Management of the Thrombosed Filter-Bearing Inferior Vena Cava

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Semin Intervent Radiol 2012;29:57–63

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Abstract

Keywords

- vena cava filters
- vena cava inferior
- venous thrombosis/therapy
- thrombectomy/methods

Inferior vena cava (IVC) filter thrombosis is a complex problem. Thrombus within an IVC filter may range from an asymptomatic small thrombus to critical IVC occlusion that affects both lower extremities. The published experience of IVC thrombosis management in relation to filters is either anecdotal or limited to a small group of patients; however, endovascular treatment methods appear to be safe and effective in patients with IVC thrombosis. This review focuses on filter-related IVC thrombosis and its endovascular management.

Objectives: Upon completion of this article, the reader will be able to identify the endovascular management and technical challenges of treating patients with filter-bearing IVC thrombosis.

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Although inferior vena cava (IVC) filters mechanically provide protection from lower extremity deep vein thrombosis (DVT) migration to the lungs, thrombosis at or below the filter may occur. It is generally unclear whether thrombosed filter-bearing IVC is a complication of the filter in the form of primary thrombosis of the device or is due to filtering of a thromboembolism. Symptoms may range from mild ambulatory leg swelling to limb-threatening ischemia, depending on multiple factors such as the extent of the thrombus, venous valvular and endothelial damage, collateral pathway formation, lower extremity thrombus burden, and IVC thrombosis. Published reports of filter-bearing IVC thromboses are limited and standard management is unclear.^{1,2} This article describes filter-related IVC thrombosis and outlines the management of this process.

IVC Filters and Filter Bearing IVC Thrombosis

In all of its iterations, the IVC filter is a commonly used device that functions as a physical trap for thrombus migrating from the legs or pelvis in the prevention of pulmonary embolism (PE). However, relatively little is known about the long-term complications of filters, including but not limited to IVC thrombosis. Specific filter designs could be a potential complicating factor in the development of IVC thrombosis, although specific data to this point are sparse. One of the earliest filter designs, the Mobin-Uddin “umbrella” filter, was introduced in 1967. This filter had 18 small perforations in a membrane suspended between steel struts; however, the very small perforations resulted in unacceptable high rates of IVC thrombosis (up to 60%).³ IVC filter design was significantly improved several years later by Greenfield et al when the conical filter design was introduced.⁴ Since that time, the incidence of filter-induced IVC thrombosis has decreased. The most ideal filter in terms of shape, size, delivery platform, and composition has not yet been determined.

IVC filter thrombosis is a complex problem that is not only related to filter design and characteristics but is also related to the patient's comorbid conditions such as contraindication to anticoagulation, hypercoagulable states, and the presence of malignancy. Contraindication to anticoagulation is probably the most common indication for IVC filter placement; however, this condition itself may create a predisposition to IVC thrombosis in the setting of indwelling IVC filters.

Issue Theme Venous Thromboembolism; Guest Editors, Suresh Vedantham, M.D., F.S.I.R., and Nael Saad, M.D.

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Tel: +1(212) 584-4662.

DOI <http://dx.doi.org/10.1055/s-0032-1302453>.
ISSN 0739-9529.

Additionally, a contraindication to anticoagulation may make the treatment of IVC filter-induced thrombosis more difficult to manage. If a patient is not a candidate for anticoagulation, he or she is typically not a candidate for more aggressive catheter-directed thrombolysis.

Thrombus burden within an IVC filter may range from an asymptomatic small thrombus to complete IVC occlusion that affects both lower extremities. When the IVC filter thrombus burden is small, most patients are asymptomatic, and the diagnosis is made incidentally by cross-sectional imaging. In this situation, the optimal management is unclear. In contrast, if the patient has a thrombosed filter-bearing IVC with total venous occlusion, significant lower extremity edema and pain are often present, and severe complications such as sensory deficits, venous stasis, or ulceration may also be present. In such a clinical setting, treatment depends on the ability of the patient to undergo anticoagulation and/or thrombolysis. Fortunately, many patients who undergo IVC filter placement in the setting of a contraindication to anticoagulation have a temporary contraindication, and therefore they may possibly tolerate more aggressive treatments when needed.

Ahmad et al⁵ reported on filter thrombosis rates by evaluating a large number of patients ($n = 1718$) with IVC filters. On follow-up evaluation with computed tomography (CT), 18.6% of all patients had some degree of IVC filter thrombosis. The vast majority (>98%) of these patients were asymptomatic, and total occlusion of the filter-bearing IVC was seen only in 2% of the patients who had filter thrombus (<0.4% of all patients).⁵ This report confirms that filter-bearing IVC complete thrombosis is a very uncommon problem.

Many authors recommend continued anticoagulation therapy in the setting of IVC filter placement to prevent IVC thrombosis, although the evidence supporting this is open to debate.⁵⁻⁸

Imaging Evaluation

Once patients with filter-bearing IVC thrombosis develop clinical symptoms (typically lower extremity swelling and pain), imaging with ultrasound (US) is generally the first diagnostic examination. For lower extremity evaluation for DVT, Doppler US is the gold standard imaging study; unfortunately, US is significantly limited in evaluating the iliac veins and IVC. As an alternative imaging modality, contrast-enhanced CT scan is one of the more useful modalities to demonstrate the filter-IVC-thrombus relationship, the extent of clot burden, and the degree of occlusion. Drawbacks to CT are the radiation and use of iodine-based contrast material. Contrast-enhanced magnetic resonance imaging is another valuable technique for diagnosis of IVC thrombosis, especially in evaluating the extent of the thrombus. However, susceptibility artifact from most filters limits visualization of the thrombus burden within the filter. Venography is generally reserved for catheter-directed interventions, and it remains the gold standard for diagnosis of IVC thrombosis; limitations to catheter venography are the use of iodine-based contrast material, radiation exposure, and its invasive nature.

Filter Bearing IVC Thrombosis and Management

The published experience of management of filter-related IVC thrombosis is either anecdotal or limited to a small group of patients.^{9,10} Published experiences of endovascular management of filter-related IVC thrombosis is mainly in the setting of extension of lower extremity DVT.^{11,12}

In 1988, Angle et al reported on eight patients with filter-related IVC thrombosis.² In this study, three of eight patients had filter-related thrombosis managed successfully by catheter-directed thrombolysis and adjunctive balloon angioplasty. The first article specifically addressing catheter-directed treatment for filter-bearing IVC thrombosis endovascular management was reported by Vedantham et al. In this study, the authors reported their experiences with 10 patients, achieving a technical success rate of 80%.¹

Even with the paucity of published data, endovascular treatment methods appear to be safe and effective in patients with filter-related IVC thrombosis, with results comparable with those reported for catheter-directed iliofemoral DVT therapy.¹ The pulse-spray technique using thrombolytics was first advocated by Hansen et al in 1994.¹³ Subsequently, pulse-spray technique became used commonly at several institutions, eventually evolving into combined techniques used in conjunction with mechanical thrombectomy devices. Although pulse-spray and/or mechanical devices may be successful in isolation in select patients, large thrombus burdens in the IVC typically require catheter-directed thrombolytic infusion that may last 24 to 72 hours. In theory, because of a large thrombus burden and the potential involvement of bilateral iliofemoral veins, patients with IVC thrombosis often require greater thrombolytic doses than patients with isolated extremity DVTs. Furthermore, the indwelling IVC filter creates an obstruction to establishing venous outflow, producing further potential difficulties for the endovascular procedure.

Tools for Clinical and Technical Success

Patient Selection

Anticoagulation is the mainstay treatment for extremity DVT with or without IVC thrombosis, especially in patients with few symptoms. Generally, even most symptomatic patients will benefit from anticoagulation, which, in the absence of contraindications, should be started immediately. Unfortunately, in a certain subset of patients, thrombus progression may occur when fully anticoagulated. At our institution we currently consider a more aggressive catheter-directed course if the following criteria are met: a recent increase in symptom severity despite adequate anticoagulation therapy, lifestyle-limiting lower extremity symptoms, or imaging confirmation of an increasing thrombus burden while on anticoagulation. Extension of thrombus into the existing filter should also be documented with cross-sectional imaging.

Patient Preparation and Clinical Assessment

Informed consent is obtained from each patient after a discussion of the risks and benefits of use of catheter-

directed thrombolysis, mechanical thrombectomy, possible venoplasty, and possible venous stent placement. During the consent process, surgical treatment alternatives are discussed. Specifically, patients are informed that this procedure may require several days in the intensive care unit to monitor vital signs, laboratory results, and observation of possible bleeding complications. The possible contraindications to the procedure, particularly to concomitant anticoagulation and thrombolytic therapy, are identified. In the setting of contraindications to the procedure, alternative options such as an open surgical approach are considered. Contraindications to catheter-directed therapies are oftentimes relative and still may be less morbid than alternative procedures.

High-resolution imaging equipment, an experienced interventional radiologist, a nurse dedicated to patient monitoring during the procedure, and a well-trained technologist are considered essential for procedural success.

Thrombolytics such as tissue plasminogen activator (tPA), heparin, or direct thrombin inhibitors, conscious sedation medications, possible oral antiplatelet agents, and prophylactic antibiotics prior to stent placement are often used or administered before, during, or after completion of the endovascular procedure. All possible medications used in the periprocedural period should be readily available. Finally, iodine-based contrast material, or alternatively carbon dioxide, may be used judiciously in patients at risk for contrast-induced nephropathy.

Venous access for endovascular treatment is obtained via US guidance. If the entire lower extremity deep venous system is involved with DVT, access via the tibial veins may be attempted. In most patients, even in those with clot extending into the calf, the popliteal veins may be accessed through the clot. In the setting of isolated involvement of the iliac veins or filter-bearing IVC, a common femoral vein approach is favored. This approach is preferable due to the many potential difficulties arising from more peripheral lower extremity venous access, such as difficulty in crossing occlusions that are far downstream from the access site due to less pushability of endovascular devices, as well as a requirement of a larger quantity of contrast agent for venograms from a peripheral approach. Relatively longer venous sheaths may be helpful; however, working length restrictions with various catheters and devices may occur with more peripheral punctures. In contrast, more distal venous access sites are essential if thigh or calf veins are involved with DVT. Oftentimes, due to the limitations previously mentioned, calf vein thrombi are generally not addressed with catheter-directed therapy and are hoped to resolve with a use of anticoagulation medication after the thrombolysis procedure. Other venous accesses, such as an internal jugular vein approach, may be used, particularly in helping to overcome technical difficulties with the lower extremity approaches.

Mechanical Thrombectomy and Pulse-Spray Pharmacomechanical Thrombolysis

Changes in technology and the commercial availability of mechanical thrombectomy devices are making the use of

such devices more ubiquitous. This recent change in the way thrombolysis procedures are performed is important to recognize when reading the published literature regarding catheter-directed treatment of filter-bearing IVC thrombosis. Most of the available reports use techniques that may be considered out of date.

The ideal thrombectomy device would be low in cost, easy to use, have a low profile, be flexible, would not damage an indwelling device such as an IVC filter, and would be equally efficient in both large and small vessels. Although such a device is not currently available, many of the currently available devices do possess one or more of these characteristics. Currently, two commonly used mechanical thrombectomy systems are the AngioJet system (Possis Medical, Minneapolis, MN) and the Trellis device (Bacchus Vascular, Santa Clara, CA).

The AngioJet system is a percutaneous mechanical thrombectomy device that can be used in two different ways. First, as a mechanical thrombectomy device, heparinized saline is forcibly injected into the thrombus while the aspiration port actively removes thrombus out of the catheter. Using the pulse-spray setting on the device, 4 to 8 mg of tPA is placed in a 100-mL bag of saline and forcefully injected into the thrombus. In this setting, however, the catheter aspiration port is blocked, thereby disallowing removal of the thrombus and allowing the tPA to dwell within the clot. Following the pulse-spray technique, the AngioJet system may be removed to allow a prolonged dwell time for the tPA, or after a period of time (at our institution ~15 minutes), mechanical thrombectomy with the aspiration port reengaged may be performed with the same AngioJet catheter. At our institution, we prefer to use the pulse-spray technique, and do not routinely perform mechanical thrombectomy; after pulse-spray, we typically initiate catheter-based continuous thrombolytic infusion. Our rationale for not performing mechanical thrombectomy after thrombolytics is because we believe the thrombus burden in the IVC is too large to debulk solely with mechanical thrombolysis, and we are concerned about the potential hemolytic complications of the AngioJet system with prolonged use.¹⁴ In our experience, pulse-spray pharmacomechanical thrombolysis appears to shorten overall thrombolytic infusion time, but limitations include the inability to adequately treat chronic thrombus, the lack of available catheters to treat very large vessels such as the IVC, and the unknown long-term sequelae of using the pulse-spray setting on the AngioJet system including potential endothelial damage.

The Trellis system may be an effective alternative mechanical device for use in the iliofemoral vein and potentially for IVC thrombosis. The Trellis device consists of a thrombolytic delivery catheter with proximal and distal occlusion balloons that prevent thrombolytic medications escaping into the systemic circulation. With the balloons inflated, a closed embolic protection system is created, with the additional benefit of maintenance of a high concentration of thrombolytic agent. At the end of the treatment, the residual clot fragments and remaining thrombolytic drug may be aspirated, if desired. Limitations exist, though, for the use of the

Trellis device in patients with indwelling IVC filters because the device cannot be used directly in the filter-containing IVC. The most appropriate use of this system for patients with filter-induced DVT would be in debulking the thrombus burden in the iliac veins and the infra-filter IVC.

Catheter-Directed Thrombolysis

Following initial pulse-spray pharmacomechanical thrombolysis (or in lieu of pulse-spray altogether), catheter-directed venous thrombolysis with a multiple-side hole infusion catheter/wire system is often performed. To accomplish this, the catheter is preferentially positioned within the thrombosed venous segment so the thrombolytic agent can be infused directly into the thrombus.

The dose and types of the thrombolytic agent used in catheter-directed thrombolysis vary from institution to institution. Either tPA (Genentech, San Francisco, CA) or urokinase (Abbott Laboratories, Chicago, IL) are typically used, depending largely on institutional preference. Due to an unwanted side-effect profile, streptokinase is rarely if ever used for this patient population. At our institution, we prefer to use tPA and have adopted an initial empirical dose of 1 mg/hour. During all tPA infusions, the patient stays in the intensive care unit (ICU) to facilitate close clinical and laboratory observation.

The use of systemic anticoagulation during thrombolysis is controversial, particularly with regard to whether patients should be fully or partially anticoagulated. Fully anticoagulated patients should have activated partial thromboplastin times (aPTTs) of 60 to 90 seconds, compared with partially anticoagulated patients who receive empirical subtherapeutic doses of heparin at ~500 U/hour. At our institution, we have adopted subtherapeutic anticoagulation and use an empirical heparin dose of 500 U/hour. However, on specific occasions, depending on operator preference and certain clinical factors such as severe thrombus burden or in patients with a documented thrombophilia, full heparinization may be warranted. In select circumstances, such as heparin-induced thrombocytopenia, direct thrombin inhibitors may be used instead of heparin. For all patients, aPTT and fibrinogen levels are monitored at 6-hour intervals, with dose reductions made when fibrinogen levels decrease to <100 mg/dL. Prophylactic intravenous antibiotics are given during the initial procedure, and depending on the patient's risk factors, additional doses may be administered at the operator's discretion.

Follow-up venography is typically obtained 12 to 24 hours following initiation of catheter-directed thrombolysis. If residual thrombus is present on the follow-up venogram, it may be due to chronic thrombus, which is thrombolysis resistant, or subacute thrombus, which needs an extended period of thrombolysis. Lengthy thrombolysis and ICU stays may increase complication rates, and therefore they are avoided if at all possible. To avoid prolonged thrombolytic infusions, in the setting of incomplete thrombus resolution, more aggressive treatments such as mechanical thrombectomy, balloon venoplasty and/or maceration, or stent placement may be undertaken. Currently, many operators stop thrombolysis

after 2 or 3 days of treatment due to the accelerated risk of bleeding.

Once the IVC thrombosis is resolved, if the existing filter is a permanent type, placing a stent inside the IVC and thereby crushing the existing IVC filter may be considered. This method usually creates reasonable flow and patency in the IVC, with mild bulk effect from the existing hardware. If the existing filter is an optional or retrievable type, following thrombolysis of the clot, filter retrieval may be the best option. In most cases with optional filters, filter retrieval obviates the need for balloon venoplasty or stent placement (►Fig. 1).

Balloon Venoplasty and Stent Placement

Balloon venoplasty of the filter-bearing IVC may be performed for several reasons. "Balloon maceration" of the thrombus is commonly performed to increase the effect of thrombolytics by maximizing the thrombolytics-thrombus surface interaction. Balloon dilation of the filter-bearing IVC may also be performed to create a channel to allow the thrombolytics to better interact with thrombus. If there is hyperplastic tissue (neointimal hyperplasia) incorporating the filter into the wall of the IVC, balloon venoplasty may be effective in disrupting the tissue and improving blood flow through the filter. Balloon venoplasty is also commonly used after stent placement to increase the intraluminal diameter of IVC at the level of the filter.

On occasion, filter-bearing IVC thrombosis is an isolated finding without lower extremity involvement. If a patient is not a good candidate for anticoagulation and caval filtration is not needed, stenting of the IVC may be performed. Stent placement is also used to recanalize chronically occluded IVCs arising from malignant conditions.^{15,16} Stenting of the filter-bearing IVC is not typically first-line therapy due to the potential bulk effect within the IVC, as well as typical lower extremity DVT involvement. In selected cases, however, stent placement is an alternative.¹⁷ One potential disadvantage of IVC stent placement is the lack of data regarding long-term patency rates. Even though primary patency of IVC stents is reported to be 80% at a mean of 19 months, long-term patency rates of those IVC stents remains unknown.^{17,18} The types of stents reportedly used in thrombosed IVCs are either self-expandable stents such as Wallstents (Boston Scientific, Natick, MA) or balloon-expandable stents such as Palmaz (Johnson & Johnson, Warren, NJ). Those patients who receive stents typically undergo lifelong oral antiplatelet therapy.

Secondary Filter Use During Endovascular Treatment for Filter-Induced DVT

Placement of a second filter downstream from the indwelling filter during the initial thrombolysis procedure for filter-bearing IVC thrombosis is highly controversial. Advocates of placing a new filter typically cite a fear of the thrombus embolizing during thrombolysis. In many cases, however, the location of the initial filter is immediately below the level of the renal veins, and the IVC is usually patent at and above (downstream from) the filter; therefore, placement of a new filter would be in a suprarenal location. If there is a large

Figure 1 Endovascular management of a thrombosed filter-bearing inferior vena cava (IVC) in a 61-year-old man with bilateral iliofemoral deep venous thrombosis. (A) Digital subtraction venography demonstrates extensive thrombosis of the filter-bearing infrarenal IVC. Contrast is stagnant upstream from the IVC thrombus, and there is no antegrade flow observed within the IVC. (B) Follow-up venogram following pharmacomechanical pulse-spray thrombolysis with 8 mg of tissue plasminogen activator overnight (16 hours) of catheter-directed thrombolysis was performed. Residual thrombus within the IVC filter is noted. At this time, filter retrieval was planned. (C) Following filter retrieval, residual thrombolytic-resistant thrombus and/or fibrin is observed within the filter. (D) Follow-up IVC venogram following successful filter retrieval demonstrates patency of both the iliac vein and IVC. The patient's symptoms gradually resolved over the next 12 hours. The patient was placed on an anticoagulation regimen, and placement of a new IVC filter was not indicated.

thrombus burden above the initial filter, an additional filter may be better justified. Overall, at our institution we do not typically use an additional filter in most cases, with the exception of a free-floating thrombus above the existing

filter. If a second filter is placed, we prefer to place an optional filter in the suprarenal location, with the intent of retrieving the new filter at the end of the thrombolysis procedure. Operators should be particularly careful while performing

manipulations from a jugular approach through a newly placed filter before it has established a good interaction with the IVC wall because such manipulations may lead to filter tilt or migration. At our institution, if we place a new suprarenal filter we prefer to use access sites below the preexisting filter (e.g., femoral vein) for intervention.

At the conclusion of the procedure, in the setting of catheter-directed thrombolysis, mechanical thrombectomy, and/or balloon angioplasty without stent placement, the preexisting filter may remain in place and is typically fully functional. If the filter is a permanent type, and there is an adequate flow within the IVC and filter, the procedure may be concluded after determining the need for postprocedure anticoagulation. If the IVC filter is an optional type, after a successful endovascular procedure, we prefer to retrieve the preexisting filter with or without placement of a new filter, depending on the clinical scenario. We do this because IVC filter replacement or retrieval provides the opportunity to remove some residual thrombolytic-resistant debris within the filter (►Fig. 1C).

Technical Challenges

Treatment of filter-bearing IVC occlusions present specific technical challenges. In some instances, particularly in patients with chronic obstructions, traversal of the occluded segment may be impossible with standard catheter and wire techniques. One way in which some operators overcome this issue is to obtain two separate venous accesses to gain “through-and-through” access. Gaining such access may help facilitate traversal of the occluded IVC. Other technical failures may occur due the presence of large collateral veins such as the lumbar venous system. These large venous collaterals may create additional difficulties with transversal of the occluded IVC segment, particularly by confusing the operator into thinking that the wire used in the intervention has traversed the occluded vein when in actuality the wire may be in a large adjacent lumbar collateral.

Popliteal vein access, commonly used for lower extremity DVT interventions, may also be used in the treatment of IVC thrombosis. For these interventions, longer sheaths may be needed (e.g., Raabe vascular sheath; Cook Bloomington, IN). Sheaths used for these interventions are typically 6 to 9F in diameter and up to 90 cm in length. Placing a longer sheath from the popliteal vein provides several advantages in facilitating transversal of difficult-to-cross IVC occlusions, particularly with regard to the pushability of catheter and wire systems. Other advantages of longer sheaths include performing follow-up venograms closer to the level of obstruction, performing venography with less contrast than if it were injected from the popliteal vein, and providing a more stable system during balloon angioplasty and stent placement. One of the disadvantages of longer sheaths, however, is the need for a longer working length of devices placed through the sheaths.

Most of the published experience with filter-bearing IVC thrombosis is with permanent filters. Many recent reports discussing interventions in optional filter-bearing IVC throm-

bosis describe some instances of deformation of the filter during interventions, such as crushing and potential fracture of the filter. This deformation may lead to filter failure or potentially predispose the IVC to further thrombosis. For these reasons, filter removal should be considered once successful IVC thrombolysis has been accomplished, even if another filter is to be placed. Filters that are deformed during thrombolysis may be especially difficult to remove; however, there are specific reported maneuvers to overcome this problem.¹⁹

Complications

In one of the early reports on thrombolysis for filter-bearing IVCs, Vedantham et al reported a 10% major bleeding complication rate. However, this translated to a single patient (1 in 10) who had undergone a very high tPA infusion rate (2.5 mg/hour).¹ Due to this complication, these authors suggested using lower rates of thrombolytics. In this report, there were no other significant complications such as intracranial or gastrointestinal hemorrhage, clinically detectable PE, or renal failure. The most appropriate thrombolytic dose and rate have not been determined; however, many operators use infusion rates that parallel those used during lower extremity DVT lysis (0.5 to 1.0 mg/hour). Higher infusion rates are unlikely to improve thrombolysis results, particularly in the setting of chronic filter-adherent thrombus.

Surgical Treatment

Until the recent development of endovascular techniques, surgery was the only option in the treatment of IVC occlusions. The role of surgery has significantly decreased due to the advances in endovascular devices and techniques, and it is rarely used today.

In select patients or in those patients who fail endovascular techniques, surgical venous thrombectomy or bypass surgery may be performed.^{20,21} Unfortunately, the outcomes of surgical interventions are marginal. In one large series, the 3-year postoperative patency rate was only 62% for 44 surgical reconstructions performed in the treatment of IVC occlusion.²⁰ Although this particular report did not stratify IVC occlusions based on the presence of an IVC filter, it is likely that surgical interventions with a filter in place have an even lower success rate due to the more complex interventions that may be performed and the persistent indwelling nidus for thrombus formation. In some patients, adjunctive procedures to facilitate venous patency, such as venoplasty or the creation of high-flow states through the creation of an upstream arteriovenous fistula creation, are also used.²¹

Postprocedure Patient Management

Once a filter-bearing IVC is successfully thrombolysed, clinical follow-up of the patient is essential. Although not definitively established, it is likely that a filter-bearing IVC that has undergone one thrombosis is likely to undergo another. Because long-term complications such as IVC thrombosis are a possibility as long as the filter is in place, close clinical

follow-up of patients with an indwelling IVC filter is needed; when the IVC filter is no longer deemed necessary, retrieval should be encouraged. In general, filter retrieval rates increase not solely because of improved technical success rates but more likely due to more meticulous patient management and clinical follow-up.²²

To follow these patients, as well as all patients with an indwelling IVC filter, we established a dedicated IVC filter clinic in 2007 at our institution to provide follow-up care for all filter patients. Prior to 2007, many patients in our practice with IVC filters were lost to follow-up, and optional filter retrieval rates were seen in ~10 to 15% of all patients undergoing filter placement. In 2010–2011, results were improved to 40% retrieval rates in all patients with optional filters. Most of the rest of the patients are under follow-up, leaving only a small fraction lost to follow-up.

In patients who have undergone intervention for filter-bearing IVC thrombosis, active imaging follow-up to assess for recurrent DVT may be necessary because these patients are likely at increased risk for recurrence. The optimal postprocedure imaging regimen has yet to be determined.

Modification of anticoagulation medications may be needed in high-risk patients. At our institution, the interventional radiology service collaborates with the hematology clinic for DVT and PE prophylaxis, and it manages imaging follow-up to evaluate venous patency and determine if the IVC filter is still needed.

Conclusion

Endovascular treatment of a thrombosed filter-bearing IVC is technically feasible, with high success and low complication rates. Technological advancements and development of newer endovascular devices allow interventional radiologists to treat via various methods that can be tailored on a case-by-case basis. Although the presence of an IVC filter may add technical challenges to lower extremity and IVC thrombosis management, current techniques such as catheter-directed thrombolysis, power pulse spray, the use of various mechanical devices, and judicious use of tPA or stent placement will typically lead to a successful outcome. Long-term clinical success is dictated not just by performing the thrombolysis but in addressing the underlying predisposing condition and, if possible, anticoagulation and PE/DVT prophylaxis.

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