The patient represented no complaint on routine follow-ups and expressed satisfaction.

Sources of funding

None.

Ethical approval

Ethic approval has been exempted by Clinical Research Ethics Committee of Rajaie Cardiovascular Medical and research Center.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Sadeghpour Tabaei A, Jalali A and Toloueitabar Y contribute to conception, design and critical revision, work to interpretation, writing, approval and agreement of article. Asadian S, Shafe O, and Sadeghpour Tabaei S contribute to clinical data collection. All of author's agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy of integrity of any part of the work are appropriately investigated and resolved. Asadian S work to the analysis, interpretation, writing, approval and agreement of article. All of author's agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy of integrity of any part of the work are appropriately investigated and resolved.

Registration of research studies

This case report does not require registration as a research study.

Guarantor

Yaser Toloueitabar.

Provenance and peer review

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Declaration of Competing Interest

None.

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