BRIEF ARTICLE

# Central Venous Complications Associated with Ruptured Abdominal Aortic Aneurysm

*Complicaciones venosas centrales asociadas al aneurisma de aorta abdominal roto*

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## ABSTRACT

Ruptured abdominal aortic aneurysm (rAAA) represents a genuine surgical emergency. In the presence of abdominal pain, hypotension or even shock, patients require emergency transfer to an operating room adequately equipped to treat the aneurysm effectively and without delay. Occasionally, symptoms are the consequence of its relationship with adjacent structures. Aortocaval fistula and compression of the inferior vena cava (IVC) are venous complications associated with rAAA. We report cases of aortocaval fistula and IVC compression with deep vein thrombosis (DVT) due to rAAA. The four patients underwent endovascular repair. The circumstances associated with venous complications of rAAA, the treatment strategy used and the therapeutic options are described.

**Key words:** Aortic Aneurysm - Aortic Aneurysm- Abdominal/complications - Aortic Rupture / complications - Arteriovenous Fistula /etiology - Vena Cava, Inferior

## RESUMEN

La ruptura del aneurisma de aorta abdominal (AAA) representa una verdadera emergencia quirúrgica. Asociada con dolor abdominal, hipotensión e incluso shock, exige una transferencia inmediata a una sala de operaciones adecuadamente equipada para tratar el aneurisma en forma efectiva y sin demora. Ocasionalmente puede manifestarse como resultado de su relación con estructuras adyacentes. Dos complicaciones venosas asociadas con el AAA roto son la fístula aortocava y la compresión de la vena cava inferior (VCI). Los autores informan casos particulares de fístula aortocava y compresión de VCI con trombosis venosa profunda (TVP) por AAA roto. Los cuatro pacientes fueron tratados mediante reparación endovascular. Además de discutir las circunstancias asociadas con las complicaciones venosas por AAA, los autores también discuten la estrategia de tratamiento adoptada y las posibles alternativas.

**Palabras clave:** Aneurisma de la aorta - Aneurisma de aorta abdominal /complicaciones - Ruptura aórtica / complicaciones - Fístula arteriovenosa / etiología - Vena cava inferior

## INTRODUCTION

Ruptured abdominal aortic aneurysm (rAAA) represents a genuine surgical emergency. Once the rupture has been documented, and in the presence of abdominal pain and hypotension, the patient should be immediately transferred for rapid and effective treatment.

Venous complications associated with ruptured aortic aneurysm are rare. We describe two different anatomical findings and clinical presentations in patients with rAAA. Two patients presented aortocaval fistula and another two patients had compression of the inferior vena cava (IVC) or its branches.

## METHODS

Two groups of patients are presented. The first group consisted of two male patients (74 and 68 years old) with large ruptured aortic aneurysms, associated with aortocaval fistula. In both cases, ankle edema was present in one or both lower extremities.

In the second group, two male patients (70 and 84 years old) with large aortic aneurysms and retroperitoneal hematoma developed IVC or iliac artery compression and thrombosis.

### Ethical considerations

The study protocol was approved by the corresponding institutional review boards.

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## RESULTS

### Case 1

This patient was admitted with abdominal pain lasting 12 hours associated with left lower extremity edema. A computed tomography angiography revealed an 8 cm diameter infrarenal AAA associated with aortocaval fistula. On admission, the patient was hemodynamically stable (University of Washington Ruptured Aneurysm Score of 1 with an expected mortality of 22%). The patient underwent endovascular repair.

A bifurcated Endurant stent graft (Medtronic Inc, Minneapolis, Minn) was placed via bilateral femoral approach under local anesthesia. The patient evolved without pain but the ankle edema persisted. A new computed tomography angiography revealed a type II endoleak coming from the inferior mesenteric artery, which sustained a patent aortocaval fistula and required embolization of the inferior mesenteric artery. Via the common femoral vein, the aneurysmal sac was accessed through the aortocaval fistula, and from there to the origin of the inferior mesenteric artery (Figure 1). The patient evolved favorably with sudden resolution of the ankle edema in less than 12 hours and was discharged 6 days after the surgical procedure. Clinical follow-up 22 months later showed absence of edema and the computed tomography scan exhibited aneurysm exclusion, without endoleak.

### Case 2

In this case report, the patient was admitted with abdominal pain lasting 24 hours, hemodynamic instability and acute kidney failure (score of 2, with expected postoperative mortality of 69%). The computed tomography angiography showed an infrarenal rAAA with right retroperitoneal hematoma and aortocaval fistula below the right renal vein. The patient underwent emergency endovascular repair with Endurant stent-graft placement with favorable postoperative outcome and was discharged 7 days after surgery. A computed tomography scan performed nine months later showed a reduced and excluded aneurysmal sac (Figure 2).

### Case 3

This patient was admitted under mechanical ventilation with hemodynamic instability, abdominal bloating and severe edema of the left inferior extremity (University of Washington Ruptured Aneurysm Score of 1, with expected postoperative mortality of 22%). The computed tomography scan demonstrated a giant ruptured aneurysm of the left iliac artery (>9 cm), retroperitoneal hematoma and severe compression of the ileofemoral venous axis with venous thrombosis extending to the common femoral vein. The patient underwent emergency endovascular repair with placement of aortic stent-graft and coil embolization of the left iliac artery. The patient evolved with favorable outcome and was extubated on postoperative day two. Anticoagulation was started on day seven and he was discharged 11 days after surgery. The control performed 30 days later showed absence of endoleak.

### Case 4

The last patient, under follow-up for a 58 mm AAA, arrived at the emergency department by ambulance due to low back pain lasting five days. Because of the


**Fig. 1.** Treatment of a ruptured abdominal aortic aneurysm with aortocaval fistula and type II endoleak through the inferior mesenteric artery. A. Placement of the stent-graft at the level of the proximal neck. B. Sac angiography performed via the right femoral vein showing presence of a fistula and endoleak, treated with coil embolization. The sac angiography demonstrates occlusion of the endoleak. (C). D. Final computed tomography angiography with aneurysm exclusion. E. Follow-up computed tomography of the aneurysmal sac, with thrombosis and smaller size.

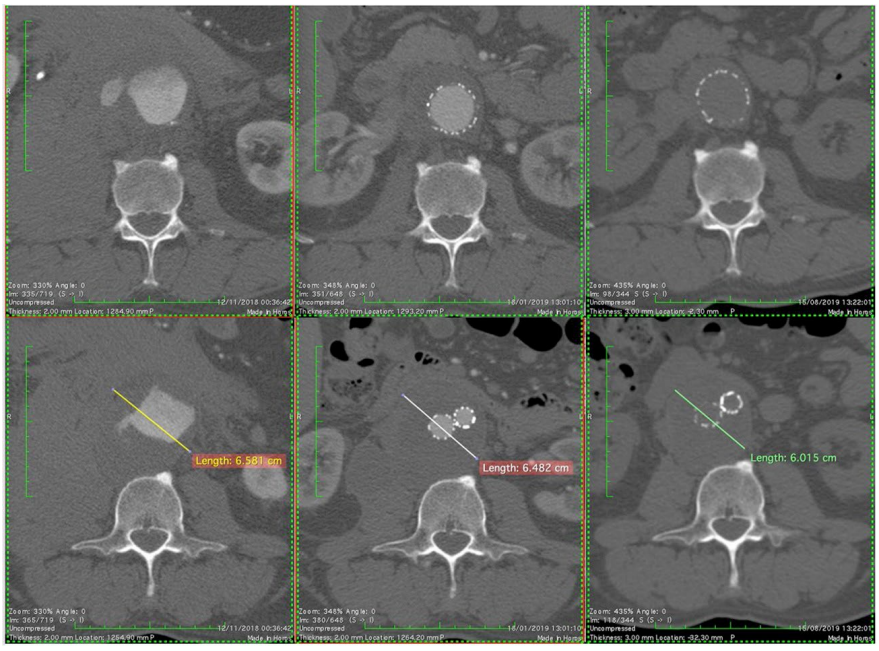


**Fig. 2.** Follow-up computed tomography angiography of the patient with aortocaval fistula after stent-graft placement.

COVID-19 pandemic, he was receiving medical treatment with intramuscular analgesics and corticosteroids indicated by telephone calls. On admission, the patient was hemodynamically stable (University of Washington Ruptured Aneurysm Score of 1) with severe edema in both lower extremities. A computed tomography angiography showed a filling defect suggestive of pulmonary embolism (PE) in the lobar branch of the right middle and right lower lobes and in the left lower lobe segmental branch. He also presented an 88 mm rAAA towards the right posterolateral wall with partial deep vein thrombosis (DVT) of both common iliac veins and IVC compression.

A Zenith bifurcated infrarenal aortic stent-graft was implanted under local anesthesia (Figure 3). After the procedure was completed, a venography was performed, which showed severe extrinsic compression of the IVC with images suggestive of thrombosis of both iliac veins (with patency).

The procedure was well tolerated without complications. In a setting in which anticoagulation was contraindicated, we did not place an inferior vena cava filter due to the severe extrinsic compression of the IVC produced by the hematoma. A computed tomography angiography performed 48 hours later showed absence of endoleak.

The dose of anticoagulants was gradually increased and the route of administration was shifted until reaching a full dose of warfarin on the seventh day. The patient was discharged on postoperative day 17. The control performed one month later evidenced exclusion of the aneurysm with IVC compression but without thrombosis.


**Fig. 3.** Patient with inferior vena cava compression due to retroperitoneal hematoma. A, aneurysm exclusion, B venography with thrombi in both iliac veins, C follow-up computed tomography of the aneurysm with aneurysmal sac exclusion

## DISCUSSION

A ruptured aneurysm associated with an aortocaval fistula has been reported in up to 6% of patients with complicated aneurysms and is the result of a spontaneous rupture directly in the IVC. (1) The triad of abdominal pain, pulsatile mass, and continuous intense murmur is present in up to 80% of cases. Rapidly, computed tomography imaging will demonstrate contrast material in the inferior vena cava during the arterial phase. Early diagnosis allows planning an effective strategy, focusing not only on the arterial but also on the venous aspect. (2)

Compression of the IVC is a well-known complication of malignancies. Abdominal aortic aneurysms may produce external IVC compression but their frequency is low. However, IVC compression by retroperitoneal hematoma when an AAA ruptures is a possible clinical presentation. (3, 4) The slow blood flow resulting from IVC compression can lead to IVC thrombosis, DVT and even pulmonary embolism.

In any of the previous two scenarios, if open aneurysm repair were required, the risk of significant venous bleeding should be expected, and care should be taken to minimize risk of air or thrombus pulmonary embolism. Important technical details include control clamping with proximal and distal venous compression, followed by direct suture closure of the venous defect.

Nevertheless, when technically feasible, endovascular repair of rAAA, even in these circumstances, provides the most rational approach with the lowest risk and the advantage of lower morbidity and mortality, significantly shorter operative time, less bleeding, shorter post-operative recovery, and better outcome. These conclusions can be reached from the analysis of historical groups, as there are no comparative studies due to the rarity of this complication. (5-12)

There are two interesting technical details in these patients supporting the publication of this study. In the first patient, the fistula persisted because of a type II endoleak, sustained by a patent inferior mesenteric artery. The persistence of symptoms and the visualization of the patent fistula in the computed tomography angiography were the indications for treatment. Venous access through the fistula was a novel technical detail. Although the transcaval approach has been described to treat type II endoleaks, we accessed the endoleak through the arteriovenous fistula.

The second aspect in these patients is thrombosis management in the setting of a retroperitoneal hematoma. We considered that stepwise anticoagulation was the most adequate strategy. There were several options to manage DVT. The endovascular approach using mechanical or pharmacological techniques was contraindicated in the setting of absolute contraindication to the use of thrombolytic or anticoagulant agents in a mildly symptomatic patient. Let us recall that the blood flow had been verified and the size of the hematoma was assumed to decrease after aneurysm exclusion. As the patient did not develop any acute complication as phlegmasia cerulea dolens due to DVT, the likelihood of a future treatment will be evaluated according to the clinical outcome. (14) The risk of postoperative mortality was evaluated using the University of Washington Ruptured Aneurysm Score (age >76 years, creatinine concentration >2.0 mg/dL, pH <7.2, and systolic blood pressure <70 mm Hg at some point; each positive point increased the risk from 22% to 100%). We believe that the interest of this score lies on the fact that it only uses perioperative variables which are crucial considering that the endovascular procedures are minimally invasive. (15)

## CONCLUSIONS

This report describes cases of ruptured AAA associated with central vein complications. Fistula, thrombosis and embolism were secondary to the rupture. Perioperative evaluation of the venous system was essential to select the appropriate venous treatment. Endovascular treatment was fundamental to manage the aneurysm with low rate of complications or mortality.

### Conflicts of interest

None declared.

(See authors' conflicts of interest forms on the website/ Supplementary material)

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