
Hyoun Ook Kim, M.D., Jae Kyu Kim, M.D., Nam Yeoil Yim, M.D., Yang Jun Kang, M.D., Hye Doo Jung, M.D.

Department of Radiology, Chonnam National University Hospital. Gwangju. The Republic of Korea

PURPOSE
To evaluate the efficiency of placing an inferior vena cava (IVC) filter through the same popliteal vein access site used for peripheral endovascular intervention (PEVI) in patients with extensive lower extremity deep vein thrombosis (DVT).

MATERIALS AND METHODS
Study population
We retrospectively analyzed the medical records of 21 patients who underwent IVC filter insertion via popliteal venous access between January 2012 and July 2015. Thirteen patients were women and 8 patients were men. The average age was 61.7 years (range, 30–86 years).

IVC filter insertion
In all patients, a popliteal vein approach in the leg with the venous thrombosis was attempted. The ipsilateral popliteal vein puncture was done under ultrasonography, with a micro-puncture set employing a 21-gauge needle (Cook Medical, Bloomington, IN, USA), and was followed by the insertion of an 8-Fr angiography introducer sheath (Radifocus; Terumo, Tokyo, Japan). A 5-Fr headhunter type angiographic catheter (Boston Scientific, Natick, MA, USA) was then introduced and passed through the venous segment containing the thrombus. After the angiographic catheter was entered into the IVC lumen, a double-basket shaped retrievable IVC filter equipped with a 90 cm length introducer set (OptEase filter; Cordis, Warren, NJ, USA) was introduced along stiff guidewire (Cook medical, Bloomington, IN, USA) and deployed in the infra-renal IVC under fluoroscopic guidance.

PEVI for DVT
After IVC filter insertion, endovascular treatment, including aspiration thrombectomy or thrombolysis, was performed for iliofemoral vein thromboses.

Measuring filter tilt
The filter tilt measurement was performed with 3-dimensional rendering software (Aquarius Infinion viewer; Terarecon, SanMateo, CA, USA). After loading the follow-up CT venography (CTV) image data using this soft ware, multi-planar reformatted images, including the coronal and sagittal plane, were obtained. With this reconstructed image data, the filter tilt was measured in the coronal and sagittal planes (Figure 1).

Filter retrieval
Filter retrieval was attempted in 17/21 patients. The reason for permanent filter placement was persistent DVT in three patients and patient refusal of the retrieval procedure in one patient. In 16 patients, the OptEase filter was successfully removed after a mean filter dwell time of 20.13 days. The longest filter dwell time was 37 days. In one patient, the filter could not be removed because the caudal hook of the filter was embedded into the IVC wall.

RESULTS
The mean DVT symptom duration for the enrolled patients was 4.01 ± 4.07 days (range, 5 hours – 14 days) (Table).

Seventeen patients showed thrombosis of the distal veins, such as the calf veins, as well as the proximal iliofemoral veins. In all patients, recalibration procedures (such as thrombectomy or catheter-directed thrombolysis) and IVC filter insertion for the prevention of pulmonary embolism (PE) were performed sequentially through a single popliteal vein access site. Aspiration thrombectomy (n=21) and catheter-directed thrombolysis (n=16) were performed to re-canalize the occluded lower extremity DVT immediately after IVC filter deployment. For catheter-directed thrombolysis, urokinase was infused continuously for several hours (range, 1.5 - 4 hours, mean, 3.21 ± 0.95 hours) at 100,000 IU/h. The median amount of infused urokinase was 320,000 IU (range, 140,000 – 540,000 IU).

Adjuvant endovascular treatment, including venous stent or balloon angioplasty in cases of flow-limiting venous pathology, was performed in 15 patients. There were no major complications during or after the procedure. In all patients (n=21), OptEase filters were successfully deployed in the infra-renal IVC through the ipsilateral popliteal vein access site. Balloon angioplasty of iliac vein was necessary in one patient with severe iliocaval stenosis prior to filter deployment. Follow up CTV data were obtained in 17 patients within 2 weeks of the procedure. The degree of filter tilt in each patient is listed in Table.

In all patients, filter tilt was measured on the CT images of the IVC using the OptEase filter. This was performed in two planes, the transverse and the sagittal plane. The tilt was measured with a caliper, in degrees, with respect to the IVC axis (Table 1). The mean tilt was 5.3° in the transverse plane and 3.9° in the sagittal plane.

Table 1: Characteristics and Degrees of Filter Tilt.

The mean dial tilt was 7.14 ± 4.48° in the coronal plane and 8.77 ± 4.59° in the sagittal plane. Although the sagittal filter tilt was larger than the coronal filter tilt, this difference was not statistically significant (P = 0.238, paired t-test). Considerable filter tilt, defined as tilt ≥ 15°, was observed in 3 patients, and maximal filter tilt was 18° (Figure 2).

Figure 2. Significant filter tilt.
A. Reconstructed coronal CT image shows the axis of the IVC filter, with a tilt angle of 1.90° (arrows = angle created by the axis of the filter with respect to the IVC).
B. Reconstructed sagittal CT image shows the axis of the filter with a tilt angle of 1.30° (arrows = angle created by the axis of the filter with respect to the IVC).

Analysis
To evaluate the efficacy of the trans-popliteal venous IVC filter insertion, we analyzed the degree of filter tilt in each patient. According to the Society of Interventional Radiology definition (1), significant filter tilt, regarded as an insertion problem, was defined as a filter tilt ≥ 15° from the IVC axis as seen in the coronal or sagittal plane. The site of filter retrieval was also evaluated to assess the ease of filter retrieval. A paired t-test was performed to compare the difference in filter tilt degree between the coronal and sagittal planes.

CONCLUSIONS
In conclusion, our study suggests that popliteal vein IVC filter insertion is an efficient procedure that can be performed in conjunction with PEVI in a single session through a single site. This method is also associated with a low occurrence of significant filter tilt.

REFERENCES