

## CASE REPORT

## EVAR Solution For Acutely Thrombosed Abdominal Aortic Aneurysm in a Patient with COVID-19

Alessandro Robaldo <sup>a,\*</sup>, Dimitri Apostolou <sup>a</sup>, Federica Persi <sup>a</sup>, Enrico Peano <sup>b</sup>, Massimo Maione <sup>a</sup>

<sup>a</sup> Vascular Surgery Unit, Santa Croce e Carle Hospital, Cuneo, Italy

<sup>b</sup> Department of Radiology, Santa Croce e Carle Hospital, Cuneo, Italy

**Introduction:** Acute thrombosis of an infrarenal abdominal aortic aneurysm (ATAAA) represents an uncommon but catastrophic pathology, which can lead to life threatening complications. This is a report of the infrequent use of an endovascular solution to successfully treat ATAAA in a patient with COVID-19 viral pneumonia and ischaemia induced lower extremity neurological deficits.

**Report:** An 89 year old white male, with a history of cardiovascular comorbidities was admitted to the emergency room with dyspnoea associated with the sudden onset of abdominal and back pain followed by partial motor and sensory deficits in both legs. The CT scan showed both an 8 cm infrarenal AAA with middle (inferior mesenteric artery patent) and distal thrombotic occlusion of the sac and non-aneurysmal but thrombosed common iliac arteries. An additional finding was imaging features typical of interstitial pneumonia. After the molecular test detected active COVID-19 infection, the patient was treated as an emergency with an aorto-uni-iliac stent graft and femorofemoral crossover graft. The post-operative course was uneventful with AAA exclusion and disappearance of ischaemic symptoms. There were no vascular complications. At three month follow up the patient remained asymptomatic and was looking after himself.

**Discussion:** This case supports the feasibility and safety of a minimally invasive endovascular procedure to treat ATAAA in selected patients with favourable anatomy and high risk of respiratory complications in the context of the COVID-19 pandemic.

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### INTRODUCTION

Acute thrombosis of an infrarenal abdominal aortic aneurysm (ATAAA) is a rare but catastrophic life threatening pathology, which can cause severe ischaemic manifestations including lower extremity pain, coolness, numbness, paraesthesiae, and muscle paralysis. Mortality with non-operative management is up to 75%. With prompt surgical management, mortality rates still range from 20% to 50%.<sup>1</sup> This is the report of a case of ATAAA in a patient with COVID-19 viral pneumonia and ischaemia induced lower extremity neurological deficit successfully treated with an endovascular solution.

### REPORT

An 89 year old male living autonomously, with a history of atrial fibrillation treated with a novel oral anticoagulant

(NOAC), heart failure, and hypertension was admitted to the emergency room with dyspnoea associated with sudden and severe lower limb pain extending up to the abdomen and back. Additional signs and symptoms included lower limb cyanosis, paraesthesia, numbness, and progressive paralysis. No recent trauma was reported.

Abdominal palpation revealed a pulsatile painful tender epigastric mass. Femoral and distal pulses were absent. Computed tomography (CT) scan revealed acute thrombosis of an 8 cm infrarenal AAA and both common iliac arteries. The thrombus extended up to the level of the inferior mesenteric artery (Fig. 1). Additional findings included typical radiological lesions of COVID-19 pneumonia, a horseshoe kidney, and occlusion of the left internal iliac artery. Laboratory COVID-19 tests were positive. Ischaemia markers were detected (serum creatinine [Cr] level 1.55 mg/dL; glomerular filtration rate [eGFR] 36 mL/min/1.73 m<sup>2</sup>; creatine kinase [CK] > 7 000 U/L; lactate 3.1 mmol/L).

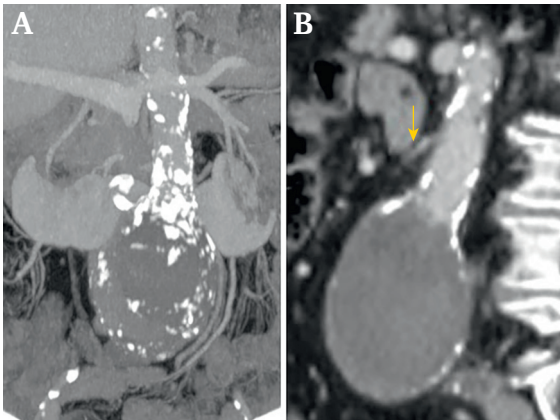
In this emergency scenario, hybrid treatment was performed comprising endovascular recanalisation of the occluded aorto-iliac segment followed by aorto-uni-iliac stent graft placement and subsequent femorofemoral crossover bypass grafting. Written informed consent was

\* Corresponding author. 10 Duccio Galimberti, Alba, Piemonte 12051, Italy.

E-mail address: [robaldo.alessandro@gmail.com](mailto:robaldo.alessandro@gmail.com) (Alessandro Robaldo).

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**Figure 1.** Computed tomography (CT) scan revealed acute thrombosis of an 8 cm infrarenal abdominal aortic aneurysm (AAA) and bilateral common iliac arteries with retrograde propagation of the aortic thrombus up to the level of the inferior mesenteric artery. (A) Maximum intensity projection (MIP) reconstruction. (B) Sagittal view of the lesion with the origin of the inferior mesenteric artery in addition to severe aortic and iliac calcification.

obtained from the patient. The procedure was performed in a dedicated hybrid operating room with high resolution imaging (Artis Zeego, Siemens, Germany). An emergency anticoagulant reversal protocol was adopted. Under regional anaesthesia both common femoral arteries were exposed with vessel loops. On the right side, an 11 cm long, 9 Fr sheath was introduced retrogradely to the distal portion of the healthy patent segment of the external iliac artery under fluoroscopic control. A low friction hydrophilic 0.035 inch guidewire and a NaviCross support catheter (Terumo Co., Tokyo, Japan) were used to perform the common iliac artery and aneurysm recanalisation. Subsequently, the sheath was placed carefully up to the lowest renal artery and exchanged for a larger one (Gore Dryseal 20 Fr  $\times$  33 cm) over an Amplatz superstiff guidewire.

A preliminary angiogram was used to confirm the pre-operative artery measurements and to mark the reference points (Fig. 2). Under controlled hypotension, a 30 mm diameter aorto-uni-iliac stent graft (Treovance, Terumo Aortic [formerly Bolton Medical], Sunrise, Florida) was deployed immediately below the lowest renal artery. An 11  $\times$  141 mm iliac limb extension was added. A 10  $\times$  40 mm bare self expandable stent was placed both to better accommodate the iliac extension and to try to preserve the internal iliac artery despite moderate stenosis at the origin of the vessel. The whole procedure was achieved with transient common femoral artery looping or clamping to avoid peripheral embolisation as well as to allow flushing of potential debris from the side port of the sheath.

The completion angiogram revealed patency of both the renal arteries and the stent graft. 8 mm Dacron femorofemoral bypass was performed in a standard fashion with tunnelling in the space of Retzius. Ligation of the left external iliac artery was avoided to try to preserve the pelvic circulation from some ipsilateral collaterals.



**Figure 2.** Preliminary angiography after the common iliac artery and aneurysm recanalisation.

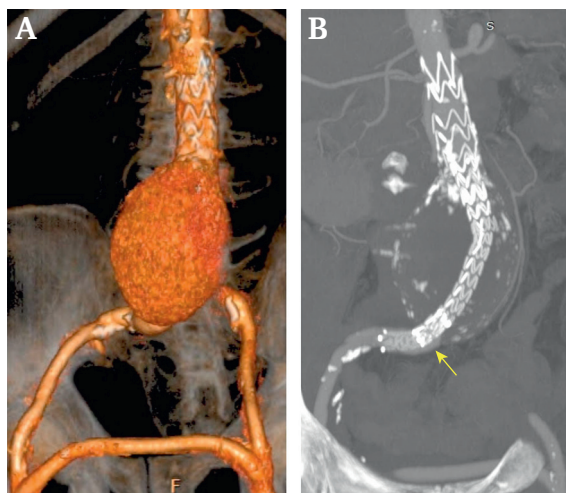
Immediate technical success was achieved and the post-operative course was uneventful. After intravenous hydration, the blood markers decreased after 72 hours (Cr level 0.93 mg/dL; eGFR 56 mL/min/1.73 m<sup>2</sup>; CK 490 U/L; lactate 1.2 mmol/L).

The patient was transferred to the medical COVID-19 ward to continue treatment for the COVID-19 infection after four days and in good condition, neurologically intact without buttock ischaemia or walking limitation with bilateral palpable pedal pulses. Post-operative coagulation blood tests did not show abnormal values. A therapeutic dose of low molecular weight heparin (4000 IU enoxaparin twice a day) as well as antiplatelet therapy (aspirin 100 mg once a day) were recommended.

At three month follow up, the patient appeared in good condition, looking after himself, and with no neurological complications. CT angiogram demonstrated stent graft patency without any signs of renal or mesenteric ischaemic areas with the exception of the right hypogastric occlusion. Some contrast in the left common iliac artery between the iliac extension and the wall of the vessel was interpreted as a small type IB endoleak. The plan was to treat it endovascularly in the event of increased aortic sac (Fig. 3).

## DISCUSSION

Spontaneous ATAAA is an uncommon condition, which often needs emergency treatment with a high mortality rate. An incidence of 0.6%–2.8% of all surgically managed AAA cases is reported.<sup>2</sup> It may result from several aetiologies including thromboembolic disease, arteriosclerosis, or coagulation disorders.<sup>3</sup> Specifically, in the present case the occlusion was probably caused by an acute thrombosis in a patient with pre-existing aorto-iliac occlusive disease,



**Figure 3.** Three dimensional reconstruction (A) and maximum intensity projection (MIP) reconstruction (B) confirm patency of the stent graft without any signs of stenosis.

dehydration, and a potential acute coagulation disorder from infection with COVID-19.

Although the literature reports that thromboses occur when AAAs are small, there is no definitive relationship between aneurysm size and the likelihood of thrombosis as confirmed by the present AAA case. Conventional surgical repair by aneurysmectomy and inline aortic revascularisation remains the treatment of choice. A less invasive extra-abdominal approach by performing an extra-anatomic bypass is described as an acceptable alternative to guarantee the limb perfusion.<sup>4</sup> However, for concomitant abdominal/back pain and considerable risk of AAA expansion or rupture, an additional procedure includes ligation of the aorta via a retroperitoneal approach.

In fact, late rupture of a previously thrombosed aneurysm has been reported.<sup>5</sup> Schwartz et al. emphasise the concept that AAA thrombosis does not preclude rupture with delayed aneurysm rupture of 15% in only six months in 13 patients with AAA thrombosis and extra-anatomic bypass.<sup>6</sup> Therefore, in the present case, as a result of the incomplete thrombosis and size of the AAA, an extra-anatomic bypass was not attempted. *In situ* surgical repair was not considered a viable option because of the extremely high risk, particularly respiratory related. An accurate CT scan evaluation, which showed both an adequate proximal neck and suitable vascular accesses, led to performance of a hybrid procedure. The ischaemic symptoms together with the epigastric abdominal pain necessitated repair of the AAA and revascularisation of the lower extremities. An endovascular option was judged the most appropriate, particularly because of the lower pulmonary complication rate.

In the context of the COVID-19 pandemic, lower resource utilisation and shorter length of hospital stay are essential. Based on these considerations, only young patients, or those with a contraindication to endovascular repair (no neck or connective tissue disorders), should be treated with open

repair.<sup>7</sup> To the best of the present authors' knowledge, similar procedures have been performed in only two cases. Both of these were characterised by sudden onset of pain and paresis of lower limbs in high risk surgical patients with small aneurysms (maximum axial aneurysm diameters were 3.5 and 3.8 cm, respectively). A standard EVAR (AneuRx Medtronic Vascular, Santa Rose, CA, USA) stent graft was used in one case and a Fluency covered stent (Bard Peripheral Vascular, Tempe, AZ) in the other, and the patients remained asymptomatic for 10 and 12 months respectively.<sup>8,9</sup>

In conclusion, this case suggests that AAA recanalisation and EVAR placement could be a safe and effective solution to treat acutely thrombosed AAA, especially for symptomatic patients and those at high risk of rupture. Prompt diagnosis and treatment is of the essence in dealing with this life threatening emergency.<sup>10</sup> In the COVID-19 era particularly, treatment should be individualised by evaluating patients' symptoms, comorbidities, aneurysm conformation, and available resources.

#### FUNDING

None.

#### CONFLICT OF INTEREST

None.

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