Arteriovenous fistula creation to maintain arterial patency in patients with COVID-19-associated acute limb ischemia.

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The emergence of novel coronavirus, SARS CoV 2 (Severe Acute Respiratory Syndrome Coronavirus 2), in 2019, and the resulting illness, COVID-19 (coronavirus disease), was declared a pandemic by World Health Organization on March 11, 2020 [1].

Coagulopathy, in the form of venous and arterial thromboembolism, despite anticoagulation, is emerging as one of the most severe sequela of the disease, and has been prognostic of worse outcomes [2]. Several clinic reports have demonstrated evidence of thrombotic microangiopathy that contribute to findings of unusual sites and presentation of thrombosis. Particularly Acute Limb Ischemia (ALI) is defined as a sudden decrease in arterial perfusion of an extremity associated with a threat to the viability of the extremity. If not promptly recognized, ALI may cause major tissue or limb loss, or death and constituting a surgical emergency [3,4]. Acute Limb Ischemia (ALI) occurs in 1.5 cases per 10,000 persons per year. During the coronavirus disease 2019 (COVID-19) pandemic, ALI occurred approximately five times more frequently in COVID-positive patients [5].

Characteristics associated with patients with COVID-19 who present with acute limb ischemia, which include male preponderance, most of the patients had at least one cardiovascular risk factor, with the most predominant being hypertension and diabetes [3]. Low rates of successful revascularization and high mortality in SARS-CoV2 patients with ALI has been reported, due to the systemic illness, hypercoagulable state and extensive thrombotic microangiopathy that involves extrapulmonary organs [1,6]. Patients with ALI COVID related do not have any of typical causes of ALI and the vessels, at the surgery, appeared to have relatively healthy and non-atherosclerotic vessels [2]. Between March 2020 and January 2021, we treated three consecutive patients, hospitalized and with thromboprophylaxis with ALI. All three patients presented thrombosis of popliteal and tibial arteries that appeared concurrently with worsening of COVID related pneumonia and two of them were asked to recover in ICU. The symptoms included: rest pain, sensory lost, mild or severe motor impairment according to category IIb of TASC II (adapted from the Rutherford classification by SVS) [7]. An urgent embolectomy was performed by exposing the popliteal artery below the knee. Surprisingly, with each patient, ALI recurred, despite palpable pulses present at the end of the surgery and anticoagulation with unfractionated heparin. In the first patient, we performed a second transpopliteal embolectomy, but ALI relapsed again. We thought that something was missing, was it perhaps an extensive thrombotic microangiopathy? In addition to reintervention with transpopliteal and trans-tibial (at the ankle) embolectomy, a distal Arteriovenous Fistula (AVF) was created between the tibial arteries and veins at the ankle. This technique is based on prior experience with peripheral bypass when small crural vessels are heavily diseased. In this setting, AVF is associated with increased graft patency rates. The high resistance, low flow state seen in the bypass contributes to graft occlusion. The Thrombotic Threshold Velocity (TTV) described is a flow rate below that arterial thrombosis occurs predictably. The fashioning of an AVF at the distal anastomosis is hypothesized to counteract this flow limiting state [8,9]. Likewise we suppose that extensive thrombotic microangiopathy at the foot might have been caused due to high peripheral resistance and so the cause of occlusion of tibial arteries. The second and third patients, at the second embolectomy, were treated by performing AVF on tibial vessels.

In all three patients, the AVF preserved patency and triphasic flow of popliteal and tibial arteries. One patient died after 3 weeks in the ICU from COVID-19 pneumonia, and the other two are doing well. At 12 months follow up, patients can walk without any problems, and the tibial arteries and AFV are patent on duplex.

COVID -19 has revolutionized our lives, and also our clinical practices. About this experience, however limited at three patients, we think that AVF at the ankle can be useful in situation of protracted ALI, as well as in ALI COVID-19 related acute limb ischemia, to manage the extensive thrombotic microangiopathy associated with both of these conditions.

References

1. Warkentin TE, Kaatz S. COVID-19 versus HIT hypercoagulability. Thromb Res. 2020;196:38-51.

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2. Abou-Ismail MY, Diamond A, Kapoor S, et al. The hypercoagulable state in COVID-19: Incidence, pathophysiology, and management. Thromb Res. 2020;194:101-15.
3. Topcu AC, Ozturk-Altunyurt G, Akman D, et al. Acute limb ischemia in hospitalized COVID-19 patients. Ann Vasc Surg. 2021;74:88-94.
4. Sánchez JB, Alcalde JD, Isidro RR, et al. Acute limb ischemia in a Peruvian cohort infected by COVID-19. Ann Vasc Surg. 2021;72:196-204.
5. Ilonzo N, Judelson D, Al-Jundi W, et al. A review of acute limb ischemia in COVID-positive patients. Semin Vasc Surg. 2021;34(2):8-12.
6. Lewis CT, Dayal R, Sundaram V, et al. Revascularization outcomes in COVID -19 patients with acute limb ischemia. JVS. 2020-e374.
7. Gerhard-Herman MD, Gornik HL, Barrett C et al. AHA/ ACC Guide- line on the Management of Patients with Lower Extremity Peripheral Artery Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Circulation. 2017;135(12):e686-e725.
8. Aherne T, Kheirelseid E, O'Neill D, et al. The use of arteriovenous fistulae as an adjunct to peripheral arterial bypass: a systematic review and meta-analysis. Eur J Vasc Endovasc Surg. 2016;51(5):707-17.
9. Dardik H. Update on the role of the distal arteriovenous fistula as an adjunct for improving graft patency and limb salvage rates after crural revascularization. Ann Vasc Surg. 2015;29(5):1022-28.

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