

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

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Abstract

The utilization of IVC (inferior vena cava) filters for pulmonary embolism prevention has been increasing worldwide. A well-known complication is filter fracture and migration of the fragment to the heart. The goal of this study was to identify and discuss the clinical presentation and management of these patients. A systematic review of the literature was conducted between 1985 and 2015. A total of 23 articles were published on 37 migrated fragments to the heart reported in 29 patients. 69.0% complained of chest pain and 27.6% were asymptomatic. Ten patients underwent observation, three had successful endovascular retrieval, 12 had open-heart surgery and four cases were unreported. A case report was included for our own patient. There appears to be a consensus that observation is appropriate for asymptomatic patients. Symptomatic patients with pericardial effusion may benefit from open-heart surgery. Patients with cardiac tamponade should be managed with open surgery. Based upon these findings and other details in the cases, we have proposed a management algorithm.

Introduction

Pulmonary embolism (PE) is the third most common cause of cardiovascular disease-related death after acute ischemic syndromes and stroke, accounting for 300,000 deaths annually. First-line anticoagulation medications for PE prevention are contraindicated in certain patient populations and the alternative is mechanical filtration. However, the incidence of IVC filter fracture has been reported between 1.0 and 40.0%, mostly associated with increased indwelling time, the interval between filter placement and patient presentation. Case reports have been published on the devastating effects of fragment migration to the heart, causing intense chest pain, pericardial effusion, cardiac tamponade and death. This review was designed to gather and discuss physician experience with these challenges cases and propose guidelines for management.

Methods

Medline, Embase and Web of Science databases were searched for all English-language reports of IVC filter fragments to the heart from 1985 to 2015. The bibliography of each identified article was also searched for relevant publications. All case reports, series and previous reviews were included in this systematic review.

No randomized control trials were identified. Reports of whole filter migration to the heart were excluded. Publications with fractured struts that did not migrate or migrated to locations other than the heart, including the pulmonary vasculature, were not included. We have included a case report from our own experience that meets the inclusion criteria.

Results: Systematic Review

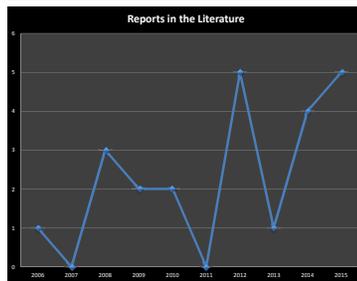


Figure 1: A total of 23 articles published on 29 cases of IVC filter fracture and migration to the heart. An increasing trend in the number published is shown.

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|-----------------------------------|----------------|----------------|
| Gender | 21/29 reported | 72.4% |
| Male | 8 | 38.1% |
| Female | 13 | 61.9% |
| Obesity | 4 | 13.8% |
| Physical Exertion | 4 | 13.8% |
| Symptoms | 29/29 reported | 100.0% |
| Chest Pain | 20 | 69.0% |
| Asymptomatic | 8 | 27.6% |
| Dyspnea | 6 | 20.7% |
| Shoulder Pain | 6 | 20.7% |
| Nausea | 2 | 6.9% |
| Imaging | 21/29 reported | 72.4% |
| Computed Tomography | 17 | 81.0% |
| Echocardiogram | 9 | 42.9% |
| Fracture Location in Heart | 24/37 reported | 64.9% |
| Right Ventricle | 16 | 66.7% |
| Pericardium* (Includes 4 from RV) | 8 | 33.3% |
| Interventricular Septum | 3 | 12.5% |
| Left Ventricle | 1 | 4.2% |
| Average Indwelling Time | 43.0 months | 4 - 120 months |
| Management | 25/29 reported | 86.2% |
| Open-heart Surgery | 12 | 48.0% |
| Observation | 10 | 40.0% |
| Endovascular Retrieval | 3 | 12.0% |
| Filter Body Follow Up | 18/29 reported | 62.1% |
| Successful Retrieval | 12 | 66.7% |
| Left in situ | 6 | 33.3% |
| Complications | 2/29 reported | 6.9% |
| Sternal Wound Dehiscence | 1 | 50.0% |
| Possible PE | 1 | 50.0% |
| Uneventful Follow Up | 10/29 reported | 34.5% |
| Mortality ("sudden death") | 1 | 3.4% |

Table 1: Results of the literature review. * Four fragments were located within both the right ventricle and the pericardium.

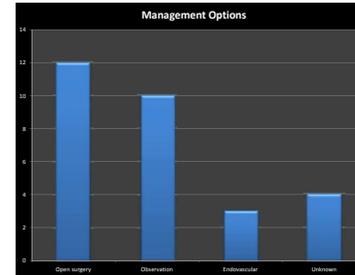


Figure 2: The different management options chosen for the 29 cases presenting with IVC filter fracture and migration to the heart.

Case Presentation

A 23 year old woman presented with sudden onset retrosternal chest pain following an attempt to move a heavy object from her vehicle. Multiple fractured struts of an inferior vena cava filter were identified in the distal right and left pulmonary artery branches, and in the free wall of the right ventricle. A small pericardial effusion was noted. Because of the depth of penetration into the right ventricle, it was perceived not to be amenable to endovascular retrieval. Over several days of observation, she continued to have progressive retrosternal and left shoulder pain.

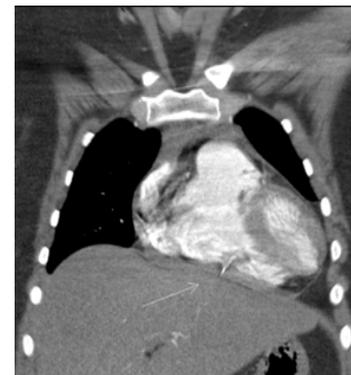


Figure 3: Fractured strut embedded in the right ventricular free wall, protruding into the diaphragm.

She underwent exploratory sternotomy and extraction of a strut that was partially protruding from the right ventricle and abrading the diaphragmatic pericardium. The patient recovered quite well and was discharged on the third postoperative day. There were no concerns at her 3 month follow up visit.

Discussion and Conclusions

With the expanded use of IVC filters, cardiovascular surgeons and interventionalists should be aware of the clinical presentation and management of IVC filter fracture and migration to the heart. There appears to be a consensus in the literature that observation and close follow up are appropriate options for asymptomatic patients. In addition, symptomatic patients with pericardial effusion may benefit from open-heart surgery. Cardiovascular compromise such as cardiac tamponade should be managed with open surgery. We encourage the continued publication of these challenging cases; more experience and data are still needed.

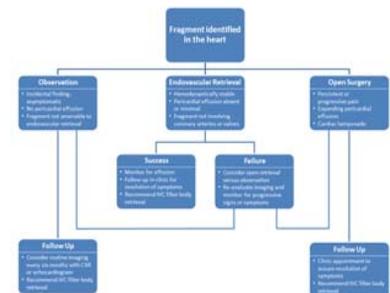


Figure 4: A proposed management algorithm for patients presenting with IVC filter fracture and migration to the heart.

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