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Retrievable vena cava filters in trauma patients for high-risk prophylaxis and prevention of pulmonary embolism

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Abstract

Background: Venous thromboembolic (VTE) disease remains a significant cause of morbidity for trauma patients because many patients have injuries that may preclude effective VTE prevention and treatment. Retrievable vena cava filters may prove beneficial in this subset of trauma patients.

Methods: Trauma patients at risk for VTE were identified and managed by institutional protocol. Patients who required a vena cava filter were managed with a device that could be retrieved or left in situ. A retrospective review of medical records was used to identify the use, indications, and complications associated with a retrievable filter.

Results: Fifty-three retrievable filters were placed in 51 patients. Two of these patients received a second filter, and 1 received a filter in the superior vena cava. Thirty-two filters were placed prophylactically, whereas 21 were placed for demonstrated venous thromboembolism (VTE). Retrieval was successful in 24 of 25 attempts. Twenty-nine filters became permanent: 10 for continued contraindications to anticoagulation without known VTE, 12 for known VTE and continued contraindications to anticoagulation, 1 for technical reasons, and 6 because of patient death. There were no complications of bleeding, device migration or thrombosis, infection, or pulmonary embolism.

Conclusions: A retrievable vena cava filter appears safe and effective for the prevention of pulmonary embolism in the high-risk trauma patient who cannot receive anticoagulation.

Keywords: Adult; Pulmonary embolism; Thromboembolism; Trauma; Vena cava filters; Venous thrombosis

Trauma patients are at high risk of developing deep venous thrombosis (DVT) and pulmonary embolism (PE). The incidence of DVT in hospitalized trauma patients has been reported to be as high as 35% to 65% [1–3]. The rate of PE in trauma patients is reported to be as high as 22% with estimated mortality of 8% to 35% [3,4]. Venous thromboembolism (VTE) results in significant morbidity and mortality, increasing the length of hospital stay and thus the cost of care [5,6]. Prophylaxis against DVT can be challenging in the multiply injured patient, many of whom will have ≥1 contraindication to both mechanical compression devices and chemoprophylaxis. Prophylactic insertion of an inferior vena cava (IVC) filter has been suggested as another option for prevention of PE in high- risk trauma patients [7–9].

The potential benefits of permanent caval filters must be weighed against the risks associated with their use including filter migration, venostasis, infection, and vena caval occlusion [10]. Recent reports have suggested the utility of employing a caval filter that is retrievable [11,12]. A retrievable device may allow protection from PE during the interval when risk for VTE is highest and chemoprophylaxis is contraindicated while avoiding the long-term risks associated with permanent filters. This study evaluates our experience with placement and retrieval of the Gunther Tulip Filter (GTF) (Cook, Bloomington, Indiana) device in traumatically injured patients.

Methods

This is a retrospective review of our experience with retrievable vena cava filters in the population of the trau-

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matically injured. Our hospital is a 520-bed American College of Surgeons–verified level I trauma center that admits approximately 1,400 trauma patients/y. All multiply injured patients are admitted to the trauma service. At the time of admission and daily thereafter, each patient is assessed for risk of VTE according to institutional VTE protocol.

The trauma service protocol for VTE directs patients identified as being moderately to high risk for VTE to receive prophylactic treatment with sequential compression devices, enoxaparin, or both. Patients at moderate risk and unable to receive either mechanical or chemoprophylaxis undergo daily surveillance physical examination and serial Duplex ultrasound studies of the lower extremities. High-risk patients with intracranial hemorrhage or contusion, incomplete spinal cord injury or paraspinal hematoma, ongoing uncontrolled bleeding, intraoccular hemorrhage, need for epidural catheter, or solid organ injury and who cannot receive prophylaxis with either compression devices or enoxaparin are evaluated for prophylactic placement of a retrievable vena cava filter. The retrievable filter is also used in trauma patients with known DVT who have contraindications to anticoagulation at the time of DVT diagnosis and are thus at significant risk for PE. When the patient is no longer at risk for VTE or can receive anticoagulants, the filter is then removed. The filter is placed and retrieved by according to standard interventional radiology processes.

Placement of retrievable vena cava filter

The attending trauma surgeon made all requests for placement of the GTF device. Placement of the filters in high-risk trauma patients is again governed by an institutional protocol created by a multidisciplinary consensus task force. Informed consent was obtained for all patients receiving the filter either directly or through family designee. In the angiography suite, venous access was obtained through either the jugular or femoral vein using sterile technique. A 5F pigtail catheter with sizing markers was then placed at junction of distal common iliac vein and proximal IVC. An inferior venocavogram was performed, and the images were evaluated with respect to the anatomy of the renal veins, the infrarenal vena cava diameter, the possible presence of clot in the IVC or iliac veins, and the presence of aberrant or collateral veins. The IVC filter was then placed in the infrarenal position and evaluated for its vertical position. If the filter had been placed by the jugular approach, it was possible to reposition the filter at the time of deployment if the filter was positioned inappropriately. The introducer sheath was then removed, and hemostasis was achieved by manual compression.

Retrieval of vena cava filter

The attending trauma surgeon again made requests for retrieval of the filter. The same institutional task force authored a companion protocol guiding the retrieval of vena cava filters. Informed consent was again required and obtained for the retrieval procedure. Under angiographic guidance, the right internal jugular vein was accessed. A 5F straight catheter was then placed below the filter in the infrarenal IVC, and an inferior venocavogram was performed to assess the possible presence of thrombus in the vena cava or within the filter. If more than one third of the filter was involved with thrombus, or if extensive IVC thrombus was present, the filter was not removed and thus became permanent. If no significant thrombus was identified, a short 11F sheath was placed at the neck, and a long 9F sheath was placed immediately above the filter. A 20- or 25-mm gooseneck snare was then placed through the long sheath, and the hook at the superior apex of the GTF device was snared. The snare was then tightened around the hook, and the filter was collapsed and withdrawn into the 9F sheath and removed from the neck. The 11F short sheath was then removed, and hemostasis was achieved by manual compression.

Design, setting, and selection of participants

This was a descriptive study documenting the retrieval rate and complications associated with this filter and analyzing the clinical course of 51 consecutive trauma patients undergoing insertion of the GTF IVC filter. The study received Institutional Review Board approval. Consent for filter placement and retrieval was obtained from the patient or family before the specific procedure. Data were gathered concurrently using IBM-compatible Windows 98 and Office XP software (Microsoft, Redmond, Washington). Protected health information data were stored in password-protected files. Demographics and injury data were analyzed using the institutional trauma registry.

Results

Demographics

Between January 1, 2001 and September 30, 2003, 53 retrievable IVC filters—including 1 retrievable superior vena cava (SVC) filter—were placed in 51 trauma patients. The demographic and disposition details of the patients are listed in Table 1. All patients sustained multiple injuries (Table 2). Thirty-eight (75%) patients had multiple (>2) long-bone fractures; 29 (57%) had chest trauma; and 26 (51%) had traumatic brain injury.

During the 21 months of this study, 2,426 patients were admitted to the trauma service, and the overall mortality rate was 4.9%. There were 52 (2.1%) confirmed incidents of DVT and 5 (0.2%) confirmed incidents of PE in these patients. No deaths of patients on the trauma service were attributed to PE during the period of this study.