Inferior Vena Cava Filters
Truth or Dare?

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Venous thromboembolism (VTE) is common, with an incidence of >400 out of 100,000 people in the United States. VTE recurrence is also frequent, occurring in 40% of patients, with mortality as high as 30%. Also, if left untreated, pulmonary embolism (PE) will occur in as many as 40% of all proximal deep vein thrombosis (DVT). Although first-line treatment for VTE is anticoagulation, some patients cannot receive this therapy, and others will experience treatment failure. Consequently, inferior vena cava filter (IVCF) use has been steadily rising in the United States and Europe for the past 2 decades.

Most IVCFs in modern use allow for retrieval once the indication for use has passed. Practically, a variety of devices and techniques with escalating aggressiveness can be used to remove filters, and the Food and Drug Administration recommends that efforts should be made to retrieve these devices as early as possible. When filters are centered in the inferior vena cava and not firmly attached to the caval walls, dedicated filter grasping devices are often all that is required. A problem arises when filter components are embedded into the caval wall. In these cases, more aggressive retrieval techniques need to be used. Existing techniques may include use of endobronchial forceps and, in extreme cases, open surgical removal. Another solution that may be appropriate in cases of caval thrombosis or occlusion is to perform venoplasty and stenting. In these cases, the IVCF may be retrieved or restrained between a stent and the caval wall.

In this issue of *Circulation: Cardiovascular Interventions*, Kuo et al tackle this problem by using a novel technique. They present their prospective experience in 100 consecutive patients in whom laser-assisted removal of embedded IVCF was implemented. Filters were retained for a mean of 855 days, some having been implanted for > 18 years, whereas others required special efforts after only 37 days. By using a combination of a laser sheath (Spectranetics, Colorado Springs, CO) and a force gauge to ensure that the force being used did not exceed safe limits, retrieval rate was 98%, although not all filters were designed for retrieval. Major adverse events occurred in 3% of cases. During postprocedure surveillance, 4 other patients experienced adverse events, not necessarily directly attributed to the procedure. Patients were grossly divided into 2 groups: those who had various clinical symptoms attributed to the IVCF and those who were asymptomatic, yet wished to avoid potential filter-related complications or required indefinite anticoagulation because of presence of the device.

The justification for IVCF use is based in the concept that various patient groups at risk for VTE who cannot receive anticoagulation will benefit from a mechanical barrier that will prevent potentially fatal PE. Although societal guidelines differ in their approach to IVCF use, consensus does exist that an IVCF should be used in patients who have an acute VTE and cannot receive adequate dose anticoagulation. In addition, when anticoagulation has clearly failed in patients with acute VTE, IVCFs are indicated as well. Still, the increased use of IVCF is not supported by high-quality evidence. To date, there have been no studies that randomized patients with VTE to receive either an IVCF or anticoagulation, no studies that compared patients at risk for PE who receive an IVCF or other modes of VTE prophylaxis, and no proof that placement of IVCFs prolong life or lower mortality rates in broad patient populations. Despite less than robust data to support their use, patients are routinely offered IVCF if they present with poor cardiopulmonary reserve, a free-floating iliocaval DVT, and are planned for surgical pulmonary embolectomy or before catheter directed therapy for proximal DVT. Filters are even occasionally used in high-risk patients in conjunction with anticoagulation, implying the imperfection of standard anticoagulant therapy. More recently, analysis of population data has shown that IVCF may be useful in unstable patients with massive PE. Actually, the most commonly reported indications for filter insertion as presented in a comprehensive summary of all the available IVCF-related literature published until 2010 included an absolute contraindication to anticoagulation (48%), failure of adequate anticoagulation (7%), and prophylaxis without PE or DVT in clinical scenarios deemed to place patients at high risk for VTE (17%). Thus, for many common clinical situations in which IVCF are being used, there is lack of data or consensus on the efficacy of these devices.

Surprisingly, retained IVCF-related complications are another area of uncertainty. Clearly, IVCFs are associated with complications including filter migration or embolization, strut fracture, and penetration into adjacent structures, thrombosis, lower extremity edema, post-thrombotic syndrome, DVT, and recurrent PE. However, data about the risk factors and timeline of these complications have actually not been
adequately evaluated to date. In our experience, derived from
758 retrievable IVCF during a median follow-up of 342.0
[81.5–758.0] days, indwelling IVCF-related complications
occurred in 17.7% of patients. Mean time to complication was
only 32 [13.0–116.8] days and, importantly, there were nearly
no complications after 6 months have elapsed since the time of

The need for anticoagulation for retained filters has also
not been studied in well-designed prospective randomized
trials. The common convention suggests that anticoagulation
should be administered only according to the original VTE-
related indication, regardless of filter status. Prolonged
anticoagulation administration in patients with retained fil-
ters has potential advantages such as reducing filter-related
IVC thrombosis and minimizing recurrent PE and carries an
increased risk of bleeding. In our aforementioned experi-
ence, early and late complications occurred at similar rates,
whether or not anticoagulation was administered.

Although Kuo et al5 summarize their impressive experience with this
novel technique for the removal of difficult to retrieve
IVCF, and although they report relatively few complications,
there are some unorthodox elements in their approach that
need to be highlighted. First, the authors used thrombolytic
agents when they encountered thrombus within the filter in
3 patients. Although they do not report any major bleeding as a
consequence, this measure does raise the question of
necessity compared with added risk. Given the prolonged
time of indwelling filters, there was likely no urgency to filter
removal. Thus, perhaps a trial of anticoagulation would have
achieved thrombus resolution with lower hemorrhagic risk.
Second, the authors describe their strategy of using stent-
grafts in cases in which there was accidental caval perfora-
tion. Stent-grafts have been studied most commonly in the
arterial system, and there is little objective data about their
use in the low flow venous system. Thus, their use may have
replaced a potentially benign IVCF with a potentially throm-
botic implant and may add a potential long-term consequence of
this technique. As noted by the authors, there are some other inherent limi-
tations to their study. Specifically their technology is not Food
and Drug Administration approved for the indication of IVCF
removal and, although it was safe to use, this was in the hands
of a group of clinicians particularly skilled in this technique.
Thus, paradoxically, their evident expertise is a source for
potential bias for clinicians less versed in using this technol-
ogy for these purposes.

In these series, many patients were asymptomatic. Although
retrieval in symptomatic patients cannot be easily disputed,
filter removal in asymptomatic patients is less straightforward.
Retrieval may not have been necessary in several of these
patients. A control group in which filters were left indwelling
without retrieval attempts would have allowed the reader to
draw meaningful clinical conclusions about the value of
a challenging filter retrieval. It is likely that most of these
patients would have probably never experienced any filter-
related complications because the filters were indwelling for
prolonged periods by the time the study took place.

Kuo et al5 summarize their impressive experience with this
novel technology and draw conclusions about its efficacy and
safety in aiding in the extraction of difficult to retrieve IVCF.
Innovative use of laser catheter retrieval may indeed have a
place for those symptomatic patients in whom IVCF retrieval
is deemed clinically important and in whom more conven-
tional attempts have failed. Nonetheless, other conclusions
can actually be drawn from this same experience. First, and
foremost, these series reinforce the fact that IVCF should be
inserted only when indicated and retrieved as soon as possi-
ble. Although the authors contend that as many as 60% of fil-
ters cannot be retrieved, modern series point to much higher
retrieval rates, especially if retrieval attempts are performed
early after implantation. In our experience, retrieval success
was 87.9% and, in another modern report, >80% of filter
retrieval attempts were successful.17 It follows that a more
pressing issue is actually improving on patient surveillance to
minimize patients being lost to follow-up, therefore resulting
in missed opportunities for filter retrieval. It has been shown
that implementation of systematic methods for patient fol-
low-up will improve filter retrieval rate.18 Furthermore, limit-
ing IVCF to those patients who can truly benefit from them
may also improve patient outcomes. To ensure appropriate
patient selection before insertion, a thorough consultation
should be performed and consideration should be given to
advantages and disadvantages of the procedure. Preferably,
patients should be involved in the decision-making process,
especially when controversy exists. It is our contention that
rather than using extreme measures to retrieve IVCF in
asymptomatic patients, if retrieval is difficult, filters should
usually remain in place. Anticoagulation is probably not
needed in asymptomatic patients with retained IVCF once
the original indication has passed. Finally, although the deci-
sion about the duration of anticoagulation is often paramount,
considering the relationships between vascular intervention
and medical management is likely more prudent.

Disclosures
M.R. Jaff is a noncompensated member of Data Safety and
Monitoring Board in Ekos; a member of the Scientific Advisory Board
in Astra Zeneca Pharmaceuticals; and a board member in Vascular
Interventional Advances Physicians, a 501 (c) 3 not-for-profit educa-
tion and research organization. Dr Weinberg has no conflict to report.

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Key Words: Editorials ◼ deep vein thrombosis ◼ inferior vena cava filter ◼ pulmonary embolism ◼ retrieval
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doi: 10.1161/CIRCINTERVENTIONS.113.000818

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