

CASE REPORT

Infectious Disease

Acute aortic occlusion associated with COVID-19: A rare complication of a not so rare disease

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Recent literature has reported a high prevalence of thrombotic events associated with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) responsible for causing coronavirus disease 2019 (COVID-19) infection. Although venous thromboembolism complications have been well studied, arterial thrombosis is less well described. Our aim is to describe acute aortoiliac occlusion (AAO), itself a rare condition, as a complication of COVID-19 infection and review existing literature regarding its presentation and available treatment modalities. Over a 2-week span in late 2021, 2 patients with recent COVID-19 infection presented to our tertiary care hospital with AAO. Each case was treated with a multimodal therapeutic approach, including vascular interventional radiology guided thrombolysis, vascular surgical approach, and systemic anticoagulation. Although two separate primary approaches were taken, each resulted in high morbidity and death in both cases. Acute aortic occlusion is a rare disease associated with high morbidity and mortality. COVID-19 has further been associated with arterial thromboembolic complications, including AAO, as presented here. More research is needed to identify patients at highest risk of developing arterial thromboembolic disease after COVID-19 infection as well as to determine ideal therapeutic options in order to improve the exceedingly high morbidity and mortality associated with this complication.

KEYWORDS

acute aortic occlusion, anticoagulation, COVID-19, hypercoagulable, thromboembolism

1 | BACKGROUND

The thrombotic complications of coronavirus disease 2019 COVID-19 have been widely reported. Most research and meta-analyses to date have focused on the risk of venous thromboembolism.¹⁻⁴ More rarely, COVID-19 has been associated with arterial thrombosis.⁵⁻⁷ Acute aortoiliac occlusion (AAO) is itself a rare condition with an incidence estimated to be 3.8 per 1 million person-years.⁸ Mortality ranges from 17% to 52% with optimal management strategies not yet well defined.^{7,9,10}

COVID-19 has been associated with a strikingly high prevalence of coagulopathy leading to major thromboembolic complications including large vessel thrombosis. The systemic inflammatory response caused by the virus induces a hypercoagulable state leading to both micro- and macro-vascular pathologic processes by increasing levels of procoagulant clotting factors, disruption of vascular endothelial cells resulting in microangiopathy and local thrombus formation, and a systemic coagulation imbalance as indicated by various laboratory abnormalities.¹¹⁻¹⁵

Here we present 2 cases of patients with COVID-19 complicated by AAO, the risk factors and typical presentation, and describe

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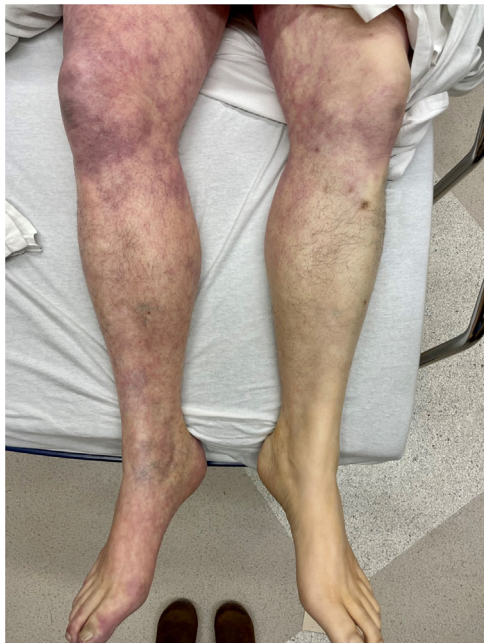


FIGURE 1 Physical examination findings of patient presented in Case 1 with acute aortic occlusion as a result of COVID-19 infection

various therapeutic approaches available to physicians who may encounter similar presentations.

2 | CASE PRESENTATION

Case 1: A 54-year-old male with a past medical history of seizures presented with a chief complaint bilateral lower extremity pain and decreased movement. He reported 2 days of progressive bilateral lower extremity pain, cold sensation, and now decreased movement. He had tested positive for COVID-19 10 days before presentation, although he denied infectious symptoms at the time and had not received any COVID-19 vaccination.

Vitals were notable for a heart rate of 102, blood pressure of 122/100, O₂ saturation in the low 80s on room air improving to 93% on 15 L/min non-rebreather mask. He was noted to be in severe distress, moaning secondary to pain. Bilateral lower extremities had decreased sensation, absent motor function, and were cool without any pulses. The right lower extremity was mottled, but the left was not (Figure 1). At the time of presentation bilateral lower extremity compartments were noted to be soft.

Labs were notable for a leukocytosis of 18.2/nl, creatinine kinase of 4244 unit/L, and lactate of 4.2 mmol/L. Computed tomography (CT) imaging revealed near complete occlusion of the distal aorta and proximal bilateral common iliac arteries secondary to large non-calcified plaque/thrombus (Figure 2). Imaging was negative for acute pulmonary embolism.

A heparin infusion was initiated in the emergency department. Arterial aspiration thrombectomy followed by balloon angioplasty as well as local arterial tissue plasminogen activator (tPA) infusion for residual

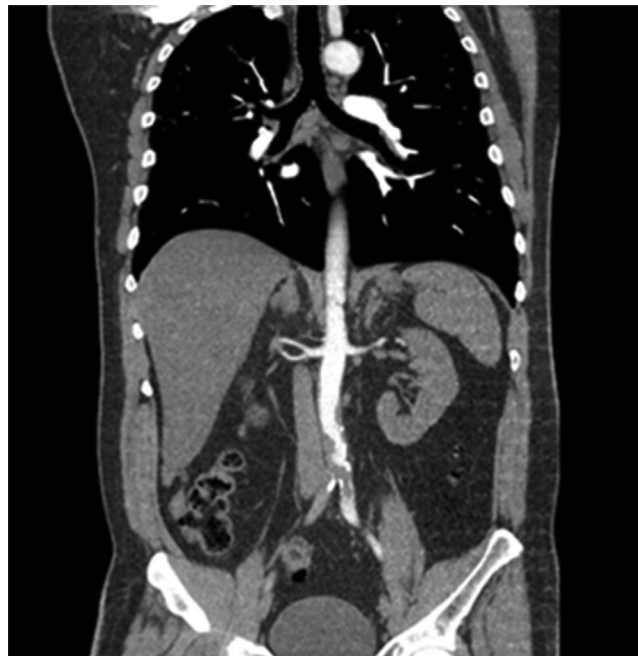


FIGURE 2 Computed tomography angiography (CTA) imaging revealing infrarenal aortic occlusion with extension into the bilateral common iliac arteries

aortoiliac thrombus was performed by vascular interventional radiology. The patient was subsequently admitted to the surgical intensive care unit (ICU) on continued intra-arterial thrombolytic therapy and heparin infusion.

Ultimately the patient had a complicated and prolonged ICU admission. This included left lower extremity (LLE) below-knee amputation and compartment syndrome in the right lower extremity (RLE) requiring 4 compartment fasciotomies, respiratory failure requiring mechanical ventilation, and multi-organ system failure. The patient died on hospital day 15.

Case 2: A 65-year-old female with a history of hypertension and hyperlipidemia presented with RLE numbness and weakness for 1 day. She initially called emergency medical services for pain in her RLE that started acutely that morning; however, by the time of presentation she endorsed primarily numbness and an inability to move her RLE most notably at the foot. She denied any LLE symptoms. She also noted intermittent shortness of breath, although she was unable to provide an exact timeline and had received 1 dose of the mRNA COVID-19 vaccination.

Vitals were notable for tachycardia to the 120s with tachypnea in the 30s saturating 85% on room air. On examination she was anxious appearing, uncomfortable; however, she was not noted to be in extremis. Both lower extremities were cool without palpable or dopplerable pulses. She had absent motor and sensory function in the RLE distal to the knee with a normal LLE motor and sensory examination.

Labs were notable for a leukocytosis of 20.0/nl, lactate of 7.4 mmol/L, creatinine kinase of 208 unit/L, and acute kidney injury with creatinine of 2.28. COVID-19 testing was positive. CT angiography

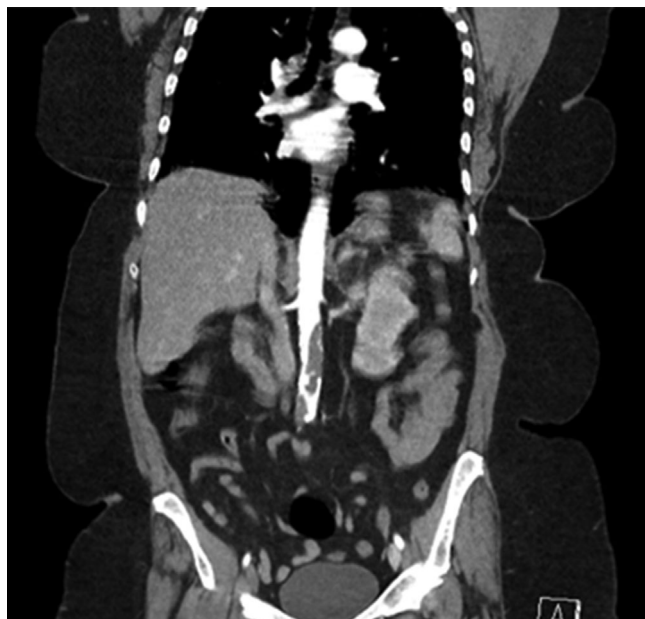


FIGURE 3 Computed tomography angiography (CTA) imaging revealing near occlusive filling defect of the infrarenal aorta seen in Case 2

revealed near occlusive filling defect of the infrarenal abdominal aorta, occlusive filling defect in the right common iliac artery as well as several occlusive defects within the left popliteal region (Figure 3). Moderate and mild degrees of atherosclerotic calcification were seen in the abdominal aorta and lower extremities, respectively.

A heparin infusion was initiated in the ED. Vascular surgery performed bilateral aortoiliac and lower extremity thrombectomies, and RLE 4-compartment fasciotomies.

The patient had a prolonged hospital stay complicated by the development of heparin-induced thrombocytopenia, multidrug resistant bacteremia, and multisystem organ failure and was ultimately transitioned to comfort care before death.

3 | DISCUSSION AND CONCLUSION

We have presented 2 patients with AAO associated with COVID-19. Given its rarity, physicians must have a high index of suspicion by considering both historical risk factors and physical examination findings to appropriately diagnose and treat. Atherosclerosis is the most common cause of both peripheral arterial disease and thrombotic aortoiliac occlusive disease and thus the risk factors are similar: smoking, age, family history, diabetes, hypertension, and hyperlipidemia. The most common cardiac risk factors for embolic disease include atrial fibrillation, congestive heart failure, and mitral valve disease.¹⁰ Prior aortic surgery also appears to be a risk factor with graft/stent occlusion occurring in approximately 15% of cases.⁸ Aortic aneurysm involvement appears to be a less common etiology secondary to earlier surgical management than in earlier decades.¹⁰

Clinical presentation is often sudden and characterized by lower extremity pain, paralysis, paresthesia, poikilothermia, and mottled extremities. CT angiography is currently the preferred imaging study. Prior studies have noted that neurology consultation is often obtained before vascular surgery given that patients often emphasize their motor or sensory deficits, thus delaying time to diagnosis and definitive treatment.^{9,16} This delay in diagnosis and appropriate specialist consultation is important as both mortality and morbidity are related to the duration of ischemia as well as the complications of reperfusion injury.¹⁷

The expected timing of arterial thromboembolic events is uncertain. In a retrospective analysis of COVID-19 patients with limb vascular ischemia, the median time from onset consistent with infection to the development of limb ischemia was 19 days (11–23 days) and another case series reported incidence between days 7–24.^{17,18} As noted previously, 1 patient presented on day 10 after a positive polymerase chain reaction test; however, this patient did not report significant infectious symptoms and so may have in fact been later in his disease course. The second patient did not test positive until the day of admission and did not report significant symptoms before this making the time of onset similarly unclear. Given this lack of data, we recommend physicians have a high index of suspicion for arterial thrombosis in COVID-19 patients regardless of the timing of their infectious onset.

Previously published case reports have shown an association between AAO and COVID-19 infection.^{18,19} Acute aortic thrombosis, as compared with coronary, cerebral, and peripheral arterial thrombosis, is rare and as such there are no specific guidelines on management, which can vary by etiology of occlusion be it embolus, in situ thrombosis of a previously atherosclerotic aorta, or occlusion of prior surgical sites. In a large population based cohort study, Grip et al sited the most common methods for revascularization as being thromboembolectomy (32.0%), thrombolysis (22.4%), axillobifemoral bypass (18.9%), and aorto-bi-iliacal/bifemoral bypass (18.2%). Notably, endovascular techniques became more frequent over time increasing from 15.6% to 43.8% during the 1994–2000 and 2008–2014 time frames, respectively.⁸ In a smaller study, Robinson et al noted a similar range of approaches.²⁰ Interestingly, in-hospital mortality did not vary significantly according to etiology (embolism 38% vs in situ thrombosis 29%, $P = 0.67$); however, it did vary widely according to procedure (transfemoral embolectomy 50%, aortoiliac thrombectomy 100%, axillobifemoral bypass 30%, aortobifemoral bypass 0%, and endovascular therapy 25%, $P = 0.08$).

We were able to find one case report of systemic tPA administration for a patient who presented with acute aortoiliac and lower extremity arterial thrombosis.²¹ tPA was successful in restoring patency of the proximal aortoiliac occlusion, which was followed by open thrombectomies, however the patient died on hospital day 17. It was concluded systemic fibrinolysis may be an adjunct to surgical or endovascular revascularization in patients with extensive arterial thrombosis. Some authors suggest endovascular and intra-arterial thrombolytic therapy may be reserved for those deemed to have an excessively high surgical risk.^{9,17} Dossa et al further highlight all embolic etiology be treated with systemic heparin followed by lifelong systemic anticoagulation

given risk of recurrence, reported 40% in their case series, as well as seeking to determine embolic origin.⁹

In conclusion, a growing volume of literature has reported on the association of COVID-19 infection with thromboembolic complications. Arterial complications including acute aortic occlusion are rarer, less well described, and with less clear ideal treatment options. Timely diagnosis is of the utmost importance and relies on awareness of its presentation, evaluation, and appropriate specialist consultation. Given the morbidity and mortality associated with acute aortic occlusive disease described here, more research is needed to identify patients at highest risk of developing arterial thromboembolic disease, as well as to determine and clearly define ideal therapeutic approaches for this patient population.

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