A Case of Huge Colon Carcinoma and Right Renal Angiomyolipoma Accompanied by Proximal Deep Venous Thrombosis, Pulmonary Embolism and Tumor Thrombus in the Renal Vein

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INTRODUCTION

Prevention of pulmonary embolism (PE) has emerged as an important issue in perioperative management (1–3). A huge tumor in the abdomen inhibits venous perfusion by pressing the inferior vena cava (IVC) and a malignant tumor causes a hypercoagulable state that often leads to deep venous thrombosis (DVT) (3). A preoperative IVC filter (VCF) is reported to be particularly effective in the cases of proximal DVT or in which PE has already developed (4). However, complications, including recurrent DVT, may occur with long-term VCF placement, and guidelines for the use of VCF have yet to be established (5,6). Using VCFs, we successfully removed a huge angiomyolipoma (AML) in the right kidney and ascending colon cancer in a patient with the preoperative diagnosis of PE associated with a tumor embolus in the right renal vein and DVT in the right lower extremity. Here, we report the case and discuss the relevant literature.

CASE REPORT

The patient was a 70-year-old female in whom a tumor in the right lower abdomen had been detected 3 years earlier, but left untreated. She visited a local doctor due to enlargement of the tumor and was diagnosed with a huge AML in the right kidney and ascending colon cancer. She was admitted to our hospital in October 2006. Computed tomography (CT) showed a very large tumor (14 × 12 × 8 cm) in the right kidney that projected out of the kidney and was associated with a beak sign (Fig. 1A). The tumor was...
diagnosed as AML based on the CT image. In addition, the CT image revealed a huge tumor (14 × 10 × 10 cm) in the region ranging from the cecum to the ascending colon (Fig. 1B). It was unclear if the cancer had invaded beyond the bowel wall, but the tumor was compressing the surrounding organs and the IVC.

The two tumors were in contact with each other and shared the entire right abdomen. Colonoscopy demonstrated a huge tumor occupying the ascending colon to the cecum, and the biopsy indicated adenocarcinoma. Furthermore, a tumor embolus was found in the right renal vein and was confirmed to be free-floating by ultrasonography and CT image (Fig. 1C). A thrombus was also found between the right external iliac vein and the femoral vein (Fig. 1D), and a thrombus with low absorbance or a tumor embolus was found in the common basal artery of the right lung (Fig. 2A). Pulmonary arteriography showed that the anterior artery of right lung was occluded and a floating embolus was present in the right common basal artery, resulting in a diagnosis of PE (Fig. 2B). The patient was asymptomatic with no episodes indicating PE, and respiratory function tests, including blood gas analysis and a spirogram, were normal. The plasma D-dimer level was slightly elevated, 3.60 μg/ml; but other coagulation tests were within normal limits, such as the prothrombin time, 11.4 s; activated partial thromboplastin time, 24.4 s and fibrin degradation product level, 8.3 μg/ml. The patient had no history suggestive of congenital coagulation disorder. Based on these findings, the patient was diagnosed with ascending colon cancer and AML in the right kidney, with PE and DVT.

The patient had two huge tumors that occupied the entire right half of the abdomen, DVT in the right external iliac vein and PE. Consequently, she was considered to be at high risk of developing secondary fatal PE during or after surgery, therefore, VCFs were preoperatively inserted into the supra- and infrarenal IVC (Fig. 3). Also, unfractionated heparin (10 000 U/day) was administered as perioperative anticoagulant treatment. In October 2006, the patient

**Figure 1.** Computed tomography (CT) revealed two huge tumors, tumor thrombi extended from the renal tumor and deep venous thrombosis in the right iliofemoral vein. (A) The white arrowheads indicate the tumor originating from the right kidney. (B) The black arrowheads show the tumor in the ascending colon. (C) Coronal view of CT demonstrated the tumor (white arrowheads) protruding from the right kidney and the renal vein cranially compressed by the tumor. The black arrows indicate the extensive tumor thrombus in the right renal vein. (D) Coronal view of CT demonstrated the two huge tumors. The white arrowheads indicate the renal tumor, and the black arrowheads show the colon carcinoma. The two tumors compressed the inferior vena cava (IVC) to the left side. The white arrows indicate the thrombus in the right iliac vein.
underwent right hemicolectomy and right nephrectomy. Monitoring the tumor embolus in the right renal vein by intraoperative ultrasonography, the right side of the IVC was clamped and the right renal vein was resected, followed by IVC reconstruction. The operation time was 3 h and 30 min, and the hemorrhage volume was 613 ml. The postoperative outcome was good. The embolus in the right external iliac vein was still present after surgery, and therefore the VCF in the suprarenal IVC was removed 14 days postoperatively, while the filter in the infrarenal IVC was left in place permanently. The trapped embolus was not found in the removed suprarenal filter. Pathological analysis demonstrated that the ascending colon cancer was well-differentiated adenocarcinoma of Dukes B stage, and that an abscess had formed around the tumor. The tumor in the right kidney was AML. The thrombus in the right renal vein was extended and derived from the AML (Fig. 4). The patient is alive without tumor recurrence and without PE or recurrent DVT 1 year and 6 months after surgery.

**DISCUSSION**

The patient in the present report had asymptomatic PE before surgery, an unusual pathogenesis caused by pronounced ascending colon cancer and AML in the right kidney. The coexistence of two abdominal tumors as potential causes of PE is extremely rare. VCFs were inserted into the supra- and infrarenal IVC preoperatively, and the two huge tumors were removed without perioperative complications.

Regarding the possible cause of thrombosis, it is well-known that a huge tumor in the abdomen often causes a hypercoagulable state that frequently leads to DVT through the inhibition of venous perfusion by compressing the IVC. In the present case, other than giant tumors, abscess formation around the ascending colon carcinoma might have contributed to the hypercoagulopathy.

**Figure 2.** (A) Computed tomography revealed pulmonary embolization (white arrowhead) in the right common basal artery. (B) Pulmonary arteriography demonstrated a floating embolus (black arrowhead) in the right common basal artery.

**Figure 3.** Angiography demonstrating the inserted vena cava filters (VCF). Schema demonstrates the VCFs, the tumor thrombi in the renal vein, and the thrombus in the right iliac vein. (1) the suprarenal VCF, (2) the infrarenal VCF, (A) tumor thrombi in the renal vein, and (B) the thrombus in the right iliac vein.
An interesting aspect of this case is the perioperative management required to prevent PE arising from both an AML-derived tumor embolus and DVT in the right lower extremity. The patient had already developed PE, and preoperative VCF placement was clearly required; however, the appropriate number and positioning of the VCFs required discussion. When a single VCF is placed in the suprarenal IVC, it cannot be removed if the VCF is occluded, resulting in perfusion injury in the renal vein. In contrast, when a single VCF is placed in the infrarenal IVC, development of PE due to renal AML-derived tumor embolus is a concern. However, the latter risk can be solved by removal of the renal AML. Consequently, we decided to place VCFs in the supra- and infrarenal IVC before surgery and then remove the VCF in the suprarenal IVC after the operation. The decision regarding the removal of the VCF in the infrarenal IVC was made after postoperative evaluation of the DVT in the right lower extremity. Since the thrombus was still present in the right iliofemoral vein 2 weeks after surgery, the infrarenal VCF has been permanently left in place without complications, to date.

The necessity of perioperative prevention of venous thromboembolism is well established and is included in the thromboprophylaxis guidelines of the American College of Chest Physicians (ACCP) (5). In the ACCP guidelines, the risk of thromboembolism in patients undergoing surgery is classified into four levels, with recommended prevention strategies for each level. The current case was in the ‘highest risk’ level of the ACCP guidelines because of being surgery of 40-year-old or older, and prior development of both DVT and PE. The recommendations include drug therapy and the use of graduated compression stockings and/or intermittent pneumatic compression. However, the ACCP guidelines do not propose definite instructions for VCF, and the indications and patient selection criteria for VCF placement remain widely debated topics. VCFs are strongly recommended for two groups of patients: those who have a proximal DVT or PE or both, in whom it is too dangerous to administer anticoagulation therapy; and those who continue to have recurrent emboli despite receiving appropriate levels of anticoagulants (7). Currently, there are two classes of VCF, in use: permanent and retrievable. A retrievable VCF has a preventive effect equivalent to a permanent VCF, and it can be placed while a risk of PE development cannot be ruled out, resulting in the prevention of the risk of complications, including recurrent DVT caused by long-term placement. For these reasons, a retrievable VCF is normally used in our institution. In the current case, the free-floating thrombus, which can cause fatal PE, was revealed in the iliofemoral vein 6 weeks after surgery, therefore, the infrarenal VCF was inevitably left in place permanently.

There is a paucity of prospective controlled trials for the prophylactic use of VCF. The PREPIC study is the only prospective randomized trial of the utility of vena cava filters in patients with documented lower extremity DVT and no contraindication of anticoagulants (8, 9). In this study, there was a statistically significant decrease in early PE (within 12 days) in the filter group (1.1%) compared with the no-filter group (4.8%) (8). However, an 8-year follow-up study showed that the recurrent PE rate was 6.2 and 15.1%, the symptomatic recurrent DVT rate was 35.7 and 27.5% and mortality was 48.1 and 51.0% in the filter and no-filter groups, respectively (9). These results suggest that a VCF has a certain preventive effect on PE development, but that there is an increased long-term risk of DVT and no improvement of mortality. However, the patients in the PREPIC study and in almost all studies of VCF efficacy had poor systemic conditions, including older age, trauma, cancer or respiratory insufficiency, and consequently many patients may have died from other diseases before the preventive effect of the VCF on fatal PE became evident. Therefore, a clinical trial in patients in good systemic condition and longer expected survival is required to evaluate the efficacy of the VCF.

A VCF may be used as a safe perioperative device in patients with a tumor embolus that is movable to the IVC, complications of DVT or a history of PE, but awareness of potential complications is important. The PREPIC study demonstrated a significant increase in symptomatic recurrent DVT in the filter group (odds ratio = 1.87), and an extensive review of the use of retrievable filters reported complication rates of 6–30% for caval thrombosis, 3–69% for filter migration and 5–70% for post-phlebitic syndrome (9, 10). Therefore, care should be taken with the application of a VCF.

AML accounts for ~3% of renal parenchymal tumor lesions (11). Definite indications for AML resection have not been established, but resection is normally conducted in a patient with symptoms, a tumor with a large diameter and a tumor thrombus in the IVC or renal vein with formation of a tumor embolus (12, 13). Kutcher et al. (14) first reported renal AML associated with tumor embolus in the IVC in 1982, and since then many similar cases have been reported, including cases in which the tumor embolus reached the
right atrium from the IVC. In contrast, renal cell carcinoma most frequently forms a tumor embolus in the renal vein. In 1913, Berg (15) reported nephrectomy and cavotomy to treat RCC with a tumor thrombus extending into the IVC, and radical nephrectomy with vena caval thrombectomy has now become a standard treatment for this entity. Many methods of suprarenal IVC control have been used, including suprarenal IVC clips, vascular clamping guided by transesophageal echocardiography and sternotomy with direct clamping, and placement of a suprarenal VCF before nephrectomy to prevent fatal PE has been proposed (16–18).

In conclusion, we have reported the case of a patient with huge AML and colon carcinoma with DVT, tumor thrombus and PE, in whom VCFs were inserted into the supra- and infrarenal IVC for safe perioperative control. For a high-risk patient with DVT and a tumor embolus, VCF is effective for the prevention of fatal PE. Although a patient requiring two VCFs might be rare, double VCFs should be considered if there are two causative thrombi of PE in the supra- and infrarenal veins.

Conflict of interest statement
None declared.

References