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Retrievable inferior vena cava filters in geriatric trauma: Is there an age bias?

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ABSTRACT

Background: Trauma patients are at increased risk for developing venous thromboembolic (VTE) disease. The EAST (Eastern Association for the Surgery of Trauma) practice management guidelines identified risk factors for VTE, as well as indications for prophylactic inferior vena cava filters (IVCF). In a 2009 study, our institution found a 26% retrieval rate for IVCF. Lack of retrieval was most consistently due to lack of follow-up. Our study is a follow-up analysis for retrieval rate of IVCF, since the formation of a geriatric trauma service. We anticipated that geriatric trauma patients would have a lower rate of IVCF retrieval compared to the general trauma patient.

Methods: Our study population consisted of trauma patients admitted from January 2008 to August 2013, with documented VTE or high risk for VTE with contraindication to anticoagulation. Inclusion criteria: IVCF placed in trauma patients. Exclusion criteria: permanent filters, retrievable filters placed permanently, non-trauma patients, superior vena cava filters and patients who died before discharge. **Results:** During the study period, 160 trauma patients had an IVCF placed, of which 147 survived and were discharged. Of those patients, 66% (97/147) were planned for retrieval. Overall, the retrieval rate was 34% (33/97). Following age categorization, rates were 47% (30/64) and 9% (3/33) for those < 65 and ≥ 65 years old, respectively. Applying Fisher's Exact Test to a crosstab of planned retrieval by age category yielded a statistically significant difference, $p < 0.0005$ at $\alpha = 0.05$. In the geriatric population with IVCFs not retrieved, 23% (7/30) died and 67% (20/30) were lost to follow-up.

Conclusion: IVCF plays a critical role in the management of trauma patients with VTE, particularly the geriatric population. Since our 2009 study, we have improved nearly ten percentage points (26% to 34%); however, we exposed an age bias with retrieval rate being lower in patients ≥ 65 compared to those < 65 (9% vs. 47%).

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Background

Hospitalized patients are at risk for developing several disease processes additional to their original ailment. Venous thromboembolic (VTE) disease is one of the most common developments in hospitalized patients. An average of 60% of hospitalized trauma patients who remained in bed for a minimum of ten days developed silent deep-vein thrombosis (DVT) [1]. The development of lower extremity DVT puts patients at increased risk of

developing pulmonary embolism (PE), which carries a much higher rate of mortality.

Given the increased risk of DVT and subsequent PE in certain high-risk trauma patients, it is incumbent upon physicians to apply practice guidelines developed by groups such as EAST (Eastern Association for the Surgery of Trauma) and CHEST (American College of Chest Physicians) to determine the best course of action for anticoagulation [2,3]. In patients with known DVT and contraindication to anticoagulation, e.g. severe spinal cord, brain or ocular injury, a need exists for prevention of PE, specifically life-

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threatening PE. In this situation, research supports the use of a prophylactic inferior vena cava filter (IVCF) in very high risk trauma patients who cannot receive anticoagulation due to risk of bleeding and who have injuries that will immobilize them for prolonged periods of time, e.g. Glasgow Coma Scale (GCS) <8, spinal cord injury, complex pelvic fractures, multiple long bone fractures or patients with a temporary high risk of PE prior to major surgery [2,4,5].

The use of IVCF has increased over the last two decades; in large part due to the development and adoption of the retrievable IVCF [6]. The use of IVCF has been particularly efficacious in the trauma patient population. [7,8,9] In general, trauma patients who have a normal life expectancy receive retrievable IVCFs [2,3,10]. Long term studies of retrievable IVCFs demonstrate a 96% patency rate with complications including recurrent non-fatal PE (1.5%), caval occlusion (3.5%) and caval penetration (2%) [2,5]. Other risks include filter migration and fracture. One of the most common long-term complications of retrievable filters is the actual retrieval process itself [11–13]. Although studies in 2007 demonstrated that filters can be inserted and retrieved safely up to one year later, a retrieval rate of between 6 and 50% within a year of insertion has been documented in the literature, with the primary failure of retrieval due to lack of follow-up [3,11,14,15].

In 2009, Helling et al. published a retrospective, observational cohort analysis at Conemaugh Memorial Medical Center, a regional trauma center (Level 1) in Western Pennsylvania [14]. This study examined the rate of retrieval of IVCFs in trauma patients between the years 2003–2006. They found a 26% retrieval rate within a year and a half from insertion of the IVCF. A noticeable trend for failure to retrieve was the transfer of a patient to an extended care facility with no follow through for the removal of the IVCF.

Our study is a follow-up analysis, at the same hospital, for the rate of retrieval of IVCFs compared to Helling et al. Since the time of the previous study, a dedicated Geriatric Trauma Institute (GTI) was formed, with the purpose of improving outcomes in the geriatric trauma patient population (>= 65 years of age). Age, a non-modifiable risk factor, contributes to increased morbidity and mortality and has been a key driver of a new direction in the clinical thought process at our hospital—through aggressive and focused treatments in this patient population. In our study, we anticipated an age bias and that geriatric trauma patients would have a lower rate of IVCF retrieval compared to the general trauma patient population.

Methods

This is a single institution, observational, retrospective, cohort study at a rural community-based Level 1-Trauma Center. Inclusion criteria were: patients admitted for trauma related injuries between January 2008–August 2013 who received an IVCF prophylactically or for treatment of VTE during their hospitalization and whose IVCF was placed by the vascular surgery, cardiothoracic, or the interventional radiology department. The presence of a DVT was confirmed by ultrasound duplex imaging of the venous system based on clinical suspicion. Exclusion criteria included filters placed permanently, retrievable filters placed with no intent of retrieval, filters placed in non-trauma patients, patients who received superior vena cava filters, and patients who received a filter and expired during the same admission.

Conemaugh Memorial Medical Center, a Level 1 Regional Resource Trauma Center in Johnstown, Pennsylvania, admitted 7,140 trauma patients over the study period. The trauma database was queried for patients that met the inclusion criteria. The objective was to re-evaluate the IVCF retrieval rate after the 2009 study, with particular attention to the geriatric population following the implementation of the GTI.

All study patients were screened for VTE via an internally developed screening tool. Per the screening tool, the following scale was used to categorize the patient's risk:

- TOTAL RISK: Low (score = 0–1), Moderate (2–4), High (5–6) Very High (7+); (sum of the scores from the individual components below)

- ✓ AGE: 41–60 (score = 1), 61–70 (2), >70 (3)
- ✓ TRAUMATIC BRAIN INJURY (TBI) with GCS < 9: (score = 1), TBI with acute abnormal CT Scan (2)
- ✓ MEDICAL HISTORY: Cancer (score = 1), VTE (3), Congestive heart failure (3), Prolonged immobility >48 h (3), High-dose estrogen use (3), Involved trauma (3), Spinal cord injury (5), Major surgery (2), Vascular injury (1), Stroke (1), Total hip or knee replacement (1), Hip Fracture surgery (5), Hyper-coagulable state (1), Acute myocardial infarction (1), Fractures of pelvis, hip or leg (2), Obesity (1), Pregnancy (2), Varicose veins (1)

In our institution, the low risk group has no specific recommendations. However, all trauma patients are classified at a minimum as moderate risk of VTE and meet the criteria for prophylactic anticoagulation. These patients receive low molecular weight heparin, 30 mg twice daily or unfractionated heparin, 5000 units subcutaneously three times daily, in addition to the use of sequential compression devices (SCDs). The high-risk group, in addition to the recommendations of the moderate risk group, is also considered for full dose anticoagulation and a vascular surgery consult or interventional radiology to analyze risk assessment score and evaluate for an IVCF.

Patients with signs and symptoms of VTE (i.e. calf pain, lower extremity edema, venous distention, pain on dorsiflexion, dyspnea, or tachycardia) undergo screening for VTE by ultrasound imaging of lower extremities. Patients with documented VTE are treated with anticoagulation; however, if contraindicated, these patients are seen by the vascular surgeon or interventional radiology for evaluation and placement of an IVCF for the treatment of VTE. If the patient does not have documented VTE but has a risk score that is high or very high and a contraindication to anticoagulation, a prophylactic IVCF could be placed.

The filters placed were one of the following: G2 Filter System (Bard Peripheral Vascular Inc., Tempe, AZ), Trapease Permanent Vena Cava Filter (Cordis Corp., Fremont, CA), Eclipse Vena Cava Filter (Bard Peripheral Vascular Inc., Tempe, AZ), Option Retrievable Vena Cava Filter (Rex Medical, L.P., Conshohocken, PA), Meridian Vena Cava Filter (Bard Peripheral Vascular Inc., Tempe, AZ), or Gunther Tulip (Cook Inc., Bloomington, IN).

Patient demographics included age, gender, injuries, Injury Severity Score (ISS), indications for placement (prophylaxis or therapeutic), type of IVCF, time to retrieval, length of stay (LOS), and comorbidities. Patients' follow-up was at the vascular, cardiothoracic, interventional radiology department or the trauma clinic. Patients that were not discharged home were transferred to personal care homes, rehabilitation or long term acute care facilities either in our area or closer to the patient's home. A number of patients that were lost to follow-up did remain in the area but were unable to return to clinic for reasons unknown.

Results

From January 2008 through August 2013, 160 trauma patients, 2% (160/7140) of trauma admissions, underwent retrievable IVCF placement. Of the 160 patients, 147 survived and were discharged with an IVCF. The types of filters placed in these 147 were: 39 Eclipse, 65 G2, 16 Meridian, 16 Option, 7 Trapease, and 4 Tulip. In further evaluating these patients, 66% (97/147) were planned to undergo retrieval, with the remaining 34% (50/147) placed

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