COVID-19 and Aortic Thrombus: A Deadly Combination

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ABSTRACT

Background: Coronavirus disease 2019 (COVID-19) continues to be associated with additional presentations and complications. COVID-19 can affect the extra-pulmonary system and alter the pathophysiology of the arteriovenous system leading to thromboembolic complications. We present here a case of COVID-19 associated with aortic arch thrombus in a patient on anticoagulants.

Case report: A 58-year-old male with diabetes mellitus and bronchial asthma was admitted to the intensive care unit (ICU) with severe acute respiratory syndrome where he was immediately placed on antivirals and antibiotics as well as therapeutic doses of anticoagulants. In the 8th day of admission, he was found to have elevated D-dimer and inflammatory markers. His chest radiography showed worsening bilateral air space opacities particularly in the periphery of the left lung. Computed tomography (CT) angiography of the pulmonary arteries (CTPA) revealed acute thrombus in the aortic arch with bilateral extensive pulmonary consolidations and ground glass opacities. He was immediately placed on heparin infusion and discharged on the 18th day in stable conditions.

Conclusion: Despite the administration prophylactic dose of anticoagulants, COVID-19 patients have the risk of developing arterial or venous thrombosis that can lead to an urgent need to understand the process of this complication to reduce delayed diagnosis and mortality.

Keywords: COVID-19, Aortic thrombus, Elevated D-dimer, Anticoagulants

INTRODUCTION

The COVID-19 has now affected nearly 187 million people worldwide and 276,000 in Bahrain. The mortality is more than 4 million worldwide and 1,300 in Bahrain[1]. COVID-19 has a variety of systemic manifestations ranging from asymptomatic carriers to severe respiratory distress and multiple organ dysfunction. Many reports also show a hypercoagulable state associated with COVID-19 infection that could be caused by antiphospholipid antibodies and vascular endothelial inflammation through a unique mechanism of thrombo-inflammation triggered by viral infection, thus leading to a cytokine storm, complement activation, and endotheliitis[2-4]. We present here a case referred to our institution for ICU care with severe respiratory distress due to COVID-19 with severe hypoxemia and increased oxygen requirement that was later complicated with an aortic arch thrombosis.

METHODS

Data was obtained retrospectively from our institution's medical records in addition to the direct encounter with the patient. This case was admitted in the field intensive care unit of the Bahrain Defence Force hospital. No similar cases have been presented in the same unit during the pandemic. Patient's consent was taken. The patient's personal information was kept private.

CASE REPORT

A 58-year-old male was diagnosed with COVID-19 via a polymerase chain reaction (PCR) nasopharyngeal swab test. He was admitted to the field intensive care unit (ICU) because of increased oxygen requirements and increased severity of symptoms. He was known to have type two diabetes mellitus and bronchial asthma. He did not receive any vaccine against COVID-19. His social history was insignificant. Upon arrival to the intensive care unit (ICU), he was on a non-rebreather mask, and his oxygen saturation was maintained at the beginning.

Laboratory evaluations initially showed leucocytosis with neutrophils predominance and elevation of D-dimer, fibrinogen, C-reactive protein, ferritin, and interleukin-6. His initial chest radiography showed bilateral increased broncho vascular markings. He was kept on a venturi mask on the second day of admission and maintained oxygen saturation above 90% until the 8th day of admission when he developed hypoxemia and was kept on a high flow nasal cannula. He clinically presented with drowsiness and slurred speech later the same day.

The neurological examination revealed no sensory or motor deficits. Bilateral carotid and axillary arteries pulses were present in addition to the bilateral radial pulses. There were no acute changes in the blood pressure. Laboratory investigations showed a white blood cell count of 10.88 with 89.1% of neutrophils, markedly elevated D-dimer, and increased fibrinogen. High inflammatory markers were noted including C-reactive protein, lactate, ferritin, and lactic dehydrogenase. Following the laboratory results, echocardiogram (ECHO) and radiological studies were done for further evaluation. The ECHO was unremarkable with an ejection fraction of 60%. Chest radiography showed worsening appearance of the air space opacities particularly in the left lung. Non-contrast computerized tomography (CT) scan of the brain was done to exclude any acute cerebrovascular insults which was negative. Computed tomographic pulmonary angiography (CTPA) was done as well and revealed acute mural thrombus in the aortic arch with

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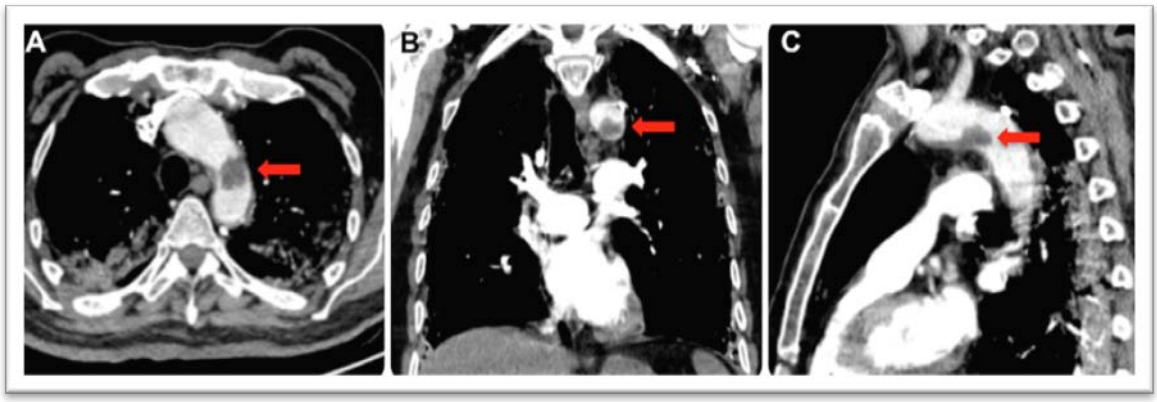

Figure 1: Computed tomographic pulmonary angiography (CTPA) shows an acute mural thrombus in the aortic arch

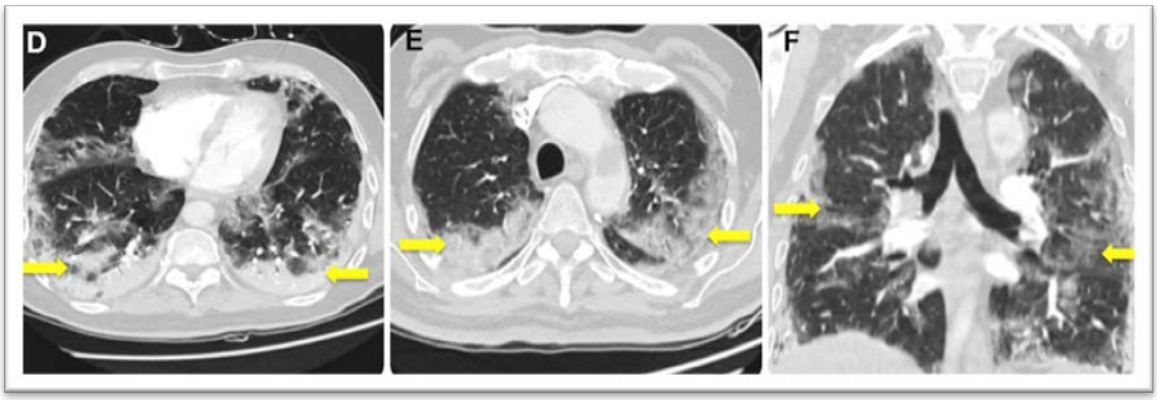

Figure 2: Lung window images of CTPA show extensive pulmonary COVID-19 changes demonstrated as bilateral pulmonary air bronchograms and ground glass opacities

no evidence of any filling defect in the pulmonary arteries including segmental and subsegmental branches (Figure 1).

There were also extensive pulmonary COVID-19 changes that presented as bilateral pulmonary air bronchograms and ground glass opacities as shown in the lung window images of the mentioned study (Figure 2). The patient received antiviral and antibiotics medications during admission in addition to steroid and vitamins. He was placed on a therapeutic dose of anticoagulant on the first day of admission as prevention. This was replaced by heparin infusion immediately after the diagnosis of aortic arch thrombus. The patient remained in the hospital for 18 days. He clinically improved, and oxygen supply was tapered down until he maintained oxygen saturation on room air. His laboratory results and chest radiography showed improvement relative to prior evaluations. He was discharged from the facility on anticoagulants and advised to follow up in the outpatient vascular clinic.

DISCUSSION

The accumulative reports and studies published on COVID-19 have shown a variety of manifestations with multisystem involvement. One of these is the cardiovascular system leading to thrombotic events causing deep venous thrombosis, pulmonary embolism, peripheral ischemia, as well as ischemic organ damage. Recent observational reports and studies showed a strong association between COVID-19 infection and hypercoagulable state leading to thrombo-embolic events in arteriovenous system[4]. Despite prophylactic and therapeutic doses of anticoagulants such as enoxaparin, patients still show evidence of thrombosis that raises questions about the unusual pathophysiologic associations with COVID-19 infection. It is known that critical illnesses, sepsis, and long hospitalization are related to hypercoagulable state, and it appears that COVID-19 contributes to a hypercoagulable state but with a different pattern[5].

Studies have shown an association of COVID-19 with inflammatory thrombosis including a correlation with elevated inflammatory markers such as C-reactive protein, lactic dehydrogenase, ferritin, interleukin-6, and D-dimer as well as elevated levels of fibrinogen, factor VIII, and von Willebrand factor (vWF)[6-8].

Excessive release of cytokines is associated with thrombosis formation through induction of neutrophils, monocytes, as well as the endothelium: These eventually lead to a prothrombotic state. High levels of cytokine release were noted in patients with severe COVID-19 infection including increased levels of tumour necrosis factor (TNF), interleukin-6, and interleukin-7[9]. These cases were associated with severe illness and death in many studies[10-12]. The COVID-19-associated cytokine storm has a good response to corticosteroid therapy and was used in the management in our case[13]. The use of IL-6 antagonists such as tocilizumab, sarilumab, and siltuximab also showed a reduction in the cytokine production in cases of COVID-19; such therapy promotes better outcome and prevents acute respiratory distress syndrome (ARDS)[14].

A recent retrospective analysis study conducted over 11-week period from March 1, 2020 to May 15, 2020 at 7 hospitals within Northwell Health in New York State, USA detected 49 patients of 12,630 confirmed COVID-19 patients with arterial thromboembolism. The most common pre-existing conditions were hypertension and diabetes at 53% and 35% respectively. This study also reported the anatomical

distribution of the thromboembolisms: upper and lower extremity ischemia in 14% and 71% of patients, respectively; bowel ischemia in 4%; and cerebral ischemia in 10%. Another 12% of these patients had a thrombus in multiple locations. Moreover, 16% of them presented with deep vein thrombosis and arterial thrombus concomitantly. The study also reported that 55% of these patients developed the ischemic event while in hospital after the diagnosis of COVID-19, but 45% of them presented with signs of acute arterial ischemia and were later diagnosed with COVID-19[15].

Another retrospective multicentric study conducted in three centres between France and Italy from March 8th to April 25th, 2020 included 209 admitted patients and reported that 9.6% of patients suffered from arterial thrombosis. Two patients were discovered to have aortic thrombosis[16].

A systematic review of 27 articles conducted between November 1, 2019, and June 9, 2020 showed that arterial thrombosis developed in approximately 4% of critically ill patient in the intensive care unit who were admitted with COVID-19 infection. More than 95% were symptomatic with arterial thrombosis, and 18% of them showed multiple arterial involvement. Of the 90 COVID-19 patients included in the study, 19% were reported to have a thrombus in the great vessels (aorta, common iliac, common carotid, and brachiocephalic trunk) with a mortality rate near 20%[17].

The Journal of Emergency Medicine reported a case of aortic arch thrombus and pulmonary embolism in a 53-year-old medically-free woman with COVID-19 at Southside Hospital at Northwell Health, New York. She presented with 10 days of dyspnoea, fever, cough, and hypoxemia in which she was treated successfully with unfractionated heparin, alteplase, and argatroban[18]. Our study confirms what was reported in the literature and the importance of reporting such cases during pandemic. All previous studies agreed the association between COVID-19 and thrombosis which our study highlighted the significance of this association despite being the patient on high dose anticoagulants. In our case, pharmacological management was preferred over surgical intervention because the patient was maintaining stable blood pressure and pulse with good response to heparin therapy eventually leading to clinical improvement. As patient was improving with heparin therapy, there was no indication to change it or add another modality of treatment.

Despite the pharmacological and interventional management of such cases, COVID-19-associated thrombosis is considered a life-threatening condition that requires proper investigation for early detection.

CONCLUSION

Though many of these patients were already on prophylactic dose of anticoagulants, many of them developed arterial or venous thrombosis, which underscores the urgent need to understand and properly manage this phenomenon. In such cases, the management could either be medical or surgical depending on the scenario and the anatomical distribution of the attack; however, there is no definitive agreement on the management of the aortic thrombus and a lack of reports or studies describing evidence-based treatment. Many cases result in limb loss, organ infarction, or even death.

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Competing Interest: None

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