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Inflammatory popliteal aneurysm associated with SARS-CoV-2 infection

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Abstract. – BACKGROUND: SARS-CoV-2 infection involves the phase of viral replication and inflammatory response predicting the severity of COVID-19. Vascular involvement in SARS-CoV-2 infection has been well established. Thrombotic complications are common, while only few cases of dilatative diseases have been reported.

CASE REPORT: We herein report the case of a 65-year-old male patient with an inflammatory 25-mm saccular popliteal artery aneurysm detected six months after symptomatic COVID-19 (pneumonia, and pulmonary embolism). The popliteal aneurysm was surgically managed with aneurysmectomy, and reversed bifurcated vein graft. Histological examination detected the infiltration of monocytes and lymphoid cells into the arterial wall.

CONCLUSIONS: Popliteal aneurysm could be related to inflammatory response related to SARS-CoV-2 infection. The aneurysmal disease should be considered mycotic and surgically managed without prosthetic grafts.

Key Words:
SARS-CoV-2 infection, Inflammatory popliteal aneurysm, Reversed vein graft.

Introduction

SARS-CoV-2 is a global pandemic[1]. Vascular endothelium is actively involved in the inflammatory process leading to COVID-19; evidence[2] support the idea that this infectious disease includes complex interactions between the innate immune response, the coagulation/fibrinolytic pathways, and the vascular endothelium, resulting in a procoagulant condition. In fact, coagulopathy is commonly associated to SARS-CoV-2 infection[3]. Venous thromboembolism, and acute arterial thrombosis have been both reported in literature[4,5]. Aneurysmal disease have been also anecdotally reported[6,7].

Popliteal artery aneurysms (PAAs) are the most common arterial peripheral aneurysms (70%)[8]. Atherosclerosis is the most common cause of this degenerative disease, and the diagnosis is usually incidental[9]. Primary inflammatory PAAs are really uncommon[10].

We herein report the case of a 65-year-old male patient with an inflammatory 25-mm saccular popliteal artery aneurysm detected six months after symptomatic COVID-19.

Case Report

A 65-year-old male patient was referred to our vascular outpatient setting after the incidental diagnosis of a 25-mm right PAA.

His medical history was notable for arterial hypertension, and former smoking. No connective tissue disorder was known. The patient denied any signs or symptoms in the right lower limb, including pulsatile mass or swelling.

The patient was admitted to our Hospital in 2021 due to symptomatic COVID-19 with pneumonia and pulmonary embolism. Several Duplex scan examinations of the lower limbs have been performed to exclude deep venous thrombosis (DVT). In addition, these examinations excluded arterial vascular anomalies with multiphasic flow to the tibial vessels of both limbs. After COVID-19 the patient has been discharged with indication for direct oral anticoagulant therapy for a period of 6 months.

The arterial lesion has been detected during a lower limb Duplex scan examination performed after the withdrawal of direct oral anticoagulant therapy. The same radiologist detected a 25-mm right PAA. Computed tomography angiography (CTA) confirmed the diagnosis of a saccular 16×25 mm right PAA involving the origin of anterior tibial artery, and tibio-peroneal trunk (Figure

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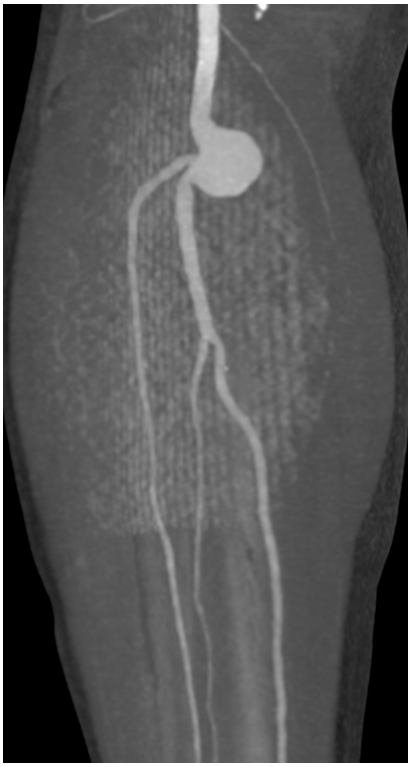

Figure 1. Preoperative computed tomography angiography showing the popliteal artery aneurysm involving the ostia of anterior tibial artery and tibio-peroneal trunk.

1). There was no evidence of further aneurysms in other anatomical districts.

A Positron Emission Tomography (PET) was negative for infection at right PAA as well as bacterial cultures (Figure 2).

After the surgical dissection (Figure 3), the patient underwent aneurismectomy and graft interposition of anterior tibial artery and tibio-peroneal trunk with a reserved segment of great saphenous vein (GSV). Because of the involvement of two vessels, it was necessary a selective reconstruction of both vessels with a bifurcated graft (Figure 4). The GSV was half-divided crosswise and the two ends joined to ''gun barrel'' in order to have a proximal diameter in accordance with the diameter of the popliteal artery. Final angiography showed the patency of vein bifurcated graft and all three tibial vessels (Figure 5).

Histological examination detected the presence of an inflammatory aneurysm with medial-intimal mixoid degenerative changes, and infiltration of monocytes and lymphoid cells into the arterial wall, mainly CD3+ but also CD4+, CD8+, and CD20+ (Figure 6).

In-hospital stay was free of complications. The patient was discharged on the fourth postoperative day with lifelong monoantiplatelet therapy

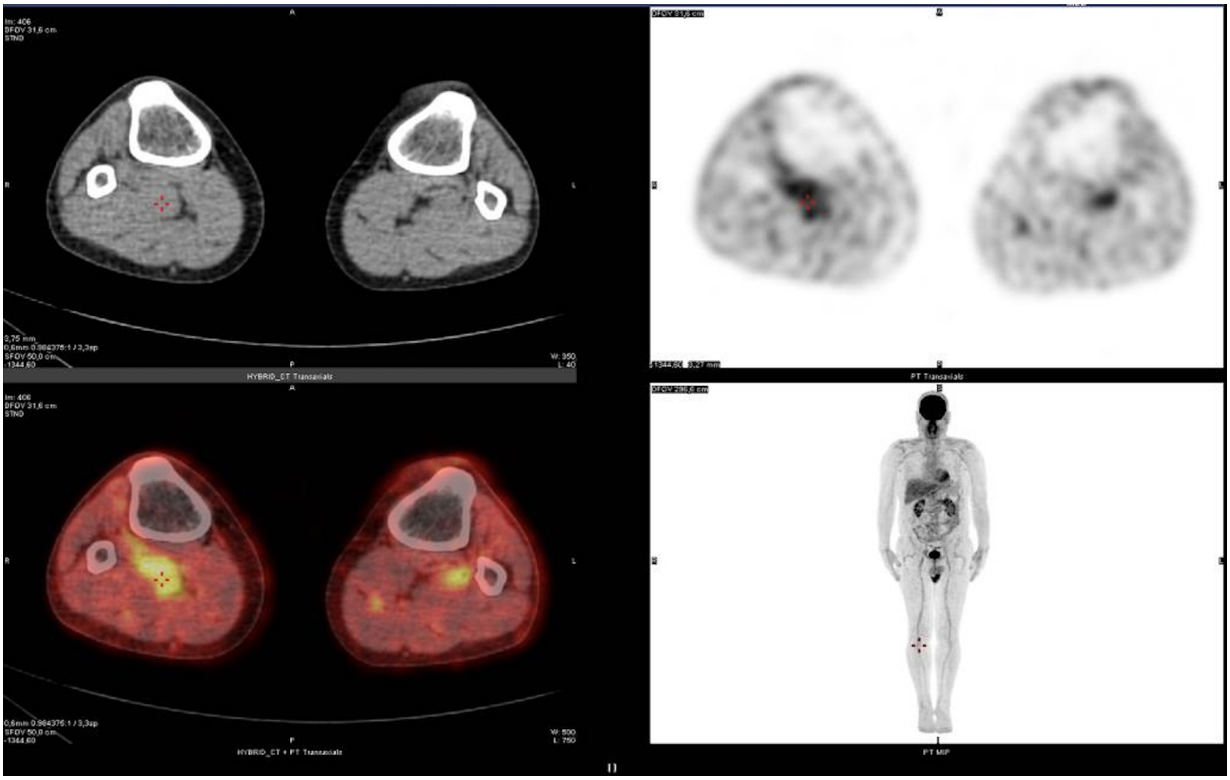

Figure 2. Positron emission tomography showing no sign of infection at right popliteal artery aneurysm.

associated with low weight molecular heparin for a period of 1 month. At 6-month follow-up, the patient was alive with no surgical complications. The peripheral pulses were well palpable; in addition, at Duplex scan examination the bifurcated vein graft was patent as well as the three tibial vessels with multiphasic flow.

Discussion

Few cases of dilatative disease in peripheral arteries related to SARS-CoV-2 infection have been reported in literature. Most of these cases were associated with coronary aneurysms, as well as Kawasaki-like disease in children population[6,11,12].

In a recent article, Xu et al[13] described the mechanisms related to SARS-CoV-2 affecting the abdominal aortic aneurysm (AAA) pathogenesis. The authors reported that the potential influences of SARS-CoV-2 on AAA pathogenesis should include: augmented angiotensin converting enzyme (ACE)-angiotensin II-AT1 receptor activity resulting from decreased reciprocal ACE2-angiotensin 1-7-Mas activation; increased production of proaneurysmal mediators stimulated by viral spike proteins in ACE2-negative myeloid cells or by ACE2-expressing vascular structural cells; augmented local or systemic cross-talk between viral targeted nonvascular, nonleukocytic ACE2-expressing cells *via* ligand recognition of their cognate leukocyte receptors; and hypoxemia

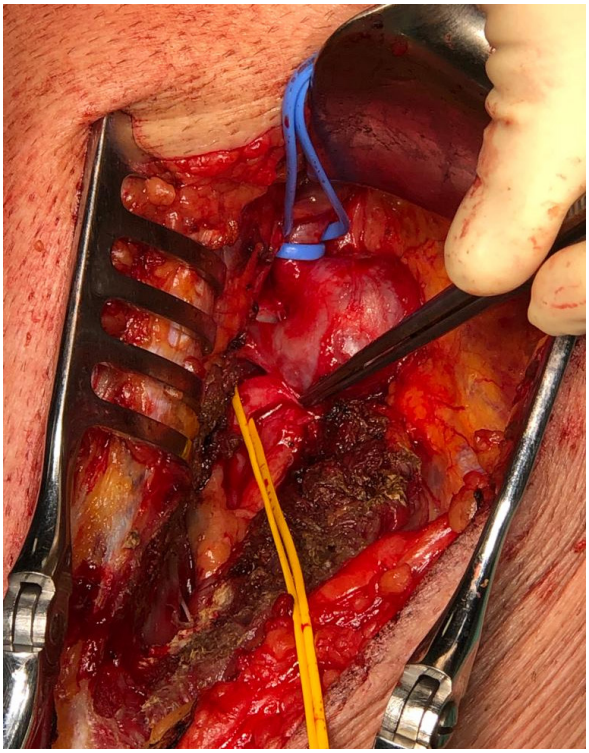

Figure 3. Surgical dissection of infragenicular popliteal artery, anterior tibial artery, and tibio-peroneal trunk.

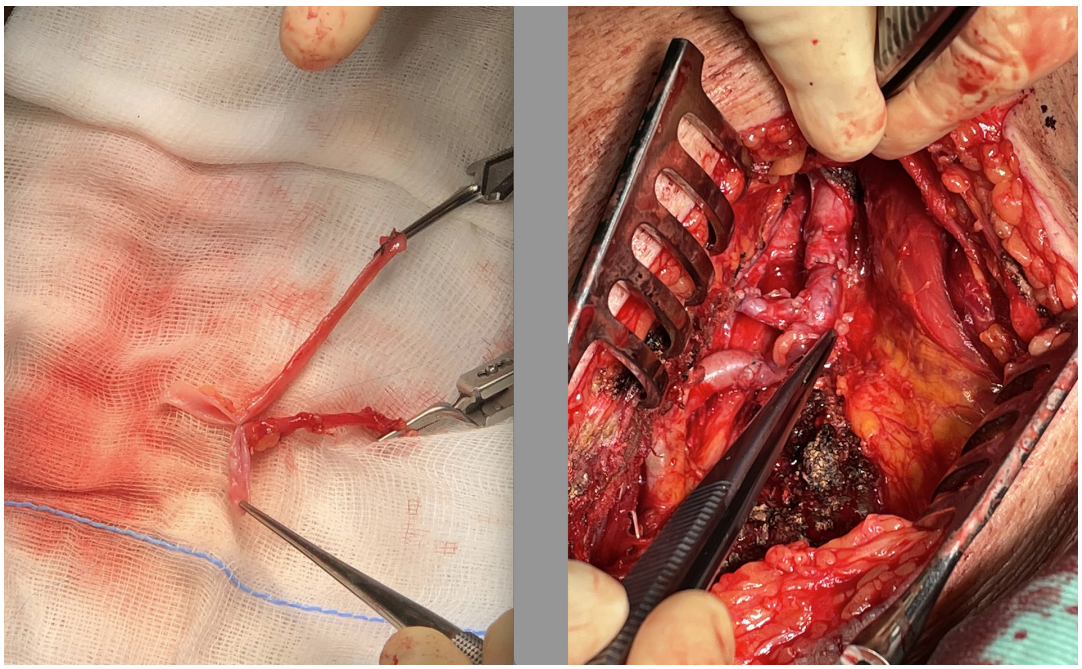

Figure 4. Bifurcated vein graft with reversed great saphenous vein.

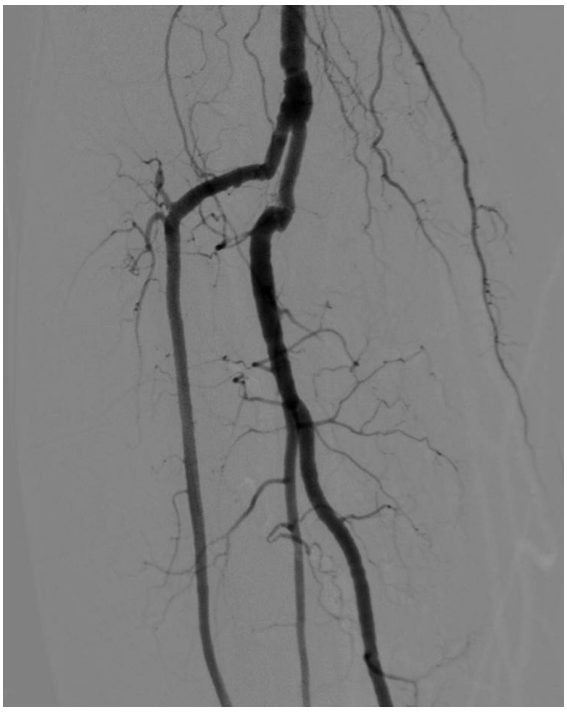

Figure 5. Completion angiography showing the patency of bifurcated graft, and three tibial vessels.

and increased systemic inflammatory tone experienced during severe COVID-19 illness[13].

The possibility to have a dilatative disease related to SARS-CoV-2 infection could be explained with an augmented inflammatory response. The localization of this triggered response cannot be established. Therefore, we could expect different localizations of aneurysmal disease rather than the 'standard' aorta.

In this case report, we reported a 65-year-old male patient with a PAA detected six months after symptomatic COVID-19. The patient had neither traumas nor history of connective tissue disorders. The severity of COVID-19, including pneumonia and pulmonary embolism, could explain the augmented inflammatory response with the subsequent formation of an aneurysm at the right popliteal artery.

At the time of diagnosis, in our patient there was no possibility to differentiate between a mycotic or an inflammatory peripheral aneurysm. However, the PET should be considered mandatory in order to exclude signs of infection at the aneurysmal level[14]. In our case, the bacterial cultures were negative, as well as the PET examination. Therefore, the orientation was towards an inflammatory aneurysm related to COVID-19. In literature, only one case of inflammatory popliteal artery aneurysm has been reported[10].

In our case the choice to perform open surgery was still consequent to the possibility to obtain a histological examination of the arterial wall of the PAA in order to have an accurate diagnosis. In addition, the localization of the PAA contraindicated an endovascular approach due to the lacking of an adequate landing zone immediately above the ostium of the anterior tibial artery. In addition, the suspicion of a mycotic aneurysm forced us to use autologous material and not prosthetic grafts. For all these reasons we preferred to perform a bifurcated graft with a reversed GSV.

One of the key points was the postoperative pharmacological treatment. Some authors suggest the use of direct oral anticoagulants or low weight molecular heparin for a period ranging from 45 days to 6 months after COVID-19 symptoms[15]; however, no recommendation has been given for patients with arterial disease related to COVID-19. Therefore, we decided to establish a lifelong monoantiplatelet therapy associated with low weight molecular heparin for a period of 1 month in order to reduce the prothrombotic propensity of a patient with a history of symptomatic COVID.

Conclusions

Popliteal artery aneurysm could be related to inflammatory response related to SARS-CoV-2 infection. Histological examination is mandatory to obtain an accurate diagnosis. Even if the clinical and radiological examinations revealed no sign of infection at popliteal level, the aneurysmal disease should be considered mycotic and

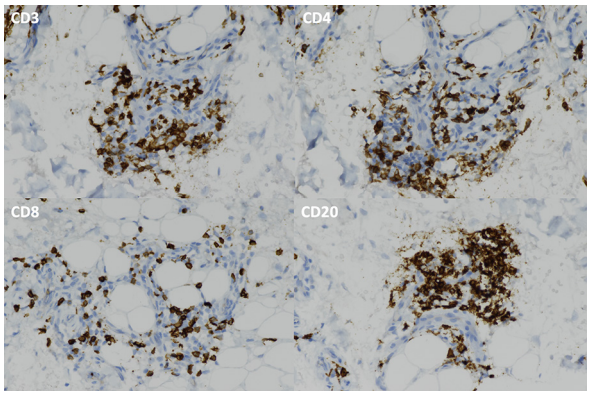

Figure 6. Histological examination showing infiltrates of monocytes and lymphoid cells into the arterial wall (CD, Cluster of Differentiation; magnification: 40×).

surgically managed without prosthetic grafts. In these patients a standardized pharmacological treatment has not yet been established.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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Authors' Contribution

Raffaella Berchiolli, editing, final revision, final approval; Lorenzo Torri, writing, final revision, final approval; Daniele Adami, final revision, final approval; Giulia Bertagna, final revision, final approval; Francesco Cannovaro, final revision, final approval; Nicola Troisi, writing, final revision, final approval; All authors read and approved the final version of the manuscript.

Informed Consent

The patient gave his written consent to the current publication. IRB approval was waived.

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