Technical and Financial Feasibility of an Inferior Vena Cava Filter Retrieval Program at a Level One Trauma Center

Kristofer M. Charlton-Ouw,[1,2] Samuel S. Leake,[1] Cristina N. Sola,[1] Harleen K. Sandhu,[1] Rondel Albarado,[2,3] John B. Holcomb,[2,3] Charles C. Miller 3rd,[1,2] Hazim J. Safi,[1,2] and Ali Azizzadeh,[1,2] Houston, Texas

Background: Considering new guidelines for retrievable inferior vena cava filters (IVCFs), we examine our initial experience after establishing a comprehensive filter removal program in our level 1 trauma center. We evaluated the technical and financial feasibility of this program and barriers to IVCF retrieval, including insurance status and costs, in trauma patients.

Methods: Trauma patients receiving IVCFs from May 2011 to 2013 were consented and prospectively enrolled in the study program. Retrieval rates were assessed for the years before study initiation. Primary outcome was IVCF retrieval. Hospital financial data for retrieval were examined and univariate analysis performed. Hospital cost-to-charge and payment-to-charge ratios were assessed.

Results: Before study initiation from April 2009 to 2011, 66 IVCFs were placed in trauma patients with only 2 retrievals in 2 years. During the study period, 247 trauma patients had IVCF placement of which 111 (45%) were enrolled. The main reason for nonenrollment was lack of referral by the implanting team. Retrieval was attempted in 100 outpatients with success in 85 (85%). Patients enrolled in the program were more likely to have their filters removed (73% vs. 18%; odds ratio, 12.6; 95% confidence interval, 6.6–24.3; $P < 0.001$). Mean time from placement to attempt was 6.2 ± 4.0 months (range, 0.5–31.8). Of the total attempts, 29% were nonresource patients, 11% had Medicaid, and 60% had commercial insurance including Medicare patients. Chances of successful retrieval were higher if performed later during the study ($P = 0.03$). Successful retrieval was not related to insurance status ($P =$ not significant). The mean total hospital charges related to retrieval were $4,493 (range, $2,510–$9,106). Successful retrieval contributed to lower total charges ($P < 0.01$). Factors contributing to higher total charges were retrieval attempt later in study period ($P = 0.01$) and commercial insurance status ($P = 0.04$).

Conclusions: The rate of IVCF placement in trauma patients increased 4-fold over 4 years. The rate of IVCF retrieval increased more than 14-fold during the same period after establishment of the retrieval program. Elective outpatient retrieval of IVCFs in all eligible trauma patients is financially feasible without loss to the health care system even in regions with high rates of uninsured. A major barrier to successful filter retrieval was lack of patient referral into the program by implanting physicians. Hospital administration and physician outreach are important determinants of successful IVCF retrieval in trauma patients.

Presented at the Peripheral Vascular Surgery Society 2014 Winter Meeting, January 30–February 2, Steamboat, CO.

[1]Department of Cardiothoracic and Vascular Surgery, University of Texas Medical School at Houston, Houston, TX.

[2]Memorial Hermann Hospital, Texas Medical Center, Houston, TX.

[3]Division of Acute Care Surgery, Department of Surgery, University of Texas Medical School at Houston, Houston, TX.

Correspondence to: Kristofer M. Charlton-Ouw, MD, FACS, Department of Cardiothoracic and Vascular Surgery, University of Texas Medical School at Houston, 6400 Fannin Street, Suite 2850, Houston, TX 77030, USA; E-mail: Kristofer.CharltonOuw@uth.tmc.edu

Ann Vasc Surg 2015; 29: 84–89
http://dx.doi.org/10.1016/j.avsg.2014.05.018
Published by Elsevier Inc.
Manuscript received: March 2, 2014; manuscript accepted: May 18, 2014; published online: June 12, 2014 .

INTRODUCTION

Venous thromboembolic events (VTE) are common in hospitalized trauma patients.[1] Inferior vena cava filters (IVCFs) are designed to prevent fatal pulmonary embolism from lower extremity deep vein thrombosis. The use of retrievable IVCFs has increased, especially in high-risk trauma patients.[2] Much of the enthusiasm for retrievable IVCFs stems from the ability to remove the filter when patients are no longer at high risk for VTE. However, there is a need for further follow-up to ensure removal in an appropriate time frame, especially in trauma patients.

Several recent reports describe low IVCF retrieval rates without a dedicated follow-up program.[3–5] After establishment of our own IVCF retrieval program, we noted several barriers to successful filter removal in our health care system. One barrier was initial difficulty in scheduling elective outpatient IVCF removal in uninsured or underinsured patients. Another barrier was the difficulty in contacting these patients for further follow-up after hospital discharge. We established a research study within our hospital system to remove all IVCFs regardless of insurance status when medically appropriate. We report on the technical and financial feasibility of such a program with trauma patients.

MATERIAL AND METHODS

The Committee for the Protection of Human Subjects, the local institutional review board, approved the study. Our practice setting is in the fourth largest city in the United States, in one of the busiest level 1 trauma centers in the country, with >6,000 trauma admissions annually. We began prospectively enrolling patients in an IVCF retrieval program in May 2011. Patient referrals were primarily through the hospital electronic medical record and ordering system and by telephone referral to the study hotline. We collaborated with both the trauma/general surgery service and interventional radiology (IR) departments. We obtained written consent to allow investigators access to the medical records and to contact patients for follow-up. Patients were contacted by a clinic nurse or study coordinator via mail, telephone, and electronic mail. Determination of eligibility for IVCF removal was made by clinicians participating in the study (K.C.O. and A.A.) and in consultation with the patient's health care providers as needed. Patients not enrolled in the retrieval program had follow-up and filter removal per usual care.

Once we determined that the patient was eligible for IVCF retrieval, the patient was scheduled for elective removal. Patients did not routinely have lower extremity venous duplex scans before filter removal unless symptomatic. The goal of the study was to remove the filter within 6 months from implantation regardless of insurance status if medically appropriate. We initially established the program with the aim of retrieving filters before discharge but it quickly became apparent that this was not often feasible because of scheduling difficulties and many patients persistently deemed high risk for VTE at the time of discharge. For example, inpatients with IVCFs and spinal paralysis, we typically scheduled filter retrieval after 3 months postinjury.[6,7] Most patients, therefore, had IVCF retrieval after initial hospitalization as an outpatient procedure.

Patient anticoagulation was not held for the retrieval procedure. All retrievals were done using fluoroscopy guidance in a hospital setting. A sheath was placed in the femoral or jugular vein and contrast venography was done before removal attempt to detect thrombus within the filter. Filters were removed using a number of different devices including snares and cones. If a filling defect was found occupying >20% of the filter, the removal attempt was abandoned and the patient was started on anticoagulation for at least 3 months. A computed tomographic venogram was done to ensure thrombus resolution before a subsequent filter retrieval attempt. Patient participation in the study ended after IVCF removal or if a clinical determination was made to leave the filter permanently in place. Patients whose filters could not be removed continued in the study and had annual abdominal X-ray and were started on daily aspirin.

We reviewed all trauma patients who had IVCFs placed during the study period. We collected data on indication for filter placement, length of time from implant to removal, retrieval procedure details, complications, and outcomes. We limited analysis of hospital costs, charges, and payments related to IVCF retrieval to outpatients. The few patients who had IVCF retrieval during their initial inpatient admission usually had multiple procedures, often occurring in the same operative setting, and isolating financial data relating solely to IVCF retrieval was not practical.

Medicare patients were grouped with commercial insurance patients. For the purposes of analysis, uninsured and Medicaid patients were grouped together. Hospital cost-to-charge ratios (CCR) were assessed using the Healthcare Cost and Utilization Project (HCUP).[8] Payment-to-charge ratio (PCR)