Optimizing IVC Filter Utilization: A Prospective Study of the Impact of Interventional Radiologist Consultation

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Purpose: The use of inferior vena cava filters (IVCFs) is under increasing scrutiny because of device safety and economic considerations. The aim of this study was to test the hypothesis that interventional radiologist (IR) consultation results in better utilization of optional and permanent filters.

Methods: Over 6 months, an IVCF decision-making database at a single institution was prospectively studied. After IR consultation, each case was classified as concordant (agreement between the referring physician and the IR over filter choice) or discordant (disagreement over filter choice). The consulting IR estimated the likelihood of retrieval attempt for all optional filters at the time of placement (0%-100%). Chi-square and *t* tests were used for statistical analyses. The null hypotheses were rejected at $P < .05$.

Results: Sixty-six IVCFs (23 permanent, 43 optional) were placed in 66 patients. Sixteen of 66 decisions were discordant. In 7 of the 16 discordant cases, patients received optional filters; of these, 6 (86%) were declared permanent by the referring physician. For this group, the IR's prospective estimate of subsequent retrieval was 6.4% (0%-15%; $P < .001$). Fifty of 66 decisions were concordant. Of these, 36 patients received optional filters. Thirty-one of 36 concordant optional filters (86%) were successfully retrieved ($P < .001$). For this group, the IR's prospective estimate of subsequent retrieval was 88.3% (80%-100%; $P < .001$). Of the 5 concordant devices not retrieved, 2 patients died, and 3 devices were declared permanent. There were no IVCF placement or retrieval failures. No patients were lost to follow-up.

Conclusions: Interventional radiologists can prospectively predict the likelihood of optional filter retrieval. Significantly higher retrieval rates are achieved as a result of IR consultation. Interventional radiologist consultation positively affects IVCF device choice, patient safety, and effective utilization.

Key Words: Inferior vena cava filter, optional filter, retrievable filter

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INTRODUCTION

In response to adverse events associated with optional inferior vena cava filters (IVCFs), the FDA [1] released a formal alert and notice on August 9, 2010, titled "Removing Inferior Vena Cava Filters: Initial Communication." The FDA recommended "that implanting physicians and clinicians . . . consider removing the filter as soon as protection from [pulmonary embolism] is no longer needed."

This recommendation prompted subsequent publications focused on improving historically low retrieval rates, as low as 5%, by establishing interventional radiology-driven patient follow-up clinics [2-4]. Although these studies were able to achieve significantly improved retrieval rates by tracking patients after filter placement, they also found that a significant proportion of potentially retrievable devices were placed in patients with clear indications for permanent devices [2,3]. Our experience is that, in the setting of interventional radiology-driven follow-up, a majority of filters are never retrieved because they are declared permanent (82.5%), rather than failed

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retrievals (12.5%) or patients who are lost to follow-up (2.5%) [3]. Each retrievable filter that is placed in a case in which a permanent filter is indicated effectively decreases retrieval rates.

Thus, retrospective interventions, such as meticulous and systematic follow up, though successful, are inherently dependent on and limited by the ability of the physicians involved to prospectively assess which patients will benefit from filter retrieval. Systematic follow-up must be combined with prospective measures to select the optimal device in each patient.

In contradistinction to previous studies, our study focuses on prospectively optimizing filter selection to improve filter retrieval rates. Both filter selection and the decision to retrieve a filter are complex decisions requiring experience with each specific device, knowledge of filter biodynamics, and clinical assessment of each patient. Thus, we propose that interventional radiologist (IR) consultation is crucial to optimizing filter selection and improving outcomes. In this prospective study, we test the hypothesis that with specific preprocedural consultation, IRs can prospectively and accurately determine the likelihood of optional filter retrieval and subsequently make recommendations that will optimize utilization and improve filter retrieval rates.

METHODS

Study Design

This prospective open study was conducted with the approval of the institutional review board. Over a 6-month period from January to June 2011, all consultations for IVCFs were managed by an experienced IR ($\geq$5 years since fellowship) in our tertiary care, urban, university hospital-based practice. The institutional electronic medical record was reviewed for patient demographics, history of presenting illness and overall prognosis, medical history, documented venous thromboembolism or pulmonary embolism (PE), current medications, disposition, and relevant imaging.

The case was then discussed with the referring physician, and a decision for either an optional filter or permanent filter was made. If there was agreement between the IR and the referring physician, this was deemed a concordant decision. If there was disagreement between the attending IR and the clinical referring attending physician, this was deemed a discordant decision. In either case, if an optional filter was deployed, the attending IR was required to prospectively estimate the likelihood of a subsequent attempt (successful or not) at retrieval of the optional filter, with 0% representing no future attempt at retrieval and 100% representing absolute certainty of future retrieval attempt.

Decision to Retrieve the Filter

All patients were followed similarly to the IVCF clinic model as described by Minocha et al [3]. The decision to retrieve the filter, and therefore discontinue primary or secondary prevention of PE, was based on several clinical factors in accordance with the guidelines set forth by the Society of Interventional Radiology [5]. The IR and referring physician reached a joint decision before attempting to retrieve the IVCF in all cases. Consensus decisions to "convert" an optional filter into a permanent filter were made by the referring clinical and consultative services.

Filter Placement and Retrieval

All filters were placed and retrieved using long established and accepted techniques. All deployed devices are FDA approved and commercially available. The selection of a specific filter was at the sole discretion of the operating IR.

Statistical Analysis

Statistical analysis of the mean prospective estimates of retrieval for cases of concordance and discordance was performed using two-tailed Student's t tests. Comparison of the rates of retrieval was performed using the χ^2 test. The null hypothesis was rejected at $P < .05$.

RESULTS

Concordance vs Discordance

Sixty-six consecutive patients were enrolled in this study. Concordant decisions were made in 50 of 66 patients (76%). Thirty-six of 50 concordant decisions (72%) resulted in the placement of an optional filter. The remaining 14 patients received permanent filters. Of the 36 optional filters, 31 (86%) were successfully retrieved. Five optional filters (14%) were later deemed permanent devices because of patient death (n = 2) or ongoing medical or surgical conditions (n = 3).

Discordant decisions were reached in 16 of 66 cases (24%). Nine of these patients received permanent filters, while the remaining 7 (44%) received optional filters. Six of these 7 optional filters (86%) were later deemed permanent. Only 1 (14%) was later retrieved ($P < .001$).

Potentially Retrievable Filters

Of the 43 patients in whom optional filters were deployed, there were 36 concordant decisions and 7 discordant decisions. In the 36 concordant decisions, the mean prospective estimate of a subsequent retrieval attempt was 88.3% (range, 80%-100%). Eventually, 31 of these 36 filters (86%) were retrieved. There were no failed retrievals.

In the 7 cases in which the referring physician ordered an optional filter and the IR recommended a permanent filter, only 1 filter was actually retrieved (14%). The remaining 6 filters (86%) were later deemed permanent. The difference in retrieval rates between the concordant and discordant groups of 86.1% and 14.3%, respectively, was statistically significant ($P < 0.001$).