Little is known about the cause of BAA; however, it is believed to be associated with increased bronchial artery blood flow or weakening or injury of the vessel walls. Moreover, BAAs can be acquired as a result of atherosclerosis, inflammatory lung diseases such as bronchiectasis and tuberculosis, or trauma, or it can be congenital, as in the context of pulmonary sequestration, pulmonary artery agenesis, and hereditary hemorrhagic telangiectasia (4). In the present case, absent a history of other etiologies, the findings were mostly congenital. Additionally, it is most likely that the bronchial–pulmonary arterial fistula was the primary congenital abnormality, whereas the aneurysm developed secondarily as a result of increased blood flow through the fistula.

The symptoms associated with BAA depend on the location of the BAA (intrapulmonary or mediastinal). The most common symptom of intrapulmonary BAA is hemoptysis, whereas mediastinal BAA presents with a variety of symptoms caused by compression of the adjacent structures, such as hemoptysis, dysphagia, hoarseness, superior vena cava syndrome, and severe chest pain mimicking acute aortic dissection caused by rupture (3,4). Therefore, the asymptomatic nature and incidental diagnosis of mediastinal BAA in the present case are rare.

Although CT angiography provides excellent imaging for the initial diagnosis of BAAs, selective bronchial arteriography is essential for treatment strategy, especially in cases with a concurrent bronchial–pulmonary arterial fistula. To exclude a BAA with bronchial–pulmonary arterial fistula and to prevent recurrence of the BAA, occlusion of all feeding arteries into the aneurysm and those extending into the pulmonary artery is necessary. If all the feeding arteries cannot be cannulated and occluded by transcatheter means, dense packing of the aneurysm with coils or open surgery should be considered for complete treatment of the aneurysm. In the present case, all the outflow arteries could be cannulated by a microcatheter in the preceding bronchial selective angiography; therefore, we decided to perform endovascular treatment to exclude the aneurysm. Moreover, as all outflow arteries could be embolized, we decided to occlude the residual short inflow artery by stent grafting to achieve complete exclusion of the aneurysm instead of packing the aneurysm with coils, which was an acceptable option.

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Covered Endovascular Reconstruction of Aortic Bifurcation Technique in Infected Aortic Aneurysm

From: Uei Pua, MBBS, MMed, FRCR, FAMS
Lawrence Han Hwee Quek, BMBS (Flinders), FRCR, MMED, FRANZCR, FAMS
Glenn Wei Leong Tan, MBChB, FRCS (Glasg), MMed, FRCSEd
Departments of Diagnostic Radiology (U.P., L.H.H.Q.) and General Surgery (G.W.L.T.)
Tan Tock Seng Hospital
11 Jalan Tan Tock Seng
Singapore 308433
Yong Loo Lin School of Medicine (U.P.)
National University of Singapore
Lee Kong Chian School of Medicine (L.H.H.Q.)
Nanyang Technological University
Singapore

Editor:

An infected aortic aneurysm is an uncommon but potentially fatal condition, and endovascular techniques are increasingly being recognized as an alternative to surgery (1,2). Covered endovascular reconstruction of aortic bifurcation (CERAB) is an endovascular technique used in the treatment of chronic occlusive aortoiliac disease (3,4). We modified the CERAB technique to treat a patient with an infected aortic aneurysm. Ethics board approval is not required for case reports in our institution.

A 56-year-old man presented to the hospital with a 3-week history of fever and low back pain. Complete blood count revealed leukocytosis with a total white cell count of 23.7×10^9/L and an elevated C-reactive protein level of 228.6 mg/L. Computed tomography (CT) revealed a saccular aneurysm measuring 35 mm in diameter arising from the distal abdominal aorta with surrounding phlegmon extending from the level of the left renal artery to the left common iliac artery (**Fig 1**). The diagnosis of infected aortic aneurysm was made based on the clinical presentation and imaging appearance. The aneurysm was found to have increased in size over 4 days, reaching a diameter of 54 mm (**Fig 1**). Pertinent aortic anatomy included a native aortic diameter of 13 mm at the level of the left renal artery and 13 mm × 8 mm at the aortic bifurcation because of extrinsic compression by the phlegmon. In view of the rapid rate of aneurysmal enlargement and small

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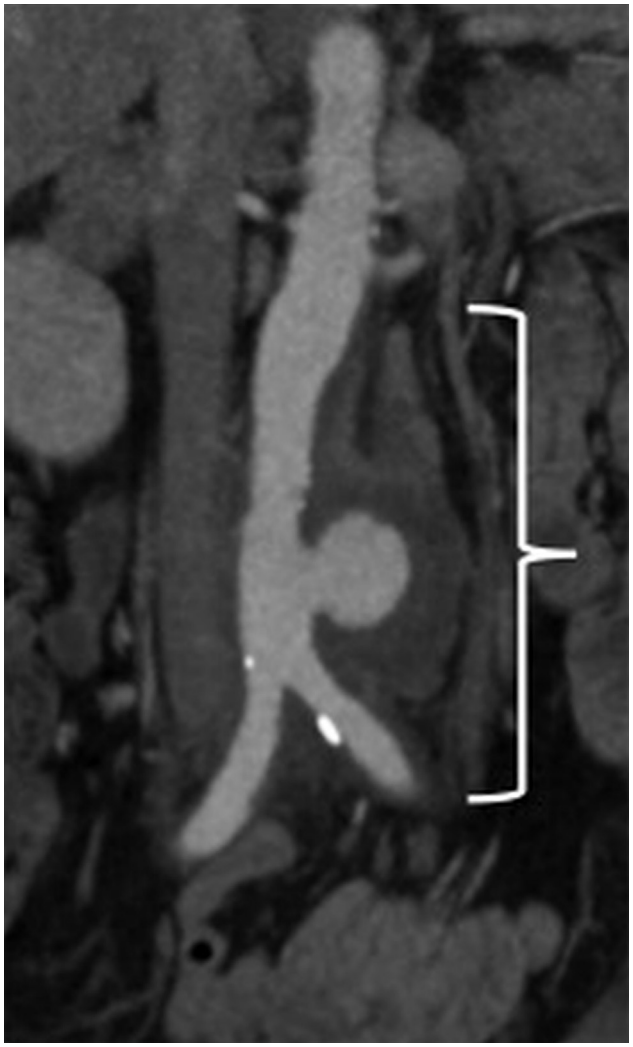

Figure 1. Coronal CT image obtained 4 days after presentation. A saccular aneurysm is seen arising from the anterolateral wall of the abdominal aorta with surrounding phlegmon, with rapid progression within a 4-day period (from 35 mm to 54 mm in diameter). CT revealed phlegmon extending from the level of the left renal artery to the left common iliac artery (bracket). The aortic diameter at the left renal artery was 13 mm, whereas the diameter at the aortic bifurcation was 13 mm × 8 mm because of extrinsic compression by the phlegmon. The dimensions were unfavorable for endovascular repair using available off-the-shelf bifurcated devices.

native aortic dimensions, the multidisciplinary decision was made for endovascular repair by modifying the CERAB technique.

An 11-F sheath was inserted in the right common femoral artery for delivery of Advanta V12 stent grafts (Atrium Medical Corp, Hudson, New Hampshire) in the aorta and right common iliac artery. A 7-F sheath was inserted in the left common femoral artery for delivery of the left common iliac artery component. Another 5-F sheath was inserted cranial to the 7-F sheath to position a microcatheter in the aneurysm sac. This access served as a backup for sac embolization should CERAB fail to exclude the aneurysm.

The aneurysm sac was accessed with a PX SLIM microcatheter (Penumbra, Inc, Alameda, California) (**Fig 2a**, inset). This microcatheter was to be confined by the stent grafts and removed only after confirmation of successful aneurysm exclusion. First, a 14 mm × 41 mm Advanta V12 stent graft was positioned and deployed 5 mm above the aortic bifurcation. A 14 mm × 61 mm Advanta V12 stent graft was deployed cranial to the first stent with a 2-cm overlap and the landing just below the left renal artery. This stent was further overdilated using a 16 mm × 60 mm XXL balloon (Boston Scientific, Marlborough, Massachusetts) to achieve a conical configuration (**Fig 2b**, inset). Two 8 mm × 59 mm Advanta V12 stent grafts were deployed in each common iliac artery, with the proximal aspect of the stent grafts (flow divider) positioned above the neck of the aneurysm within the aortic component (**Fig 2b**) (3). Completion angiography showed exclusion of the aneurysm (**Fig 2c**).

Before the removal of the microcatheter, contrast agent injection showed partial thrombosis of the aneurysm (**Fig 3a**). However, on delayed angiography, there was opacification of the median sacral artery from the sac (arrow in **Fig 3a**). Sac embolization was performed through the microcatheter using 4 mL of 1:4 *N*-butyl cyanoacrylate:ethiodized oil mixture to fill the aneurysm sac completely to eliminate the possibility of type 2 endoleak. The microcatheter was retrieved and final aortography confirmed exclusion of the aneurysm sac with no endoleak (**Fig 3b**).

The patient was discharged 9 days later. Within 3 weeks, his total white cell count and C-reactive protein levels normalized. The causative organism was not isolated despite multiple blood cultures; screening for immunodeficiencies and infective endocarditis was negative. Imaging follow-up after 8 months showed patent stent grafts and decrease in aneurysm size with complete thrombosis (**Fig 4**). The patient remained well at a monthly clinic visit at 13 months and will remain on oral antibiotics lifelong.

Treatment options for infected aneurysms include surgical/hybrid techniques such as use of homografts or antibiotic-soaked prostheses, exclusion of the infected segment followed by extraanatomic bypasses, or aortouniiliac endografts. Endovascular techniques such as endovascular aortic repair (EVAR) have shown acceptable results (1,2), and EVAR using bifurcated devices was our initial choice, but it was considered not ideal because of the small native aortic dimensions. For instance, the proximal landing zone with the aortic diameter of 13 mm represents a 40% oversizing with our smallest available EVAR device (diameter of 23 mm) (**Fig 2a–c**). Additionally, the small aortic bifurcation of 13 mm × 8 mm would pose a challenge for bifurcated EVAR.

An advantage of the large-diameter Advanta V12 stents (any size > 14 mm) is the ability to be dilated after placement to 22 mm, which provides the flexibility