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Case Report

Successful treatment of ascending aortic thrombosis associated with coronavirus disease 2019: Case report

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ABSTRACT

Coronavirus disease 2019 (COVID-19) has been associated with arterial thrombosis, including aortic thrombus with embolism as well as venous thrombosis. We report a case of a 59-year-old man with COVID-19 showing thrombus in the ascending aorta and occlusion of the lower limb artery on computed tomography. Anticoagulant therapy via continuous intravenous infusion of heparin was started with a therapeutic target range (activated partial thromboplastin time 42–70 s, 1.5–2.5 × patient baseline). The patient was then transferred to warfarin medication and prothrombin time-international normalized ratio was managed at 1.5–2.5. The disappearance of the thrombus was confirmed on the 20th day after starting anticoagulant therapy. Anticoagulant therapy was then discontinued, and computed tomography angiography (CTA) 3 months later showed no recurrence of aortic thrombi or embolism. Anticoagulant therapy alone may be considered for arterial thrombosis in COVID-19 and follow-up CT may allow for early discontinuation of anticoagulant therapy to confirm disappearance of thrombus.

Learning objective: Coronavirus disease 2019 (COVID-19) is recognized to cause arterial thrombosis as well as venous thrombosis. However, treatment of aortic thrombosis in patients with COVID-19 has not yet been established. Anticoagulants alone may be effective against aortic thrombi in patients with COVID-19 and follow-up computed tomography may allow for early discontinuation of anticoagulant therapy to confirm disappearance of thrombus.

Introduction

Coronavirus disease 2019 (COVID-19) has been associated with arterial thrombosis as well as venous thrombosis, and aortic thrombi with embolism have been reported [1–3]. Surgical or anticoagulant treatment of aortic thrombosis associated with COVID-19 has been reported in some cases [1–3]. A case of aortic thrombosis associated with COVID-19 with good outcome after 3 months of antiplatelet and anticoagulation therapy has also been reported [1], but there is no consensus. In this report, we present a case of aortic thrombi and occlusion of lower extremity arteries during COVID-19 infection, which was treated with anticoagulation alone, and after computed tomography angiography (CTA) showed disappearance of the thrombi, anticoagulation was stopped early, and no recurrence of arterial thrombi or embolism was observed thereafter.

Case report

A 56-year-old man with hypertension, dyslipidemia, and hyperuricemia presented with one-week history of fever, fatigue, and dyspnea, and was diagnosed with COVID-19 in early May 2021. He was treated at home; however he was hospitalized due to worsening blood oxygen level (<90 % on 5 L/min of oxygen) after a week. He was treated for COVID-19 with dexamethasone 6 mg daily, tocilizumab 640 mg daily. He had been receiving subcutaneous injections of 5000 units of heparin twice a day to prevent thrombosis, but it was discontinued on day 9 of hospitalization when blood sputum appeared. On day 14 of hospitalization, numbness, and coldness in the sole of the foot and poor palpation of the dorsal foot artery were observed. CTA showed poor contrast in the left posterior tibial artery (Fig. 1) and an 11-mm long thrombus in the ascending aorta (Fig. 2A, C), and a 1-mm long thrombus in the descending thoracic aorta (Fig. 2B, C). The patient was then transferred to our hospital on the 15th day. He complained of coldness, numbness, and pain with left predominance below the bilateral ankles. Vital signs revealed his condition was stable at 36.8 °C, blood pressure was 139/96 mmHg, normocardia with a pulse of 75 beats/min. His respiratory rate

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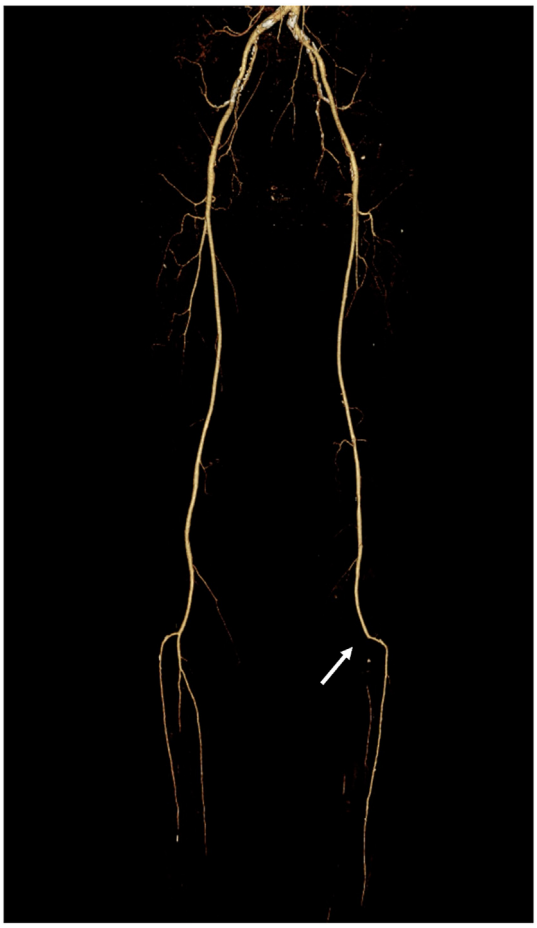

Fig. 1. Lower limb arterial occlusion in CTA. CTA 3D reconstructed image, with arrow showing occlusion of left posterior tibial artery.
CTA, computed tomography angiography.

was normal at 18 breaths/min, but blood oxygen level was 96 % on 8 L/min of oxygen via an oxygen mask. Physical examination revealed palpable bilateral popliteal arteries, but no bilateral palpability in the dorsalis pedis arteries. There was sensation of coldness distal to the ankles, but no sensory disturbance, color deficiency, or livedo. Doppler signals were not audible in the posterior tibial and dorsal foot arteries on the left, and only in the dorsal foot artery on the right. Cardiac auscultation revealed no audible murmur.

Blood tests in our hospital revealed leukocytosis (14.9×10^9/L; normal range, 3.9–9.8$\times$ 10^9/L), and hyponatremia (126 mEq/L; normal range 136–148 mEq/L). C-reactive protein and creatine kinase levels were normal. D-Dimer was increased (18.83 μg/L; normal range, 0–0.99 μg/L), activated partial thromboplastin time (aPTT) was normal at 27.7 s (normal range, 24.3–38.9 s), and platelet count was normal. The coagulation system screening revealed increased anti-cardiolipin antibody IgG (48.8 U/mL, normal range, 0–9.9 U/mL) and anti-cardiolipin-beta2-glycoprotein I complex antibody (4.1 U/mL, normal range, 0–3.5 U/mL) levels, while lupus anticoagulant, protein C, protein S, and antithrombin III were in normal ranges. The electrocardiogram showed no abnormalities.

Surgical thrombectomy for lower limb ischemia was not indicated because >24 h had passed since the onset of symptoms, the physical examination showed no loss of color or sensation in the feet, and blood tests showed no elevation of myogenic enzymes. The ascending aortic thrombus was 11-mm long, with a high risk of embolism, and surgical thrombectomy was considered, but the risk of general anesthesia was assumed to be high due to the severe pulmonary damage caused by COVID-19. Anticoagulant therapy via continuous intravenous infusion of heparin was started with a therapeutic target range (aPTT 42–70 s, 1.5–2.5 × patient baseline). The patient was then transferred to warfarin medication and prothrombin time-international normalized ratio was managed at 1.5–2.5. For lower limb arterial occlusive disease, intravenous alprostadil, oral lima prost alphadex, and tramadol hydrochloride were started; subsequently his symptoms improved with no further elevation of myogenic enzymes. On the 20th day since transfer to our hospital, CTA revealed no thrombus in the ascending aorta and the distal thoracic aorta, with no appearance of embolic symptoms. Warfarin therapy was discontinued because D-dimer was negative and the thrombus had disappeared. There was no recurrence of blood sputum during the therapeutic administration of heparin and warfarin for ascending aortic thrombosis. The patient was discharged on the 27th day since transfer to our hospital, because he no longer required oxygen support on exertion, and living indoors was possible. CTA 3 months after discharge showed no recurrence of thrombus and no appearance of thrombosis.

Discussion

Ascending aortic thrombi associated with COVID-19 have been reported [1–3], but effective treatment has not been established. Follow-up CT, as in this case, may allow early discontinuation of anticoagulation therapy.

Regarding the thrombo-embolic events observed in COVID-19, an underlying coagulopathy is strongly suspected. Viral infections may be responsible for the imbalance in coagulation, increasing the overall risk of thrombosis [4]. Increased von Willebrand factor and expression of tissue factor and Toll-like receptors contribute to the procoagulant state [4]. In addition, one study showed that about 52 % of patients hospitalized with COVID-19 tested positive for at least one type of antiphospholipid antibodies [5]. However, the interpretation of this result is limited due to the acute inflammatory state and the treatment with heparin, which may result in false positives [6].

The etiology of thrombus in ascending aorta is unclear, but atherosclerosis or debris on atherosclerotic plaques was thought to be the most frequent cause. Laperche et al. described 23 cases of thrombi of the aorta, and in 21 cases, pathological examination revealed small atherosclerotic plaques [7]. Our patient had some atherosclerosis distal to the abdominal aorta on CTA, in the absence of any sign of aortic disease in the area of thrombus attachment.

There is no consensus about the treatment of ascending aortic thrombosis associated with COVID-19. In general, arterial thrombosis in the ascending aorta is associated with a higher risk of recurrence [8], and surgery is often performed for ascending aortic thrombosis associated with COVID-19 [2,3]. Also, anticoagulant therapy alone successfully treated ascending aortic thrombosis associated with COVID-19 without new embolisms in some cases [1,2]. Ascending aortic thrombosis is associated with a high risk of embolism and often requires surgery, while in the case of aortic thrombosis associated with COVID-19, the risk of surgery under general anesthesia is often high due to severe lung damage caused by COVID-19. Surgical treatment for embolism or ascending aortic thrombosis may be considered if the embolism is fatal or if the condition of the patient, especially pulmonary function, can allow the patient to tolerate surgery under general anesthesia. Anticoagulant therapy may be considered if the embolism is not fatal or if the general condition prevents the patient from undergoing surgery under general anesthesia. However, the duration of anticoagulant therapy is recommended for 90 days for venous thrombosis associated with COVID-19 [9], but is not clear for arterial thrombosis. In addition, the previous report did not confirm the thrombus condition in the ascending aorta on CT after the initiation of anticoagulation therapy, and it is possible that embolism may have occurred without symptoms or that the thrombus may have disappeared early in the course of the disease. In this case, myogenic enzymes were not elevated, and lung injury due to COVID-19 was observed, and the patient was treated

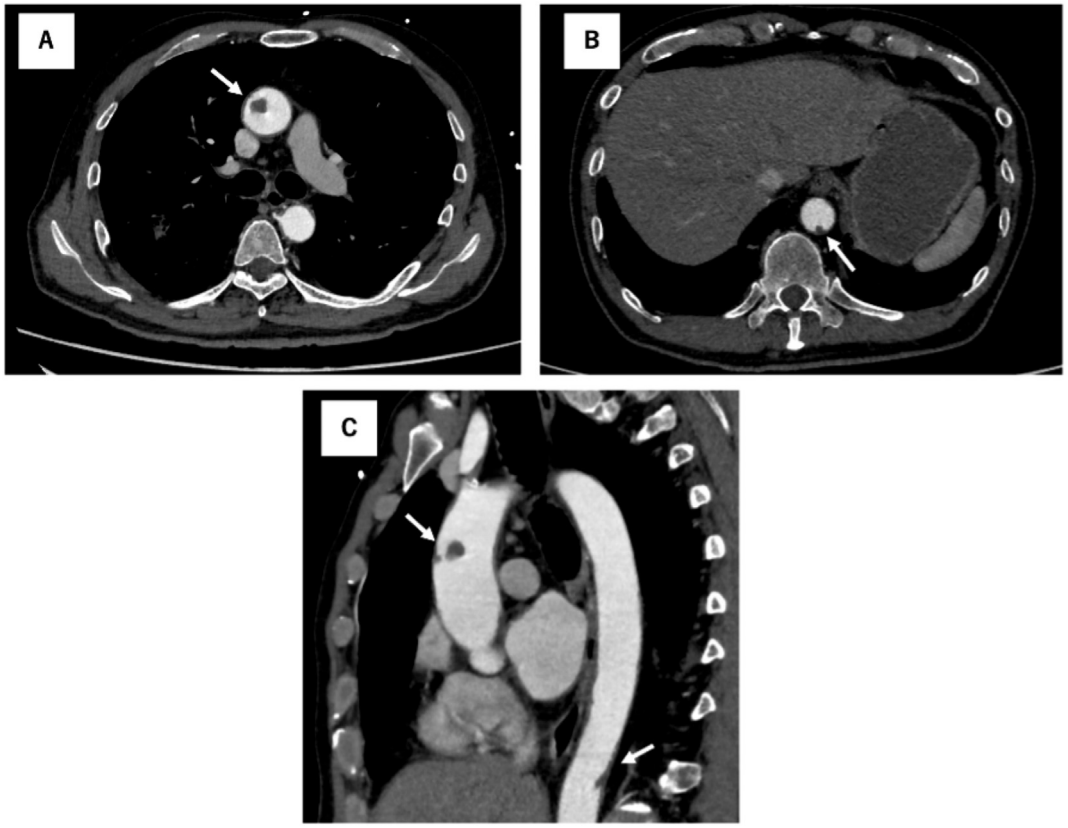

Fig. 2. Aortic thrombi in CTA. (A) CTA in the axial view, with arrow showing thrombus in the ascending aorta. (B) CTA in the axial view, with arrow showing thrombus in the descending thoracic aorta. (C) CTA in the sagittal view, with arrows showing thrombi in the ascending and descending thoracic aorta.
CTA, computed tomography angiography.

with anticoagulant therapy. Blood sputum was observed during the course of the disease, and it was not safe to continue anticoagulation therapy. Therefore, anticoagulant therapy was discontinued after CT revealed disappearance of the thrombus, and CT showed no recurrence of thrombus or new embolisms 3 months later. Follow-up CT may be useful to determine the duration of anticoagulant therapy for ascending aortic thrombosis associated with COVID-19.

Conclusion

Ascending aortic thrombus is a hazardous condition with high potential of thromboembolic complications. COVID-19 could be considered a significant risk factor, leading to coagulopathy and hypercoagulable state with increased risk of thrombosis and embolism. For aortic thrombosis, surgical thrombectomy is considered, but in patients with COVID-19, the risk of general anesthesia is higher than usual due to pulmonary damage, and treatment with anticoagulants alone may be reasonable. Follow-up CT may be useful to determine the duration of anticoagulant therapy for arterial thrombosis associated with COVID-19.

Declaration of competing interest

The authors declare that there is no conflict of interest.

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