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Case Report

Bidirectional loop-snare technique for adherent inferior vena cava filter retrieval

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ABSTRACT

Placement of a Günther Tulip Inferior Vena Cava (IVC) Filter™ (Cook, Bloomington, IN, USA) is an alternative treatment option to prevent pulmonary embolism in patients in whom anticoagulation therapy is contraindicated. Most patients require filter placement for only short periods, after which it can be retrieved. IVC filter retrieval becomes more difficult as the indwelling time increases. We developed a new method to retrieve the Günther Tulip IVC Filter™, namely, the bidirectional loop-snare technique (BLT). The key to the BLT procedure is to use 2 snares from both the jugular and femoral access routes. The jugular snare catches the filter hook and the femoral snare relieves the adhesion between the filter leg and IVC wall. Pulling from both the jugular and femoral ends increases the power to retrieve the IVC filter, and leads to successful filter retrieval.

<**Learning objective:** An inferior vena cava (IVC) filter is placed in patients with a risk of pulmonary embolism. Most patients require filter placement for only short periods, after which it can be retrieved. Occasionally, IVC filter retrieval is difficult because of long-term placement. We developed a novel, simple method for filter retrieval, using a bidirectional approach and two snares simultaneously.>

Introduction

The standard treatment for pulmonary embolism and deep vein thrombosis is anticoagulant therapy. However, in cases in which anticoagulant therapy is contraindicated, placement of an inferior vena cava (IVC) filter might be a good alternative option for the prophylaxis of pulmonary embolisms caused by lower extremity deep vein thrombosis.

Usually IVC filter placement is required for only a short period; however, in some cases, permanent placement may be needed. Long-term filter placement is associated with increased risks of venous thrombus formation, caval thrombosis, migration, and perforation [1]. Thus, IVC filter retrieval is extremely important to reduce the risks of device-associated complications. We developed a new method to retrieve the Günther Tulip IVC Filter™ (Cook, Bloomington, IN, USA), which was introduced in 1992 and is still used worldwide, namely, the bidirectional loop-snare technique (BLT).

Case report

The patient was a 24-year-old woman with a history of infant-care neurosis. She consumed a large amount of benzodiazepine in an attempt to commit suicide. She lost consciousness and was left unattended for a long time. She was not taking oral contraceptives or other medication that could cause thrombosis. Blood assessment did not indicate congenital coagulation defects. Computed tomography (CT) revealed abundant thrombosis in the left common femoral vein with extension into the common iliac vein and pulmonary embolism. A Günther Tulip IVC Filter™ was implanted at another hospital, before administration of anticoagulation therapies.

She presented to our hospital for filter retrieval 99 days after filter placement. CT was performed before retrieval and showed

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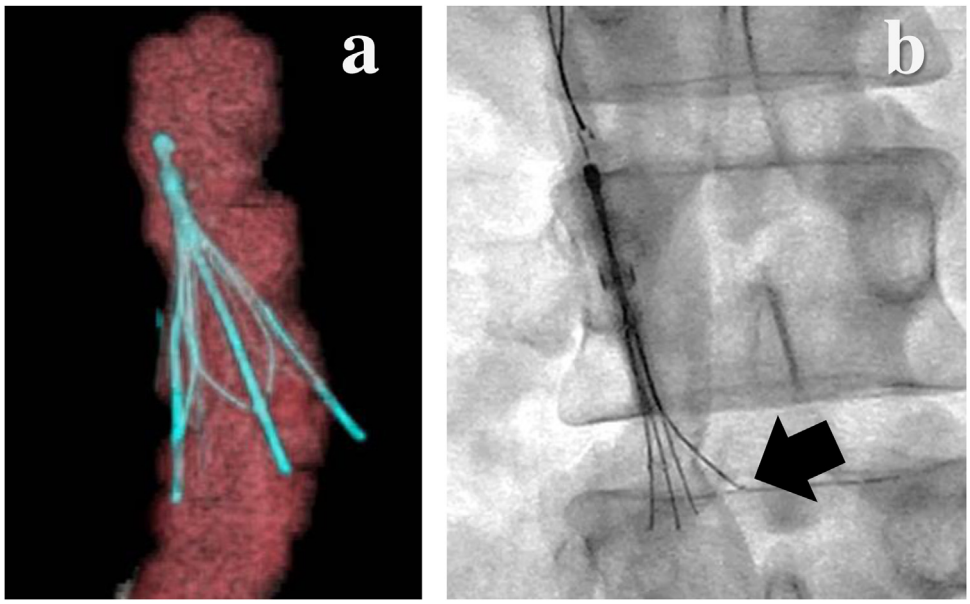

Fig. 1. Computed tomography scan obtained before filter retrieval. (a) Three-dimensional reconstruction image. The apex of the filter is slightly tilted, and one strut of the filter appears outside of the inferior vena cava. (b) Inferior venocavography during conventional retrieval. The inferior vena cava shrunk with advancement of the sheath. The arrow shows the stuck filter leg.

that one of the filter legs was outside of the IVC wall (Fig. 1a). Further, the apex of the filter was slightly tilted but not embedded in the IVC wall. Thus, conventional retrieval was thought to be possible. A Günther Tulip Retrieval Set™ (Cook) was inserted from the right jugular vein as usual. The retrieval systems were advanced, and the filter hook was caught without difficulty; however, the retrieval sheath would not pass through the filter legs. Inferior venocavography indicated "shrink sign" of the IVC with advancement of the retrieval sheath (Fig. 1b). We attempted other known retrieval methods, such as the balloon-assisted technique and single loop snare technique; however, they were unsuccessful. The filter legs seemed tightly anchored and adhered to the caval wall. Thereafter, we additionally punctured the right femoral vein and inserted another retrieval set. We used the snare inserted through the femoral side to encircle the filter tip and lowered the snare in middle portion of the filter, following this we used the snare inserted through the jugular side to grab the filter hook. We then exerted a strong force on the retrieval systems on both sides to pull the filter. This led to successful retrieval of the anchored and adhered IVC filter from the caval wall (Fig. 2). No

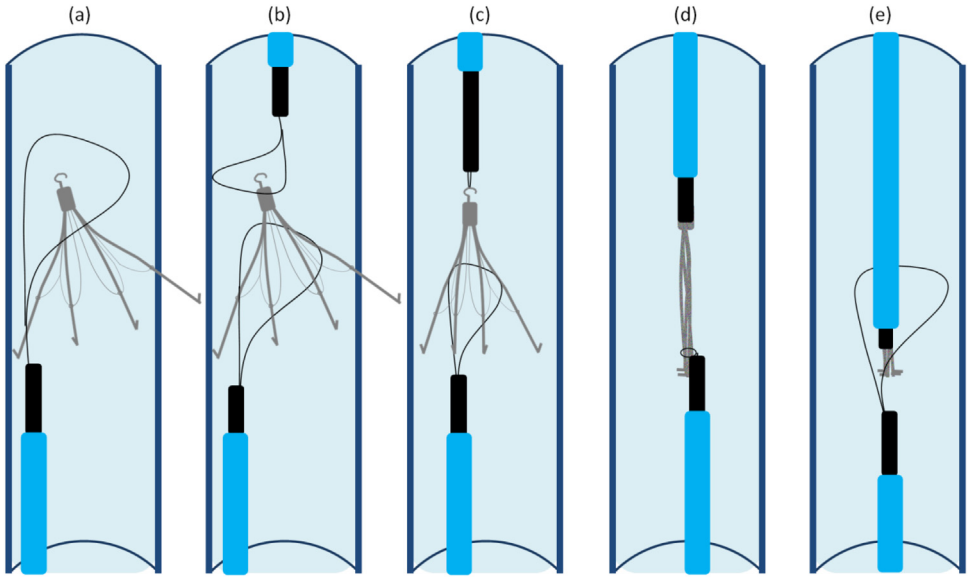

Fig. 2. The bidirectional loop-snare technique uses two Günther Tulip Retrieval Sets™ inserted from jugular and femoral approaches. (a) The Günther Tulip IVC Filter™ is encircled from the top with the snare inserted through the femoral side. (b) The snare is held in the middle portion of the filter leg and the filter hook is grabbed with the snare from the jugular side. (c, d) The jugular side sheath is gradually advanced and the snare from the femoral side is tightened, following which the systems on both sides are pulled with equal force, maintaining alignment. (e) After the filter leg is closed (free from inferior vena cava wall), the snare on the femoral side is opened and the filter is retrieved by the jugular approach sheath.

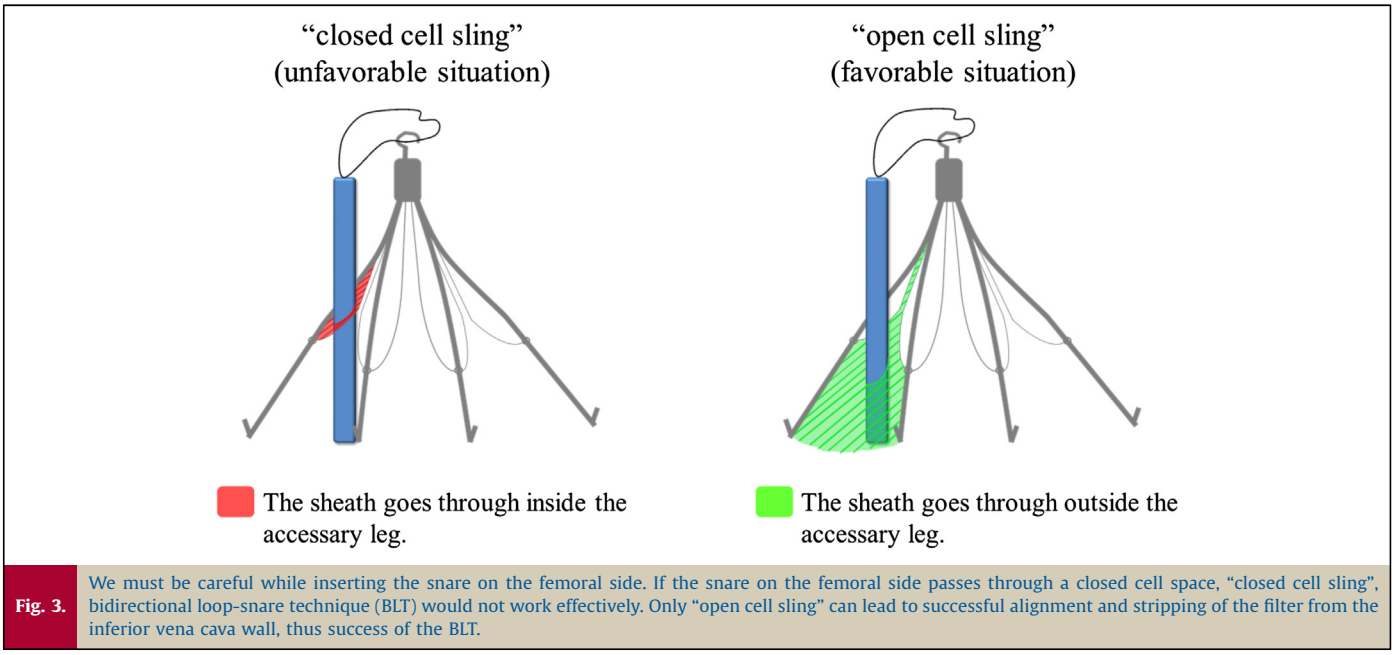

Fig. 3. We must be careful while inserting the snare on the femoral side. If the snare on the femoral side passes through a closed cell space, "closed cell sling", bidirectional loop-snare technique (BLT) would not work effectively. Only "open cell sling" can lead to successful alignment and stripping of the filter from the inferior vena cava wall, thus success of the BLT.

major complications during retrieval were noted, and the patient was discharged 2 days after the procedure. She has been followed up for almost 3 years, without recurrence of venous thromboembolism.

Discussion

The use of the IVC filter has markedly increased over the past decade [2]. However, IVC filters intended for short-term placement are not always removed once the risk for pulmonary embolism subsides. The retrieval rate of the Günther Tulip IVC Filter™ is around 40% in Japan.

Smouse et al. reported that the probability of successful retrieval of the Günther Tulip IVC Filter™ is greater than 94% within 12 weeks but decreases to 67% 26 weeks after implantation [3], indicating that Günther Tulip IVC Filter™ retrieval becomes more challenging after 12 weeks. In another study, the filter dwelling time was found to be strongly associated with chronic IVC fibrosis, and an indwelling greater than 45 days is an important risk factor for retrieval-associated complications [4]. Many IVC filter-associated complications due to unnecessary long-term indwelling have been reported [5,6]. Thus, in a patient implanted with a retrievable IVC filter, retrieval should be considered as soon as possible, on the basis of the patient's risk profile.

In the present case, the patient was referred to our hospital for filter retrieval about 3 months after placement. The conventional method of retrieval was not effective because the strut was embedded and strongly adhered to the caval wall (Fig. 1a). The IVC wall shrunk with advancement of the sheath, as shown in Fig. 1b. This "shrink sign" in the IVC is indicative that attempts of retrieval should be discontinued to avoid caval injury. Thus, we believed that freeing the leg from the embedded lesion through bidirectional traction and subsequently performing conventional retrieval was the safest way to retrieve the IVC filter.

In the BLT, it is important to release the captured filter leg from the femoral approach snare before the filter is completely housed in the jugular approach sheath. Another important point is to carefully monitor the space through which the snare on the femoral side enters. If the snare on the femoral sider passes through the "closed cell" space, the BLT would not work effectively and the filter legs would not close sufficiently even after the snare is tightened. In this case, the snare on the femoral side must be passed through "open cell" space, which will lead to successful retrieval (Fig. 3). The filter-adherent specimens were pathologically examined, and the vessel intima was confirmed. The BLT minimized vessel injury during separation of the embedded struts from the caval wall.

In conclusion, the BLT is a feasible filter-retrieval technique in cases in which IVC filter retrieval is difficult. When attempting this technique, physicians must consider both the potential for vascular injury and the benefits of filter.

Conflict of interest

Authors declare that there is no conflict of interest.

Acknowledgment

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