

# Considerations for Patients With Peripheral Artery Disease During the COVID-19 Pandemic

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## Abstract

New York City was one of the epicenters of the COVID-19 pandemic. The management of peripheral artery disease (PAD) during this time has been a major challenge for health care systems and medical personnel. This document is based on the experiences of experts from various medical fields involved in the treatment of patients with PAD practicing in hospitals across New York City during the outbreak. The recommendations are based on certain aspects including the COVID-19 infection status as well as the clinical PAD presentation of the patient. Our case-based algorithm aims at guiding the treatment of patients with PAD during the pandemic in a safe and efficient way.

## Keywords

SARS-CoV2, COVID-19, peripheral artery disease, intermittent claudication, critical limb ischemia, acute limb ischemia

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New York City was the early epicenter of the COVID-19 pandemic in North America. Despite the currently lower numbers of infections and deaths, our clinical practice vaccination will take time to be widely utilized and no proven treatment for the disease had to adapt because. This document is based on the experiences of experts from various medical fields involved in the treatment of patients with peripheral artery disease (PAD) practicing in hospitals across New York City during the outbreak. While the American College of Surgeons and the Society of Vascular Surgery<sup>1</sup> and the American College of Cardiology's Interventional Council, and the Society of Cardiovascular Angiography and Interventions<sup>2</sup> released documents to guide postponing non-essential surgical PAD procedures and the management of cardiovascular disease in general during the pandemic our illustrated approach is aligned with those recommendations but provides more specific guidance for the triage of patients with PAD symptoms including interventional and surgical procedures.

## Intermittent Claudication (IC)

Revascularization for IC is generally indicated in case of failure of conservative approach.<sup>3</sup> However, during the peak surge

of the pandemic deferring these procedures is essential. Guideline-directed medical therapy (GDMT) should be continued in all patients with IC (Rutherford class [RF] 0 to 3) regardless of their COVID-19 infection status.<sup>3</sup> Close follow up via telehealth is mandated, and any deterioration of PAD symptoms should prompt re-evaluation.

## Critical Limb Ischemia (CLI)

According to current guidelines patients with resting pain (RF 4) and patients with minor (RF 5) or major (RF 6) tissue loss should

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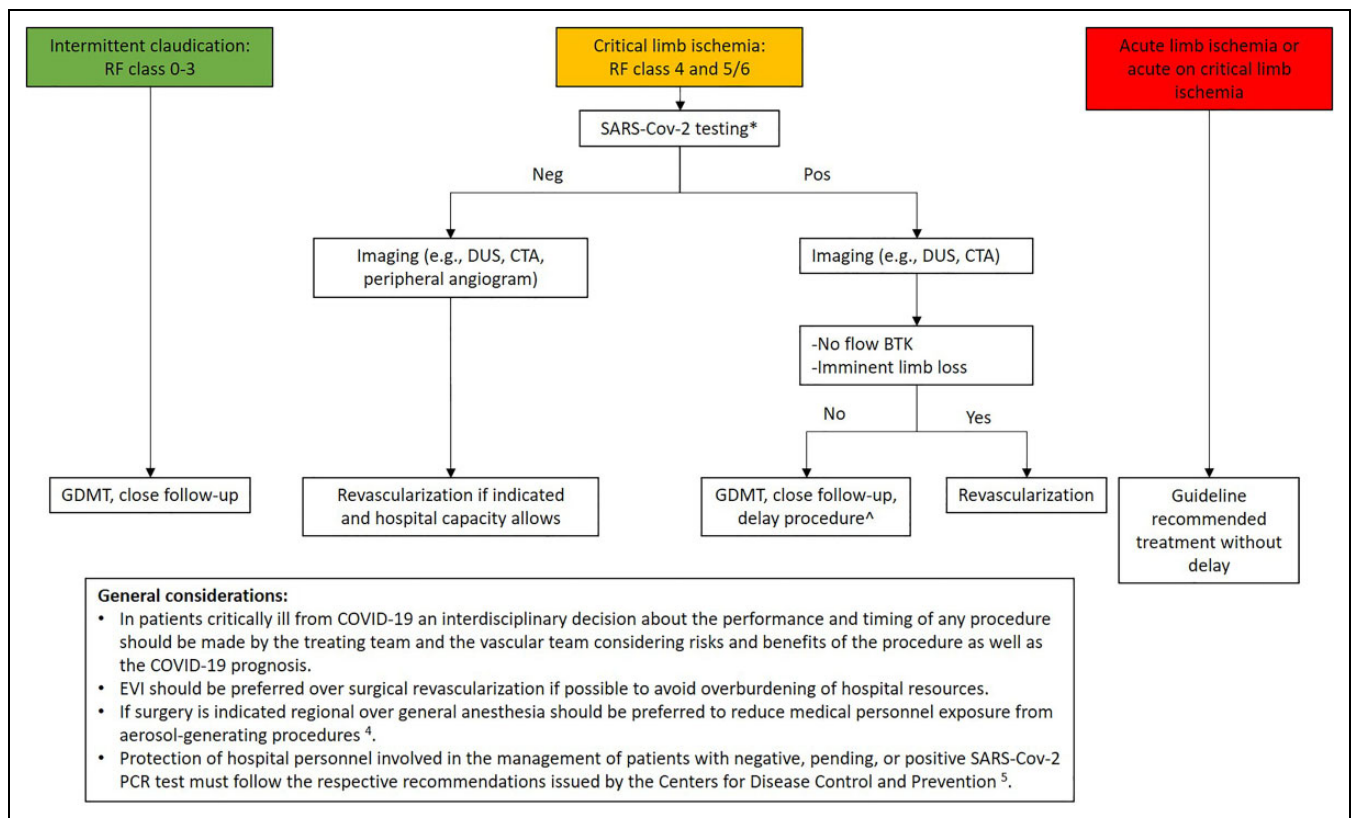
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**Figure 1.** Algorithm for the management of patients with peripheral artery disease during the COVID-19 pandemic. CTA indicates computed tomography angiography; DUS, Doppler ultrasound; EVI, endovascular intervention; GDMT, guideline-directed medical therapy; PAD, peripheral artery disease; PCR, polymerase chain reaction; RF, Rutherford. <sup>^</sup> delay until 14 days after positive COVID-19 PCR test with 3 days of being afebrile (<100 F) not on antipyretics and significant resolution of symptoms. \*Patients with pending SARS-Cov-2 polymerase chain reaction test result should be managed as if being positive.

undergo immediate imaging followed by revascularization.<sup>3</sup> During the peak surge of the pandemic a differentiated approach that considers the COVID-19 status as well as the specific PAD presentation should be applied. If tested negative, patients should undergo Doppler ultrasound (DUS), computed tomography angiography (CTA), or peripheral angiogram followed by revascularization if indicated and if hospital resources allow. If tested positive for COVID-19, DUS or CTA should be performed to exclude total occlusion of arteries below the knee (BTK), and conservative treatment with GDMT should be pursued. In case of persistent flow BTK and the absence of imminent limb loss, revascularization should be postponed until 14 days after the positive SARS-Cov-2 polymerase chain reaction (PCR) test with 3 days of being afebrile (<100 F) not on antipyretics and significant resolution of symptoms. In patients with RF class 5 or 6 wound care is crucial, and close monitoring for progressive tissue loss, wet gangrene, and ascending cellulitis is mandated since these represent indications for immediate revascularization regardless of COVID-19 status.

## Acute Limb Ischemia (ALI) or Acute on CLI

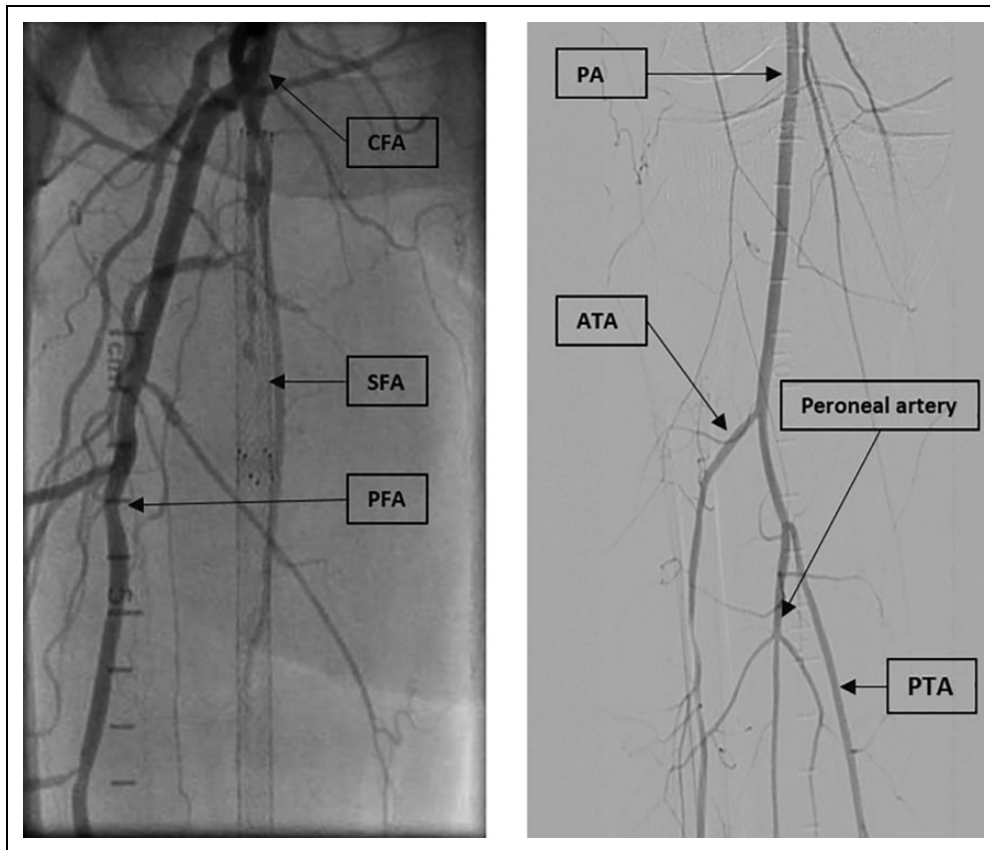
In patients presenting with ALI or acute on CLI, treatment should not be postponed regardless of COVID-19 status, and

therapy should be applied according to current guidelines.<sup>3</sup> In ALI stage I and IIa, endovascular intervention (EVI) may be preferred over surgery to avoid overburdening hospital resources. In addition, since catheter-directed thrombolysis requires 24 hours of intensive care unit stay and repeat peripheral angiogram, mechanical thrombectomy may be preferred. Nevertheless, if the EVI results are not optimal, a low threshold should be maintained to convert to surgical therapy. Although reported in single cases, systemic thrombolysis as initial treatment of ALI in patients with severe COVID-19 cannot be recommended due to the lack of supporting evidence.<sup>4</sup> In patients with ALI stage III (non-salvageable limb), a decision on the timing of major amputation should be based on the severity of COVID-19 symptoms.<sup>5</sup>

In addition to the above recommendations, the general considerations illustrated in Figure 1 should be taken into account and may guide clinical practice. The 2 following cases are only examples to demonstrate how our clinical experience during these times have contributed to these recommendations.

## Case 1

A 57-year-old female with a past medical history of diabetes mellitus (DM), hypertension, hyperlipidemia, and current



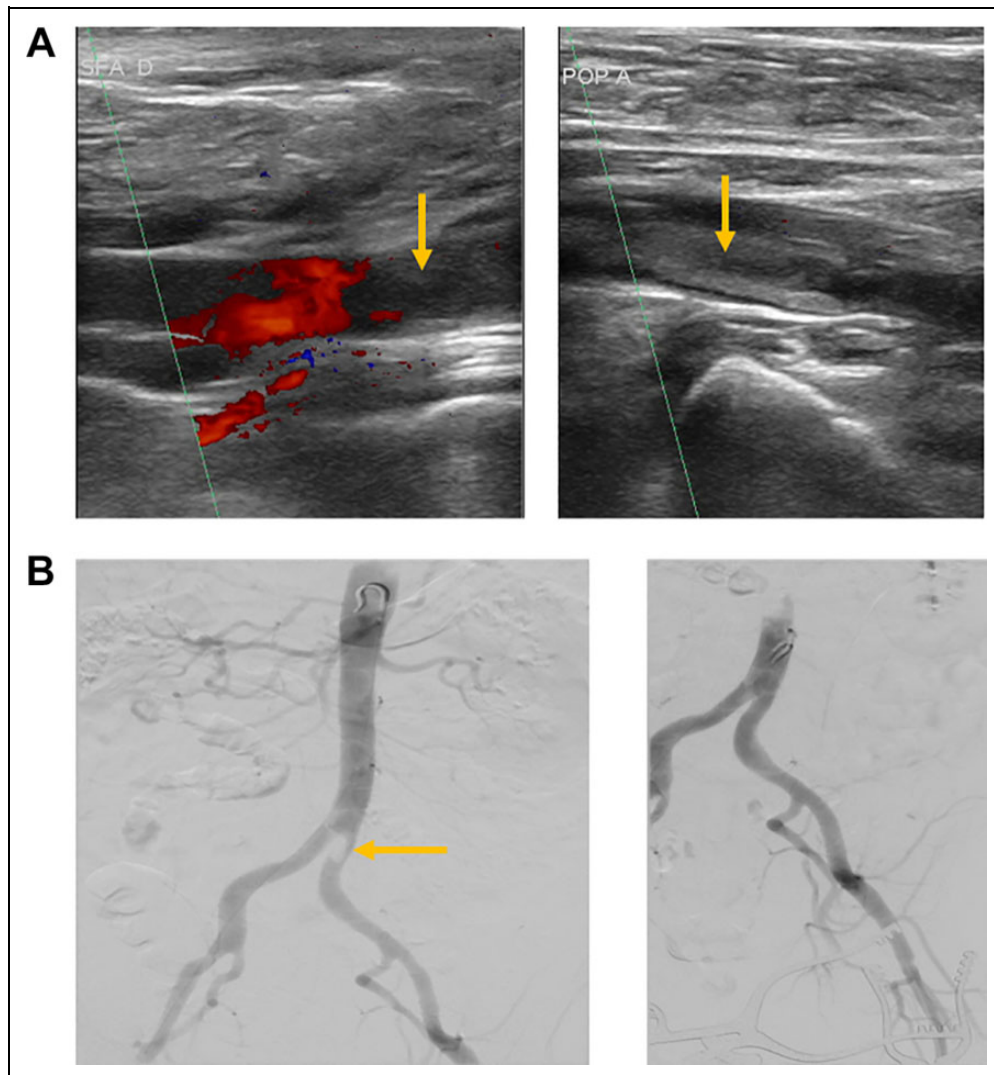
**Figure 2.** Peripheral angiogram of the right lower extremity. ATA indicates anterior tibial artery; CFA, common femoral artery; PA, popliteal artery; PFA, profunda femoral artery; PTA, posterior tibial artery.

smoking presented to the outpatient clinic with progressive right lower extremity pain progressing to rest pain in the last 5-7 days. The patient did not have any fever, shortness of breath, or cough and had no known prior contact with COVID-19 positive subjects. The patient had a percutaneous right coronary intervention in 8/2019 and superficial femoral artery (SFA) stent implantation in 9/2019. The DUS revealed an occlusion in the stented SFA segment and resting ankle-brachial index of 0.28 on the right and 0.87 on the left. Due to the acuity of symptoms and the DUS findings, the decision was made to perform a peripheral angiogram. The angiogram revealed thrombotic occlusion of the SFA with the reconstitution of the distal segment, and 3-vessel run off to the foot (Figure 2). The SARS-CoV-19 virus PCR test was obtained prior to the angiogram and came back positive. Her chest X-ray was normal, and other COVID-19 prognostic biomarkers (e.g., D-dimer, lymphopenia) were negative. Based on the clinical presentation (Rutherford class 4; normal motor function with no imminent limb loss) and due to positive COVID-19 status, taking into consideration the high risk of intubation and general anesthesia to the patient and medical personnel, intervention was deferred. Other factors contributing to this decision included the consideration that endovascular intervention in this highly thrombotic in-stent stenosis might require catheter-directed thrombolysis as a bailout

strategy. According to our institutional protocol, patients who undergo catheter-directed thrombolysis require ICU admission for the duration of thrombolysis followed by repeat angiogram 24 hours later. At the time of the patient's presentation New York was approaching the peak of the pandemic and ICU capacities were extremely limited. However, due to the young age of the patient and failed prior EVI the vascular team decided that surgical revascularization with femoral-popliteal bypass is the best long term approach for the patient. The patient was treated with guideline-directed medical therapy (GDMT) plus rivaroxaban 2.5 mg BID, and analgesic agents. She was discharged home with telehealth surveillance twice per week. Her lower extremity symptoms did not deteriorate, and she underwent successful surgical revascularization utilizing a venous femoral-popliteal bypass after 2 weeks with a negative SARS-COV-2 virus PCR test.

## Case 2

A 54-year-old male with no significant past medical history was admitted with acute left leg pain for 3 days and acutely worsening chronic cough. He was found to be hypoxic on admission (SpO<sub>2</sub> 90% on room air) and was placed on oxygen support. He was confirmed SARS-CoV-19 virus PCR test positive. D-dimer level on admission was 6,802 ng/mL, and

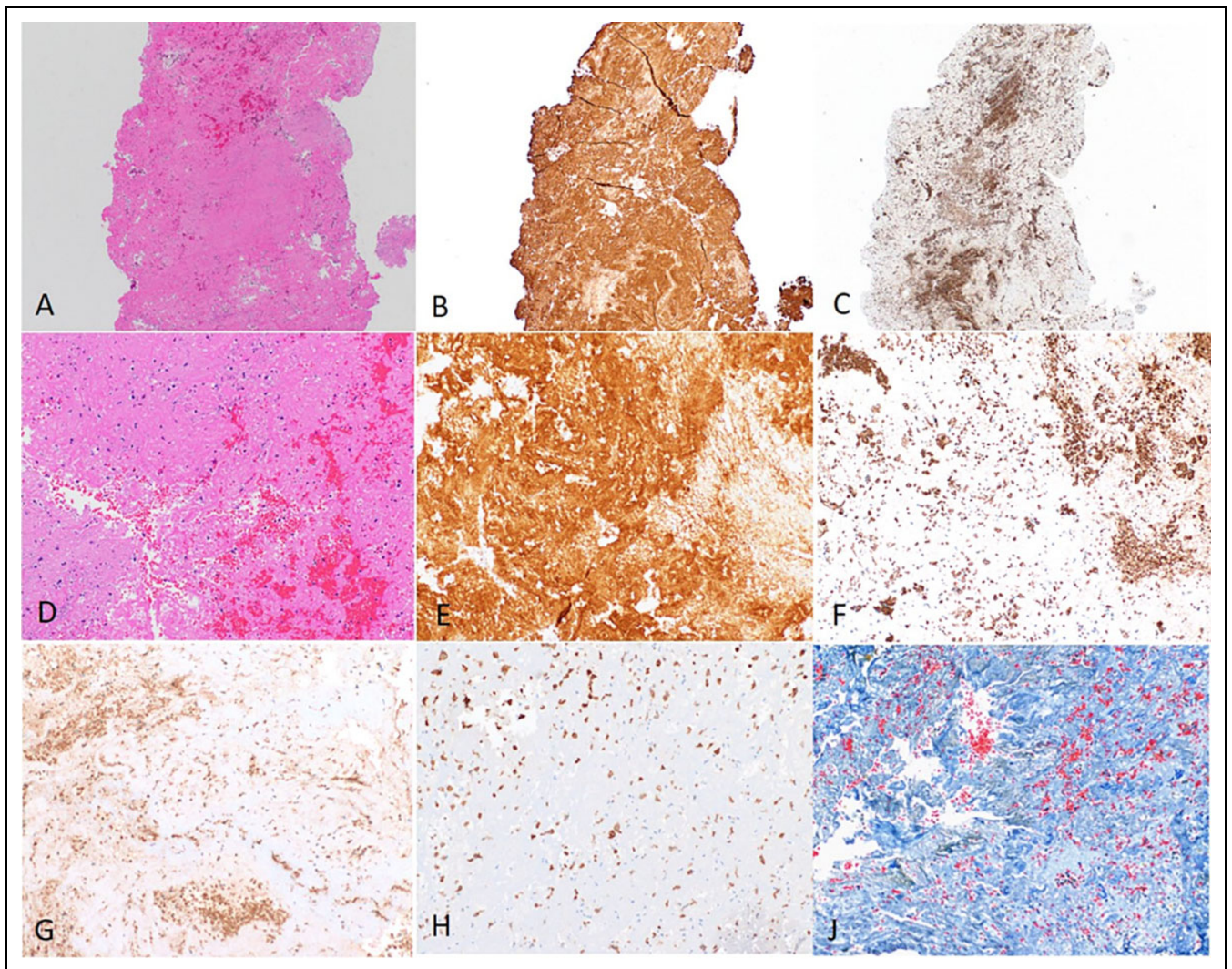


**Figure 3.** Panel A: Duplex imaging of the popliteal artery: color flow is identified in the distal superficial femoral artery with an abrupt cutoff due to a popliteal lesion (yellow arrow) and no discernible flow. Panel B: Angiographic characterization of the left lower extremity: an aortogram demonstrates a non-occlusive iliac lesion that was successfully removed via an open embolectomy.

DUS showed isolated popliteal artery occlusion with reconstitution of tibial arteries as well as soleal vein thrombosis (Figure 3, panel A). Additionally, he was diagnosed with pulmonary thromboembolism. Therapeutic anticoagulation with heparin was administered. His chest X-ray was abnormal with multiple areas of infiltrates. Given his tenuous pulmonary status, the vascular team deferred emergent lower extremity revascularization. After initial improvement of the patient's foot pain, the clinical condition worsened with an increase in ischemic pain and deterioration of the neurologic status of the affected limb on day 8. The vascular team decided that an emergent peripheral angiogram should be performed due to imminent limb loss. An intraoperative angiogram demonstrated a second lesion in the left common iliac artery (Figure 3, panel B) in addition to the earlier popliteal lesion. Surgical intervention was performed with embolectomy of the

popliteal and common iliac artery. The completion angiogram revealed excellent blood flow to the left lower extremity. Intravenous heparin was discontinued post-procedure. The postoperative course was unremarkable, and anticoagulation therapy was resumed on the third postoperative day. During surgery, gray-white thrombi were retrieved, and clot pathology demonstrated platelet-rich thrombus with red blood cells and minimal fibrin (Figure 4). Therefore clopidogrel therapy was initiated. After further discussion with the vascular team, the patient was discharged home on oral anticoagulation (due to PE/DVT) and clopidogrel (for arterial thrombosis) with complete recovery on day 14.

As we continue to learn more about the pathologies associated with SARS-CoV-2 infection, it is essential to mention that our document reflects our institutional experience and might be subject to modification in the near future.



**Figure 4.** Histopathological characterization of the gray-white thrombus retrieved from the common iliac artery: image A and D is the thrombus at low and high magnification (hematoxylin and eosin). The clot is composed predominantly of platelets (CD61 staining in B and E) and few red blood cells (stain for glycophorin in C, F). Other minority components of the thrombus include neutrophils (myeloperoxidase in G), macrophages (CD163 in H). There is no fibrin seen on azocarmine stain (image I). Magnification:  $\times 20$ : images A, B, C;  $\times 40$ : images D-I.

Additionally, our considerations certainly apply to regions that are considered epicenters of the pandemic. Nevertheless, in view of the currently increasing numbers of infections in many other regions of the world our insights constitute a differentiated approach that may help others to identify the cases in which procedures can be safely postponed in order to avoid an exhaustion of the health care system but also the cases in which a procedure should not be postponed to avoid further harm for the patient. The application of this suggested triage system will facilitate the ongoing care of PAD patients during the current pandemic.


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