

Retrievable Inferior Vena Cava Filters in Trauma Patients: Prevalence and Management of Thrombus Within the Filter

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WHAT THIS PAPER ADDS

This study retrospectively reports the incidence of infra-filter thrombus after placement of a retrievable IVC filter in patients with bone fracture in one of largest trauma centers in China. A technique of filter retrieval with manual negative pressure aspiration thrombectomy was introduced. Application of this technique changed the strategy for management of massive filter thrombus in the study center. The duration of therapy, associated costs, and the risk of hemorrhage were also reduced sharply.

Objective: The incidence of thrombus was investigated within retrievable filters placed in trauma patients with confirmed DVT at the time of retrieval and the optimal treatment for this clinical scenario was assessed. A technique called “filter retrieval with manual negative pressure aspiration thrombectomy” for management of filter thrombus was introduced and assessed.

Methods: The retrievable filters referred for retrieval between January 2008 and December 2015 were retrospectively reviewed to determine the incidence of filter thrombus on a pre-retrieval cavogram. The clinical outcomes of different managements for thrombus within filters were recorded and analyzed.

Results: During the study 764 patients having Aegisy Filters implanted were referred for filter removal, from which 236 cases (134 male patients, mean age 50.2 years) of thrombus within the filter were observed on initial pre-retrieval IVC venogram 12–39 days after insertion (average 16.9 days). The incidence of infra-filter thrombus was 30.9%, and complete occlusion of the filter bearing IVC was seen in 2.4% (18) of cases. Retrieval was attempted in all 121 cases with small clots using a regular snare and sheath technique, and was successful in 120. A total of 116 cases with massive thrombus and IVC occlusion by thrombus were treated by CDT and/or the new retrieval technique. Overall, 213 cases (90.3%) of thrombus in the filter were removed successfully without PE.

Conclusions: A small thrombus within the filter can be safely removed without additional management. CDT for reduction of the clot burden in filters was effective and safe. Filter retrieval with manual negative pressure aspiration thrombectomy seemed reasonable and valuable for management of massive thrombus within filters in some patients. Full assessment of the value and safety of this technique requires additional studies.

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INTRODUCTION

Retrievable inferior vena cava (IVC) filters were developed to avoid the long-term complications of permanent filters, which can be either left in place permanently or safely retrieved after a fairly long period of time when they have become unnecessary. The use of IVC filters has increased dramatically in the past decade with the availability of retrievable filters.¹ IVC filter thrombus is often detected on a cavogram before filter retrieval, and can exist to different

degrees, ranging from an asymptomatic small thrombus to severe IVC occlusion. The incidence of IVC thrombus discovered at the time of filter retrieval can be as high as 30%.² It is often suspected that filter thrombus may propagate and lead to PE, IVC occlusion, and extensive DVT.³ Moreover, removal is not appropriate if the filter contains a large amount of thrombus.² Delaying filter retrieval prolongs filter dwell time, which can make retrieval difficult or even result in failure of the attempted retrieval. To date there are limited data on treatments of IVC filter thrombus, and optimal management has not been well established.⁴

The present study concerns the largest trauma center in China, with about 4000 bone fracture procedures each year. At this center, retrievable IVC filters have been used in trauma patients with DVT since 2007. A review of experience with retrievable IVC filters was undertaken with

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specific attention paid to the management and clinical outcomes of IVC filter thrombus after placement of retrievable IVC filters in bone trauma patients. In addition, a new technique of aspiration thrombectomy for treatment of IVC filter thrombus is introduced and assessed.

PATIENTS AND METHODS

Patients and anticoagulant therapy

The study was designed as a retrospective, observational cohort analysis, and was approved by the ethics committee at the study institution. From January 2008 to December 2015, 764 trauma patients who received implantation of retrievable filters at the center were referred for filter retrieval. These patients had lower limb DVT confirmed by Doppler ultrasound and needed major orthopedic surgery for their lower limb and/or pelvic fractures. Among them, the patients with intra-filter thrombus detected on pre-retrieval cavograms were included in the study for evaluation. Indications for filter placement in this cohort were consistent with the recommendations of the *Guideline for Diagnosis and Treatment of Deep Vein Thrombosis* (2nd edition) issued by the Chinese Society for Vascular Surgery (CSVS)⁵ and *The Expert Consensus for Diagnosis and Treatment of Deep Vein Thrombosis in Bone Trauma Patients* issued by the Chinese Association of Orthopedics.⁶

For patients presenting with relative contraindication to anticoagulation, the filters were placed and a reduced dose (generally half dose) low molecular weight heparin (LMWH) was administered subcutaneously during the peri-operative period. For those with an absolute contraindication to anticoagulation, the filters were deployed alone to prevent PE. Once the high bleeding risk decreased, usually within a few days, anticoagulation was started.

Aegisy Filter placement and retrieval

The Aegisy Filter (Lifetech Scientific Co., Ltd, Shenzhen, China) is a retrievable filter that can be implanted through a femoral vein approach and extracted by the same access. It is made of a nickel titanium alloy with the asymmetric lantern design. The manufacturer suggests that the optimal removal time of the filter is within 12 days. In this study, IVC filters were generally deployed 1–2 days before or on the day of orthopedic surgery.

Retrieval was attempted in all patients in whom filter placement no longer appeared necessary. Retrieval is considered in the following clinical scenarios: patients who have received full anticoagulation and are in stable condition, and who have no new, recurrent, or progressive symptoms or clinical findings of DVT; there is no need for additional procedures during a short time; the patient or consenting guardian agrees to have the filter removed. A cavogram via femoral vein was routinely obtained at the time of filter retrieval to assess the location and any potential clot burden of the filter. The retrieval was attempted if no large thrombus was detected within the filter. A

retrieval set including a 12F delivery sheath and a goose-neck snare was used in the procedures.

Management of thrombus within a filter

Any free floating filling defect within a filter detected on the cavogram indicated the existence of thrombus, and its size and location were assessed. Management of thrombus within a filter depended on its size or clot burden. The filter was retrieved if deemed safe to do so, left in place as a permanent device, or retrieved after successful endovascular treatment to reduce the clot burden.

Based on its size the filter thrombus was graded into one of the following three types:

Small thrombus: a clot detected within a filter on cavogram less than 1 cm × 1 cm;

Massive thrombus: a large filling detected over 1 cm × 1 cm within the IVC at the level of the filter on cavogram, but not beyond the filter, and not presenting with complete occlusion of the filter;

Complete occlusion of IVC by thrombus: severe thrombus burden in the filter and presenting with complete occlusion of the IVC.

When a small thrombus was found, retrieval was attempted without additional techniques to reduce thrombus size (Fig. 1).

Massive thrombus within the filter, or IVC occlusion by filter thrombus was usually considered to be a contraindication to filter removal. In the absence of contraindications, patients underwent catheter directed thrombolysis (CDT) via a 4F-5F catheter with multiple side hole (Uni-fuse, AngioDynamics, USA) by continuous urokinase infusion of 300–500 units per kilogram per hour for 1–7 days. Follow up venography was typically obtained at an interval of 24–48 hours to observe the size of the thrombus. When its size decreased to less than 1 × 1 cm or disappeared, retrieval was attempted (Fig. 2). If the volume of clot showed no regression after 1 week of treatment, retrieval was abandoned and the filter was left in place as a permanent one. These patients received treatment with long-term oral anticoagulants.

Since 2014, a technique described as “filter retrieval with manual negative pressure aspiration thrombectomy” has been performed successfully for management of filter thrombus at the study center. When a relatively large thrombus within a filter is detected on the cavogram, a 12F delivery sheath is inserted from the femoral vein with the tip of the sheath positioned below the filter, and then a goose-neck snare is inserted into the IVC through the sheath. When the snare catches the hook of the filter, the filter is slowly withdrawn into the sheath by approximately 1/4 to 1/3. At the same time, manual negative pressure is applied by a 20 mL syringe from the side port of the sheath in an attempt to aspirate the thrombus into the sheath. After the filter is completely pulled into the sheath, the sheath together with the snare and the filter are taken out of the femoral vein.

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