Intraoperative disruption of a Greenfield vena cava filter

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SUMMARY.—A case illustrating fracture and translocation of a Kim-Ray Greenfield filter strut due to intraoperative manipulation of the filter during cholecystectomy is presented. Awareness of this previously unreported complication is essential in preventing its occurrence.

KEY WORDS.—Greenfield filter · Vena cava, interruption · Pulmonary embolism.

The Kim-Ray Greenfield Filter is one of several intraluminal devices which have been used for vena cava interruption in patients who demonstrate recurrent pulmonary embolism despite adequate anticoagulation, or who have a contraindication or complication related to anticoagulation. Its design provides caval patency rates of 95-97% which lead to a favorable reduction in the incidence of chronic lower extremity edema and recurrent thrombophlebitis as compared with caval ligation or clipping. In addition, its transvenous method of insertion avoids the need for general anesthesia, laparotomy, and discontinuation of anticoagulation which are required for caval ligation. This has allowed a reduction in operative mortality from 15% to 4%.

Complications associated with use of the Greenfield Filter are few, including failure of insertion and malpositioning of the filter. In our experience of 123 attempted filter placements, these have occurred in 8.1% and 5.3% of cases, respectively. This report documents an unusual complication of filter placement which, to our knowledge, has not been previously reported—fracture and migration of a filter strut due to unrecognized operative manipulation.

Case report

A 23-year-old woman who had undergone craniotomy and excision of an arteriovenous malformation from the left central Sylvian fissure developed pain and swelling of the right calf in June, 1978. Venous Doppler and phleborheographic examination of the lower extremities confirmed the clinical diagnosis of right iliofemoral thrombosis. Because of her recent neurosurgical procedure, she was felt to have an absolute contraindication to anticoagulation and caval interruption was elected. A preoperative inferior venacavagram demonstrated thrombus in the right external iliac and ascending lumbar veins. A Kim-Ray Greenfield filter was inserted under local anesthesia through the right internal jugular vein. The filter was placed in an infrarenal position under fluoroscopic control, and a postoperative abdominal radiography confirmed its position adjacent to the second lumbar vertebral body. The patient did well and showed no evidence of venous insufficiency or recurrent deep venous thrombosis over the next several years.

Five years later, in November 1983, the patient was admitted with a three-day history of nausea, vomiting, and right upper quadrant abdominal pain. Significant findings on physical examination included a temperature of 99.7°F, right subcostal tenderness with voluntary and involuntary guarding, hypoactive bowel sounds, and a normal rectal and pelvic examination. The total leukocyte count was 9,500 cells per cubic millimeter with a left shift. Other laboratory
values included normal alkaline phosphatase, amylase, bilirubin, and serum transaminase levels. The chest radiograph was normal, while an abdominal roentgenogram showed the Greenfield filter in place with no change in its position or orientation (Fig. 1A). Ultrasound of the gallbladder demonstrated multiple stones, with no dilatation of the intrahepatic or extrahepatic ductal system, and a diagnosis of acute cholecystitis was made. At operation, an acutely inflamed gallbladder was removed without incident. Operative cholangiography revealed a patent common bile duct with no ductal stones, and incidental note was made of a broken filter strut lying in a paracaval position (Fig. 1B). No effort was made to retrieve the broken strut or to explore the vena cava.

The patient made an uneventful recovery, but returned two weeks after hospital discharge with an acute deep venous thrombosis of the left leg, documented by Doppler venous examination and phlebography. An inferior venacavagram showed complete occlusion of the left common iliac vein with collateral filling of the ascending lumbar and epidural veins. Although the broken strut was found to have migrated to the left subdiaphragmatic space (Fig. 2), the patient remained asymptomatic and had a normal abdominal examination. She was discharged following anticoagulation for left iliofemoral thrombosis. Follow-up examination two months later showed no evidence of sequelae, and a repeat abdominal roentgenogram showed the broken strut to have returned to a left paracaval position (Fig. 3).

Discussion

The Kim-Ray Greenfield vena cava filter has generally proved to be a safe means of caval interruption for the prevention of pulmonary embolism in selected patients. Greenfield reports the following complications of filter insertion: lower extremity edema 11.8%, recurrent thrombophlebitis 5.2%, recurrent embolization 2.6%, and retroperitoneal hemorrhage 1.3%. Misplacement during insertion has been noted in 12-18% in early series and failure of transvenous filter placement was cited in 12%. The latter is expected to be less prevalent with current improvements in insertion catheter design, including a reduction in capsule diameter and provision for a guide wire. Less commonly described has been migration of the filter following placement.
A final consequence of filter placement has been penetration of the vena caval wall by the filter struts. Cimochowski noted this finding in 100% of patients who were studied postoperatively or examined at autopsy, and others have confirmed the frequency of this occurrence. This has resulted in documented paracaval organ penetration in one case, and may potentially increase the risk of recurrent embolization due to uneven penetration of the struts and loss of caval compartmentalization.

We have described a case of fracture and intraperitoneal migration of a Greenfield filter strut apparently due to inadvertent manipulation of the filter during cholecystectomy. Although this has had no apparent sequelae in this patient, such an occurrence might lead to retroperitoneal hemorrhage, organ damage, and incomplete protection against embolization. It might also cause caval thrombosis due to intimal injury, or embolization of clot residing in the filter at the time of its manipulation. A final complication, which has been noted in two cases at this institution, is tearing of the surgeon's glove during laparotomy and retroperitoneal exploration after previous filter placement. This subjects both the patient and the surgeon to a higher risk of infection.

As vena caval filters become widely used, subsequent inadvertent intraoperative manipulation of the filter devices may also become more prevalent. The potential for injury to the patient and the surgeon is apparent. It is essential that the presence of an intracaval device be recognized preoperatively and that manipulation of the device be carefully avoided, especially when dissection is carried out in the retroperitoneum or in the vicinity of the duodenum or vena cava.
References


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