



# Upper extremity arterial thromboembolism in a patient with severe COVID-19 pneumonia: A case report

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Novel coronavirus disease (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) that often affects the upper respiratory tract.<sup>[1]</sup> It was declared as pandemic by the World Health Organization (WHO) on March 11<sup>th</sup>, 2020. As of January 2021, nearly 100 million cases and more than 2 million deaths have been reported.<sup>[2]</sup>

Although COVID-19 primarily affects the respiratory system, it can affect multiple organ systems in certain cases, leading to serious complications, such as acute respiratory distress syndrome (ARDS) and multiple organ failure.<sup>[3]</sup> Nearly 20 to 55% of patients with COVID-19 experience coagulation disorders that cause high mortality in line with the severity of the clinical picture.<sup>[4]</sup> Mortality in patients with thrombotic events requiring intensive care is 5.4 times higher than that in such patients without

## ABSTRACT

Although novel coronavirus-2019 (COVID-19) primarily affects the respiratory system, it can affect multiple organ systems, leading to serious complications, such as acute respiratory distress syndrome (ARDS) and multiple organ failure. Nearly 20 to 55% of patients with COVID-19 experience coagulation disorders that cause high mortality in line with the severity of the clinical picture. Thromboembolism can be observed in both venous and arterial systems. The vast majority of thromboembolic events are associated with the venous system and are often observed as pulmonary embolism. Arterial thromboembolisms often involve the arteries in the lower extremities, followed by those in the upper extremities. Herein, we report a rare case of COVID-19 pneumonia whose left arm was amputated at the forearm level after arterial thromboembolism in the left upper extremity. This case report is valuable, as it is the first reported case of upper extremity arterial thromboembolism in Turkey, as well as the only case in the literature in which the patient underwent four surgical interventions and is still alive.

**Keywords:** Amputation, arterial thromboembolism, coagulopathy, COVID-19, upper extremity.

this condition.<sup>[5]</sup> Thromboembolism can be observed in both venous and arterial systems. The vast majority of thromboembolic events are associated with the venous system and are often observed as pulmonary embolism.<sup>[6]</sup> Arterial thromboembolisms often involve the arteries in the lower extremities, followed by those in the upper extremities.<sup>[7]</sup>

Herein, we report a rare case of COVID-19 pneumonia whose left arm was amputated at the forearm level after arterial thromboembolism in the left upper extremity, despite receiving anticoagulant treatment in the intensive care unit (ICU), and was discharged with recovery after treatment. This case report is valuable, as it is the first reported case of upper extremity arterial thromboembolism in Turkey, as well as the only case in the literature in which the

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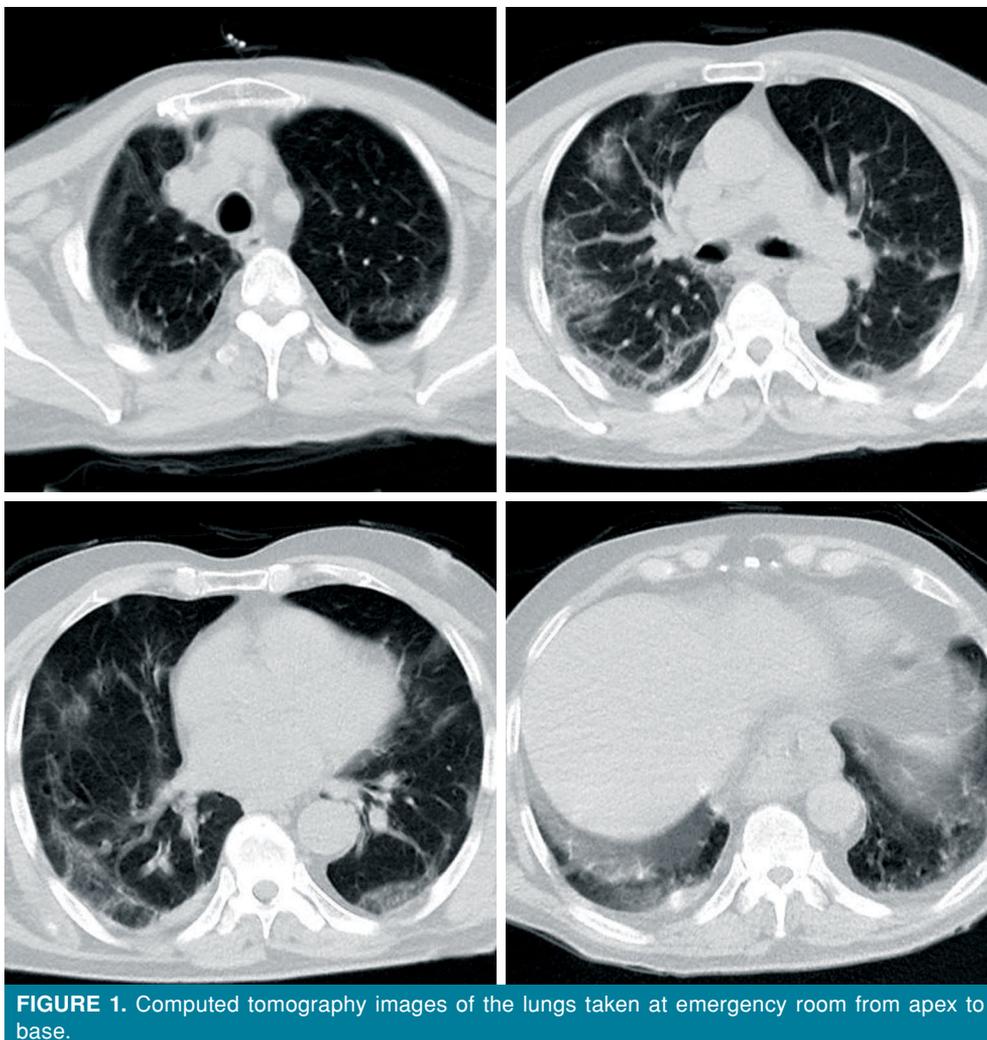
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patient underwent four surgical interventions and is still alive.<sup>[8]</sup>

### CASE REPORT

A 73-year-old male patient with poor general condition presented to the emergency department on November 13<sup>th</sup>, 2020 with the complaint of dyspnea. The patient had no history of additional diseases other than hypertension and benign prostatic hyperplasia (BPH); however, he received no permanent antihypertensive treatment. The patient was evaluated with a preliminary diagnosis of COVID-19 pneumonia and underwent thoracic computed tomography (CT) in the emergency department. Multiple bilateral ground-glass opacities and areas of consolidation were observed on CT images. The clinical condition of the patient was compatible with that of severe ARDS (Figure 1). Although the patient was given oxygen

with a Venturi mask at 16 L/min in the emergency department, oxygen saturation was <85%, and the patient was shifted to the ICU with the diagnosis of COVID-19 pneumonia. Based on laboratory parameters of the patient assessed during hospitalization in ICU, activated partial thromboplastin time (aPTT) and international normalized ratio (INR) increased. In addition, D-dimer and ferritin levels were above normal. The platelet count was within normal limit (Table I). During the ICU follow-up, high-flow oxygen and intermittent non-invasive ventilation-continuous positive airway pressure (NIV-CPAP) therapy was initiated with a Venturi mask. On Day 5 of hospitalization, the patient had severe pain in the left arm and, on physical examination, the extremity was found to be cold with the development of cyanosis in the distal part, particularly in the fingers. Nevertheless, brachial and radial pulses could not be detected. The patient underwent consultation at



**FIGURE 1.** Computed tomography images of the lungs taken at emergency room from apex to base.

**TABLE I**  
Preoperative laboratory findings

Test	Result	Reference
INR	1.68	0.8-1.5
aPTT	79.9	20-40
D-Dimer, µg/mL	0.93	0-0.5
Ferritin, ng/mL	>2000	22-322
Platelets, K/mm <sup>3</sup>	131.0	130-424

INR: International normalized ratio; aPTT: Activated partial thromboplastin time.

cardiovascular surgery clinic to evaluate the possible vascular pathology. The CT-angiography showed the lack of blood flow in the distal end of the left brachial artery (Figure 2). The cardiovascular surgery clinic planned emergency revascularization for the patient.

An incision was made in the left antecubital region under the infraclavicular block. After the radial and ulnar arteries were explored, arteriotomy was performed. Distal and proximal thrombectomy was performed using a 3-Fr Fogarty® catheter. An abundant organized thrombus material was removed. The upper extremities were palpated to detect distal pulses, and cyanosis in the hand began to decrease. Heparin infusion was started, and the patient was transferred to the ICU. Cyanosis in the hand increased again



**FIGURE 2.** A computed tomography angiography image before the first thromboembolectomy.

12 h after the operation, and repeated thrombectomy was planned for the patient. The thrombus material developing in the radial and ulnar arteries was cleaned with a 3-Fr Fogarty® catheter by entering from the previous incision under the left infraclavicular block. The upper extremities were palpated to detect distal pulses, and the patient was transferred to the ICU. Heparin infusion was administered for one week with follow-up measurement of INR. Afterward, warfarin and low-molecular-weight heparin (LMWH) were simultaneously initiated. Despite all medical and surgical treatments, ischemia persisted in the distal part of the extremity, and a demarcation line started to form (Figure 3). With the recommendations of the cardiovascular surgery clinic, amputation was decided as the treatment course, and the orthopedics and traumatology clinic was consulted for amputation.

On Day 13<sup>th</sup> after the second thrombectomy, the left arm of the patient was amputated under the left infraclavicular block at the level of the distal forearm. On Day 6 after amputation, the patient was discharged from the ICU and transferred to the pandemic ward, since the patient did not require NIV-CPAP therapy. Oxygen saturation was 90% (after administration of oxygen treatment at 2 to 3 L/min with nasal cannulation), and arterial blood gas levels were within normal limits.

During follow-up in the pandemic ward, the patient underwent consultation with an orthopedic and traumatology specialist due to necrosis at the



**FIGURE 3.** Clinical appearance before amputation.



**FIGURE 4.** Clinical appearance before stump revision.

wound site. Stump revision was planned for the patient (Figure 4). After receiving a negative polymerase chain reaction result for COVID-19 and completing COVID-19 treatment, the patient was transferred to the orthopedics and traumatology clinic. Stump revision was performed under infraclavicular block 22 days after the first amputation, and the amputation level was raised to the proximal forearm level. The patient whose wound site was clean during the ward follow-up was discharged with recovery on Day 10 after surgery. No complications were observed during follow-up in the postoperative three weeks.

A written informed consent was obtained from the patient for all diagnostic and therapeutic procedures. The patient and his family were informed that data from the case would be submitted for publication and gave their consent.

## DISCUSSION

It has been demonstrated that COVID-19 affects almost every organ system and causes significant morbidity and mortality. Currently, there is a growing number of evidence in the literature that severe COVID-19 infection causes hypercoagulability that is unlike other infection-related coagulopathies.<sup>[4,9]</sup> Hypercoagulability may cause pulmonary and deep vein thrombosis, as well as peripheral artery thromboembolism in critically ill patients, despite anticagulant therapy.<sup>[10]</sup> A significant elevation of D-dimer and fibrinogen levels with prolonged prothrombin time and aPTT times is

frequently reported as hemostatic abnormalities in patients with COVID-19 and have been associated with poor survival rates.<sup>[11]</sup>

Autopsy studies of patients who died from COVID-19 have shown the presence of generalized thrombotic microangiopathy that predominantly affects older males with cardiovascular comorbidities.<sup>[12]</sup> However, acute limb ischemia has been also reported in young patients without comorbidities and in those receiving prophylactic LMWH therapy.<sup>[13]</sup>

Klok et al.<sup>[5]</sup> reported thromboembolic complications (27% venous thromboembolism and 3.7% arterial thromboembolism) at a rate of 31% in their study in which they examined 184 patients who were treated in the ICU due to COVID-19. Although they reported that 70% of this patient group had coagulopathy, this condition was found to be an independent predictor for thromboembolic complications.

Although arterial thromboembolism is not a common condition in other infection-related coagulopathies, it is more common in patients with COVID-19 due to the direct endothelial damage caused by SARS-CoV-2 and indirect effect of systemic inflammation.<sup>[14]</sup> The increased production of the cytokines interleukin (IL)-1, IL-2, IL-6, and tumor necrosis factor-alpha after systemic inflammation activates thrombosis by causing platelet, endothelial, and neutrophil activation.<sup>[15,16]</sup>

Etkin et al.<sup>[7]</sup> reported limb loss rate and overall mortality rates of 18% and 46% in their study including 46 patients with acute arterial ischemia. Among these patients, lower extremity (71%), upper extremity (12%), cerebral (10%), and mesenteric (4%) involvement were noted. In addition, simultaneous venous thromboembolism (16%) was detected in this patient group. A total of 83% of these patients had D-dimer levels above 1,000 ng/mL.

To the best of our knowledge, the number of cases of upper extremity arterial thromboembolism in patients with COVID-19 is limited in the literature. In these cases, revascularization was achieved with anticoagulant therapy or after thrombectomy.<sup>[7,13,17-19]</sup> In the present case, although arterial thromboembolism was performed twice, revascularization could not be achieved and amputation was required at the forearm level.

The most important advantages of peripheral nerve block, compared to general anesthesia and neuraxial block, are that it has less negative

respiratory and hemodynamic effects and a shorter recovery time.<sup>[20]</sup> Therefore, it is a good alternative in severe cardiological and pulmonary diseases or in many high-risk situations that prevent general or neuraxial anesthesia, such as anticoagulant therapy. Since the anesthetist would have direct contact with the patient's airway during intubation and extubation while performing general anesthesia, peripheral nerve block has also the advantage of being a less risky option, particularly in cases of COVID-19.<sup>[21]</sup> In addition, it has been demonstrated to be useful in preventing phantom pain that may develop later in cases of amputation.<sup>[22]</sup> Hence, we also preferred peripheral nerve block in our case to avoid possible complications of general anesthesia.

In conclusion, whether patients has comorbide diseases, predispozan factors or not hypercoagulability status can be seen in COVID-19 patients. Although venous thromboembolisms are frequently seen clinic presentations arteriel thromboembolisms can be seen too. Care must be taken especially in ICU patients; rapid identification, evaluation and surgical intervation (if needed) are essential for good prognosis.

#### Declaration of conflicting interests

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