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**Fig.** Angiography computed tomography three-dimensional reconstruction of three cases of infrapopliteal arterial thrombosis.

Of the four cases, two underwent surgery. One patient had undergone open bilateral popliteal direct thrombectomy of all distal vessels and one had undergone open femoral-popliteal and radial-ulnar thrombectomy. Both patients recovered immediate patency of all declotted arteries and experienced improved clinical symptoms, despite the finding of segmental distal asymptomatic rethrombosis at 24 hours after surgery (plantar arch or one of the distal infrapopliteal vessels). The other two patients did not undergo surgery because of their extremely poor respiratory condition and relatively well-tolerated ischemia; these patients have continued to receive follow-up.

The vascular community should be aware of this new thrombotic complication in critically ill patients with COVID-19. It can be due to the hypercoagulable secondary status, and surgery is a valuable treatment option for complicated cases, despite the risk of rethrombosis.

*Gaspar Mestres, MD, PhD*

*Roger Puigmacià, MD*

*Carla Blanco, MD*

*Xavier Yugueros, MD, PhD*

*Montserrat Esturrica, MD*

*Vincent Riambau, MD, PhD*

Department of Vascular Surgery  
Cardiovascular Institute  
Hospital Clinic Barcelona  
University of Barcelona  
Barcelona, Spain

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## Intra-arterial thrombosis associated with COVID-19



Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a global pandemic. The development of an acquired thrombophilia with activation of the coagulation cascade in response to the inflammatory process has been described.<sup>1</sup> SARS-CoV-2 appears to have an affinity for angiotensin-converting enzyme 2 receptors that seem to be downregulated, which may drive the proinflammatory/prothrombotic consequences.<sup>2</sup>

As this is a novel illness, there has been limited opportunity to understand and to investigate the effect of SARS-CoV-2. In severe disease, there appears to be elevation of D-dimer levels. Prolongation of prothrombin time and activated partial thromboplastin time seems to be associated with an increased risk of acute respiratory distress syndrome and death.<sup>3</sup> The development of disseminated intravascular coagulation appears to be common in nonsurvivors.<sup>4</sup>

There appears to be an increased risk of pulmonary thromboembolic events in ventilated patients with SARS-CoV-2, despite the administration of low-molecular-weight heparin prophylaxis. In a small series of minimally invasive autopsies, a significant proportion of patients were found to have small fibrinous thrombi in pulmonary arterioles.<sup>1</sup> Similar data have been described across Europe with revision of low-molecular-weight heparin prophylaxis dosing. As well as the described pulmonary thrombotic complications, a series of early circuit occlusions has been encountered in patients on hemofiltration as a consequence of multiple organ dysfunction syndrome from SARS-CoV-2.

Recently, a small number of patients have presented with systemic intra-arterial thrombosis and a diagnosis of SARS-CoV-2. There is some evidence to suggest that this may occur, with a small series reporting ischemic strokes in patients in intensive care units.<sup>5</sup> In our experience, patients presenting with limb-threatening ischemia and SARS-CoV-2 have had no other clear reason for development of intra-arterial thrombosis. Management has been dictated primarily by the severity of the organ dysfunction. A conservative approach with the prescription of therapeutic low-molecular-weight-heparin with subsequent conversion to a direct-acting oral anticoagulant has been an effective strategy.

Vascular surgeons have to recognize the potential for limb- and life-threatening arterial occlusion events in patients with SARS-CoV-2. Further research is required to try to elucidate the mechanisms by which this disease process activates the coagulation cascade.

Kirsten Victoria Hamilton, MBChB, MRCS Ed  
Keith Kelso Hussey, MBChB, FRCS Ed, MD

Queen Elizabeth University Hospital  
Glasgow, Scotland

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## An increased severity of peripheral arterial disease in the COVID-19 era



The recent coronavirus 2019 (COVID-19) pandemic has significantly increased the pressure on our healthcare system around the world. The health emergency has changed the organization of health institutions and focused attention on pandemic management. This has led to important changes in the treatment of patients without COVID-19 and has resulted in the most difficult access to care with delays in diagnosis and treatment. Vascular diseases, including peripheral arterial disease,

will require rapid treatment in most cases. The severity of peripheral arterial disease is assessed using a functional classification system (Fontaine or Rutherford). The most severe grades of classifications include critical limb ischemia (CLI). CLI is defined by limb pain at rest, nonhealing wounds or ulcers, and/or gangrene in one or both legs.<sup>1</sup> CLI requires rapid revascularization to avoid tissue loss and amputation. The introduction of the lockdown in Italy from March 9, 2020, led to the closure of outpatient activities and prevented early observation of patients with CLI. Furthermore, the fear of contagion led to an underestimation of the symptoms and delayed access to treatment through the emergency room. Thus, patients with severe CLI with significant septic ulcers and gangrene arrived at our vascular surgery department. For most of these patients, it was not possible to save the limbs, and, therefore, they underwent amputation surgery. We observed that the number of amputations performed in our department from March 9 to April 20, 2020, was significantly greater than the number performed in the same period in 2019. Specifically, we performed 9 amputations during this period compared with 5 amputations performed in 2019 in the same period; an increase of almost 50%. We believe that the COVID-19 pandemic has led to the poor treatment of patients with other pathologic entities; thus, it is necessary to adopt more suitable measures to avoid other serious consequences on the health of citizens. Consequently, it is necessary to identify paths that will allow these patients to have rapid access to treatment with marked improvements in outcome.

Giuseppe Sena, MD  
Giuseppe Gallelli, MD

Department of Vascular Surgery  
"Pugliese-Ciaccio" Hospital  
Catanzaro, Italy

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## Cardiovascular examination should also include peripheral arterial evaluation for COVID-19 patients



The global impact of coronavirus disease (COVID-19) on vascular surgical services has been initially addressed by Ng et al.<sup>1</sup> This change in how vascular surgery