





IVC Filter Retrieval before and after Implementation of IVC Filter Retrieval Alert System (IFRAS): A Single-Center Experience

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Arab J Intervent Radiol 2023;7:31–34.

Abstract

Objective The aim of this study was to evaluate the effectiveness of the IVC filter retrieval alert system (IFRAS) in increasing the inferior vena cava (IVC) filter retrieval rate.

Materials and Methods This study was a case-based retrospective study, for patients who had IVC filter insertion from January 2013 to December 2019 with a sample of 756 patients. The sample was divided into two groups for filter retrieval rate: before the implementation of the tracking system (IFRAS) between 2013 and 2015 with a sample of 321 patients, and after the implementation of the tracking system (IFRAS) between 2016 and 2019 with a sample of 435 patients. This study aimed to compare the IVC filter retrieval rate before and after the implementation of the IFRAS. The tracking system (IFRAS) protocol was applied by a dedicated employee¹ who is actively tracking patients and strictly following them up with a referred physician or interventional radiologist through the interventional radiology clinic.

Results The IVC filter retrieval before the implementation of the tracking system (2013–2015) was 38.3% (123/321), and it became 54.25% (236/435) after the implementation of the tracking system with a *p*-value less than 0.001. Before implementing the tracking system, patients with no follow-up after IVC filter insertion were 45.17% (145/321), and this decreased to 41.15% (179/435) after implementing the tracking system.

Conclusion The study proved a statistically significant difference in increasing the IVC filter retrieval rate after implementing the IFRAS.

Keywords

- ▶ IFRAS
- ▶ increasing IVC filter retrieval rate
- ▶ IVC filter retrieval

Introduction

Anticoagulation therapy is considered first-line therapy for venous thromboembolism (VTE), and it is often initiated immediately after diagnosis. However, patients with VTE and contraindications to anticoagulation may require an inferior vena cava (IVC) filter to reduce the risk of pulmonary emboli originating from lower extremities.

Filter removal for each patient should be considered when the risk/benefit profile favors removal of IVC filter and the procedure is possible with patient’s health state, then the patient should be referred for IVC filter removal.¹

Currently, the used IVC filter type is a retrievable type that has an advantage of reducing long-term complications compared to permanent types. However, a systematic review of 37 clinical studies showed low retrieval rates ranging from 12 to 45% with a mean retrieval rate of 34%.²

One of the major obstacles after IVC filter insertion is not retrieved IVC filter (this is called missed filter). Missed filter increases the rate of long-term complications,^{3,4} and retrieval become difficult. Tracking patients’ post-insertion is one of the solutions to improve filter retrieval rate when it is no longer needed.

This study aimed to compare the IVC filter retrieval rate and its effectiveness before and after the implementation of the IVC filter retrieval alert system (IFRAS) for the improvement in IVC filter retrieval.

Methods

The study is a case-based retrospective study. Medical records of patients with inserted IVC filters from January 2013 until December 2019 were reviewed. A total sample size of 756 patients was achieved (►Table 1).

The sample was divided into two groups: first group between 2013 and 2015 before implementing tracking system (IFRAS) with 321 patients and the second group after implementing tracking system (IFRAS) between 2016 and 2019 with 435 patients. The retrieval rate was evaluated in both groups (►Fig. 1).

The tracking system (IFRAS) was implemented at our institution to improve the IVC filter retrieval rate. For any patient who needs an IVC filter, the referring physicians consult interventional radiologists for filter insertion

indication. After filter insertion, an interventional radiologist should fill a form that includes the contact number of the referring physician and the indication of filter insertion.

A dedicated employee follows up with patients strictly through the forms that were filled by the interventional radiologist and documented data reserved in an excel sheet, along with the setting reminder after 3 months. An assigned employee evaluates each patient after 3 months post-filter insertion to check whether the filter is removed or not. The employee informs the referring physician about the patients who have filters to evaluate the patient’s condition and then decide whether the filter needs to be kept or retrieved. Patients who no longer need the filter are booked by an interventional radiology (IR) coordinator for an IVC filter retrieval. Some patients request to be referred to other medical initiations. A dedicated employee contacts those patients after 3 months of filter insertion to determine whether they still have the filter or not. Patients who still have the filter are booked to be evaluated in the IR clinic at our institution for the possibility of filter removal.

Through our study, the indications of filter insertion before and after the implementation of tracking system IFRAS include a contraindication to the anticoagulant, a complication of anticoagulant, and a recurrent VTE despite adequate anticoagulant. The most common indication of IVC filter insertion worldwide is the contraindication to anticoagulant,⁵ which was being noticed through our study as well.

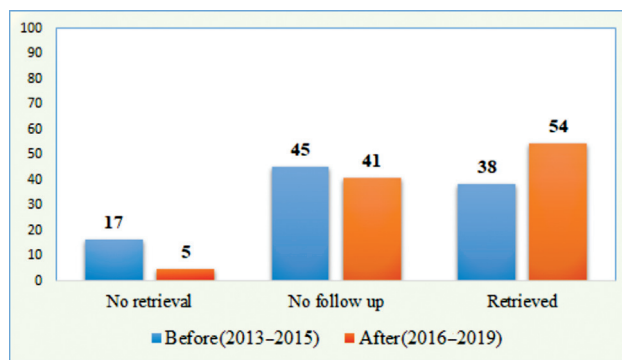


Fig. 1 Inferior vena cava retrieval by alert system.

Table 1 Demographic characteristics of the study groups

	Alert system		p-Value
	Before (2013–2015) n = 326	After (2016–2019) n = 439	
Male, n (%)	197 (60.43)	272 (61.96)	0.667 ^a
Female, n (%)	129 (39.57)	167 (38.22)	
Age (mean ± SD)	55.83 ± 21.85	57.22 ± 22.78	<0.0001 ^b

Abbreviation: SD, standard deviation.

^aChi-squared test.

^bWilcoxon rank-sum test.

Table 2 Indications of IVC insertion by alert system

	Indication record	Alert system
	Before (2013–2015) <i>n</i> = 326	After (2016–2019) <i>n</i> = 439
Contraindication to anticoagulant, <i>n</i> (%)	150 (55.76)	253 (58.97)
Complication of anticoagulant, <i>n</i> (%)	2 (0.74)	13 (3.03)
Recurrent VTE despite adequate anticoagulant, <i>n</i> (%)	7 (2.60)	34 (7.93)
Prophylaxis, <i>n</i> (%)	110 (40.89)	129 (30.07)

Abbreviations: IVC, inferior vena cava; VTE, venous thromboembolism.

The indications of filter insertion are mentioned in detail as shown in ► **Table 2**.

Data Analysis

Gender, indications of IVC filter insertion, and retrieval were reported in frequency and percentages. Gender and IVC filter retrieval were compared between groups by using chi-squared test. Continuous variables were compared between groups by using Wilcoxon rank sum test. *p*-Value less than 0.05 was considered significant. Statistical analyses were carried out using SAS version 9.4 (SAS Institute, Cary, North Carolina, United States).

Result

In the filter insertion Time Category, the sample was classified into before (2013–2015) and after (2016–2019) implementing the IFRAS. The sample size before implementing the IFRAS was 321 patients. After implementing the IFRAS, the sample size became 435 patients. Moreover, in the Filter Status category, the sample was classified into three groups: no filter retrieval, no follow-up, and retrieved filter.

The IVC filter retrieval before the implementation of tracking system (2013–2015) was 38.3% (123/321), and it became 54.25% (236/435) after the implementation of the tracking system with a *p*-value less than 0.001. Before implementing the tracking system, the percentage of patients with no follow-up after IVC filter insertion was 45.17% (145/321), and it decreased to 41.15% (179/435) after implementing the tracking system. Some reasons behind the lost follow-up of some patients were due to loss of connection or due to referral to another facility. The percentage of the rest of patients with no IVC filter retrieval category before the activation of the tracking system was 16.5% (53/321). It decreased to 4.6% (20/435) after the implementation of the tracking system due to long-term contraindications to anticoagulant therapy or poor clinical status (► **Fig. 1**).

Discussion

We started a new project in our institution to increase the retrieval rate of the IVC filter by tracking patients and follow them up with a referred physician or interventional radiologist through the IR clinic. By implanting the track-

ing system IFRAS, the long-term complications of IVC filter can be avoided. The long-term complications include increasing risk of subsequent deep vein thrombosis, IVC filter migration, filter embolization, symptomatic penetration outside IVC (e.g., aorta, ureter, bowel, nerve, and pancreas), filter fracture, symptomatic IVC occlusion, and vena cava stenosis.^{3,4,6}

Our protocol is processed by actively tracking patients and strictly follow them up. The new protocol showed statistically significant improvement in the IVC filter retrieval rate. Before the implementation of tracking system, the IVC filter retrieval rate was 38.3%; however, after implementing the tracking system, it increased to 54.25% (*p*-value < 0.001). In comparing the result of the increasing rate of IVC filter retrieval in this study to other published papers in methods and techniques, the tracking system is effective as other studies in increasing the IVC filter retrieval rate. The tracking system showed results parallel to other studies' results in effectiveness.^{7–11}

Multiple papers published methods and techniques to increase the IVC filter retrieval rate. Sutphin et al⁷ technique showed improvement in IVC filter retrieval from a baseline of 8 to 40%. The technique was mailing clinicians and patients regarding patients who had filters placed within 8 months.

Lynch technique⁸ showed improvement in IVC filter retrieval rate from 24 to 59%. The technique was used in the study to follow up with patients after filter insertion and contact them by mails at regular intervals once or more times.

Another study by Minocha et al⁹ evaluates the retrieval rate of IVC filter retrieval pre-initiation and postinitiation of IVC filter dedicated clinic. Postinitiation of clinic improvement in retrieval rate of IVC filter increased from 29 to 60%.

O'Keeffe et al¹⁰ developed a policy to follow up IVC filter postinsertion by dedicated nurse practitioners. After the establishment of this policy, the IVC filter retrieval reaches 47%.

Ko et al¹¹ started a protocol for IVC filter follow-up by physician assistants for post-IVC filter insertion patients. The protocol showed improvements in retrieval rate attempts from 42 to 95%.

Arabi et al¹² evaluated a tracking system at King Abdulaziz Medical City in Riyadh. The sample size was smaller and time interval was shorter compared to the current study. The

result showed minimal improvement of filter retrieval post-implementation of tracking system (IFRAS).

Conclusion

The study proved a statistically significant difference in increasing the IVC filter retrieval rate after implementing the IFRAS.

Funding

None.

Conflict of Interest

None declared.

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