Ruptured Abdominal Aortic Aneurysm Treated with Endovascular Repair in a Patient with Active COVID-19 Infection during the Pandemic

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We report a patient who presented with acute abdominal pain during the COVID-19 pandemic. His work-up revealed rupture of a 5.8 cm abdominal aortic aneurysm. He also had fever, cough, and shortness of breath and radiologic evidence of COVID-19 infection. After careful consideration, he underwent successful endovascular repair under local anesthesia with good short-term results.

INTRODUCTION

In early 2020, the United States health system was inundated with the COVID-19 pandemic. In New York City, the epicenter of the US outbreak, almost all hospital resources were directed toward supporting surge beds for COVID patients. However, vascular surgery emergencies still needed to be addressed. We describe a case of a ruptured abdominal aortic aneurysm (AAA) presenting to a Brooklyn, NY hospital in the middle of the pandemic. Fundamental vascular surgery treatment principles were maintained, with a few special considerations. The patient gave his consent to have his case published.

CASE REPORT

A 54-year-old male presented to the emergency department with one day of abdominal pain. Review of symptoms was notable for fever, cough, and shortness of breath for 5 days. His medical history included hypertension, coronary artery disease, Wolff-Parkinson-White syndrome, and history of left nephrectomy. On presentation, he was febrile to 101.2° Fahrenheit. His heart rate was 96 beats per minute, blood pressure 154/96 mm Hg, and saturation 97% on room air. A computed tomography (CT) showed a ruptured 5.8 cm AAA with hematoma adjacent to the head of the pancreas. The lungs had bilateral, multifocal, peripheral ground glass opacities consistent with COVID-19 infection (Fig. 1). The anatomy was acceptable for endovascular repair with an adequate infrarenal neck and distal landing zones in the common iliac arteries.

The patient was taken emergently to the hybrid operating room (OR) with the intention of performing an endovascular repair (EVAR) under local anesthesia. The procedure was performed with proper personal protective equipment for all OR staff. A Gore Excluder (W. L. Gore & Associates, Flagstaff, AZ) bifurcated endograft was deployed via bilateral percutaneous femoral accesses (preclosed with Perclose ProGlides [Abbott Vascular, Santa Clara, CA]) without complications (Fig. 2). After surgery, the patient was admitted to a monitored surgical floor. He was restarted on aspirin 81 mg daily and clopidogrel 75 mg daily which he had been on for his coronary stents. He was started on hydroxychloroquine and azithromycin at the recommendation of our infectious disease consultants. He was febrile in the 3 days after surgery with a high of 104.0° Fahrenheit, but otherwise had an unremarkable hospital course. His initial COVID-19 PCR from the emergency department came back negative, but repeat testing during the hospitalization was positive. He was discharged to home on postoperative day four, under home quarantine.

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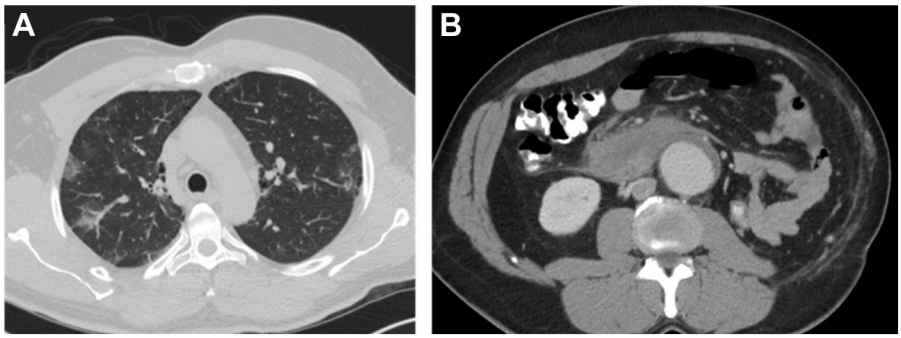

Fig. 1. Preoperative CT. **(A)**, Bilateral ground glass opacities in the lung periphery. **(B)**, Ruptured abdominal aortic aneurysm with adjacent hematoma.

He was seen 2 weeks after surgery without complaints. His CT at that time showed the endograft to be satisfactory position with stable sac size (5.8 cm) and a small type II endoleak. The limbs were widely patent limbs with no mural thrombus. The retroperitoneal hematoma was resolving, as were the ground glass opacities in the lungs (Fig. 3). The patient was enrolled into our standard surveillance protocol, with repeat imaging at 6 months, 12 months, and then yearly after that.

DISCUSSION

The vascular surgeon's role and vascular conditions treated in the COVID-19 pandemic has been varied. Many vascular surgeons have been asked to step out of their usual roles to help out in other ways, such staffing a ''line service'', or filling in as intensivists or hospitalist on COVID units. In the early experience with COVID-19 patients, vascular complications predominantly were thromboembolic in nature, both venous and arterial.[1–3]

Other vascular issues fell by the wayside, and elective vascular surgery was nonexistent. However, both COVID-19-positive and COVID-19-negative patients continued to have need for emergent vascular surgery in the midst of the pandemic. The patient described here was self-quarantining at home with suspected COVID-19 when he ruptured his AAA. We cannot assume that one had to do with another, and we do not suggest there is a relationship between COVID-19 infection and aneurysmal disease. In this patient with relatively good potential for survival, not offering intervention at this juncture was not an option. However, care of the patient with a ruptured aneurysm during this crisis does require special consideration regarding the type of surgery and anesthesia.[4]

His treatment still followed standard protocols for a ruptured aortic aneurysm. Regardless of COVID-19 status, we use an endovascular first approach for ruptured aneurysm, as recommended by the 2018 Society of Vascular Surgery guidelines.[5] During this time, when there was a severe shortage of ventilators and intensive care beds, being able to avoid open surgery was paramount to prevent further reduction of already scarce resources. Fortunately, the patient's anatomy was favorable for an endovascular repair.

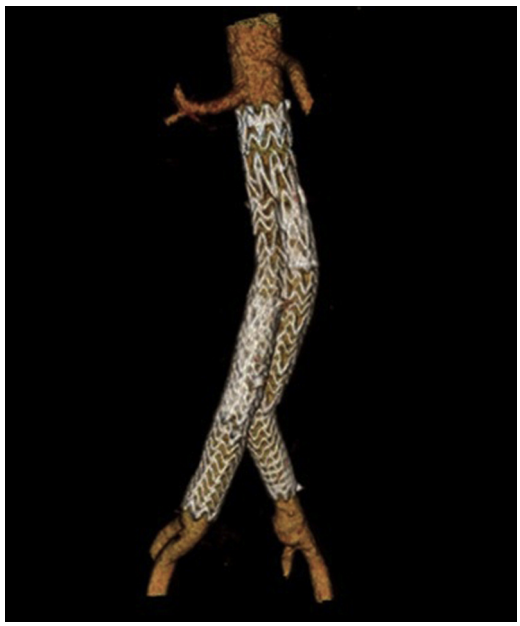

Fig. 2. 3-D reconstruction of completed endovascular repair.

At the time of this patient's presentation, our hospital had already set up 3 dedicated ORs for COVID-19-positive patients, one of which was a hybrid room. These rooms were equipped with portable high efficiency particulate air filtration units. COVID carts were also placed in front of each OR

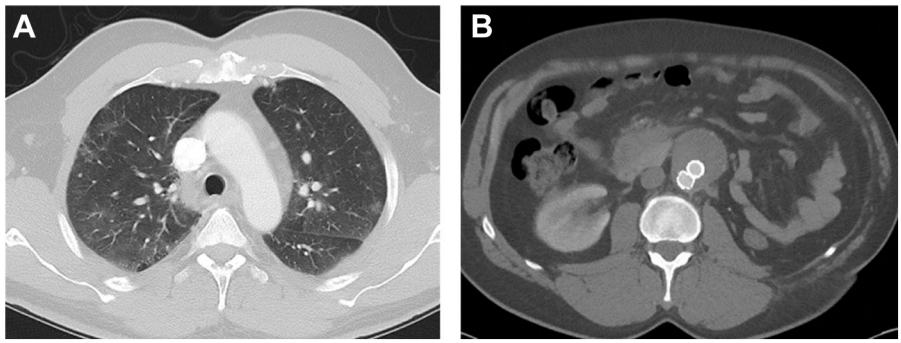

Fig. 3. Follow-up CT. **(A)**, Resolving ground glass opacities. **(B)**, Patent endograft with resolving hematoma.

with bundles of complete personal proactive equipment (PPE). These were given to every staff member who was required to enter the OR. These bundles contained a bouffant cap, an N95 mask, face shield, full body (''bunny'') suit, knee-high shoe covers, and elbow-high latex gloves. After PPE was donned, we ''scrubbed'' the gloves with Avagard (chlorhexidine gluconate 1%/ethyl alcohol 61%), then put on sterile gown and gloves over everything. All nonessential personnel were prohibited from entering the OR. We utilized two circulating nurses, one inside the OR and one outside the OR to prevent repeated entering and exiting. Recovery occurred in the OR, as the regular postanesthesia care unit had already been converted to a COVID intensive care unit. After recovery, patients were transferred to dedicated COVID floors.

The concomitant fever and a viral pneumonia secondary to presumed, and later proven, COVID-19 infection raised additional concerns. Although it is primarily a respiratory infection, some patients develop systemic involvement.[6] The effect of implanting an endograft in an active COVID-19 infection is unknown. The potential increased risk of limb thrombosis was taken into account as these patients are thought to be in a prothrombotic state.[1–3] Considering the risks and benefits, and the available resources, we felt endovascular repair would still be preferable at this time. After the procedure, we immediately resumed aspirin and clopidogrel. Fortunately our patient did not have any thrombotic events. At the time of his presentation, we did not think full anticoagulation was necessary. However, as more and more arterial thrombotic complications are being reported, we feel a short course of anticoagulation after aortic stent graft implantation with either a low molecular weight heparin or novel oral anticoagulant would be justified until the COVID-19 infection is cleared.

Another consideration was the type of anesthesia for the repair. The patient's hemodynamics and mental status gave us the option to perform the case under local anesthesia. Local anesthesia for EVAR of a ruptured AAA correlates to shorter ICU stays, lower pulmonary complications, and lower mortality compared with general anesthesia in a Vascular Quality Initiative database analysis.[7] Equally important, intubation has been shown to be a major aerosol producing procedure, in turn a potential threat all personnel in the operating room.[8] Finally, this would avoid the chance of not being able to extubate after the procedure, thus tying up another ventilator in the hospital. The main reason in favor of general anesthesia would be to avoid an emergent intubation in the middle of the procedure. We had an extensive discussion with our anesthesiologist before bringing the patient into the OR, and for the reasons aforementioned, chose to use local anesthesia for the case thus avoiding intubation and minimizing exposure to the staff.

Finally, we asked our infectious disease colleagues for their recommendations on therapy specifically for the COVID-19 infection. The patient was started on hydroxychloroquine and azithromycin, which was the regimen given to all COVID-19 patients that were admitted to the hospital at that time.

CONCLUSION

Ruptured AAA in COVID-19-positive patients can be treated endovascularly with satisfactory short-term results. This is important as it can often be performed without intubation, thereby minimizing risk of exposure to the surgeon and OR staff. Hospital preparedness during a pandemic is also vital to success in emergent operations. Long-term effects of implanting an endograft during an active COVID-19 infection are unknown and will need to be monitored.

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