

# Development of a postoperative occlusive thrombus at the site of an implanted inferior vena cava filter

## A case report

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### Abstract

**Rationale:** Although an inferior vena cava (IVC) filter is placed to prevent fatal pulmonary embolism (PE), several complications associated with an IVC filter have been reported. We describe a case with symptomatic PE, of which the origin was an occlusive IVC thrombus that developed from the placement of an IVC filter after a laparoscopy-assisted total gastrectomy (LATG).

**Patient concerns:** A 71-year-old man underwent LATG under general anesthesia alone. He had an IVC filter implanted 13 years ago. An intravenous infusion of unfractionated heparin was substituted for the discontinuation of oral warfarin four days before the surgery. The proposed operation was performed and took a total of 404 minutes including the total duration of pneumoperitoneum that took 374 minutes. After the surgery, he experienced severe shivering reactions that required frequent bolus infusions of antihypertensive drugs. On the third postoperative day, he complained of dyspnea after taking a short walk, and subsequently lost consciousness. While he spontaneously recovered without requiring any resuscitation efforts, we performed computed tomography (CT) examination for suspected PE.

**Diagnoses:** The CT showed that a massive thrombus was occupying the intravenous space from the IVC filter to the left common iliac vein with several embolic defects in the peripheral pulmonary arteries present.

**Interventions:** An anticoagulant therapy was established with 10 mg of oral apixaban given twice a day for the first four days, followed by a reduction to 5 mg.

**Outcomes:** On the 17th postoperative day, an ultrasound vascular examination confirmed the complete disappearance of deep venous thrombus (DVT).

**Lessons:** As an IVC filter itself may be a potential source of DVT, we should carefully manage patients with a previously implanted IVC filter throughout the perioperative period.

**Abbreviations:** CT = computed tomography, DVT = deep venous thrombus, IVC = inferior vena cava, LATG = laparoscopy-assisted total gastrectomy, PE = pulmonary embolism, PT = prothrombin time, VTE = venous thromboembolism.

**Keywords:** anticoagulant therapy, inferior vena cava filter, inferior vena cava thrombus, postoperative period, pulmonary embolism

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## 1. Introduction

The placement of an inferior vena cava (IVC) filter is often considered for the prevention of fatal pulmonary embolism in the presence of deep vein thrombus (DVT), especially when an anticoagulant therapy is contraindicated. Several complications associated with implanted IVC filters have recently been described.<sup>[1]</sup> These include recurrent DVT, IVC thrombosis, and pulmonary embolism (PE).<sup>[1]</sup> It was reported that a duration longer than 30 days after the insertion of an IVC filter increases the rate of occurrence of thrombo-embolism.<sup>[2]</sup> Therefore, a retrievable filter should be removed immediately if the risk of PE is negligible. In contrast, patients with a permanent IVC filter may require a long-term anticoagulant therapy.<sup>[3]</sup> However, because an anticoagulant therapy is temporarily interrupted during a perioperative period, it may be logical to consider surgical patients with an IVC filter to be vulnerable to thrombotic events combined with postsurgical hypercoagulability. We describe the unexpected development of an occlusive thrombus in the IVC at the site of an implanted filter with symptomatic PE after a laparoscopy-assisted total gastrectomy (LATG).

## 2. Case report

A 71-year-old man (height 165 cm, and weight 66 kg) was scheduled to undergo LATG as a prior endoscopic submucosal dissection for early gastric cancer was not curative. He had an IVC filter that was implanted 13 years before for DVT. We had no detailed information on the type of IVC filter implanted. While he was receiving 1.5 or 1.75 mg of oral warfarin every other day, prothrombin time (PT) was 2.06 (value of INR), and blood concentration of FDP was 2.5  $\mu\text{g}/\text{mL}$  (normal value;  $<5.0 \mu\text{g}/\text{mL}$ ). His other medications were 2 antihypertensive drugs (benidipine 8 mg and enalapril 5 mg daily), 2 antidiabetic drugs (glimperide 0.5 mg and sitagliptin 25 mg daily), and aspirin 100 mg daily because of an old cerebral infarction. The preoperative enhanced CT examination showed neither the apparent evidence of PE or DVT. Intravenous infusion of unfractionated heparin of which the daily dose was 10,000 units was substituted for the discontinuation of oral warfarin 4 days before the elective surgery. PT recovered to 1.09 (INR), and aPTT was 30.8 seconds (normal range; 21.5–43.1 seconds) 1 day before the surgery.

After the induction of general anesthesia, he was placed in the lithotomy position with both legs raised and the under-knees were compressed with elastic stockings. The proposed operation was uneventfully performed under general anesthesia with continuous infusion of remifentanyl (0.15–0.3  $\mu\text{g}/\text{kg}/\text{min}$ ), inhalation of desflurane (3–4%), and intermittent administration of rocuronium (10 mg). The total operation time was 404 minutes, which included the total duration of pneumoperitoneum of 374 minutes. During the pneumoperitoneum with an insufflation of carbon dioxide, the intra-abdominal pressure was kept below 10 mmHg. While the blood loss throughout the entire operation was negligible, the total infused volume of crystalloid was 3450 mL, and urine volume was 750 mL. Immediately after the removal of the tracheal tube, systemic shivering reactions occurred despite maintaining the core temperature  $>36^\circ\text{C}$  by warming with a forced air blanket, and severe hypertension and tachycardia were induced. We needed to administer frequent bolus infusions of both nicardipine and diltiazem. It took approximately 30 minutes to stabilize his hemodynamics with the disappearance of shivering reactions, and he was then transferred to the intensive care unit for the postanesthesia care. His 2-day stay in the intensive care unit was uneventful, and he was subsequently discharged to the general ward with the requirement of continuous nicardipine infusion for hypertension.

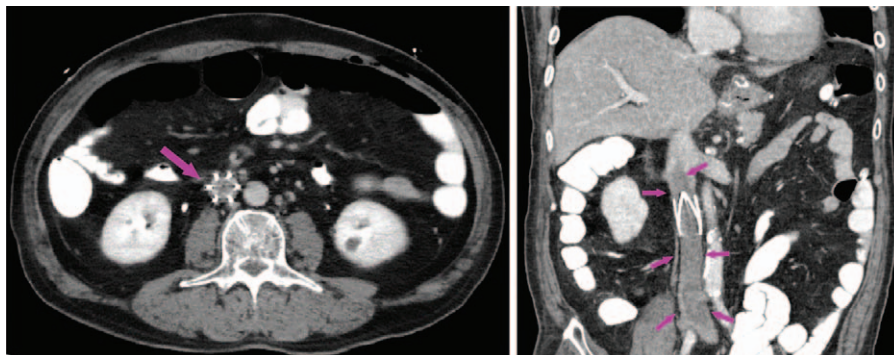
On the third postoperative day, while he took a voluntary walk for several meters under assistance by an attending nurse, he

suddenly complained of dyspnea and subsequently lost consciousness. Cardiopulmonary resuscitation due to an impalpable pulse was almost initiated, but the patient spontaneously recovered consciousness, and his blood pressure gradually increased to within normal range without any intervention. To investigate the cause of the events, we performed an enhanced CT examination, which showed a massive thrombus in the IVC that extensively occupied the intravenous space from approximately 2 cm proximal to the IVC filter to the left common iliac vein (Fig. 1). It also showed several embolic defects in the peripheral branches of the bilateral pulmonary arteries (Fig. 2). However, a transthoracic echocardiography did not indicate a pressure-overloaded right ventricle that is characteristic of life-threatening PE. At that time, the plasma level of D-dimer was increased to 123.9  $\mu\text{g}/\text{mL}$ . As he was hemodynamically stable after the recovery from symptomatic events, oral anticoagulant therapy with apixaban was recommended after consultation with a cardiologist. Ten milligram of apixaban was given twice a day for the first 4 days, and apixaban was then continued by reducing to 5 mg twice a day. On the 15th day after the initiation of anticoagulant therapy, an ultrasound vascular examination of the lower abdomen and bilateral lower limbs confirmed the complete disappearance of VT. The plasma level of D-dimer also decreased and almost reached the normal value of 6.6  $\mu\text{g}/\text{mL}$ . Throughout his prolonged hospitalization from the introduction of oral anticoagulant therapy, we did not notice any recurrence of symptomatic PE and any adverse event including serious bleeding. On the 19th postoperative day, he was discharged from our hospital.

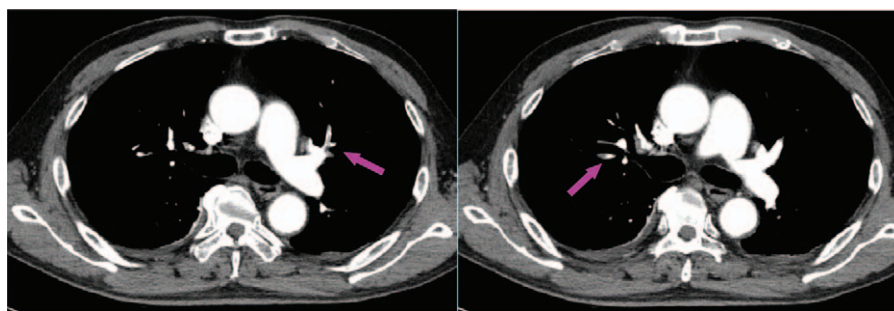
## 3. Discussion

Vena cava thrombus has been reported to an IVC filter related complication, but as presented in this case, the occlusive IVC thrombus which progressively developed at the site of the IVC filter may be rare in the early postoperative period.<sup>14)</sup> We did not notice the occurrence of an IVC thrombus until the serious symptoms of PE such as dyspnea and a transient circulatory shock emerged. It was fortunate that he rapidly recovered from PE-induced hemodynamic impairment without any therapeutic intervention. If a larger mass of thrombus had been detached, and then traveled into the main pulmonary artery, this patient would have been at risk of life-threatening PE.

A prospective, multicenter Japanese study in 2006 found that venous thromboembolism (VTE) was diagnosed by postoperative venography in 24.3% of patients undergoing open major



**Figure 1.** On the cross-sectional and coronal CT image, the purple arrows indicate a massive thrombus in the IVC occupying an intravenous space from approximately 2 cm proximal to the IVC filter to the left common iliac vein. CT=computed tomography, IVC=inferior vena cava.



**Figure 2.** On the cross-sectional CT images, the purple arrows indicate embolic defects in the peripheral branches of the bilateral pulmonary arteries. CT = computed tomography.

abdominal surgery.<sup>[5]</sup> Moreover, in a recent Japanese study with a limited number of 101 patients, a doppler ultrasound sonography of the lower limbs also revealed that asymptomatic VTE occurred in 18.3% of patients by 7 days after laparoscopic surgery for gastric and colorectal cancer.<sup>[6]</sup> The incidence of VTE following abdominal surgery is not low in Japan regardless of open or laparoscopy-assisted procedures. Therefore, we should take protective measures as recommended by American college of chest physicians guidelines for thromboprophylaxis of non-orthopedic surgical patients in the perioperative period.<sup>[7]</sup> However, for this patient, we did not expect that the IVC filter itself was a potent source of PE due to a rapidly developing IVC thrombus at the site of the filter. Due to an underestimated occurrence of PE by the presence of a protective IVC filter for PE, we might have delayed restarting an anticoagulant therapy in the earlier postoperative period.

A significant alternation in venous hemodynamics of the lower limbs is considered as a contributing factor for triggering an initiation of the clotting process. In a previous study of female patients undergoing total abdominal hysterectomy under general anesthesia, the results showed that the venous flow of the lower limbs as measured by using duplex ultrasound was markedly attenuated from the intraoperative to the early postoperative period.<sup>[8]</sup> The maximum flow reduction was 34.6% of the preoperative baseline value in the early recovery phase.<sup>[8]</sup> Another study showed that the venous volume flow and velocity in the lower limbs significantly increased after performing epidural blockade under general anesthesia due to a sympatholytic action in patients undergoing total abdominal hysterectomy.<sup>[9]</sup> In this patient, the postoperative severe shivering reaction might also have had a further detrimental effect on the venous flow of the lower limbs by inducing an exaggerated peripheral vasoconstriction through the over activation of the sympathetic nervous system.

Moreover, a simulated study using computational flow model showed that a substantial flow disturbance was noted downstream of captured clots within IVC filters.<sup>[10]</sup> This result may suggest that once some clots are attached to or generated in an IVC filter, the already impaired venous flow is further worsened, resulting in an accelerated progression of clot formation distal to the IVC filter. Although it is difficult to pinpoint the exact time of thrombus development in this patient, we suspect that cascade of reactions for thrombus development began at least by the early postoperative period.

It was recommended to administer 10mg of apixaban, a reversible inhibitor of blood coagulation activated factor X, twice a day orally for an initial loading dose after consultation with a

cardiologist for the treatment of symptomatic VTE. The Apixaban for the treatment of Japanese subjects with acute venous thromboembolism (AMPLIFY-J) study showed that apixaban had a similar therapeutic effect on thrombotic burden compared with a combination therapy with unfractionated heparin and warfarin.<sup>[11]</sup> A loading of 20mg apixaban daily should be continued for first 7 days according to the study design. However, we shortened the period from 7 to 4 days, and then gave a reduced dose of 10mg daily to avoid bleeding after a major abdominal surgery and in consideration of his advanced age (>65 years). On the ultrasound vascular examination at approximately 2 weeks after starting apixaban, the DVT completely disappeared in both the lower abdomen and bilateral lower limbs. Even in this patient with an extensively occlusive IVC thrombus, an oral anticoagulant therapy with apixaban can afford a comparable efficacy in dissolving a thrombus safely without adverse bleeding events as shown in the AMPLIFY-J study.<sup>[11]</sup> If oral medication can be tolerated in an acute phase of VTE, apixaban should be considered as a useful alternative to establish anticoagulant therapy.

We experienced an occlusive thrombus in the IVC with symptomatic PE after LATG in a surgical patient who had a previous placement of IVC filter. As an IVC filter itself is thought to be a potential source of DVT perioperatively, we should cautiously manage patients with an implanted IVC filter to prevent an occurrence of VTE by using proper thromboprophylaxis and careful monitoring.

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