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CASE REPORT

CLINICAL CASE

Graft Fungal Infection After Ascending Aorta Replacement

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ABSTRACT

Aortic graft infection is an uncommon but highly fatal complication. Correct diagnosis and timely treatment are somewhat challenging. This study presents a case report of successful recognition and treatment of this complication. (J Am Coll Cardiol Case Rep 2024;29:102377) © 2024 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

HISTORY OF PRESENTATION

A 42-year-old man was admitted to the hospital with a 4-month history of intermittent fever. He underwent ascending aorta replacement at the local hospital due to acute Stanford A aortic dissection 5 months ago. One month after the surgery, he started to have intermittent fever with maximum body temperature reaching 38.5 °C, whereas the results of repeated blood cultures were negative. Four months after the surgery, he developed a persistent fever with maximum body temperature reaching 38.5 °C. Aorta computed tomography angiography (CTA) indicated that after the ascending aorta replacement, there was a low-density filling defect in the distal anastomosis of the ascending aorta; we considered the possibility of thrombus formation at the site of anastomosis.

LEARNING OBJECTIVES

- To be able to recognize warning signs of possible aortic graft infection.
- To provide experience in the diagnosis and treatment of graft fungal infection.

PAST MEDICAL HISTORY

The patient had a history of hypertension for 5 years with a maximum systolic pressure of 170 mm Hg.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis mainly includes thrombus, bacterial infection, and malignancy.

INVESTIGATIONS

On arrival, vital signs of the patient were as follows: 39.2 °C body temperature, 108 beats/min heart rate, and 20 breaths/min breathing. Blood pressure in the right upper limb was 121/91 mm Hg, whereas in the left upper limb it was 123/93 mm Hg. Blood pressure recorded in the right lower limb was 154/91 mm Hg,

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ABBREVIATIONS AND ACRONYMS

AGI = aortic graft infection

CTA = computed tomography angiography

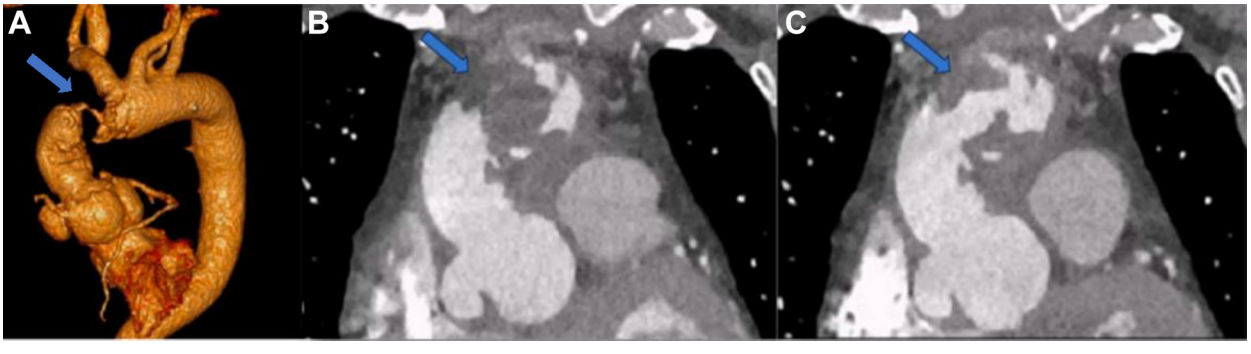
whereas in the left lower limb it was 157/81 mm Hg. Laboratory studies revealed the following: white blood cell count 11.66 × 109/L, C-reactive protein 94.42 mg/L, and erythrocyte sedimentation rate 50 mm/h. Blood culture results were negative.

Electrocardiogram-gated aorta CTA showed that after ascending aorta replacement, the distal anastomosis of the ascending aorta had irregular filling defect in the vessel lumen; the largest diameter of the filling defect was approximately 38 mm. The lumen at the anastomosis is obviously narrow, and the surrounding aortic vessel wall was thickened. Four-dimensional CTA results suggested that vegetations oscillated in the aortic lumen with the cardiac cycle, the lumen of the aortic anastomosis was nearly completely occluded in the end-diastole phase, and it was open during the systole (Figure 1). Meanwhile, the 4-dimensional computed tomography findings revealed poor healing of the sternum with signs of destruction of bone structure at the incision site. Contrast-enhanced magnetic resonance imaging also showed filling defects at the distal anastomosis of the ascending aorta. At the same time, whole-body diffusion-weighted imaging showed high intensity signal at the distal anastomosis of the ascending aorta and behind the sternum on diffusion-weighted imaging, suggesting there was limitation of diffusion at this site. Combined with the medical history, infection was considered first (Figure 2).

MANAGEMENT

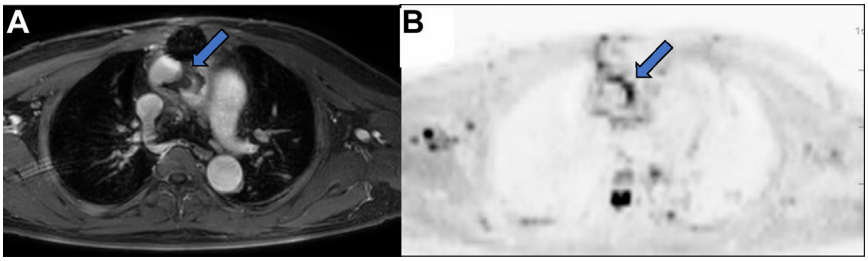
We performed aortic sinuplasty and ascending aorta and total aortic arch replacement in the patient. Extensive pericardial adhesions were seen during the surgery, with purulent secretions around the distal anastomosis of the ascending aortic artificial blood vessel. The artificial blood vessel was adjacent to the sternum, and the infection invaded the sternal stem to the defect of the cortical bone inside the sternal stem. Vegetations growing like cauliflower were seen in the artery near the anastomosis (Figure 3), and grew widely around the anastomosis and the lesser curvature of the aortic arch. Intraoperative rapid freezing pathology revealed thick hyphae that were twisted and folded together, suggesting an infection with Mucor. Postoperative pathology showed spores and hyphae in necrotic tissue (Figures 4A and 4B), with positive Periodic acid-Schiff stain (Figure 4C) and positive Grocott methenamine silver stain (Figure 4D); these results were consistent with fungal infection. The specimens removed during the operation showed a large amount of fungal growth through microbial culture, which was identified as Mucor. Next-generation sequencing was performed by Agene Technology Co Ltd, which further confirmed that the pathogenic microorganism contained in the tissue was Mucor. Postoperative CTA showed that the artificial vessels were unobstructed (Figure 5). After the surgery, the patient started antifungal treatment with

FIGURE 1 Imaging of Aorta Computed Tomography Angiography



(A) Volume reconstruction image of aortic CTA, the distal anastomosis of the ascending aorta was filled with defects and the lumen was severely narrowed (arrow). (B) During diastole, the lumen of the aortic lesion is almost occluded (arrow). (C) During systole, the lumen of the aortic lesion is partially open (arrow).

FIGURE 2 Contrast-Enhanced Magnetic Resonance and Whole-Body Diffusion-Weighted Imaging



(A) Aortic MRA, low signal filling defect can be observed at the aortic anastomosis (arrow). (B) MR WB-DWI imaging (black-and-white flipping), localized high signal is observed in the infected area of the aorta (arrow).

amphotericin B, posaconazole, and fosfomycin. During this period, the patient had intermittent fever with maximum body temperature reaching 38.8 °C. On the 17th day after surgery, the patient's body temperature decreased to 37.2 °C, and there was no fever after drug withdrawal the next day with unremarkable hemogram. The patient was then discharged from the hospital.

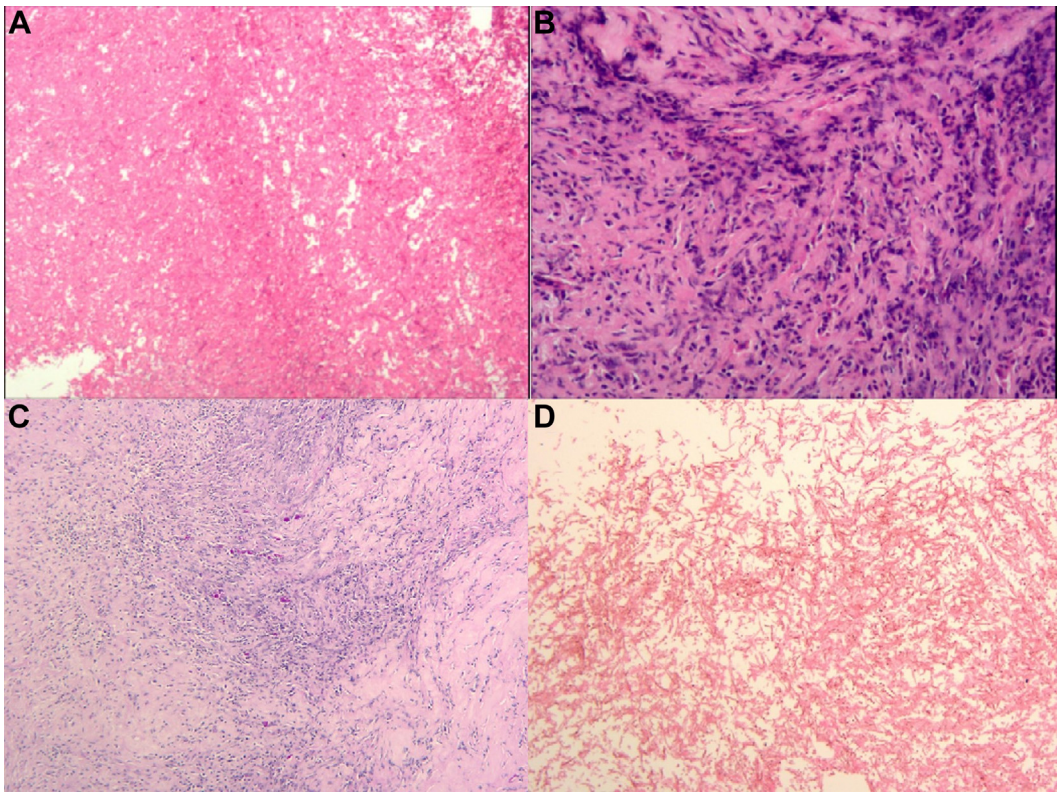
DISCUSSION

Aortic graft infection (AGI) is a rare and fatal postoperative complication after surgery or interventional therapy of aortic disease. The maximum mortality from AGI could be up to 75%, which makes its treatment and prognosis still an exceedingly complex clinical challenge.[1] Lacking a unified and specific definition of AGI, the diagnostic and treatment approaches differ significantly with variable outcomes at present. Anagnostopoulos et al[2] reported that the criteria of AGI diagnosis, based on the expert consensus of the Management of Aortic Graft Infection Collaboration,[3] were efficient both with 93% sensitivity and specificity. According to expert consensus, the European Society for Vascular Surgery[4] reported the 2020 Clinical Practice Guidelines on the Management of Vascular Graft and Endograft Infections. Furthermore, Chinese expert consensus reported in 2019 about the perioperative treatment of thoracic endovascular aortic repair.[5] The AGI diagnostic criteria were classified into 3 categories, which were the same as the Management of Aortic Graft Infection Collaboration: clinical/surgical, radiologic, or laboratory. The radiologic criteria were classified as major and minor. The major criteria consist of perigraft fluid on computed tomography scan 3 months or more after insertion, perigraft gas on computed tomography scan 7 months or more after insertion, and increase in perigraft gas volume. The minor criteria were suspicious perigraft gas/fluid/soft tissue inflammation, aneurysm expansion, and pseudoaneurysm formation. Based on the diagnostic criteria previously mentioned, we were suspicious of AGI in the patient with the clinical/surgical criteria (major) and radiologic/laboratory criteria (minor).

FIGURE 3 Gross Specimen

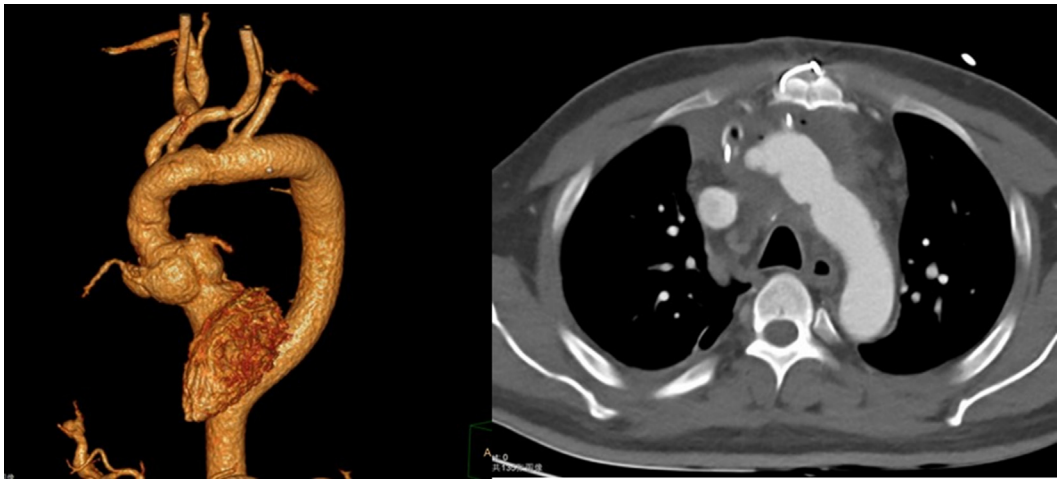
According to the European Society for Vascular Surgery,[4] gram-positive bacteria are up to 58%, gram-negative bacteria are about 34%, and anaerobes are 8% in the responsible microorganisms of graft infection; they did not mention the morbidity of fungal infection. Bakoyiannis et al[6] reported the first case of graft infection due to fungus in 2006. The computed

FIGURE 4 Postoperative Pathology



(A and B) Spores and hyphae were seen in necrotic tissue, which is consistent with fungal infection (×200). (C) Positive periodic acid-Schiff stain (×200). (D) Positive Grocott methenamine silver stain (×200).

FIGURE 5 Postoperative Computed Tomography Angiography



The artificial vessel was unobstructed.

tomography scan demonstrated the characteristic sign of gas within the native aneurysmal sac around the stent graft, which satisfied the present radiologic criteria (major). However, the case of fungal infection we reported is rare in clinical diagnosis because it did not conform to radiologic criteria. In this case, no clear perigraft gas/fluid was observed on computed tomography scan, while presenting the growth of bacterial embolus in the vascular lumen infiltrated extravascular, which increased the difficulty of diagnosis to some extent.

Aorta CTA is the preferred approach for graft infection diagnosis. Electrocardiogram-gating CTA, on the patient examined, could collect a cardiac cycle image, which clarified the influence and activity of vegetation on the lumen. Furthermore, positron emission tomography/computed tomography and magnetic resonance imaging could also be applied to evaluate the diagnostic potency of graft infection. A high uptake pattern of ^{18}F-fluorodeoxyglucose activity may help identify endograft infection with a higher sensitivity (more than 90%) and specificity (59%-80%) via ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography.[7] Chakfé et al[4] suggested that magnetic resonance imaging would not be recommended as the first choice in radiologic diagnosis of suspicious infection of AGI. However, Zhang et al[8] demonstrated that focal infection often presents a high signal of diffusion-weighted imaging due to its diffusion, which may contribute to AGI diagnosis. In the present case, according to whole-body diffusion-weighted imaging, we found limited diffusion-weighted imaging high signal in the anastomotic stoma of the distal ascending aorta and sternum based on background suppression, suggesting the possibility of graft infection and making it a shred of potent evidence for diagnosing graft infection.

FOLLOW-UP

The patient was followed up for 6 months after discharge and recovered well without fever.

CONCLUSIONS

AGI caused by fungus is an infrequent postoperative complication. The combination of multimodal imaging and clinical history is helpful for correct diagnosis.

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KEY WORDS aorta, graft infection, imaging diagnosis, surgery