Patient perspectives on inferior vena cava filter retrieval

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ABSTRACT

Objective: Inferior vena cava (IVC) filter retrieval rates remain low. Previous literature identified provider and system factors to enhance retrieval, but patients' perspectives have not been studied. This study compared the attitudes of men and women with retained filters to identify patient factors that would increase compliance and facilitate retrieval when indicated.

Methods: A retrospective single-center review of all patients undergoing IVC filter placement between 2009 and 2011 was performed. The electronic medical records were reviewed to identify patients with retained filters who were potential candidates for removal. Patients' demographics, comorbidities, and indication for filter placement were noted. A telephone survey inquiring about the patient's awareness of IVC filters and risks of leaving them permanently in place was conducted. Additional questions addressed patient-physician relations, preferences in communication, and attitudes toward television commercials on IVC filter lawsuits. Patients' characteristics and survey responses were compared between men and women.

Results: There were 604 patients who underwent IVC filter placement. The overall retrieval rate was 30%. Telephone survey was conducted for 42 patients with retained filters who were identified as possible candidates for retrieval. There was no difference between the men and women in terms of demographics and comorbidities. The survey demonstrated that 12% of patients were not aware of having an IVC filter, and only 23% knew that it can be removed. Women were significantly more likely than men to know the risks and benefits of IVC filter placement (42.8% vs 14.2%; $P < .03$), but there was no significant difference in knowledge of the long-term complications of indwelling filters. Even though the majority of patients (88%) had an established relation with a primary care provider, only 21.4% followed up with the team of physicians of the hospitalization for IVC filter placement. Better education about IVC filters would have improved follow-up in the opinion of 97.6% of patients. Also, 50% relocated since filter placement and 35.7% changed their telephone number. There was no difference regarding use of Internet and interest in receiving educational material, but women (42.8%) significantly preferred receiving health-related communication by electronic mail, whereas men (64%) preferred telephone calls ($P = .03$). The majority of patients (59.5%) had watched commercials for IVC filter lawsuits, among whom 26% claimed to seek discussion with a medical provider after watching the commercial. The predominant cause for no follow-up was "unaware of risks of leaving the filter" (69%).

Conclusions: In this era of modern medicine, vascular specialists must educate the patient and family about IVC filters and long-term effects to optimize the patient's compliance. Electronic communication for follow-up may help capture patients who relocate and change phone numbers and seems to be particularly attractive to women. (J Vasc Surg: Venous and Lym Dis 2019;7:507-13.)

Keywords: IVC filter; IVC filter retrieval

Venous thromboembolism (VTE) remains a major health hazard and a significant cause of morbidity and mortality worldwide, accounting for up to 10% of hospital-related deaths.[1,2] Vena cava interruption is an important component of treatment in selected patients, especially if anticoagulation is contraindicated.[3] The introduction of retrievable inferior vena cava (IVC) filters significantly increased their use as safe and effective temporary implants preventing pulmonary embolism.[4,5] Despite increasing reports of long-term adverse events, IVC filter retrieval rates remain low and are estimated at 12% to 45%.[4-7]

Several studies have addressed the low retrieval rates and demonstrated inadequate follow-up, lack of a

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documented plan for the retrieval procedure, and presence of specific comorbidities (such as severe trauma and stroke) as contributing factors.[8-10] Provider-based, system-based, and web-based initiatives have been described to improve retrieval rates.[11-14] However, the perspectives of patients with retained filters have not been studied. This study compared the attitudes of men and women with retained filters to determine patient perception factors that could increase compliance and facilitate retrieval when indicated.

ARTICLE HIGHLIGHTS

- **Type of Research:** Retrospective cohort study
- **Key Findings:** Of 604 patients with retrievable inferior vena cava filters, 42 patients who were candidates for filter removal had retained filters; 12% were unaware they had a filter, 23% were unaware it could be removed, and 69% were unaware of risks of leaving the filter in place.
- **Take Home Message:** The study suggests that insufficient education of patients is an important element in the retention of retrievable inferior vena cava filters that otherwise could be retrieved.

METHODS

Population of patients. A retrospective review of all patients undergoing IVC filter placement between 2009 and 2011 was performed at Yale New Haven Hospital. The electronic medical records (EMRs) of all patients were reviewed. Patients who had successful filter retrieval or who died were excluded. The EMRs of the patients with retained filters were reviewed thoroughly to identify patients with retained IVC filters who were potential candidates for removal. Patients with prophylactic IVC filters were candidates for retrieval. Patients with VTE and a temporary contraindication to anticoagulation were considered candidates if the risk of bleeding had resolved and they were stable on anticoagulation. In addition, patients whose risk of VTE decreased and who did not require anticoagulation or vena cava interruption any more were also considered candidates. All patients aged 80 years and older were excluded as they are less likely to benefit from delayed retrieval because of relatively shorter life expectancy and potential risk of complications. Patients with paraplegia, severe immobilization, and active cancer were also excluded because of relatively ongoing increased risk of VTE. Also, patients who had failure of anticoagulation and recurrent VTE while receiving anticoagulation were not candidates for retrieval.

Variables. Patients' demographics, comorbidities, indication for filter placement (therapeutic or prophylactic), and type of filter placed were collected. Patients' socioeconomic status was estimated on the basis of the median income of home address ZIP codes.[15] Patients were divided by the quartiles of household income.

Survey. A telephone survey was conducted for all the patients who were deemed potential candidates for retrieval. Telephone consent was obtained at the beginning of the call. The survey had 25 questions (Appendix, online only). The first questions (questions 1-5) inquire about the patient's awareness of having an IVC filter, recall of discussions of risks and benefits of placement of the filter as well as the long-term risks of indwelling filters, and knowledge that they were retrievable. Next, patients were questioned about follow-up with hospital specialists who cared for the patients during the hospitalization when the IVC filter was placed and with the primary care physician (questions 6-9). The patients were then asked about change in address and telephone number and the preferred method of contact regarding medical issues (questions 10-17). Additional information about the patient's education level, employment status, and insurance status was obtained (questions 18-20). The patients who were aware of the IVC filter's being temporary were specifically asked about the reason for not following up and for suggestions to improve compliance (questions 21 and 22). Last, patients were asked about their opinion of commercials on television addressing litigation for IVC filter complications. The patients' characteristics and survey responses were then compared between men and women. The Institutional Review Board of Yale University approved the study, and an informed telephone consent from each patient was obtained before conducting the survey.

Statistical analysis. Descriptive and univariable analysis was performed using χ^2 test for categorical variables and *t*-test for continuous variables. All analysis was performed using SAS software version 9.4 (SAS Institute, Cary, NC).

RESULTS

Population of patients. A total of 604 patients underwent retrievable IVC filter placement between 2009 and 2011. The mean long-term follow-up of patients was 5 ± 2.9 years. An overall successful filter retrieval rate of 30% was noted. There were 422 patients in whom the IVC filter was not retrieved. A third (n = 162 [38.3%]) of the patients with retained IVC filters died on follow-up of conditions unrelated to the IVC filter. Among the remaining, 64 patients (16.6%) were identified as potential candidates for filter retrieval after EMR review. Patients were deemed not to be candidates for filter retrieval for ongoing risk of VTE related most commonly to active cancer (n = 96 [22.7%]), immobility (n = 25 [5.9%]), hypercoagulable disorder (n = 8 [1.9%]), or compromised pulmonary function (n = 47 [11.1%]). The telephone survey was conducted on 42 patients with retained filters, of whom 21 were women (50%). There

were 10 patients with no updated contact information who could not be reached and 12 patients who did not call back after multiple voice messages.

There was no significant difference between the male and female patients in age ($P = .42$), household income ($P = .75$), or comorbidities ($P > .05$). The majority of IVC filters were placed for a therapeutic indication (59.5%), and there was no difference between men and women ($P = .11$; Table I). The type of IVC filter placed included Bard Eclipse (7; CR Bard Inc, Covington, Ga), Cook Günther Tulip (18; Cook Medical, Bloomington, Ind), Bard G2 (16), and Bard G2X (1). The majority of the filters (80%) were placed by interventional radiologists and the remaining by vascular surgeons (20%). Based on survey results, there was no difference in the two groups in terms of education level ($P = .45$), employment status ($P = .75$), and health insurance coverage ($P = .48$).

Knowledge and attitude regarding IVC filters. The telephone survey conducted demonstrated that 12% of patients were not aware of having an IVC filter in their body. Among the 42 patients, 28% remembered discussing the risks and benefits of the IVC filter placed before the procedure, and only 23% were aware that the filter can be removed. Women were significantly more likely than men to know the risks and benefits of IVC filter placement (42.8% vs 14.2%; $P < .03$), but there was no significant difference in the knowledge of the long-term complications of indwelling filters (28.5% vs 14.2%; $P = .45$). Even though the majority of patients (88%) had an established relation with a primary care provider, only 21.4% followed up with the team of physicians of the hospitalization for IVC filter placement. The specialist to whom patients reported for follow-up after the hospitalization for IVC filter placement included vascular surgeons (11.8%), followed by primary care physicians (6.5%), interventional radiologists (3.9%), general surgeons (1.3%), trauma surgeons (1.3%), and orthopedic surgeons (1.3%). Also, it was noted that 50% of patients relocated and 35.7% changed their telephone number since the filter placement procedure. There was no significant difference in use of the Internet between men and women or with interest in receiving educational material. Most patients (59%) were interested in receiving educational material to increase awareness of filter risks and retrieval procedure. However, women (64%) significantly preferred receiving health-related communication by electronic mail, whereas men (42.8%) preferred telephone calls ($P = .03$).

Better education about IVC filters would have improved follow-up in the opinion of 97.6% of patients. The majority of the patients (59.5%) had watched and were aware

Table I. Patient and filter characteristics

Variable	Men (n = 21), % (No.) or mean ± SD	Women (n = 21), % (No.) or mean ± SD	*P* value
Age, years	46.4 ± 11.7	43 ± 15.2	.42
Household income[a]			
<$38,999	33.3 (7)	23.8 (5)	.75
$39,000-$47,999	23.8 (5)	38.1 (8)	
$48,000-$62,999	0 (0)	0 (0)	
≥$63,000	42.9 (9)	38.1 (8)	
Graduate educated	71.4 (15)	85.7 (18)	.45
Current employment	52.3 (11)	57.1 (12)	.75
Current insurance	100 (21)	90.4 (19)	.48
Comorbidities related to IVC filter placement at time of insertion			
Trauma	42.8 (9)	38.1 (8)	.75
Cancer	0 (0)	4.8 (1)	.99
Hypercoagulable disorder	4.8 (1)	19 (4)	.59
Major surgery[b]	52.3 (11)	38.1 (8)	.35
Bleeding	57.1 (12)	28.6 (6)	.06
Indication for filter placement			
Therapeutic	71.4 (15)	47.6 (10)	.11
Prophylactic	28.6 (6)	52.3 (11)	

IVC, Inferior vena cava; *SD*, standard deviation.
[a]Median household income quartiles for patient's ZIP code. For 2008, the median income quartiles are defined as follows: (1) $1-$38,999; (2) $39,000-$47,999; (3) $48,000-$62,999; and (4) $63,000 or more. We grouped them as low income (<$63,000) and high income (≥$63,000).
[b]Major surgery included patients requiring interruption of anticoagulation or prophylaxis around the time of surgery under general anesthesia. There were 11 patients who had multiple orthopedic procedures for trauma, 5 neurosurgery cases, 1 vascular trauma case, 1 bariatric surgery case, and 1 gynecology case.

of commercials for IVC filter lawsuits. Among the patients who watched the commercials, 26% sought discussion with their physicians after watching the commercial. There were 13% of patients who reported that the commercials helped them be more aware of risks of filter retention, and 13% reported that it helped them ask more thoughtful questions. Also, 27% reported that they did not believe in television commercials to accurately describe filter risks and would rather obtain the advice of a physician. The predominant cause for loss to follow-up according to our survey was "unaware of risks of leaving the filter" (69%). On the other hand, 21% (n = 9) of patients had received misleading information that the IVC filter could not be retrieved. Fear of additional procedures to retrieve the IVC filter (n = 1 [2.4%]) and fear of being admitted to the hospital (n = 1 [2.4%]) were not common (Table II).

DISCUSSION

This study underscores the importance of education and engagement of patients in treatment with IVC filters. The survey demonstrated that 12% of patients were unaware of having an IVC filter, and only 23% were aware that it can be removed. More important, the majority of patients (79%) were not aware of the long-term risks of indwelling IVC filters. All patients, however, did have informed consents in the medical records explaining the risks of filter insertion. The survey data also suggested that educational material and telephone or electronic mail reminders would help improve follow-up. Similar results were noted in a study by Winters et al[16] that adopted a multidisciplinary quality initiative program to improve patients' understanding. The program included verbal counseling, use of educational materials, regular follow-up after discharge, and hematology consultation in a 5-year study. All documents were prepared at fifth-grade reading level and verbally reinforced when given to the patients. Also, patients were scheduled for follow-up in 3 months, which if missed was followed up with a call from the thrombosis specialist nurse. This study concluded that patient education and regular planned follow-up can significantly increase the successful filter retrieval rate from 23% to 45%.

Another interesting finding of our study was that the majority of the patients (78%) had regular visits with established primary care physicians and were compliant in that respect. However, they were unaware of the importance of filter retrieval, and some were misled that the IVC filter could not be retrieved. These data suggest a potential role for educating community physicians to facilitate filter retrieval by providing patient education and reminders.

Table II. Survey results

Survey questions	Men, % (No.)	Women, % (No.)	*P* value
Patient aware of having an IVC filter	85.7 (18)	90.4 (19)	.99
Knowledge that filter is retrievable	23.8 (5)	23.8 (5)	.99
Knowledge of risks and benefits of filter placement	14.3 (3)	42.8 (9)	**.04**
Knowledge of importance of filter removal	9.5 (2)	19 (4)	.65
Aware of risks of leaving filter	14.3 (3)	28.6 (6)	.45
Followed up after procedure with hospital team	19 (4)	23.8 (5)	.99
Regular follow-up with primary care physician	95.2 (20)	80.9 (17)	.34
Better education about IVC filters could lead to improved follow-up	100 (21)	95.2 (20)	>.99
Changed address since procedure	52.3 (11)	47.6 (10)	.75
Changed phone number since procedure	38.1 (8)	33.3 (7)	.74
Frequent use of Internet or e-mail	52.3 (11)	61.9 (13)	.53
Interested in receiving educational material	47.6 (10)	71.4 (15)	.12
Preferred method of contact			
Telephone	71.4 (15)	57.1 (12)	**.03**
Electronic mail	14.3 (3)	42.8 (9)	
Postal mail	14.3 (3)	0 (0)	
Predominant reason for loss to follow-up when aware of filter			
Unaware of risks of leaving IVC filter	71.4 (15)	66.7 (14)	.29
When I asked a physician, I was told it may not be removable and so did not pursue it further	14.3 (3)	28.6 (6)	
Fear of hospital admission	0 (0)	4.8 (1)	
Fear of complication of procedure	4.8 (1)	0 (0)	
Asymptomatic, so ignored the commercial information	9.5 (2)	0 (0)	

IVC, Inferior vena cava.
Boldface entries are statistically significant.

Previous studies have associated several factors with retained IVC filters. Sex was noted to be a significant factor and was used in this study to compare other variables.[8] There was no significant difference noted between men and women in educational, employment, or insurance status. It is very unlikely that lack of insurance coverage or poor general education contributed to loss of follow-up in our population of patients because 95% had health insurance and 79% had completed graduate education. This majority of patients would probably grasp the importance of follow-up and evaluation for potential IVC filter removal. Providing educational material would likely enhance the understanding of this population of patients. In a study by Gyang et al,[10] both insurance status and distance of residence from the hospital were studied as potential factors affecting filter retrieval. There was no role of insurance status as a significant predictor for filter follow-up or retrieval. However, they noted an increased rate of follow-up in patients who were discharged to home early, possibly because the patients were in better health conditions compared with patients with longer hospital stay. From our survey, we also noted that fear of complications or hospital procedures was not a concern reported by patients. A significant number of patients in our study reported change of address (50%) and phone number (35.7%) after IVC filter placement. On the other hand, there were 10 patients (15.6%) whom we could not reach and who did not have updated contact information in the EMR, which could potentially be a cause for loss to follow up.

The Food and Drug Administration has reported 921 adverse events from 2005 to 2010, including filter migrations, fractures, vessel wall perforations, and distal embolization. However, filters are still frequently used prophylactically in patients presenting with trauma and before bariatric or orthopedic surgery in selected patients with perceived higher risk of VTE.[17-20] These adverse effects led to the Food and Drug Administration safety alert in 2010 recommending that physicians and clinicians responsible for the ongoing care of patients with retrievable IVC filters consider removal of the filter as soon as protection from pulmonary embolism is not needed.[21] This warning did increase the rate of retrieval in some centers to >90% in eligible patients.[8,16,22] The overall filter retrieval rate at our center during the study period was relatively low (30%). However, on retrospective evaluation, we noted that the majority of patients with retained filters had either died of underlying disease or were patients with ongoing VTE risk who probably continued to derive benefit from the filter. On the other hand, if all the IVC filters considered eligible for retrieval on the basis of our review were indeed removed, our center's retrieval rate would have been only 46.6%. Similar results have been reported in a study by Inagaki et al,[23] in which implementation of a multidisciplinary team approach improved the filter retrieval rate; however, the filter retrieval rate was only 49% at time of analysis as 21% were permanent, 9% of patients died, and 21% were left in situ because of malignant disease, failure of anticoagulation, continued risk of bleeding, patient's refusal, and age >80 years.

Despite the increasing awareness of the adverse events due to a retained IVC filter, the retrieval rate has been remarkably low. Nearly, 15% to 17% of the temporary filters are not retrievable because of filter migration, tilting, or IVC penetration and adherence, making it technically challenging.[24-28] Yoon et al[8] reported an overall retrieval rate of 95% among the 619 patients in whom filter retrieval was attempted (60% study population). In this study, patient-related factors associated with an increased risk of failure of filter retrieval were discussed to provide a tool for decision-making before filter placement. Male sex, older age, malignant disease, indication suggestive of VTE with inability to be anticoagulated, and a comorbid neurologic condition were considered to be clinically significant factors. In our study, women were noted to be more educated about the risks and benefits of filter placement. Women preferred electronic communication to a telephone call for their follow-up reminders.

Another factor associated with low retrieval rates is the lack of defined follow-up criteria. Logan et al[29] suggested that implementation of a three-step IVC filter management plan with regular follow-up for patients with temporary filters reduces the time to retrieval from 62 to 45 days and the failed retrieval rate by half (23% to 9%). The three-step plan includes an initial registration of filters placed by a specialist nurse, a hematology consultation to assess the patient's clinical status, and the availability of operating room services at short notice for filter retrieval. At the time of our study, there was not a formal algorithm to follow up patients with IVC filters, and the decision for retrieval was service and provider based. Since then, the hospital developed a dedicated team to track patients with IVC filters to help them follow up. On the other hand, the team sends reminders to the vascular specialists to make a final determination about retrieval of the IVC filters.

In another study,[30] we conducted a survey of vascular specialists' attitudes toward IVC filter placement and retrieval. We noted that about 45% of physicians would not suggest filter retrieval in patients after a long dwell time of 2 years or more because of higher risk of technical complications. However, several reports have been published describing successful filter retrieval in patients with a longer dwell time up to 8 years.[31,32] The use of advanced endovascular techniques in the last decade allowed removal of IVC filters with long dwell time and challenging configurations.[33-35]

Our study has limitations, however. First, it was a retrospective analysis of patients in whom filters were placed in a single center. Also, the sample size of the population

of patients involved in the survey was small. The overall retrieval rate obtained could be lower than actual value as a few patients who were lost to follow-up may have had the filter retrieved at an outside institution. However, our survey results suggest that patient education and explanation of risks and benefits of filter retention are key components that can promote follow-up visits and filter removal when appropriate. As a system, we are developing an electronic means to track patients with retrievable IVC filters and also developing educational material to instruct patients and families to improve compliance.

CONCLUSIONS

In the era of modern medicine and patient-centered care, the vascular specialist must educate the patient and family about the short- and long-term risks and benefits of IVC filters to optimize patients' compliance. Adapting electronic means of communication for follow-up may help capture patients who have relocated and changed phone numbers and is especially attractive to women.

AUTHOR CONTRIBUTIONS

Conception and design: AA, AB, CC
Analysis and interpretation: AA, AB, YZ, YY, CC
Data collection: AA, AB, HM, TS, CC
Writing the article: AA, CC
Critical revision of the article: AA, AB, YZ, YY, HM, TS, CC
Final approval of the article: AA, AB, YZ, YY, HM, TS, CC
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