

# Spontaneous Tilting after Placement of the Günther-Tulip Inferior Vena Caval Filter: A Case Report<sup>1</sup>

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Tilting of a deployed filter in the inferior vena cava (IVC) is a particular kind of periprocedural complication and this can reduce the filter's clot-trapping ability and increase the occlusion of the IVC at a later period. The authors report here on a case of spontaneous tilting of an inferior vena caval filter that was associated with thrombosis in the IVC within 2 weeks of the initially successful placement of the filter without tilting.

**Index words :** Inferior vena cava

Inferior vena caval filter

Deep vein thrombosis

Interventional procedures

Placing a filter in the vena cava of a patient suffering with deep vein thrombosis and pulmonary embolism has increased since the introduction of the percutaneous deployment technique and the development of various percutaneous devices. The criteria for successful placement of a vena caval filter requires several conditions to be met, such as the deployment and fixation of the filter at the intended position without any migration, and the parallel alignment of the filter with the axis of the vena cava (1). Tilting of a deployed filter is a particular kind of periprocedural complication and this can reduce the filter's clot trapping ability (2). We report here on a case of spontaneous tilting of the inferior vena caval filter and the extension of thrombosis over it during the follow-up period, and this occurred despite of the initially success-

ful filter placement without tilting.

## Case Report

Our institution does not require institutional review board approval for retrospective reports. A 62-year-old woman visited to the emergency room of our hospital, and she presented with a sudden headache and a drowsy mental status. A computed tomogram (CT) of the brain revealed a subarachnoid hemorrhage, and a saccular aneurysm of the left middle cerebral artery was detected on the cerebral angiogram. She was continuously bed-ridden with a stuporous mental status after performing clipping surgery for the aneurysm. At 5 weeks after surgery, she developed a swelling of her left lower extremity. The CT venogram demonstrated thrombosis in the veins of the left lower extremity at the level of the calf with extension to the common iliac vein (Fig. 1). A lung perfusion scan using <sup>99m</sup>Tc-macroaggregated albumin demonstrated multiple perfusion defects in the left lower lobe, and this corresponded to the probability of pulmonary embolism. However, she was ab-

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solute contraindicated for thrombolysis because of her recent major surgery, and so we placed a filter in the inferior vena cava (IVC) to prevent any further pulmonary embolism (3).

Under the ultrasound guidance, the right internal jugular vein was punctured using the standard Seldinger technique. Under fluoroscopic guidance, a 5-F multipurpose catheter (Cook, Bloomington, IN, U.S.A.) was placed at the confluence of the IVC; digital subtraction angiography of the IVC was then performed in the posteroanterior projection. The vena cavogram revealed the patent IVC without thrombus and both sides of the renal veins entered to the IVC at the normal level (Fig. 2A). The multipurpose catheter was exchanged for the

delivery sheath of a Günther Tulip Vena Cava MRye Filter (GTF) (Cook, Bloomington, IN, U.S.A.), and the filter was deployed in the infrarenal IVC. The vena cavograms in the posteroanterior and lateral projections were obtained after placement of the filter. The vena cavogram demonstrated successful placement of the filter without any complication, including tilting (Fig. 2B).

For two weeks after placement of the filter, she was bed-ridden without improvement of her mental status or any self-movement, and her position was changed at regular intervals to prevent bed sores. During that period, she developed swelling of right lower extremity without any improvement of the swelling of the left lower extremity. A CT venogram was performed and it depicted tilting of the filter to the right side and the infrarenal IVC was filled with thrombi (Fig. 3A, B). A vena cavogram was obtained after insertion of a multipurpose catheter through the right internal jugular vein and it depicted filling of almost all the infrarenal IVC by thrombi (Fig. 4A). The scout image of the vena cavogram showed tilting of the filter to the right side and the angle between the axis of the filter and the axis of the spine was  $9.8^\circ$ , and the difference from the initial angle was  $7.4^\circ$  (Fig. 4B). We did not try the removal of the filter because of the risk of secondary PE by the fragmentation of thrombi during the procedure, and so we placed another GTF in the suprarenal IVC to prevent any additional PE.

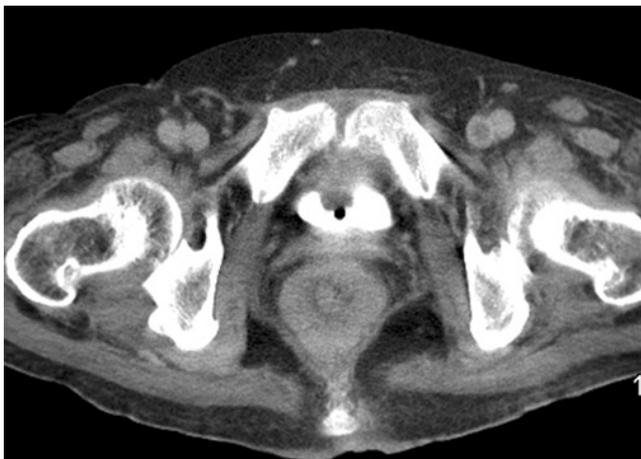


Fig. 1. The initial CT venogram shows thrombus in the left femoral vein and there was no thrombus in the right one.

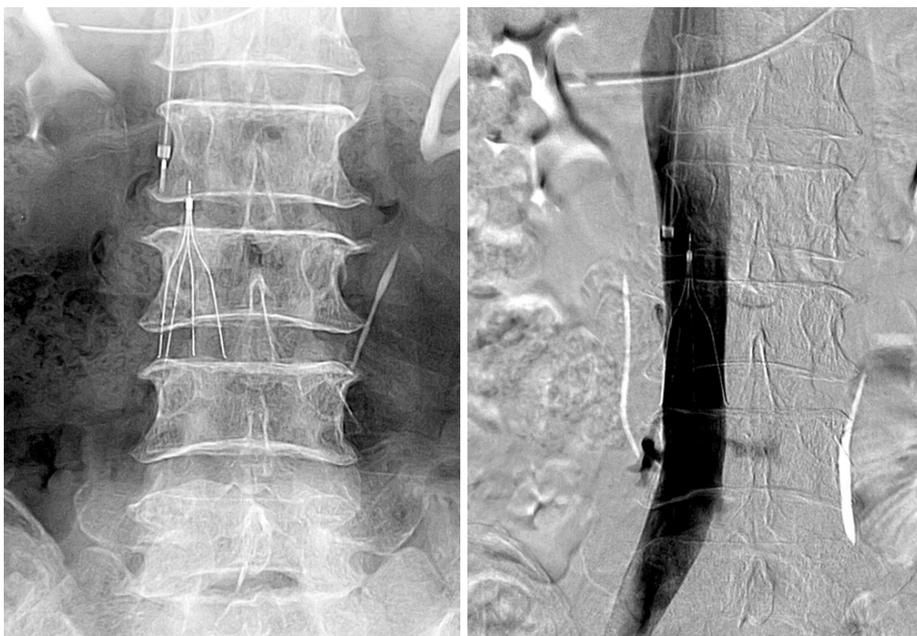
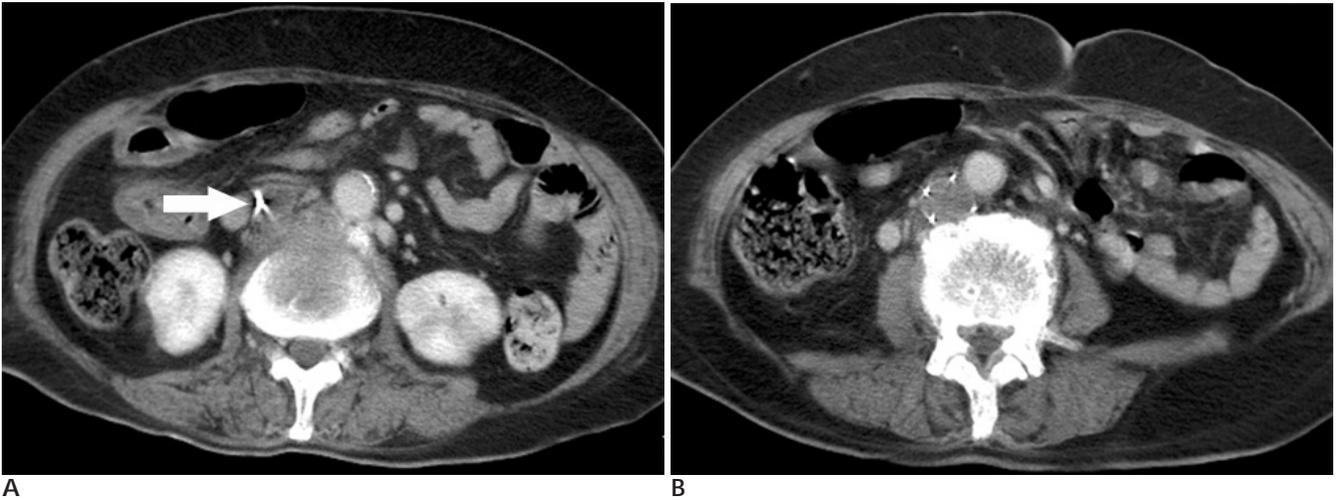


Fig. 2. The scout (A) and digital subtraction (B) images of the vena cavogram that were taken after successful placement of a Günther-Tulip filter show the parallel axis of the filter with the IVC axis without tilting.

A

B



**Fig. 3.** Follow-up CT venograms obtained at the hook eye (A) and anchoring hook levels (B) show abutting of the hook eye (arrow) of the filter to the wall of the IVC and thrombosis in the IVC.



**Fig. 4.** Follow-up vena cavograms.  
A. The scout image shows tilting of the filter to the right side.  
B. The digital subtraction image shows the filling defect at almost the infrarenal IVC by the thrombi.

### Discussion

Tilting of an IVC filter refers to eccentric positioning of non-self-centering filters during their insertion and the definition is the axis of the filter's tilt is more than 15°(4). As a result of laboratory studies with using various filters, tilting of the filter can reduce the clot-trapping ability of a filter that placed in the IVC (2, 5). Although the last clinical study that used titanium Greenfield IVC filters reported that there was no significance relative risk ( $p=.10$ ) of recurrent PE with an

asymmetric filter, the risk of PE with an asymmetric filter was 2.6 times that with a symmetric filter (6). The relative risk of IVC thrombosis in patients with asymmetric filters was 3.4 times the risk of patients with symmetric filters (7). Tilting of the GTF causes another problem because the filter is designed for being retrieved. Milward et al (8) have reported that failure of the GTF resulted from the hook eye that could not be snared during attempted retrieval because of tilting of the filter.

In our case, tilting did not occur during the procedure, but it happened during the follow-up period. In spite

that the patient could not ambulate or perform any voluntary movement, tilting of the filter did occur after its successful placement. We suggest that tilting of the filter might have developed during lifting the patient to the hospital gurney or to the bed after the procedure or during the passive changing of position that was done at regular intervals after the filter placement to prevent bed sores. Fixation of the filter is completed by the organizing thrombus; this thrombus is fibrinous material that adheres to the legs of the retrieved filters (8). However, the filter is unstable before fixation and so tilting at this time is possible. Central migration of filter may be the more serious form of tilting when the filter is at an incompletely fixed state. If the physical activity of the patient is increased, the possibility of the tilting or migration of the filter may be increased.

Although the angle between the axis of the filter and the IVC was not measured due to the thrombosis in the IVC, the angle may be similar to that angle between the filter and the spine because the IVC is generally seen to be parallel to the spine on the initial vena cavogram. The angle between the axis of the filter and the spine on the scout image of the follow-up vena cavogram was 9.8 °, and this did not violate the criteria for tilting according to a set of previously reported quality improvement guidelines (4). However, the hook eye of the filter was abutted to the wall of the IVC on the CT scan, and the angle of the filter was near to the largest angle of tilting. Therefore, we think that the angle in the criteria guidelines is too large to apply to the GTF and so new guidelines must be provided.

The relative risk of IVC thrombosis is increased in those patients with an asymmetric filter, but it is unclear that the tilting of the filter after placement was related to the thrombosis in our case. There is the possibility that the thrombosis of the IVC could have been related to either tilting of the filter or the lack of filter tilting in this case. Because the patient was diagnosed as having a subarachnoid hemorrhage and so this was a firm contraindication for anticoagulation therapy, the thrombus in the IVC might have propagated spontaneously from the left side iliac vein to the inferior vena cava, or it might have developed and was then aggravated by the captured thrombus within the filter. On the other hand, the thrombosis of the IVC might have developed by tilting of the filter and the disturbance of the blood flow. In addition to that, injury to the wall of IVC by the legs of the filter during tilting and the activation of the blood coagulation system might have also been one of the causes,

and all of the above might be the causes of the IVC thrombosis. However, we can not differentiate between these causes with any certainty.

In this case, we placed another filter in the suprarenal IVC. Grassi *et al* (4) recommended using the suprarenal filter in patients with renal vein thrombosis, for IVC thrombosis extending above the renal veins, for filter placement during pregnancy, for thrombus extending above a previously placed infrarenal filter, for pulmonary embolism after gonadal vein thrombosis and for anatomic variants such as duplicated IVC or low insertion of renal veins in their quality improvement guidelines for percutaneous permanent inferior vena cava filter placement. So this patient, who was definitely contraindicated for anticoagulation due to her recent intracranial hemorrhage, was suitable for suprarenal filter placement.

In summary, we have reported on the spontaneous tilting of a Günther-Tulip vena cava filter during the follow-up period with thrombosis formation in the patient's IVC. Information on this complication may be helpful to physicians during the placement of such filters and for the complex management of this type of patients.

## References

1. Millward SF, Grassi CJ, Kinney TB, Kundu S, Becker GJ, Cardella JF, *et al*. Technology assessment committee of the society of Interventional Radiology. Recommended reporting standards for vena caval filter placement and patient follow-up. *J Vasc Interv Radiol* 2003;14:S427-432
2. Katsamouris AA, Waltman AC, Delichatsios MA, Athanasoulis CA. Inferior vena cava filters: in vitro comparison of clot trapping and flow dynamics. *Radiology* 1988;166:361-366
3. Athanasoulis CA, Kaufman JA, Halpern EF, Waltman AC, Geller SC, Fan CM. Inferior vena caval filters: review of a 26-year single-center clinical experience. *Radiology* 2000;216:54-66
4. Grassi CJ, Swan TL, Cardella JF, Meranze SG, Oglevie SB, Omary RA, *et al*. Quality improvement guidelines for percutaneous permanent inferior vena cava filter placement for the prevention of pulmonary embolism. *J Vasc Interv Radiol* 2001;12:137-141
5. Greenfield LJ, Proctor MC. Experimental embolic capture by asymmetric Greenfield filters. *J Vasc Surg* 1992;16:436-443
6. Greenfield LJ, Proctor MC, Cho KJ, Wakefield TW. Limb asymmetry in titanium Greenfield filters: clinically significant? *J Vasc Surg* 1997;26:770-775
7. Kinney TB. Update on inferior vena cava filters. *J Vasc Interv Radiol* 2003;14:425-440
8. Millward SF, Oliva VL, Bell SD, Valenti DA, Rasuli P, Asch M, *et al*. Günther Tulip Retrievable Vena Cava Filter: results from the Registry of the Canadian Interventional Radiology Association. *J Vasc Interv Radiol* 2001;12:1053-1058

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