Hybrid open and endovascular treatment of an aortic arch pseudoaneurysm in a patient with human immunodeficiency virus infection

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ABSTRACT
We describe an hybrid approach for aortic pseudoaneurysm with open and endovascular treatment as an alternative treatment for a high-risk patient infected with human immunodeficiency virus. A 42-year-old man, serum positive for human immunodeficiency virus, presented, with a large pseudoaneurysm of the arch aorta measuring 61 × 70 mm. An aortic arch debranching was performed, completed by thoracic endovascular aneurysm repair. A control computed tomography scan performed 3 months later showed a complete thrombosis of the pseudoaneurysm. The outcome of this treatment, particularly regarding the rate of infection, is yet to be determined. Longer follow-up is needed with a greater of patients. (J Vasc Surg Cases and Innovative Techniques 2020;6:516-9.)

Keywords: Aortic arch pseudoaneurysm; Hybrid treatment; Human immunodeficiency virus

Arterial pseudoaneurysm has been reported as a possible complication of human immunodeficiency virus (HIV) infection, which is known to affect the vascular system resulting in vasculitis, perivasculitis, fibroproliferative diseases and aneurysms.1 Thoracic aortic arch (TAA) pseudoaneurysm is an uncommon, but surgically challenging problem, particularly in patients infected with HIV.

Open surgical management of vasculopathy in HIV-infected patients is characterized by high morbidity and mortality.2 The literature contains only isolated case reports and small case series on the role of endovascular therapy in patients with HIV with vasculopathy and aneurysmal disease.3,4 We describe a case of a hybrid approach with open and endovascular treatment of a TAA pseudoaneurysm as an alternative treatment for a high-risk patient infected with HIV.

The patient consented to publication of his case details and images with a signed consent form.

CASE
A 42-year-old man was admitted for the evaluation of a recurrent, nonspeciﬁc thoracic pain and dyspnea. The patient had no history of trauma, had chronic hepatitis B and V infection, and has been HIV-seropositive for 7 years. The infection was transmitted by sexual intercourse. The patient’s clinical history was positive for opportunistic infections and had an atypical mycobacteria pneumonia 6 months ago, treated with rifampicin, ethambutol, and pyrazinamide. Prophylactic treatment has been started with sulfamethoxazole and trimethoprim (Bactrim simple).

On examination, he was afebrile and normotensive. Hematologic data indicated both anemia and hypoalbuminemia: hemoglobin, 9.2 g/dL; white blood cell count, 4600/mm3; CD4 count, 180/mm 3; and albuminemia, 24 g/L. Renal function was within normal limits. Serologic nonspeciﬁc and speciﬁc tests for syphilis were negative.

The patient’s HIV infection has been well-controlled with highly active antiretroviral therapy (HAART), including two nucleoside analogue reverse transcriptase inhibitors and one protease inhibitor. Viral load was 250 RNA copies/mL. HAART was started to decrease the viral load, increase the number of CD4+ lymphocytes, and prevent opportunistic infections. Biological markers were performed to rule out bacterial infections, and his procalcitonin was less than 0.05 ng/mL and C-reactive protein was 32.4 mg/dL. Blood culture results were negative.

The diagnosis was conﬁrmed by a computed tomography (CT) scan of the chest that revealed the presence of a large pseudoaneurysm (Fig 1, A) arising on the inferior
aspect of the arch aorta measuring 61 × 70 mm (Fig 1, B).

We identified some high-risk features in this case, namely, (1) immune status with a low CD4 count, (2) opportunistic infection in the past and, (3) hypoalbuminemia, that justified hybrid approach instead of a definitive open approach in a young patient.

An aortic arch debranching was performed first, a right to left common carotid artery bypass with a 8-mm Dacron graft, using retroesophageal tunneling was performed, and reimplantation of the left subclavian artery. Second, thoracic endovascular aneurysm repair was performed under general anesthesia via a femoral artery approach. Catheterization of the aortic arch was done with a hydrophilic guidewire and angiography was performed through the pigtail catheter. After replacing the hydrophilic guide wire with a Lunderquist wire, a 40 × 36 × 167 mm Zenith Alpha endograft (Cook Medical, Bloomington, Ind) was implanted through the left femoral axis with a landing close to the innominate artery (Fig 2).

Postoperatively, the patient received dual antiplatelet therapy of clopidogrel 75 mg plus aspirin 75 mg/d for 3 months. Thereafter, aspirin 160 mg/d was prescribed indefinitely.

A control CT scan performed 3 months later showed no endoleaks, and complete thrombosis of the pseudoaneurysm. Carotid bypass with reimplantation of the left subclavian artery was patent (Fig 3, A-C). However, the diagnosis of a mycotic aneurysm has not been excluded, and we have planned long-term
clinical and imaging surveillance with control CT scans at 6, 12, 18, and 24 months postoperative. Biologic markers were performed monthly to rule out bacterial infections.

**DISCUSSION**

The last decades have been marked by an increase of a heterogeneous range of HIV-associated vascular pathologies under the rubric of HIV-associated vasculopathy. The pathogenesis of aneurysmal disease is multifactorial. Four pathophysiological processes have been implicated, including immune complex deposition causing inflammation and endothelial injury, direct HIV infection of the artery, bacterial infection, and side effects of HAART therapy. Rupture is common at an early stage with the development of pseudoaneurysms. Atypical locations of aneurysms in HIV-positive patients pose some questions concerning its etiology, optimal treatment, and postoperative disease management.

This vascular disease has a predilection for affecting young males and an association with advanced stages of HIV disease, as manifested by immune status with low CD4 counts and opportunistic infections. The present case confirms these clinical and hematologic data. Syphilis is a problem in the HIV community and can cause luetic aneurysms. Serologic tests for syphilis were negative in our patient. However, we should be aware of the potential for false-negative serology in both primary and secondary infection in the HIV-positive patient. False-positive nontreponemal antibody tests are encountered more frequently in HIV-positive individuals and may be seen in up to 11% of cases. The potential causative role of syphilis is not excluded in this case.

The rare association between infection with HIV and the development of vascular aneurysm has been reported by Marks and Kuskov in a review of 12 young HIV-positive patients with focal areas of vascular disease. There were specific clinical features in this group of patients: they were young, they were all indigenous Africans with no history of atherosclerosis, there was rapid development of focal necrotizing vasculitis with aneurysm formation, and there was a slow, progressive development of granulomatous vasculitis.

The use of HAART has resulted directly in dramatic decreases in morbidity and mortality among HIV-infected patients by decreasing the viral load and increasing the number of CD4 lymphocytes, thus allowing prevention of opportunistic infections and extending the life expectancy of persons living with AIDS. HIV-positive patients on HAART should be considered good candidates for surgery.

The results of conventional surgery are associated with a relatively increased incidence of operative morbidity and mortality owing to a high incidence of late graft infection, but they are dependent on several factors such as low CD4 lymphocyte counts and hypoalbuminemia. EVAR is a less invasive procedure, and is now often used as an alternative to open surgery, for management of abdominal and thoracic aortic aneurysms. Machado et al reported two cases of HIV-infected patients in whom an AAA was diagnosed. He emphasized the importance of HAART associated with endovascular treatment in ameliorating the inflammatory process, which lead to aneurysm regression. Thoracic endovascular aneurysm repair was an adequate approach to exclude aortic pseudoaneurysm in our case. Hybrid approach options may further expand the number of patients who can benefit from this treatment modality. Cases of hybrid open and endovascular treatment have also been reported in this population.

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**Fig 3.** A, Sagittal image of a 3-month postoperative control computed tomography angiography (CTA) revealing a complete pseudoaneurysm exclusion (arrow). B, Frontal image of CTA showing a good patency of carotid bypass (arrow) and left subclavian artery transposition. C, Three-dimensional CTA showing a complete pseudoaneurysm exclusion.
Other benefits of the endovascular approach include a decrease in the risk of transmission of blood-borne pathogens, including HIV, to healthcare workers, avoidance of thoracotomy or sternotomy incision, avoidance of aortic cross-clamping, decreased blood loss, decreased end-organ ischemia, and shorter operative time and hospitalization.14,17

In conclusion, we report a successful exclusion of a TAA pseudoaneurysm with a hybrid approach in a high-risk patient also for conventional surgery. The outcome of this treatment, particularly regarding the rate of infection, is yet to be determined. Longer follow-up is needed with a greater number of patients.

REFERENCES
1. Saraf R, Narang A, Kardile M, Udmale P. Endovascular treatment of HIV-associated spontaneous common carotid artery pseudoaneurysm in a case of miliary and CNS tuberculosis. Br J Neurosurg 2018;32:567-9.
2. Robbs JV, Paruk N. Management of HIV vasculopathy-a South African experience. Eur J Vasc Endovasc Surg 2010;39(Suppl 1):S25-31.
3. Pillay B, Ramdial PK, Naiddoo DP, Sartorius B, Singh D. Endovascular therapy for large vessel vasculopathy in HIV-infected patients. Eur J Vasc Endovasc Surg 2016;52:343-51.
4. Tsotetsi SC, Mulaudzi TV, Sikhosana MH, de Vries JPPM. Endovascular interventions for human immunodeficiency virus-associated iliac artery aneurysms. Vascular 2015;23:570-4.
5. Hsue PY, Deeks SG, Hunt PW. Immunologic basis of cardiovascular disease in HIV-infected adults. J Infect Dis 2012;205(Suppl 3):S375-82.
6. Woolgar JD, Robbs JV. Vascular surgical complications of the acquired immunodeficiency syndrome. Eur J Vasc Endovasc Surg 2002;24:473-9.
7. Lynn WA, Lightman S. Syphilis and HIV: a dangerous combination. Lancet Infect Dis 2004;4:456-66.
8. Rompalo AM, Cannon RO, Quinn TC, Hook EW 3rd. Association of biologic false-positive reactions for syphilis with human immunodeficiency virus infection. J Infect Dis 1992;165:1124-6.
9. Marks C, Kuskov S. Pattern of arterial aneurysms in acquired immunodeficiency disease. World J Surg 1995;19:127-32.
10. Hammer SM, Squires KE, Hughes MD, Grimes JM, Demeter LM, Currier JS, et al. A controlled trial of two nucleoside analogues plus indinavir in persons with human immunodeficiency virus infection and CD4 cell counts of 200 per cubic millimeter or less. N Engl J Med 1997;337:725-33.
11. Michaels SH, Clark R, Kissinga P. Declining morbidity and mortality among patients with advanced human immunodeficiency virus infection. N Engl J Med 1998;339:405-6.
12. Foschi D, Cellerino P, Corsi F, Casali A, Rizzi A, Righi I, et al. Impact of highly active antiretroviral therapy on outcome of cholecystectomy in patients with human immunodeficiency virus infection. Br J Surg 2006;93:1383-9.
13. Lin PH, Bush RL, Yao Q. Abdominal aortic surgery in patients with human immunodeficiency virus infection. Am J Surg 2004;188:690-7.
14. Machado R, Silveira D, Almeida P, Almeida R. Abdominal aortic aneurysm and human immunodeficiency virus infection, a new indication for endovascular aneurysm repair? Angiol Cir Vasc 2016;12:110-5.
15. Nation DA, Wang GJ. TEVAR: endovascular repair of the thoracic aorta. Semin Intervent Radiol 2015;32:265-71.
16. Testi G, Freyrie A, Gargiulo M, Mauro R, Maioli F, Rossi C, et al. Endovascular and hybrid treatment of recurrent thoracoabdominal aneurysms in an HIV-positive patient. Eur J Vasc Endovasc Surg 2007;33:78-80.
17. Walsh SR, Tang TY, Sadat U, Naik J, Gaunt ME, Boyle JR, et al. Endovascular stenting versus open surgery for thoracic aortic disease: systematic review and meta-analysis of perioperative results. J Vasc Surg 2008;47:1094-8.

Submitted Apr 30, 2020; accepted Aug 18, 2020.