

Surgical clinical characteristics of acute arterial thrombosis of the extremities in the context of SARS-CoV-2 infection

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Abstract

Objective: To determine the clinical-surgical features of critical limb ischaemia (CLI) within the context of infection by SARS-CoV-2. **Methods:** Cross-sectional, retrospective, observational, descriptive study, with clinical data obtained from printed and electronic records of patients with CLI treated by the Angiology and Vascular Surgery Service of the General Hospital of Mexico in the period between January 2020 and July 2021. **Results:** We evaluated the data of 33 patients with critical limb ischaemia of which 15 were positive for SARS-CoV-2 in the period from January 2020 to July 2021, females were the most affected representing the 53.3% of the total, patients under 60 years old accounted for 26.67%. Twenty-six percent of the patients presented critical limb ischaemia without having previous comorbidities, 60% of these presented with an advanced state of the disease and a delay in specialised medical care of more than 6 hours after the onset of symptoms, which warranted a major amputation in 37% of cases, the lower extremities represented 90% of the affected anatomical regions. **Conclusions:** the outcomes in our study show that the incidence of critical limb ischaemia during the SARS-CoV2 pandemic period occurred in an atypical way in a segment of young patients and without known event-generating comorbidities. Thromboembolic events, probably associated with the hypercoagulable state generated by this infection, also evolved rapidly and aggressively from the onset of symptoms despite prompt treatment.

Keywords: SARS-CoV-2. Covid-19. Critical limb ischaemia. Coagulopathy.

Introduction

The disease caused by the SARS-CoV-2 (Covid-19) coronavirus infection, declared a pandemic by the WHO on 11 March 2020, has become the most important health problem of this century and has posed challenges to the medical and scientific community of all nations since its onset in terms of identifying its multiple manifestations, which were initially poorly understood^{1,2}. Although SARS-CoV-2 infection is most often characterised by clinical symptoms such as fever, cough, myalgia and fatigue, severely ill patients may

develop acute respiratory distress syndrome and various extrapulmonary manifestations, such as acute cardiac lesions, neurological manifestations or complications due to secondary infections. Because ACE2, the entry receptor for the causative SARS-CoV-2 coronavirus, is expressed in multiple extrapulmonary tissues, direct viral tissue damage is a plausible mechanism of injury^{3,4}. Critically ill patients have impaired coagulation function, which leads to consumption coagulopathy and arterial and venous thromboembolic complications^{5,6,7}. ACE2 expression has been demonstrated in the arterial and venous endothelium of several

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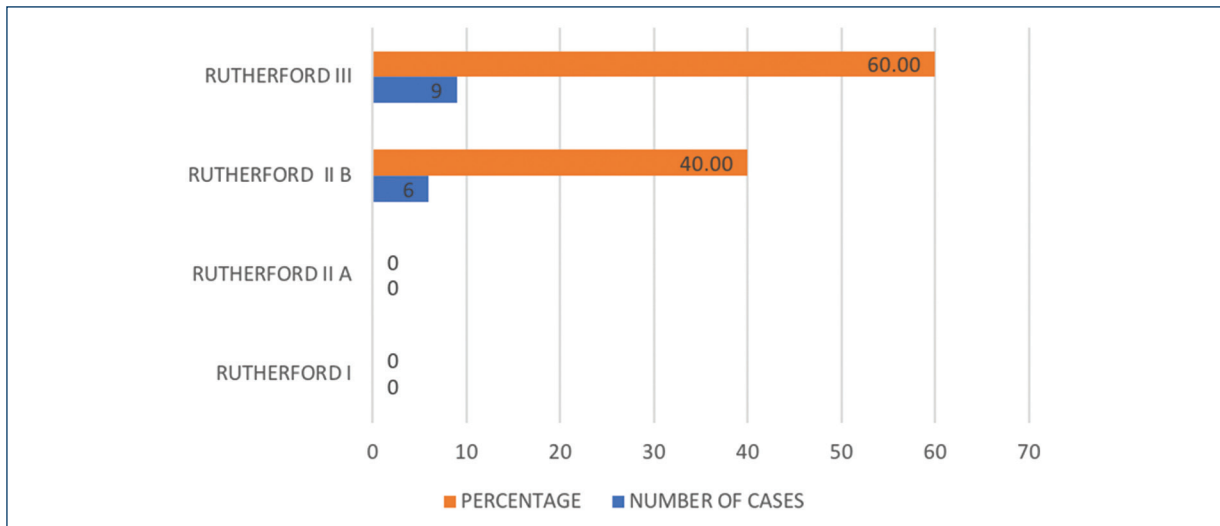


Figure 1. Rutherford Classification in positive COVID-19 cases.

organs, and histopathological studies have found microscopic evidence of SARS-CoV-2 viral particles in endothelial cells of the kidneys and lungs. Infection-mediated endothelial injury and endotheliitis, found in multiple vascular beds (including lungs, kidney, heart, small intestine and liver) in patients with COVID-19, can trigger excessive thrombin production, inhibit fibrinolysis and activate complement pathways, initiating thromboinflammation and ultimately leading to microthrombi deposition and microvascular dysfunction³.

Material and Methods

Cross-sectional, retrospective, observational, descriptive study with clinical data obtained from printed and electronic records of patients with critical limb ischaemia (CLI) who arrived at the emergency department or already admitted who required emergency treatment as a measure to salvage the affected limb. The Department of Angiology and Vascular Surgery of the General Hospital of Mexico assessed these patients in the period from January 2020 to July 2021. The primary outcomes were based on treatment used for limb salvage, most frequent anatomical site of ischaemia involvement, comorbidities, clinical stage of disease at the time of assessment and delay of specialised medical care. Inclusion criteria were patients with critical limb ischaemia, who also had positive PCR tests or laboratory swabs for SARS-CoV-2 infection seen initially at the General Hospital of Mexico. Exclusion criteria were patients who did not meet the

operational definition for Covid-19, patients with trauma-associated ischaemia and patients who were not assessed by the vascular surgery department.

Outcome

A total of 33 patients were evaluated, 17 (51.52%) of whom were male and 16 (48.48%) female with critical limb ischaemia, 15 of whom tested positive for SARS-CoV-2 in the period from January 2020 to July 2021; females were the most affected with eight cases, representing 53.3% of the total. Patients under 60 years of age accounted for 26.67% of the cases (6.67% from 18 to 39 years and 20% from 40 to 59 years) and 73.33% from 60 to 79 years. In terms of comorbidities, 32% had hypertension, 16% had diabetes mellitus, 16% had atrial fibrillation, 10% were smokers and 26% of the patients had critical limb ischaemia with no previous comorbidities. Of these patients without previous comorbidity, 60% presented with advanced disease and with a delay in specialised medical care of more than 6 hours after the onset of symptoms (Fig. 1), warranting major amputation in 37 % of cases. The therapy used in 50% of the total was anticoagulation and in 13% Fogarty balloon thrombectomy. The lower extremities accounted for 90 % of the anatomical regions affected (Fig. 2).

Discussion

During the SARS-CoV-2 pandemic period, an increase in cases of arterial ischaemia has been seen

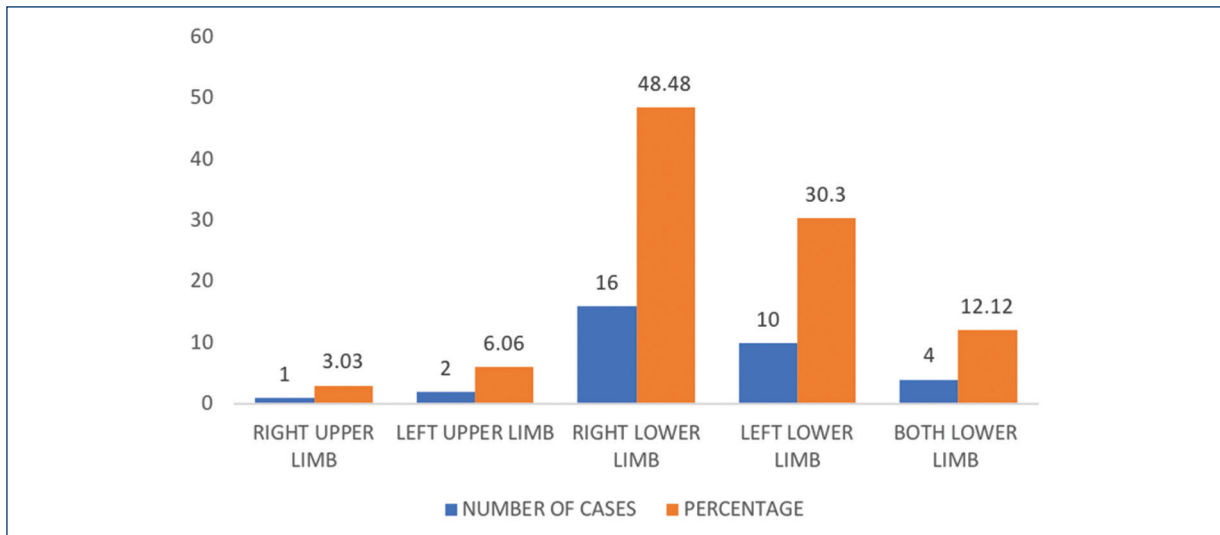


Figure 2. Anatomical region of ischaemia.

especially in critically ill and elderly patients, but also in young patients without associated comorbidities. This was observed in follow-up studies by Perini P. et al.⁸, where they reported two cases of critical limb ischaemia in young patients with Covid-19 and no comorbidities with a characteristic aggressive presentation. As in the systematic review of the European Society for Vascular Surgery, it was identified that critical limb ischaemia during the pandemic affects younger people with fewer comorbidities with worse outcomes compared to patients without COVID-19 as well as heparin resistance has been observed more frequently⁹.

In our study, we were able to assess the rapid evolution of these patients towards irreversible ischaemia, which led to amputation as a therapeutic measure in 37% of cases. In a study by Bellosta R. et al.⁹, the success of revascularisation was low in patients with Covid-19 compared to patients in previous reported series. This is thought to be due to the impossibility of obtaining effective distal revascularisation and recurrent episodes of thrombosis of the treated segments, which led to a change in their treatment protocol to include a more aggressive regimen with thrombolysis and continuous heparin infusion¹⁰.

Furthermore, because of the saturation of hospitals due to the health contingency, 60% of the patients were in advanced stages of ischaemia at the time of assessment by the specialist. Similarly, we could see that patients in intensive care developed aggressive arterial ischaemia despite the prophylactic antithrombotic treatment given during their stay in intensive care, probably due to the immobilisation to which they were forced, the

state of hypercoagulability and endothelial damage induced by SARS-CoV-2 infection.

Thrombotic events occur in 11.5% of non-ICU patients and in 29.4% of ICU patients affected by COVID-19. Arterial thrombosis, including lower limb ischaemia, has been reported in patients diagnosed with COVID-19 and in 18.6% of critically ill patients¹¹.

Coagulopathy in Covid-19 positive patients appears to be the result of the inflammatory response to infection, which is more evident and aggressive in critically ill patients. Therefore, patients who develop arterial thrombosis are at high risk of mortality, but if treated appropriately there is an improvement in overall survival especially in younger patients¹².

Conclusions

The outcomes obtained in our study demonstrate that the incidence of critical limb ischaemia during the SARS-CoV2 pandemic period was atypical in a segment of young patients with no known comorbidities that generated thromboembolic events. This was probably associated with the hypercoagulable state generated by this infection, which also evolved rapidly and aggressively from the onset of symptoms despite timely treatment.

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Conflicts of interest

The authors declare that does not exist a conflict of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

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