Rupture of the Inferior Vena Cava Associated with Complete Thrombotic Occlusion after Placement of a Caval Filter

Ken-ichi Imasaka, Masahiro Oe and Shin-ichiro Oda

We reported a case of a 41-year-old woman with a ruptured inferior vena cava (IVC): this was revealed by a swelling in the lower extremities and bursting pain. This condition was diagnosed on laparotomy. The operation involved repair of the IVC tear and thrombectomy. In this patient, a permanent IVC filter had been placed previously due to deep vein thrombosis. The head of the IVC filter had been covered by a fibrous membrane. Entrapment of the thrombus in the IVC filter might have resulted in high venous pressure in the IVC and a subsequent predisposition of the IVC to rupture. The swelling in the legs diminished slowly, and the patient was discharged with oral anticoagulation and elastic stockings. Despite clinical features and computed tomography findings, the physician's awareness of this disease remains the most important factor for early treatment. Jpn. J. Cardiovasc. Surg. 35: 231-234 (2006)

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Rupture of the inferior vena cava (IVC) without external trauma is rare. However, the mortality and morbidity associated with this disease is very high. The critical nature of this condition is due to difficulty in its diagnosis and delay in treatment. We present a case of the ruptured IVC associated with recurrent deep vein thrombosis.

Case Report

The patient in this study was a 41-year-old woman with a 4-day history of severe edema and pain in the lower limbs. The hemodynamic state of the patient was stable. Past history revealed alcoholism, heavy smoking, and insomnia. The patient had taken many hypnotic drugs due to a sleep disorder. Eighteen months before she was admitted to our hospital, a permanent Vena-Tech inferior vena cava filter (VTF) (B Braun Aesculap, Inc.™) had been placed to prevent pulmonary embolism (PE) due to deep vein thrombosis (DVT) of the right leg. After the placement of VTF, anticoagulation therapy using warfarin had been performed, but it was very difficult to keep the appropriate prothrombin time (PT) as an outpatient.

At admission, a multislice computed tomography (CT) scan confirmed the thrombotic occlusion of the IVC just below the VTF (Fig. 1). Filter migration and tilting of the VTF were not observed. We believed that the IVC had expanded due to the thrombus. In the beginning, we did not consider the possibility of an IVC rupture. After another temporary filter was placed above the VTF, the patient was explored by a midline laparotomy to remove the VTF and the venous thrombus. The exploration of the retroperitoneum revealed a longitudinal 2-cm linear tear on the left anterolateral side of the IVC (Fig. 2). The site of the VTF was 5 cm proximal to the tear in the IVC. It was confirmed that the IVC expansion observed in the CT findings was a retroperitoneal hematoma surrounding the IVC. The ruptured IVC was closed with an equine pericardium patch (Xenomedica, Baxter-Edwards, Inc.™). The head of the VTF was covered by a fibrous membrane (Fig. 3). Venous thrombectomy was performed with a Fogarty catheter and by infusion of heparinized saline via both the IVC and the left femoral vein.

The swelling in the lower extremities diminished slowly. However, residual thrombus was confirmed and it extended from the level of the renal veins to the iliofemoral veins (Fig. 4). The IVC had been blocked completely by the thrombus underneath the renal veins. We thought that the possibility of PE was low because of complete thrombotic occlusion of the IVC. We did not implant a suprarenal vena caval filter. The patient was treated with an initial course of heparin and then received sodium warfarin. During admission after the operation, the international normalized ratio was stable (1.8 to 2.0). Laboratory explorations did not show a hypercoagulable profile. Finally, the patient was discharged in good condition with administration of oral anticoagulation (aspirin and sodium warfarin).

During the 6 months after this operation, she remained free of symptoms and did not show edema in the lower extremities. A multislice CT scan at 6-month intervals revealed considerable reduction of the thrombus in the IVC (Fig. 5). Ventilation-perfusion scans revealed that no new pulmonary

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Department of Cardiovascular Surgery, Kumamoto City Hospital, 1-1-60 Koto, Kumamoto 862-8505, Japan
Fig. 1 Preoperative computed tomographic images: sagittal view
A massive thrombus had formed in the inferior vena cava just below a permanent IVC filter to the right femoral and the left popliteal vein. IVCF: inferior vena caval filter, IVC: inferior vena cava.

Fig. 2 Operative findings
The visualization of the ruptured IVC at the retroperitoneal opening (arrow). IVC: inferior vena cava.

Fig. 3 The permanent Vena-Tech inferior vena caval filter which was removed during the operation
The head of this device has been covered by a fibrous membrane (arrow).

Fig. 4 Computed tomographic image
One month after the operation, residual thrombus was revealed that extended from the level of the renal veins to the iliofemoral veins.
embolism occurred.

Comment

Venous thromboembolic disease is a significant cause of morbidity and mortality in the United States. PE, the most deadly form of venous thromboembolic disease, is diagnosed in 355,000 patients and results in as many as 240,000 deaths per year. Although anticoagulation remains the primary therapy for venous thromboembolism in most clinical situations, a vena caval filter is an important alternative when anticoagulants are contraindicated or not sufficiently effective. Thrombotic complications after the placement of a vena caval filter consist of an IVC thrombus and an access site thrombus. IVC thrombus (3.6-11.2%) after filter placement vary widely among different filter types, primarily because of differences in outcome assessment.

The VTF is constructed of Phynox, a unique nonparamagnetic alloy (cobalt, 42%; chromium, 21.5%; iron, 8.85%; nickel, 18%; molybdenum, 7.5%; magnesium, 2%; and a maximum of 0.15% carbon and 0.001% beryllium). Six struts are fused into a cone-shaped filter reminiscent of the Greenfield filter. Side rails attached to the filter cone anchor it to the caval wall. A review of several studies indicated that the use of the VTF was associated with increased rates of IVC thrombi when compared with the use of other filters approved by the Food and Drug Administration.

Filter migration and perforation of the vena cava wall have been reported as the complications of the IVC filter. In the present case, no penetration of the filter into the vena caval wall and migration were observed, and the site of the tear was 5 cm below that of the caval filter. Therefore, in this case, the etiology is considered to be the thrombus that created a high pressure below the VTF covered by a fibrous membrane. However, even if the IVC is completely occluded by a thrombus, the collateral pathways usually prevent an excessive increase in the internal pressure within the IVC. The number of collateral vessels that developed after the first placement of the vena caval filter is unknown. This patient was an alcoholic: therefore, warfarin control was very difficult to achieve. Furthermore, the patient always spent many hours playing pinball. We speculate that the rupture of the IVC occurred because of acute massive thrombotic occlusion due to which the collateral vessels were unable to prevent the resulting increase in the internal pressure. Crochet et al. reported that PE with anticoagulation failure was only a predictive factor of caval occlusion after the VTF placement. Certainly, the use of VTF, unlike other vena caval filters, tends to occlude the IVC due to thrombus formation. Nevertheless, we believe that the occurrence of IVC thrombus is due to the patient's life style rather than the VTF placement.

If feasible, routine anticoagulation should be recommended after the placement of the vena caval filter. During her admission, 11 mg per day of warfarin was necessary to maintain the appropriate PT value. We educated her with regard to improving her lifestyle. However, after she was discharged, the PT value was again unstable. She is being currently followed-up with much patience to ensure that appropriate oral anticoagulants are administered.

Clinical presentation of the ruptured IVC is usually similar to that of a ruptured abdominal aneurysm. More than one-third of the patients with a ruptured IVC die before reaching the hospital, and half of those admitted die despite resuscitation and early operation, usually because of exsanguination. Nevertheless, the hemodynamic state in our case was stable. Fortunately, the IVC was totally occluded by the thrombus.

In invasive therapy for DVT, surgical venous thrombectomy is usually performed with a Fogarty catheter through a groin incision. Fatal hemorrhage could occur if the thrombectomy is performed only with a Fogarty catheter via the femoral veins. In the absence of any relevant history, the diagnosis of this condition is usually made by laparotomy. The operation may yield good result if the possibility of
rupture is considered. In the case of a caval thrombus under a previously implanted IVC filter, only the groin approach for the surgical thrombectomy is considered very dangerous.

Conclusion

Although rare, the rupture of the IVC may be associated with a caval thrombus. In patients with a permanent vena caval filter, rupture of the venous system should be presumed in case of complete caval thrombotic occlusion.

References