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Case Reports

Surgical Treatment of Brachiocephalic Artery Aneurysm With Impending Rupture and Tracheal Communication

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Abstract

Brachiocephalic artery aneurysm is uncommon but may require surgery because it tends to enlarge, rupture, or cause symptoms related to thrombosis or compression. This case report describes a brachiocephalic artery aneurysm in a 72-year-old man who presented at the hospital with dyspnea and hemoptysis resulting from impending rupture and tracheal communication.

Keywords: Brachiocephalic trunk; aortic aneurysm; trachea; fistula

Case Report

Presentation and Physical Examination

A 72-year-old man was admitted to the emergency department with progressive dyspnea and hemoptysis. A chest radiograph revealed mediastinal dilatation, and computed tomograms showed an 8 × 6-cm² saccular aortic aneurysm with minimal contrast media leakage and tracheal compression at the origin of the brachiocephalic artery (Fig. 1). Transthoracic echocardiography showed normal cardiac structure and function, with a left ventricular ejection fraction of 65% and an ascending aortic diameter of 3.6 cm. After routine preoperative workup, the patient was scheduled for surgery.

Medical History

The patient had no history of trauma, and his medical history was unremarkable.

Technique

The operation was performed through a median sternotomy. Cardiopulmonary bypass was instituted, with an arterial cannula placed in the right axillary artery and a 2-stage venous cannula placed in the right atrium (Fig. 2). After circulatory arrest was induced and the patient was cooled systemically to a target temperature of 24 °C, bilateral selective cerebral perfusion was established (the right cerebral hemisphere was perfused through the right axillary artery while the brachiocephalic artery was clamped, and the left hemisphere was perfused directly through the left carotid artery by a 12F angiocatheter with balloon occlusion of the left subclavian artery). The aneurysm sac was opened, the thrombus filling the aneurysm was removed (Fig. 3), and an aortic safety margin was obtained from the aneurysm. The cartilaginous portion of the trachea that communicated

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with the aneurysmal sac was repaired and reinforced with an autologous pericardial patch (Fig. 4). After the repaired trachea was confirmed to have no air leaks, the distal end of a 26-mm vascular graft was anastomosed in a hemiarch fashion to the aortic arch adjacent to the origin of the left common carotid artery. The distal end of a 12-mm vascular graft was anastomosed in an end-to-end fashion to the trimmed proximal brachiocephalic artery. The proximal section of the 12-mm vascular graft was anastomosed in an end-to-side fashion to the 26-mm vascular graft (Fig. 5). The patient was weaned from cardiopulmonary bypass slowly but without difficulty. Cardiopulmonary bypass time was 239 minutes, aortic cross-clamp time was 79 minutes, total circulatory arrest time was 103 minutes, and selective antegrade cerebral perfusion time was 95 minutes.

Outcome

The patient was extubated 2 days after arriving in the surgical intensive care unit. His postoperative course was uneventful, and he was discharged on the 18th postoperative day with no serious complications. At the time of discharge, a computed tomography angiogram was suggestive of a patent graft, with no evidence of contrast media leakage (Fig. 6).

Key Points

- Brachiocephalic artery aneurysm is a rare disease. Brachiocephalic artery aneurysm with tracheal fistula is even rarer.
- With the patient on cardiopulmonary bypass, the brachiocephalic artery and proximal aorta were repaired with graft interposition, and the tracheal wall was repaired with an autologous pericardial patch.
- Cardiopulmonary bypass is useful when the shape and size of the aneurysm make the dissection surface difficult to access.

Latest Follow-Up

The patient is being observed and has reported no new episodes of hemoptysis in the past 24 months.

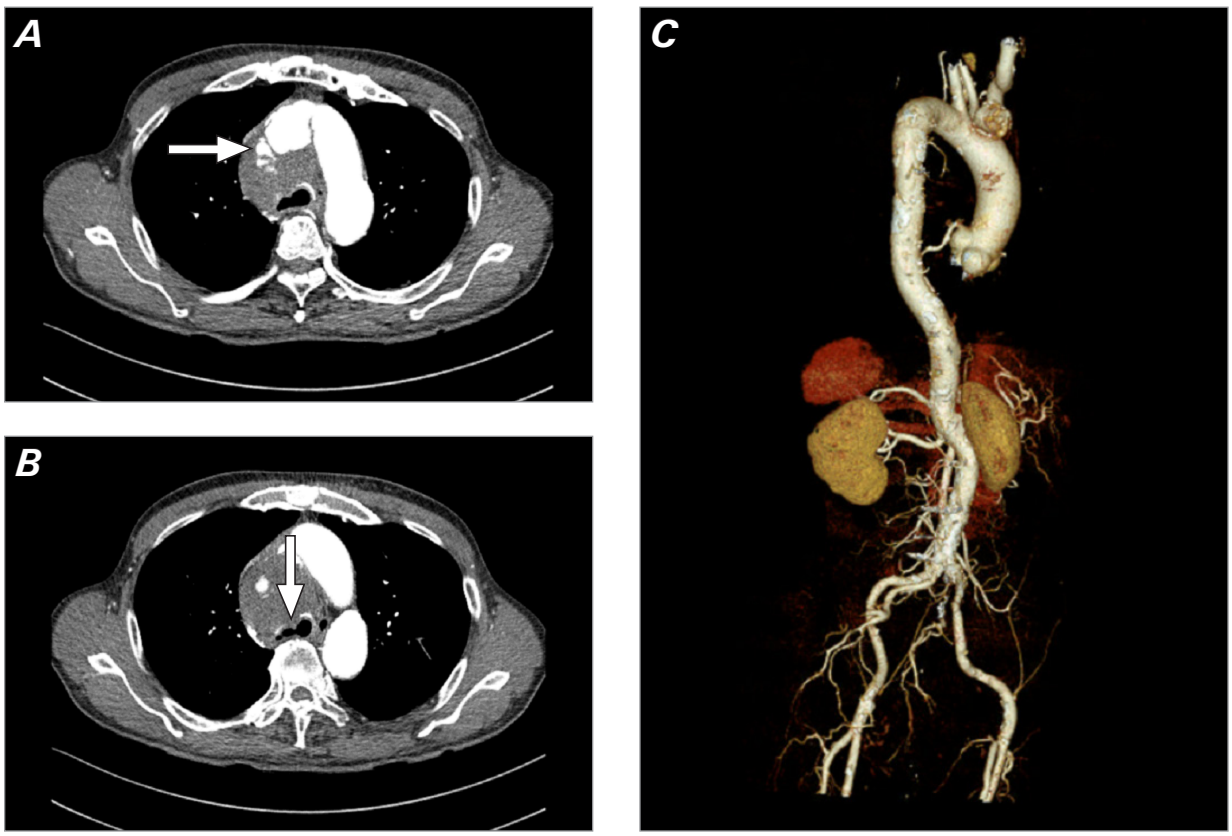

Fig. 1 Preoperative computed tomograms show (**A**) an aortic aneurysm measuring 8 × 6 cm^2 at the origin of the brachiocephalic artery, with a small volume of contrast media leakage (arrow) and (**B**) an aortic aneurysm causing tracheal compression (arrow). **C**) A preoperative 3-dimensional computed tomogram shows a saccular aortic aneurysm.

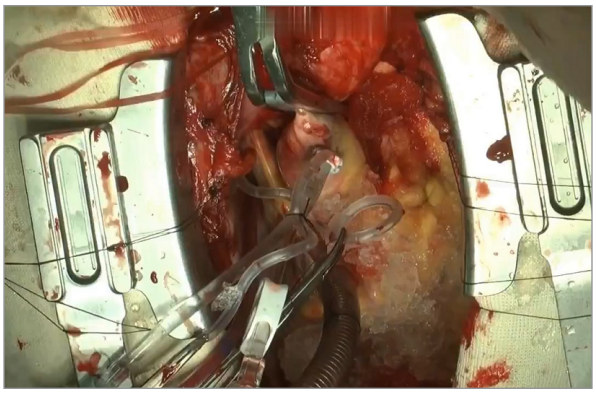

Fig. 2 A still image from the motion image shows that cardiopulmonary bypass was instituted with an arterial cannula introduced into the right axillary artery and a 2-stage venous cannula introduced into the right atrium.
Supplemental motion image available for Figure 2.

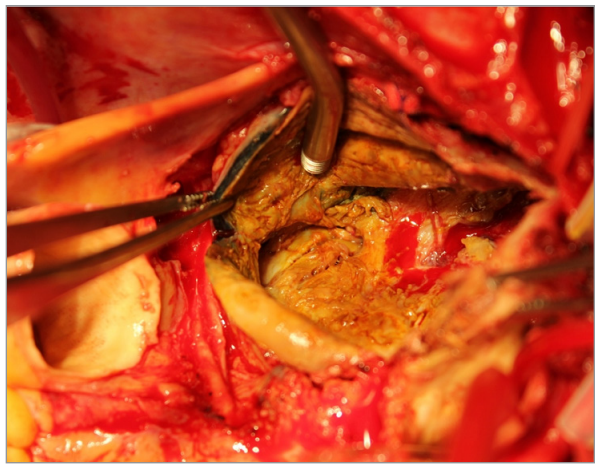

Fig. 3 Intraoperative photograph shows the brachiocephalic artery aneurysm and the thrombus inside it.

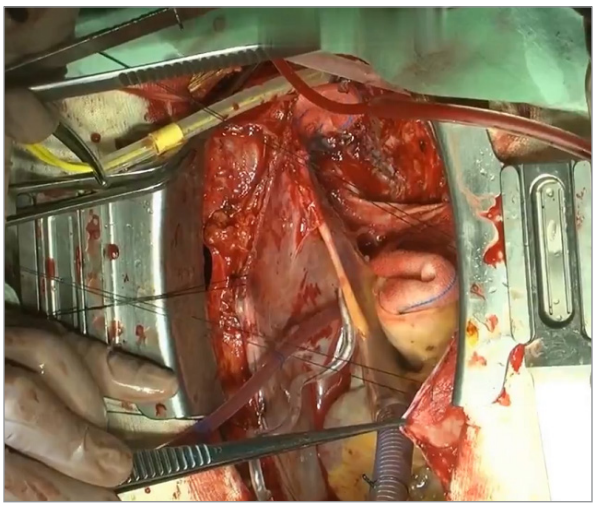

Fig. 4 A still image from the motion image shows repair of the cartilaginous portion of trachea that communicated with the aneurysmal sac.
Supplemental motion image available for Figure 4.

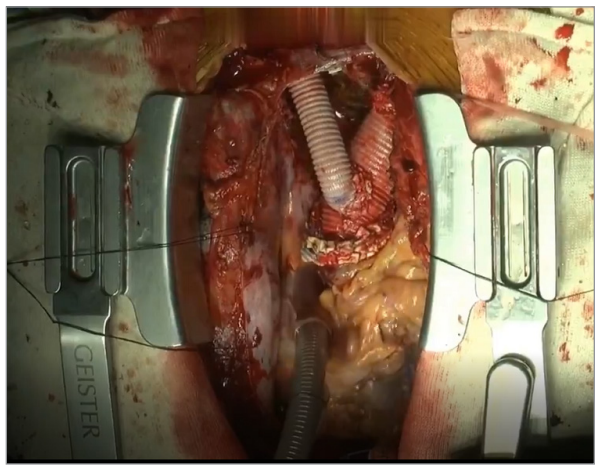

Fig. 5 A still image from the motion image shows that after the repaired trachea was confirmed to have no air leaks, the brachiocephalic artery and proximal aorta were repaired with graft interposition.
Supplemental motion image available for Figure 5.

Discussion

Brachiocephalic artery aneurysms account for 3% to 6% of all aneurysms arising in the supra-aortic vessels; they can lead to devastating complications, including thrombosis, distal embolization, compression of adjacent tissues and organs, and rupture.[1] These aneurysms are usually detected incidentally as an asymptomatic mass on computed tomograms performed for other reasons, but they sometimes present with neurologic symptoms caused by emboli or mediastinal compression resulting from aneurysmal enlargement.[2] The most common symptoms of brachiocephalic artery aneurysm result from compression and include dyspnea, dysphonia, and superior vena cava syndrome.[3] In this case, the patient presented with episodes of compressive tracheal stenosis and hemoptysis owing to tracheal erosion caused by extrinsic compression of the aneurysm and that resulted in a tracheal fistula.

Surgical repair options for brachiocephalic artery aneurysm depend on the aneurysm's shape, size, and location. Most open surgical repairs involve graft interposition, patch reconstruction with partial clamping, and partial or total arch repair.[3] Patch reconstruction with the partial clamping method is desirable because it avoids circulatory arrest; however, it does

Fig. 6 A postoperative 3-dimensional computed tomogram shows the completed repair.

not achieve anastomosis at the aneurysmal site. Okita et al[4] reported a higher incidence of pseudoaneurysm or residual aneurysm formation after patch reconstruction for saccular aneurysms of the aorta.

Kieffer et al[3] reported a series of brachiocephalic artery aneurysm cases, which they classified into 3 groups: Group A does not include the origin of the brachiocephalic artery, group B includes the origin but not the aorta, and group C includes the origin and the aorta and requires cardiopulmonary bypass for repair. In the present case, the aneurysm could be classified as group B, but it had a saccular shape, with a transverse diameter of approximately 8 cm; access to the aneurysm was too poor to allow dissection. Moreover, the aneurysm was chronically inflamed and even appeared to have tracheal communication, so exposing the tracheal lesion was unavoidable. For this reason, the aneurysm was treated with hemiarch replacement under cardiopulmonary bypass and separated right brachiocephalic artery, with vascular graft anastomosed in an end-to-side fashion to the neoaorta.

The patient had the concomitant critical conditions of aneurysm and tracheal communication. The aneurysm contained old thrombus that was compressing the trachea, and the thin, cartilaginous tracheal wall had eroded to form a fistula with the aneurysmal sac. Because the tracheal lesion was confined to the anterior portion of the trachea, the tracheal wall was repaired with multiple interrupted sutures and augmented with an autologous pericardial patch. Repairing a tracheal fistula by direct closure with an autologous patch, as done in this case, reduces the risk of fistula recurrence and infection.[5]

This report describes a case of brachiocephalic artery aneurysm with impending rupture and tracheal communication. After cardiopulmonary bypass was instituted for the patient's safety, the brachiocephalic artery and proximal aorta were repaired with graft interposition, and the tracheal wall was repaired with an autologous pericardial patch. Cardiopulmonary bypass is useful when the dissection surface is difficult to access because of the shape and size of the aneurysm.

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References

1. Stolf NA, Bittencourt D, Verginelli G, Zerbini EJ. Surgical treatment of ruptured aneurysms of the innominate artery. *Ann Thorac Surg.* 1983;35(4):394-399. doi:10.1016/s0003-4975(10)61591-3
2. Bower TC, Pairolero PC, Hallett JW Jr, Toomey BJ, Gloviczki P, Cherry KJ Jr. Brachiocephalic aneurysm: the case for early recognition and repair. *Ann Vasc Surg.* 1991;5(2):125-132. doi:10.1007/BF02016744
3. Kieffer E, Chiche L, Koskas F, Bahnini A. Aneurysms of the innominate artery: surgical treatment of 27 patients. *J Vasc Surg.* 2001;34(2):222-228. doi:10.1067/mva.2001.115807
4. Okita Y, Takamoto S, Ando M, et al. Long-term results of patch repair for saccular aneurysms of the transverse aortic arch. *Eur J Cardiothorac Surg.* 1997;11(5):953-956. doi:10.1016/s1010-7940(97)01156-1
5. Guibaud JP, Laborde MN, Dubrez J, et al. Surgical repair of an aneurysm of the innominate artery with fistulization into the trachea. *Ann Vasc Surg.* 2001;15(3):412-414. doi:10.1007/s100160010070