Inferior Vena Cava Filter Fracture and Migration: A Case Report and Review of the Literature

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Abstract
Inferior vena cava (IVC) filters are an option for the prevention of pulmonary emboli in patients who have venous thrombosis and a contraindication to anticoagulation, but their placement is not without risk. We describe a case of a patient with a Gunther-Tulip IVC filter that fractured and migrated to the left distal pulmonary artery. The leg was removed using bronchoscopy forceps and a French sheath without complication. Fracture and migration of IVC filters is rare with only a few case reports in the literature. It is important to consider given the potential for significant morbidity and mortality.

Résumé
La mise en place de filtres dans la veine cave inférieure (VCI) constitue une option pour la prévention d’une embolie pulmonaire chez les patients qui présentent une thrombose veineuse et pour qui l’anticoagulation est contre-indiquée, mais cela n’est pas dépourvu de risques. Nous décrivons le cas d’un patient dont le filtre Gunther-Tulip pour VCI s’est rompu et est allé se loger dans l’artère pulmonaire distale gauche. La jambe a été dégagée à l’aide d’un forceps bronchoscopique et d’une gaine French, et ce, sans complication. La rupture et le déplacement de filtres pour VCI est un phénomène rare; seuls quelques cas sont rapportés dans la revue de la littérature. Il est toutefois important de considérer cette éventualité compte tenu des risques de morbidité et de mortalité.
Case Presentation
Inferior vena cava (IVC) filters are used for the prevention of pulmonary emboli in patients who have a contraindication to anticoagulation, but their placement is not without risk. Complications of IVC filters include hematoma at the insertion site, deep vein thrombosis (DVT), inferior vena cava thrombosis, postphlebitic syndrome, filter penetration into adjacent structures, filter fracture and filter migration. Filter migration can be life threatening depending on the location of migration. There are reports in the literature describing migration of IVC filters but few report fracture of the filter with subsequent migration and the risk of this complication is unclear. In this report we discuss the risk of filter fracture and outcomes related to this complication.

Case Report
This is a case report of a 20-year-old man with a history of ulcerative colitis (UC) diagnosed with a DVT in the right popliteal vein as well as a catheter associated left basilic vein thrombosis during a hospitalization for an exacerbation of UC. He was initially treated with dalteparin, at a dose of 200 units/kg/day subcutaneously for one month followed by a reduced dose of 175 units/kg/day, consistent with standard practice.

Two months after his initial episodes of VTE, he developed symptomatic extension of the initial right popliteal DVT into the right superficial femoral vein and he was admitted to hospital for intravenous unfractionated heparin then transitioned back to dalteparin 200 units/kg/day prior to discharge from the hospital. A follow up ultrasound a month later revealed improvement of the clot and at the patient’s request, dalteparin was discontinued without the initiation of warfarin after a total duration of anticoagulation of six months.

He presented a month later with new right leg pain and edema and an ultrasound revealed recurrent DVT in the right external iliac vein. At the same time he had a UC related lower gastrointestinal bleed with a hemoglobin of 58g/L. His UC was refractory to previous medical treatment and given the ongoing bleeding and transfusion requirements, he required a laparoscopic subtotal colectomy and end ileostomy. Given his history of recent extensive and recurrent DVT, as well as his high perioperative bleeding risk, a Gunther-Tulip IVC filter was placed pre-operatively. Systemic anticoagulation was resumed post-operatively with IV unfractionated heparin but despite this he developed an asymptomatic 4.1 x 1.5 cm thrombus above the level of the filter, found incidentally on a follow-up ultrasound two weeks after the filter placement. He was transitioned to dalteparin adjusted according to peak anti-factor Xa levels (target 1.2 ± 0.43).

After resolution of the thrombus on follow-up imaging, removal of the filter was planned, two months after its insertion. At the time of removal, the filter was found to be tilted with the apex imbedded in the posterior wall of the IVC and one of the legs resting in the right renal vein. Initial attempts at removal were unsuccessful. Imaging at the time of a second attempt to remove the filter 30 days later, showed that one of the legs had fractured and migrated to the left distal pulmonary artery.

Figure 1. Images of chest revealing filter leg (arrow) in left pulmonary artery prior to and following removal.
(Figure 1). The patient was asymptomatic and was maintained on dalteparin. A week later, the filter leg was removed using an endovascular approach and bronchoscopy forceps through an 8 French guiding sheath without complication.

Discussion
This is a case report that describes a fracture of a filter leg and subsequent migration to the pulmonary artery. Filter fracture and migration is a recognized complication of IVC filters and the incidence reported in the literature varies with the type of device and duration of placement (Table 1) with estimates of 1% to 29%.1-2,15 Most studies commenting on rates of filter fracture are retrospective reviews with fracture and migration discovered on follow-up imaging. Tam et al, retrospectively, evaluated images of 363 patients with the Bard Recovery Filter and reported 26 fracture events (7%) at a median follow-up of 18.4 months.1 Similar rates of filter fracture were reported by Dinglasan et al who identified 15 fractures out of 148 (10%) cases of Bard Recovery, G2 and Celect filters reviewed.3 Only one report is in the literature commenting on fracture rates for the Gunther-Tulip filter and in that retrospective review of 105 cases, no filter fracture or migration occurred.11

Although less common than other filter complications, filter fracture and subsequent migration can have particularly severe consequences. Nicholson et al. reported a case of sudden death from filter fracture and migration.4 Kumar described a case where a broken arm of an IVC filter migrated to the heart, penetrated the right ventricle and required cardiac surgery.5 Hull reported a case of a patient presenting with non-sustained ventricular tachycardia after filter arm perforation, fracture and migration to the right ventricle.6 Several cases of filter fracture with migration leading to cardiac tamponade have also been reported.4,17-20 Other areas of fracture and migration include perforation of the abdominal aorta, duodenal perforation and migration to the kidney.21-23 A case of fracture and migration of an OptEase filter to the pulmonary vasculature during retrieval that required surgical removal was recently reported.24

The use of IVC filters should be considered only in patients with acute VTE who have a contraindication to anticoagulant therapy. Although filter fracture and migration is rare, it is a recognized and potentially serious iatrogenic complication. Removal of IVC filters is potentially fraught with hazard and it is important to inspect the filter to ensure it has been removed intact.

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Table 1. Inferior vena cava fracture rates

<table>
<thead>
<tr>
<th>Study</th>
<th>Filter Type</th>
<th>Median Follow-Up (mo)</th>
<th>Number of Filters</th>
<th>Number of Fractures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dinglasan et al.</td>
<td>G2, Recovery, Celect</td>
<td>13.5</td>
<td>148</td>
<td>15 (10%)</td>
</tr>
<tr>
<td>Vijay et al.</td>
<td>Recovery, G2, G2 Express</td>
<td>23.1</td>
<td>548</td>
<td>63 (12%)</td>
</tr>
<tr>
<td>Hull et al.</td>
<td>Recovery</td>
<td>30.0</td>
<td>14</td>
<td>4 (29%)</td>
</tr>
<tr>
<td>Tam et al.</td>
<td>Recovery</td>
<td>18.4</td>
<td>363</td>
<td>26 (7%)</td>
</tr>
<tr>
<td>Nicholson et al.</td>
<td>Recovery, G2</td>
<td>1.7, 0.8</td>
<td>80</td>
<td>13 (16%)</td>
</tr>
<tr>
<td>Lynch et al.</td>
<td>G2</td>
<td>6.0</td>
<td>174</td>
<td>6 (3%)</td>
</tr>
<tr>
<td>Zhu et al.</td>
<td>G2</td>
<td>4.3</td>
<td>139</td>
<td>2 (1%)</td>
</tr>
<tr>
<td>Sangwaiya et al.</td>
<td>Celect</td>
<td>2.3</td>
<td>18</td>
<td>1 (6%)</td>
</tr>
<tr>
<td>Johnson et al.</td>
<td>Option</td>
<td>6.0</td>
<td>100</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Oliva et al.</td>
<td>Recovery, G2</td>
<td>1.8</td>
<td>51</td>
<td>0 (0%)</td>
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<tr>
<td>Kalva et al.</td>
<td>TrapEase</td>
<td>6.3</td>
<td>270</td>
<td>8 (3%)</td>
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<tr>
<td>Kalva et al.</td>
<td>Recovery</td>
<td>2.7</td>
<td>40</td>
<td>3 (8%)</td>
</tr>
<tr>
<td>Rosenthal et al.</td>
<td>Gunther-Tulip</td>
<td>8.7</td>
<td>105</td>
<td>0</td>
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References