

 **Case Report** 

Inferior Vena Cava Compression Caused by a Retroperitoneal Hematoma Following an Abdominal Aortic Aneurysm Rupture

Akihiko Ikeda, MD, PhD^{1,2}

This report presents the case of a 43-year-old man with inferior vena cava (IVC) compression caused by a retroperitoneal hematoma following an abdominal aortic aneurysm (AAA) rupture. Preoperative computed tomography scans revealed an infrarenal AAA with a retroperitoneal hematoma nearly occluding the IVC. After emergency aortic grafting, IVC thrombosis, deep venous thrombosis (DVT), and pulmonary thromboembolism (PTE) arose. Anticoagulation therapy resolved these thrombotic complications. Disappearance of the hematoma and IVC recanalization were confirmed 3 months postoperatively. Although IVC compression caused by a retroperitoneal hematoma is temporary, careful attention should be paid to IVC thrombosis, DVT, and PTE as possible complications.

Keywords: ruptured abdominal aortic aneurysm, inferior vena cava compression, deep venous thrombosis

Introduction

Inferior vena cava (IVC) compression is a well-known complication of malignancy.¹ Although abdominal aortic aneurysms (AAAs) can externally compress the IVC,^{2,3} IVC compression caused by a retroperitoneal hematoma following an AAA rupture has been rarely reported to

date.^{3–7} Slow blood flow velocity resulting from IVC compression causes IVC thrombosis, deep venous thrombosis (DVT), and pulmonary thromboembolism (PTE).^{2–7} This report presents a case of IVC compression caused by a retroperitoneal hematoma following an AAA rupture.

Case Report


A 43-year-old man initially presented to another hospital with a sudden onset of abdominal pain, a blood pressure level of 70/40 mmHg, and a heart rate of 120 beats/min. He was transferred to our hospital after his computed tomography (CT) scan revealed a ruptured AAA. He had a history of cleft lip and palate surgery, and no significant family medical history was reported. On arrival at our hospital, his abdomen was obviously distended; however, no swelling of the lower extremities and engorgement of the infrainguinal superficial veins were observed. There were no physical findings specific to Marfan and Ehlers–Danlos syndromes.⁸ His CT scan revealed an infrarenal AAA with a large retroperitoneal hematoma (**Fig. 1**). An intimal flap was delineated in the AAA and bilateral common iliac arteries, indicating that the AAA rupture was caused by acute aortic dissection (**Figs. 1B and 1C**). The hematoma was located to the right of the AAA and nearly occluded the IVC (**Fig. 1D**). The dissected celiac trunk and superior mesentery artery were dilated and tortuous. Aortic root dilatation was not detected on CT. Later, magnetic resonance angiography revealed tortuosity of the vertebral arteries. Although the cleft palate and arterial tortuosity were discriminating features of Loeys–Dietz syndrome, the patient refused to undergo genetic tests required to diagnose connective tissue disorders.^{8,9} The patient was subsequently diagnosed with a ruptured AAA and thus underwent emergency surgery.

A median laparotomy was performed with the patient in the supine position. After heparinization, the proximal neck of the AAA, bilateral common iliac arteries, and inferior mesenteric artery were clamped. The posterior wall of the aneurysm was confirmed to be dissected and perforated on opening the AAA. An aortic grafting using

¹Department of Cardiovascular Surgery, Tsukuba Medical Center Hospital, Tsukuba, Ibaraki, Japan

²Department of Cardiovascular Surgery, Teikyo Chiba Medical Center, Ichihara, Chiba, Japan

Received: September 25, 2018; Accepted: December 19, 2018
Corresponding author: Akihiko Ikeda, MD, PhD. Department of Cardiovascular Surgery, Teikyo Chiba Medical Center, 3426-3 Anesaki, Ichihara, Chiba 299-0111, Japan
Tel: +81-436-62-1211, Fax: +81-436-61-4773
E-mail: ai-cvs@sd6.so-net.ne.jp

 ©2019 The Editorial Committee of Annals of Vascular Diseases. This article is distributed under the terms of the Creative Commons Attribution License, which permits use, distribution, and reproduction in any medium, provided the credit of the original work, a link to the license, and indication of any change are properly given, and the original work is not used for commercial purposes. Remixed or transformed contributions must be distributed under the same license as the original.

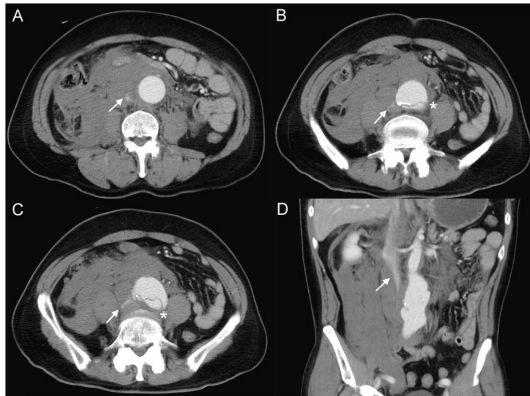


Fig. 1 Preoperative computed tomography (CT). (A–C) Horizontal CT scan views. (D) Coronal CT scan view. The ruptured abdominal aortic aneurysm (AAA) is of an infrarenal type with a maximum diameter of 40 mm and is accompanied by a large retroperitoneal hematoma. An intimal flap can be seen in the AAA, which indicates that acute aortic dissection caused the rupture of the AAA (asterisks). The inferior vena cava is nearly occluded because of external compression caused by the hematoma (arrows).

a bifurcated knitted Dacron graft (16×8 mm; Gelsoft Plus Bifurcate Graft; Vascutek Ltd., Renfrewshire, Scotland, UK) was performed without any complications. A histopathological examination of the resected aneurysmal wall showed cystic medial necrosis with elastin fiber fragmentation, which was consistent with connective tissue disorders. After surgery, the patient's hemodynamics and respiratory condition were stable, and he was weaned from the mechanical ventilator on postoperative day 4.

On postoperative day 12, the patient's CT scan revealed good patency of the implanted graft and no leakage from the anastomoses. A mural thrombus was observed in the IVC at the level of the right renal vein (Fig. 2A). The IVC below the confluence of the bilateral renal veins appeared occluded owing to the mural thrombus caused by IVC compression of the retroperitoneal hematoma (Figs. 2A and 2B). Venous vessels distal to the bilateral common iliac veins were defined, and small venous thrombi were detected in the bilateral soleus muscles (Fig. 2C). In addition, a thrombus was observed in the right distal pulmonary artery (Fig. 2D). The patient did not exhibit any symptoms related to IVC occlusion and PTE. Anticoagulation therapy with heparin and warfarin was initiated. After 1 week of treatment, the patient's CT scan revealed improvements of IVC thrombosis, DVT, and PTE. The patient was discharged 1 month postoperatively with continuous oral administration of warfarin. A CT scan obtained 3 months postoperatively revealed that the retroperitoneal hematoma had disappeared, with good patency of the IVC (Fig. 3). As IVC thrombosis, DVT, and PTE had completely resolved, warfarin was discontinued.

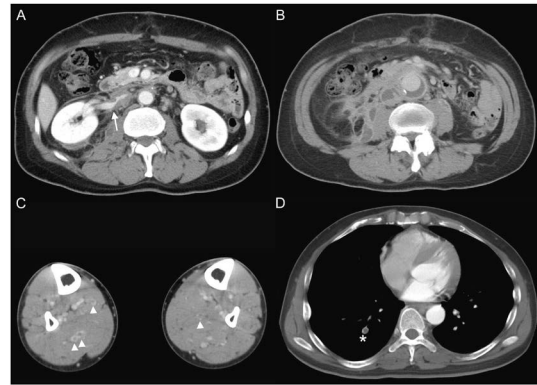


Fig. 2 Follow-up computed tomography (CT) performed on postoperative day 12.

(A) A mural thrombus is present in the inferior vena cava (IVC) at the level of the right renal vein. The right renal vein is patent with return to the IVC (an arrow). (B) The IVC below the confluence of the bilateral renal veins appears occluded owing to the mural thrombus caused by IVC compression of the retroperitoneal hematoma. (C) Venous vessels distal to the bilateral iliac veins are described. Multiple venous thrombi are present in the bilateral soleus muscles (arrowheads). (D) A small thrombus can be seen in the right distal pulmonary artery (an asterisk).

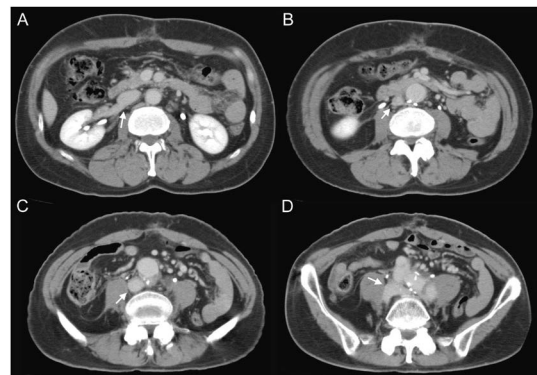


Fig. 3 Follow-up computed tomography (CT) performed 3 months postoperatively.

The retroperitoneal hematoma disappeared, and the inferior vena cava is widely patent (arrows).

Discussion

The etiology of IVC compression includes AAAs and malignancies originating from the abdominal organs.^{1,3)} IVC compression caused by a retroperitoneal hematoma following an AAA rupture is rare.^{3–7)} Ruptured AAAs are lethal vascular events that require prompt diagnosis and treatment.¹⁰⁾ Treatments for ruptured AAAs include open surgery and endovascular aneurysm repair (EVAR). Although EVAR is less invasive than open surgery,^{10,11)} we considered open surgery more appropriate for patients with aortic dissection, which was otherwise an unfavor-

Table 1 Reported cases of inferior vena cava compression caused by a retroperitoneal hematoma following an abdominal aortic aneurysm rupture

Author	Year	Age/ sex	Clinical presentation	Venous thrombosis	Tx for AAA	Tx for venous thrombosis	Outcome
Snider et al. ⁴⁾	1974	57/M	Preoperative bilateral leg edema	IVC occlusion with thrombus, DVT	Open surgery	Anticoagulation	Survived No leg edema
Gertner et al. ⁵⁾	1978	65/M	Preoperative bilateral leg edema	IVC occlusion with thrombus	Open surgery	Caval clip	Died of sepsis
Robertson and Macpherson ⁶⁾	1988	66/M	Preoperative bilateral leg edema	IVC stenosis without thrombus, DVT	Open surgery	Anticoagulation	Unknown
Shukuzawa et al. ⁷⁾	2017	65/M	No leg edema Sudden postoperative cardiac arrest	DVT, PTE	EVAR	None	Hypoxic encephalopathy

AAA: abdominal aortic aneurysm; DVT: deep venous thrombosis; EVAR: endovascular aneurysm repair; IVC: inferior vena cava; PTE: pulmonary thromboembolism

able disorder for EVAR.

Previous reports related to IVC compression caused by a retroperitoneal hematoma following AAA ruptures are summarized in **Table 1**.⁴⁻⁷⁾ Typical symptoms of IVC compression include leg edema, which is typically bilateral and can range from simple premalleolar edema to massive edema involving the thigh and perineum.³⁻⁶⁾ External compression slows the blood flow velocity in venous vessels, thereby causing IVC thrombosis, DVT, and PTE.²⁻⁷⁾ In cases of IVC compression caused by a retroperitoneal hematoma following an AAA rupture, venous thromboses can arise, both above and below the site of IVC compression, resulting in IVC occlusion.^{4,5)} In this case, the patient did not exhibit leg edema despite postoperative CT scans showing IVC occlusion. There are two possible causes of asymptomatic IVC occlusion. One involves the development of paraspinal venous collaterals.³⁾ The other is the overestimation of IVC occlusion revealed by CT scans. Due to use of the Valsalva maneuver during the CT scans, the patient's intracaval pressure was increased, and the IVC cross-sectional area was decreased considerably, as evidenced by the CT scans.¹²⁾

Several treatment options are available for IVC thrombosis, DVT, and PTE in patients with IVC compression caused by a retroperitoneal hematoma following an AAA rupture. Caval clip usage, IVC ligation, and retroperitoneal hematoma removal with aortic grafting pose a risk of increased bleeding owing to extensive dissection in the retroperitoneal space.²⁾ IVC filter placement avoids the risk of extra blood loss and can be concomitantly performed with EVAR.¹³⁾ However, it poses risks of IVC penetration, filter migration, filter fracture, and thrombotic IVC occlusion.¹⁴⁾ Anticoagulation using heparin and warfarin is essential. Successful aortic grafting with anticoagulation therapy was reported previously in a patient with a ruptured AAA with IVC thrombosis.⁴⁾ In the present case,

we decided to perform anticoagulation therapy once IVC thrombosis, DVT, and PTE were diagnosed. The mural thrombus, which was not floating, was present in the IVC at the level of the renal veins. Although the minor PTE was complicated, the patient's condition remained stable. If the PTE deteriorated despite performing anticoagulation therapy, IVC filter placement was considered.³⁾ IVC filter placement with aortic grafting for the ruptured AAA was debatable because the patient's preoperative CT scans did not reveal venous thrombosis.

Conclusion

This report presents a case of IVC compression caused by a retroperitoneal hematoma following an AAA rupture. IVC thrombosis, DVT in the soleus muscles, and a minor PTE that arose after emergent aortic grafting were resolved using anticoagulation therapy. Finally, the retroperitoneal hematoma and all venous thrombi disappeared, which resulted in good patency of the IVC. The large retroperitoneal hematoma observed following a ruptured AAA decreased gradually; however, it could cause IVC compression associated with IVC thrombosis, DVT, and PTE. A perioperative evaluation of the venous system is crucial for selecting the appropriate treatment for IVC thrombosis, DVT, and PTE accompanied by IVC compression caused by a retroperitoneal hematoma following an AAA rupture. Anticoagulation therapy becomes essential in such cases, and the method of IVC filter placement should be cautiously decided.

Disclosure Statement

The author has no conflicts of interest to declare.

References

- 1) Kraft C, Schuettfort G, Weil Y, et al. Thrombosis of the inferior vena cava and malignant disease. *Thromb Res* 2014; **134**: 668-73.
- 2) Palmer MA. Inferior vena cava occlusion secondary to aortic aneurysm. *J Cardiovasc Surg (Torino)* 1990; **31**: 372-4.
- 3) Combe J, Besancenot J, Milleret P, et al. Iliocaval venous compression due to aneurysm of the abdominal aorta: report of ten cases. *Ann Vasc Surg* 1990; **4**: 20-5.
- 4) Snider RL, Porter JM, Eidemiller LR. Inferior vena caval obstruction caused by expansion of an abdominal aortic aneurysm: report of a case and review of the literature. *Surgery* 1974; **75**: 613-6.
- 5) Gertner MH, Hargrove WC, Roberts B. A ruptured abdominal aortic aneurysm presenting as inferior vena caval obstruction. *Surgery* 1978; **83**: 605-8.
- 6) Robertson GSM, Macpherson DS. Aortic aneurysm presenting as deep venous thrombosis. *Lancet* 1988; **331**: 877-8.
- 7) Shukuzawa K, Toya N, Momokawa Y, et al. Pulmonary embolism due to inferior vena cava compression by a retroperitoneal hematoma after endovascular repair of a ruptured abdominal aortic aneurysm. *Case Rep Vasc Med* 2017; **2017**: 8172549.
- 8) Loeys BL, Dietz HC, Braverman AC, et al. The revised Ghent nosology for the Marfan syndrome. *J Med Genet* 2010; **47**: 476-85.
- 9) Loeys BL, Schwarze U, Holm T, et al. Aneurysm syndromes caused by mutations in the TGF- β receptor. *N Engl J Med* 2006; **355**: 788-98.
- 10) Speicher PJ, Barbas AS, Mureebe L. Open versus endovascular repair of ruptured abdominal aortic aneurysms. *Ann Vasc Surg* 2014; **28**: 1249-57.
- 11) Murakami Y, Toya N, Fukushima S, et al. Endovascular aneurysm repair—first strategy for ruptured aneurysm focuses on Fitzgerald classification and vein thrombosis. *Ann Vasc Surg* 2018; **52**: 36-40.
- 12) Laborda A, Sierre S, Malvè M, et al. Influence of breathing movements and Valsalva maneuver on vena caval dynamics. *World J Radiol* 2014; **6**: 833-9.
- 13) Yoshizaki T, Tabuchi N, Makita S. Inferior vena cava occlusion secondary to an inflammatory abdominal aortic aneurysm. *Interact Cardiovasc Thorac Surg* 2007; **6**: 128-9.
- 14) Caplin DM, Nikolic B, Kalva SP, et al. Quality improvement guidelines for the performance of inferior vena cava filter placement for the prevention of pulmonary embolism. *J Vasc Interv Radiol* 2011; **22**: 1499-506.