# Successful removal of a Gunther tulip vena cava filter with wall-embedded hook and migration during a retrieval attempt

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# Successful removal of a Gunther tulip vena cava filter with wall-embedded hook and migration during a retrieval attempt

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## Abstract

**Retrieval of a Gunther tulip vena cava filter implanted in a patient with inferior vena cava and right common iliac vein thrombosis was attempted by the standard method. Because the filter was tilted, the hook became attached to the vena cava wall and could not be snared. During attempts at removal by an alternative method, the filter migrated toward the right atrium. However, it was finally successfully removed.**

**Keywords:** Embolism, pulmonary, extremities, thrombosis, interventional procedures, vena cava, filters

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Inferior vena cava (IVC) filter placement provides short-term protection from pulmonary embolism in patients with thrombus in the vena cava and/or veins in the pelvis and lower extremities (1). However, long-term implantation of these devices can result in serious complications (1). As these patients have a long life expectancy, avoiding permanent filter implantation is recommended when only short-term protection is required. Temporary vena cava filters have been developed for such short-term protection (2). With this type of filter, a catheter or guide wire, part of which protrudes outside the body, is attached. However, reports of complications have increased with increases in the use of these devices. The reported problems were mainly related to the part of the device that projects from the insertion site (2). Thus, this type of filter is now seldom used.

Considering the disadvantages of permanent and temporary filters, attention has been paid to retrievable vena cava filters. These filters can be implanted without an attached catheter or guide wire and can be either retrieved or left in place permanently, if necessary. Thus, they have a broader range of clinical applications than either permanent or temporary filters (3). Whether a filter is placed permanently or temporarily can be decided based on the patient's clinical status after therapy for pulmonary embolism and/or thrombi in veins of the pelvis and lower extremities.

We describe the use of a retrievable Gunther tulip vena cava filter (GTF) in a patient with a large thrombus in the IVC and right common iliac vein. After the venous thrombus decreased in size and the risk of pulmonary embolism was considered to be lessened, we tried to withdraw the filter. Our attempt at retrieval using the standard method resulted in failure. However, we finally succeeded in its removal by modifying the standard method.

## Case report

Written informed consent for placement and retrieval of the vena cava filter was obtained from the patient for use of the standard procedure as well as modified procedures if difficulties were encountered.

A 32-year-old man presented with a thrombus in the IVC. This was incidentally noticed on enhanced CT images obtained to follow-up findings from a routine chest X-ray as part of a medical check-up. The thrombus was also distributed in the proximal portion of the right common iliac vein. Pulmonary embolism was not seen. D-dimer was elevated to 1.8 $\mu$g/mL. The patient was in apparent good health and had experienced no specific episode that could have caused deep venous thrombosis. A review of the entire family tree revealed no inherited disorder, and results of blood studies suggested no genetic causative factors.

A GTF (Cook, Bjaeverskov, Denmark) was prophylactically implanted to prevent development of a pulmonary embolism by movement of the released thrombus. Because the top of the thrombus distributed in the IVC just below the level of the renal veins, the GTF was positioned at the suprarenal IVC through the right jugular vein with the patient under local anesthesia. Anticoagulation therapy with intravenous heparin followed by warfarin sodium given by mouth was administered.

Eighteen days later, enhanced CT revealed that the venous thrombus had decreased and the risk of pulmonary

embolism had lessened. Thus retrieval of the GTF was attempted.

At first, we used the standard method of retrieval using the GTF retrieval set supplied by the manufacturer (Cook). Details of techniques to retrieve the GTF are described elsewhere (3). Devices for retrieval were inserted from the right jugular vein. However, retrieval was impossible in spite of perseverance. The filter had become slightly tilted from the position of implantation. The hook had attached to one side wall of the IVC and could not be snared. It was considered that, in implanting the GTF, more meticulous care should have been taken to orient the filter so that the hook pointed away from the contralateral IVC wall with the open side of the hook directed toward the IVC lumen. We then attempted retrieval using a modification of the standard method as described by Kuo *et al*. (4). We inserted a 4-French angled catheter (Clinical Supply, Gifu, Japan) slowly into the retrieval catheter included in the GTF retrieval set (Cook) to enter the inside of the cone from an interstice between the filter struts and to emerge from another interstice. A 0.035-inch, 260-cm-long, hydrophilic guide wire (Terumo, Tokyo, Japan) was inserted into the previously inserted 4-French angled catheter. Then another 4-French angled catheter (Create Medics, Kanagawa, Japan) was coaxially advanced from the retrieval catheter to near the distal end of the hydrophilic guide wire. A multi-snare (10 mm in diameter, pfm, Koln, Germany) was advanced into this 4-French catheter (Create Medics) and captured the distal edge of the hydrophilic guide wire that had been advanced from the 4-French angled catheter (Clinical Supply) through the inside of the GTF'S cone (Fig. 1a). After access was established across and through the filter struts, both the hydrophilic guide wire that was inserted through the 4-French angled catheter (Clinical Supply) and the multi-snare that was inserted through another 4-French catheter was pulled toward the cephalad site with tension maintained at both ends. The hook of the GTF was released from the attached IVC wall and the GTF began to move. Then when we attempted to advance the vascular sheath slowly over the filter, the GTF was immediately observed to be floating up the IVC and moving into the right atrium. A strut of the GTF was quickly grasped by pulling tightly both the hydrophilic guide wire and multi-snare into the retrieval catheter and sheath. Through this maneuver, further migration of the GTF was prevented. Finally, another GTF retrieval set was inserted from the left jugular vein and the hook of the GTF was successfully grasped with the retrieval snare that was included in the GTF retrieval set (Fig. 1b). The GTF was then retrieved.

During these actions, the patient experienced transient arrhythmias and mild back pain, but no serious complication occurred.

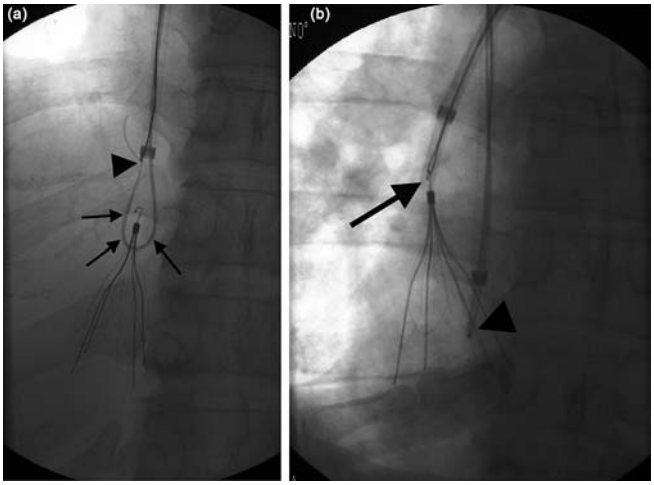


**Fig. 1** A 32-year-old man with venous thrombus in the inferior vena cava for whom Gunther tulip vena cava filter was implanted. (a) Roentgenogram shows that a 4-French angled catheter that had been inserted into the retrieval catheter was introduced to enter into the cone from an interstice between the filter struts and to emerge from another space (arrows) and that a hydrophilic guide wire was inserted into the 4-French catheter. A snare wire was inserted through another 4-French angled catheter and captured the distal edge of the hydrophilic guide wire (arrowhead). Both the hydrophilic guide wire and the snare wire were pulled toward the cephalad site with tension maintained at both ends. (b) Roentgenogram shows that the hook of the filter that had migrated into the right atrium was captured by the retrieval set inserted from the left jugular vein (arrow). Note that a leg of the filter was snared tightly to avoid further migration (arrowhead)

## Discussion

The GTF is a retrievable vena cava filter that can function as a permanent filter but can be retrieved when necessary. Ease and high frequency of success in retrieval have been described (5–7). Millward *et al*. (6) reported a high rate of success in attempts at retrieval, that is, 52 of 53 (98%) GTFs. Yamagami *et al.* (7) reported success in retrieving 77 of 80 filters (96.3%). However, among the 77 filters successfully retrieved, in five cases various modified methods in place of standard methods were used.

Care must be taken in implanting a GTF to orient the filter so that the hook points away from the contralateral IVC wall, with the open side of the hook directed toward the IVC lumen (7). Then, if the hook becomes attached to the IVC wall such as from tilting, as in the present case, the possibility of snaring the hook during retrieval would increase. In fact, tight attachment of the hook to the IVC wall was reported previously as a cause of unsuccessful retrieval (7, 8). In modifying the method of retrieval in such situations, a strategy was reported whereby an 8-French sheath introducer with a curved tip was inserted from the femoral vein with its tip positioned into the filter (8). By pressing the leg of the filter toward the wall of the IVC opposite to the resting place of the hook using the newly inserted curved sheath, the hook was moved away from the vena cava wall to the center of the IVC lumen. With the hook maintained in this position, the GTF retrieval set was advanced from the jugular vein and the hook was successfully snared. Stavropoulos *et al*. (9) reported removal of another type of retrievable filter (Recovery filter; Bard, Tempe, AZ, USA) using rigid bronchoscopy forceps when the filter tip was tilted and embedded in the IVC wall. The snare-over-guide wire loop technique that was used in the present case was also reported to be useful when the hook of the GTF is refractory to capture

using the snare in standard methods (4). However, our case raised the alarm that during filter retrieval by such a modified method, the unexpected could occur, such as migration of the GTF. To our knowledge, only one case of right arterial migration of a GTF was reported previously, although the migration occurred at implantation and not during withdrawal (10).

In conclusion, the experience of the present case shows that care must be taken with regard to the direction of the hook in implanting a GTF. An improperly directed hook might lead to failure in retrieval with standard methods and to complications such as right arterial migration of the GTF during a modified retrieval procedure. However, despite this complication, by directly snaring the hook with the second retrieval set, the GTF was successfully removed in the present case.

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