

# Inferior Vena Cava Filter Thrombosis and Retrieval: A Literature Review of IVC Filter Implications and Their Removal

**Ezra Schrem**

Sackler School of Medicine, Tel Aviv University, Tel Aviv

## Abstract

Inferior vena cava filters are used in healthcare settings today in patients to prevent the migration of blood clots from the lower extremities, or elsewhere in the body, to the pulmonary arteries. This is to prevent a type of venous thromboembolism (VTE) known as a pulmonary embolism (PE) from forming. PE can be life threatening if not treated correctly. Although the IVC filters help prevent PE, the filters themselves can induce thrombosis and may result in occlusion of the IVC. The IVC filters can also cause other complications such as deep venous thrombosis (DVT) of the lower extremity and promote unnecessary long-term anticoagulation (AC) therapy. Therefore, IVC filters should be retrieved as soon as the indications to have one in place are no longer applicable to the patient, and the patient is no longer at high risk of developing PE. Retrieval must also be done in a timely manner; the longer an IVC filter is in place, the more difficult it is to remove. This paper aims to provide a review of prior research that deals with the thrombosis of IVC filters, its possible treatment, filter removal, and the importance of follow-ups.

## Introduction

Inferior vena cava (IVC) filters are small devices placed into the IVC just below the junction of the IVC and the lowest renal vein (1). They serve to prevent the migration of a blood clot from the lower extremities, or elsewhere in the body, to the pulmonary arteries, which is where they can lodge and cause a type of venous thromboembolism (VTE) known as a pulmonary embolism (PE). The filters are generally not used as the first line of treatment in



**Micah Belzberg:** *Hearts*

preventing a PE from occurring, but rather are used in patients that are susceptible to complications arising from the use of anticoagulants, or blood thinners, such as gastrointestinal bleeding; anticoagulants are generally the first line of treatment (2). The IVC filters themselves, however, can cause thrombotic activity. Therefore, their retrieval is suggested. Many patients, however, fail to have their IVC filters removed due to the lack of appropriate follow up with their healthcare providers. Developing simple plans to help monitor IVC filters, patients can significantly assist in morbidity and mortality reduction. This signifies the opportunity for crucial improvements in clinical care that can lead to more effective and efficient prevention, diagnosis, and treatment of IVC filter thrombosis, which can ultimately help improve the quality of healthcare today.

### Key Point: What is a Catheter-Directed Thrombolysis?

This procedure involves the threading of a wire into the site of the clot, and direct delivery of thrombolytic drugs. This procedure requires lower doses of drugs than systemic therapy, and thus reduces overall risk of bleeding.

Reference: Sista AK, Kearon C. Catheter-Directed Thrombolysis for Pulmonary Embolism: Where Do We Stand? *JACC Cardiovascular Interventions*. 2015; 8(10).

### Key Point: What is a Coronary Angioplasty?

Coronary angioplasty, also known as percutaneous coronary intervention, is used to maintain the patency of blood vessels with severe atherosclerosis. It involves the insertion of a balloon into the vessel of interest with subsequent widening of the artery. Often, a wire stent is placed to prevent future narrowing.

Reference: Mayo Clinic Staff. Coronary Angioplasty and Stents. Mayo Clinic. 2017. Retrieved from <http://www.mayoclinic.org/tests-procedures/coronary-angioplasty/home/ovc-20241582>.

## Predisposing Factors of IVC Filter Thrombosis, and Management

The physical design of the filter can directly correlate with the risk of developing a thrombotic event of the filter (3). It has been shown that the greater the number of perforations in the filter, the higher the likelihood of the pathological condition (4). IVC filter thrombosis is not exclusively related to filter design, but also to patient underlying conditions including comorbidity, anticoagulant intolerance, and malignancy. Therefore, there is a dilemma due to the fact that contraindication to anticoagulants is among the most common reasons for filter placement in the first place, but this condition itself can create a predisposition to IVC filter thrombosis. In regards to management of the thrombosed IVC filter, the main lines of treatment are the use of catheter directed thrombolysis and adjunctive balloon angioplasty. There is little published data on endovascular treatment methods; however, these methods are technically feasible with great success.

### Event Rates in IVC Filter Patients

It has thoroughly been found that patients with IVC filters installed are more likely to develop a lower extremity DVT and IVC thrombosis (5). The PREPIC study was conducted to analyze the effects of permanent IVC filters and VTE. In this study, there were two experimental groups: one with patients on anticoagulants (AC) and permanent IVCF and another with patients on AC without the filters. The study shows how in increased-risk patients with

proximal DVT, the initial benefit of PE prevention through IVCF is counterbalanced by the excess of DVT and IVCF thrombosis. In other words, although PE rates decreased in patients with IVCF in this study, DVT rates increased in patients of this same study group, and therefore mortality rates remained nearly the same between the patients with the filters and without the filters (21.6% vs 20.1%). These results are derived from patients that had a filter in place for 2 years. The study also demonstrated how the lower number of PE in the filter group is similar to the higher number of IVC thrombosis of the same group of patients. Additionally, it also clearly demonstrates how patients that had the filters in place for a longer period of time had higher rates of IVC filter thrombosis (9% for patients with the filters in for 2 years, and 16% for patients with the filters for 8 years) (6). Therefore, once patients are no longer considered high risk for developing PE, the IVC filters should be retrieved to prevent its thrombosis. Permanent filters should certainly not be used, in order that retrieval will be more successful. On a side note, it is worth mentioning that the data presented in the study described above only includes patients on AC therapy with and without permanent filters that are symptomatic for VTE. The study fails to include data on patients who were asymptomatic for any type of venous thrombotic activity.

## Complications of IVC Filter Thrombosis

IVC filter thrombosis can give way to serious health complications (7). IVC filter thrombosis can range from small local clots to thrombi that could extend into the lower extremities and even completely occlude the IVC in its most severe form. The filter thrombosis can harm lower extremity venous return, which may lead to slowdown or complete stoppage of venous blood flow or static ulcers. The cause of IVC filter thrombosis may be due to emboli entrapment within the filter or in situ thrombosis because of device intrinsic thrombogenicity. In addition, the prevalence of retrievable filter thrombosis has been shown in a study to range from 0.6% to 8%, with an average of 2.8% (8). This rate of thrombosis is significantly lower than that of permanent filters. This study was a review of many other studies that have been previously conducted, and aggregated its results.

## Importance of IVC Filter Removal

It is very important to remove an IVCF that is no longer necessary, as an IVCF can lead to many complications including a deep venous thrombosis (DVT) of the lower extremity, caval thrombosis, and unnecessary life-long anticoagulation (AC) therapy (9). The combined duration of treatment for a DVT/

PE should be about 3-6 months with a combination of both AC and filter treatment modalities. After this time frame, the associated complications of the IVC filters outweigh its benefits and therefore the filters should be retrieved. Therefore, it is of great importance to follow up with an IVCF patient to ensure that a filter that is no longer critical to the patient can be removed early to prevent potential harmful effects such as IVC filter thrombosis. Filter retrieval rates need to be improved; through simply implementing a better system of monitoring IVCF patients, the medical community can prevent these patients from becoming lost to follow up.

## IVC Filter Retrieval Rates

Although IVC thrombosis rates in retrievable IVC filters are quite low, retrieval (removal) is still highly recommended as its prognosis has devastating potential, and the longer the filters are in place, the more likely they are to cause thrombosis. Furthermore, other conditions such as filter-induced DVT can also warrant filter removal. Yet, according to the American Association for the Surgery of Trauma (AAST), only 22% of retrievable filters were removed in patients nationwide in 2007. Another study claimed that the international retrieval rate is 34% (8). These retrieval rates are simply not sufficient as the US Food and Drug Administration (FDA) generally recommends that all patients with temporary IVC filters installed have them removed within 25-54 days following insertion (10). The IVC filter removal procedure has a relatively high success rate, but the removal rate still remains quite low due to the lack of appropriate patient follow up.

A Canadian study monitored all IVC filter procedures at a healthcare institution in Toronto between January 2001 and July 2013 and found that IVC filter thrombosis is the most common complication, accounting for 61.4% of all long term IVC filter related complications (11). In addition, the study demonstrated that the retrieval rate of retrievable IVC filters was 41.6%, and the average time from insertion to removal was 76.4 days, which is longer than the recommended guidelines set forth by the FDA. This low retrieval rate may be due to the lack of appropriate patient follow up, as is evidenced by the fact that in this study only 16.3% of patients with documented filter insertions had been given discharge instructions

### Key Point: Pulmonary Embolism

A pulmonary embolism or PE refers to an obstruction in a pulmonary artery by a substance that has traveled from elsewhere in the body. As a result, there is a decrease in lung perfusion, leading to a decrease in blood oxygen saturation, which results in less oxygen available for the body to consume. Treatment initially involves anticoagulant therapy with heparin administration in a hospital setting followed by warfarin.

Reference: Thompson BT, Kabrhel C. Overview of acute pulmonary embolism in adults. UpToDate 2017. Retrieved from <https://www.uptodate.com/contents/overview-of-acute-pulmonary-embolism-in-adults>.

for filter retrieval or follow up. Methodic follow up is needed to help limit the development of IVC filter related complications.

## Methodologies for Increasing Follow-Up and Retrieval

A comprehensive method designed to increase IVCF retrievals has been devised by a number of researchers (9). This method essentially consists of three components which include education, tracking, and having a dedicated person oversee the process. It is imperative that IVC filter patients, their families and friends, and healthcare providers are thoroughly informed of the implications of the filters and are able to determine when having a filter inserted is no longer necessary. It is essential that a patient understands the importance of IVCF retrieval when it is no longer required and realizes the importance of following up with their appropriate physician. Tracking refers to a system used to accurately keep tabs and records on those patients with filters in place. This could be done through the use of giving patients a wrist band or placing reminders in medical records. Other creative ways of tracking IVCF patients may also be of benefit. For example, it has been suggested that healthcare professionals place reminders on the reverse side of their business cards which tells the patient with a retrievable filter to call the office. Additionally, a study conducted at Parkland Medical Center in Dallas, Texas, followed trauma patients and non-trauma patients with IVC filters and found that trauma patients had much higher rates of IVCF retrieval compared to the non-trauma patients (55% vs 19%) (12). Here, the trauma patients were tracked and the non-trauma patients were not, suggesting the importance of follow up. A healthcare professional devoted to overseeing the whole process of IVC filter placement up until the time of its retrieval would also prove to be beneficial. Having dedicated staff can certainly help retrieval rates.

Another study was conducted to demonstrate the importance of following up and its effects on the rates of IVC filter retrieval (13). In this experiment, filter placements were studied over a 15-month period in a group of 33 patients. The study monitored the group twice: once before the implementation of a management strategy for IVC filter follow up and once after the strategy. Through the implementation of a formal plan for follow up, the number of filters

with no attempted retrieval and no consultation about retrieval decreased from 27% to 9%. Temporary IVC filters should not become unintentionally permanent because of patients overlooking the importance of a follow up.

## Conclusion

IVC filters are given to patients as a prophylactic measure to help reduce the risk of life threatening pulmonary embolism formation. The filters, however, can induce thrombosis of both themselves and the surrounding area of the inferior vena cava. Therefore, once a patient is no longer considered at high risk for PE development, the filters should be promptly removed to prevent further harm to the patient. Many patients, unfortunately, fail to get their IVC filters removed solely because of the lack of appropriate follow up from their healthcare providers. Devising simple plans to help monitor IVC filter patients can go a long way in morbidity and mortality reduction and help save lives. In addition, despite prior research such as that presented, there is still a large knowledge gap in our understanding of IVC filter thrombosis pathogenesis, management, and IVC filter retrieval. This represents an opportunity for significant improvements in clinical care that can lead to more effective and efficient prevention, diagnosis, and treatment of IVC filter thrombosis, which can ultimately help improve the quality of healthcare today.

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