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## CASE REPORT

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# Bird's Nest Inferior Vena Cava Filter Thrombosis

KY Lau,<sup>1</sup> JKW Chan,<sup>1</sup> SW Pang,<sup>2</sup> DJ Roebuck,<sup>3</sup> LTH Tan<sup>1</sup>

<sup>1</sup>Department of Radiology, <sup>2</sup>Department of Pathology, Pamela Youde Nethersole Eastern Hospital, Hong Kong, <sup>3</sup>Department of Radiology, Great Ormond Street Hospital, London, United Kingdom

### ABSTRACT

*We describe the case of a patient who died approximately 3 months after having had a jugular Bird's nest inferior vena cava filter placed for prophylaxis of pulmonary embolism. Postmortem examination revealed inferior vena cava filter thrombus and thromboembolic occlusion of the right main pulmonary artery. Referring clinicians and radiologists should be aware of this potentially fatal complication of filter placement, and in selected cases, regular assessment of caval patency after filter placement may be appropriate.*

*Key words:* Inferior vena cava, Pulmonary embolism, Thrombosis

### INTRODUCTION

Bird's nest inferior vena cava (IVC) filter placement for the prophylaxis of pulmonary embolism (PE) is an established procedure. Nevertheless, it is important to appreciate that filter insertion itself can introduce complications, as illustrated in our patient.

### CASE REPORT

A 71-year-old man suffered a haemorrhagic stroke 1 month prior to presentation with left leg swelling and tenderness. There was no fever, chest pain, shortness of breath, or haemoptysis. Duplex sonography of the left leg revealed deep vein thrombosis (DVT) extending from the popliteal vein to the superficial femoral vein. In view of the presence of a recent, massive, right, fronto-parietal haemorrhage, anticoagulation was not given. Instead, a Bird's nest IVC filter was deployed in the infrarenal portion of the IVC, via a right jugular approach (Figure 1), without immediate complication. Follow-up duplex sonography of the left lower limb and the IVC on day 28 after filter placement showed persistent DVT of the superficial femoral vein and the popliteal vein. No thrombus was detected in the IVC. At this time, the right lower limb was not swollen. The



**Figure 1.** Inferior vena cavogram following deployment of a Bird's nest filter via a right jugular approach.

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*Correspondence:* Dr. KY Lau, Department of Radiology, Pamela Youde Nethersole Eastern Hospital, 3 Lok Man Road, Chai Wan, Hong Kong.

Tel: (852) 2595 6169; Fax: (852) 2515 3194;

E-mail: drkylau@yahoo.com

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ventilation-perfusion scintigram was normal. At the time of filter placement, the patient had no known protein C, protein S, or antithrombin III deficiency.

The patient was transferred for stroke rehabilitation. Three months after filter placement, the patient was readmitted to the emergency room, due to shortness of breath, cyanosis, and shock. Diffuse crackles were heard all over his chest. A chest radiograph showed no Hampton hump, consolidation, or pleural effusion. His condition deteriorated rapidly, and he finally succumbed 2.5 hours after admission.

Postmortem examination revealed that the Bird's nest filter was present in the IVC above the confluence of the common iliac veins. An organised thrombus with a whitish 'head' and reddish, tapering 'tail' was noted to arise from the filter (Figure 2). The thrombus extended cephalad and measured about 13 cm in longitudinal extent. There was occlusion of the IVC (Figure 2). However, the left deep calf veins, popliteal vein, and



**Figure 2.** The inferior vena cava (IVC) is completely occluded by a huge IVC filter thrombus with a whitish 'head' (arrow) and a reddish, tapering 'tail' (arrowhead). This extends cephalad, to the suprarenal portion of the IVC.



**Figure 3.** Cut surface of the right lung showing extensive thromboembolic occlusion of the main pulmonary artery and its major branches.

superficial femoral vein showed no thrombus. The right deep calf veins revealed recent thrombus with occlusion. Both lungs were congested, with thromboembolic occlusion of the right main pulmonary artery and its major branches (Figure 3). The left pulmonary artery and both pulmonary veins were unremarkable. No thrombus was noted at the jugular puncture site. Since the IVC was completely occluded by a chronic and organised thrombus, the pulmonary emboli most likely originated from the 'tail' portion of the IVC thrombus. The absence of clots in the left leg veins was likely due to migration of these clots to the IVC.

## DISCUSSION

When PE is associated with a contraindication to, or a failure or complication of, anticoagulation therapy, IVC filter insertion is an indication. Other indications for IVC filter insertion include prophylaxis for PE in patients with iliofemoral or infrarenal IVC thrombus, and high-risk surgical patients. In general, percutaneous insertion of IVC filters is a precise and safe procedure.<sup>1</sup> The Bird's nest filter, a permanent IVC filter (Cook, Bloomington, Indiana, USA), has been an effective device in the

prevention of PE since it was introduced in 1982.<sup>2</sup> However, complications related to permanent IVC filters do occur. These include insertion site venous thrombosis, IVC thrombosis and obstruction, erosion of the filter through the IVC wall, recurrent pulmonary thromboembolism, migration of the filter, and phlegmasia cerulea dolens.

Although Roehm et al found no reported cases of thrombus on the Bird's nest filter after placement via the common femoral vein,<sup>2</sup> IVC filter thrombosis is not a rare event. The incidence of symptomatic IVC thrombosis and occlusion with the Bird's nest IVC filter has been variously reported as 2.9%,<sup>3</sup> 5.3%,<sup>4</sup> and 14.6%.<sup>5</sup> PE, as occurred in our patient, appears to be a common complication of IVC filter thrombosis.<sup>6</sup> Failure to demonstrate the sonographically detected thrombus in the deep veins of the left lower limb at the postmortem examination of our patient is most likely due to migration of the clot to the IVC.

The causes of IVC filter thrombosis are most likely multifactorial. The thrombogenic potential and thrombus-trapping efficiency of each device may be different. Mohan et al observed that use of the Bird's nest filter was associated with increased morbidity and mortality rates compared with the stainless steel Greenfield filter, the titanium Greenfield filter with modified hook, and the Vena Tech filter.<sup>5</sup> In an *in vitro* evaluation of IVC filters, Bird's nest filters demonstrated the highest clot-trapping capacity.<sup>7</sup> The probability of filter thrombosis may also be related to the size of the IVC and intracaval extension of DVT.<sup>6</sup> A lower rate of IVC thrombosis might be expected with the Bird's nest filter, because this device is preferentially placed in venae cavae of larger diameter.<sup>4</sup> The medical condition of a patient, such as a history of previous DVT, immobilisation, postoperative state, malignancy, cardiac disease, trauma, hypercoagulable disorders, hormonal therapy, and pregnancy, may also contribute to filter thrombosis.

Ortega et al,<sup>8</sup> and Jones and Fink<sup>9</sup> reported that no early adverse effects occurred in their patients with thromboembolic disease when anticoagulation was not used after IVC filter placement. In addition, Aswad et al reported that no case of IVC thrombosis was seen when prophylactic filter placement was performed.<sup>4</sup> Tardy et al concluded that early filter thrombosis is apparently due to intracaval extension of DVT.<sup>6</sup> This raises the question of employing adjuvant

anticoagulation, provided there is no contraindication. Harris et al, who reported phlegmasia cerulea dolens in 4 patients following prophylactic filter placement, also recommended anticoagulant therapy whenever possible.<sup>10</sup> In the presence of a contraindication to anticoagulation at the time of filter placement, the possibility of delayed anticoagulation should be considered. Tardy et al suggested that all patients with acute lumbar pain, new or worsening lower limb swelling, or other signs or symptoms compatible with recurrent DVT and PE should have prompt evaluation of caval patency. Should filter thrombosis occur, transcatheter regional thrombolytic therapy may be beneficial to re-establish caval patency.<sup>11</sup> Temporary IVC filters may have an expanding role in the prophylaxis of PE.<sup>12</sup>

Caval occlusion can be diagnosed with duplex ultrasonography, CT, cavography, and magnetic resonance angiography. However, we failed to demonstrate IVC thrombus at follow-up duplex sonography in our patient. This may be due to a combination of technical and/or patient factors, which in most cases conspire to make sonography inadequate for demonstrating IVC occlusion.<sup>6,13</sup> Whenever there is clinical suspicion, further investigation including CT or cavography should be performed to detect the presence of IVC thrombosis.

In conclusion, referring clinicians and radiologists should be aware of this potentially fatal complication of IVC filter placement. With the increasing detection of IVC thrombosis associated with thromboembolic complications, radiologists should be cautious in the selection of patients for permanent IVC filter placement. After filter insertion, IVC patency should be evaluated at regular intervals, especially in high-risk patients. The possibility of delayed anticoagulation should also be considered.

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