

◆ CASE REPORT ◆

Bird's Nest Inferior Vena Caval Filter Migration into the Duodenum: A Rare Cause of Upper Gastrointestinal Bleeding

Hasan Ali Al Zahrani, FRCS (Glasgow)

Vascular Surgery Unit, Department of Surgery, King Abdulaziz University Hospital, Jeddah, and the Al Noor Specialist Hospital, Makkah Al Mukarramah, Kingdom of Saudi Arabia

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Purpose: To report the first case of a potentially catastrophic complication of vena caval interruption with a bird's nest filter.

Methods and Results: A 55-year-old Saudi patient presented with hypovolemic shock from massive upper gastrointestinal hemorrhage. Endoscopy identified a metallic object penetrating the duodenum. Five years earlier, the patient had a bird's nest vena caval filter inserted for recurrent pulmonary embolism. During emergent laparotomy, a broken filter wire was found projecting into the duodenum, where it had induced three profusely bleeding ulcers. The wire was transected and the ulcers oversewn. A hook projecting from the inferior vena cava (IVC) was also cut flush with the vessel wall, but the IVC was not opened nor the filter replaced. The patient's postoperative course was complicated by deep venous thrombosis, but he recovered and is asymptomatic on warfarin anticoagulation after 1 year. Computed tomography (CT) at 1-year follow-up confirmed no further migration of the filter.

Conclusion: This event reinforces the need to monitor patients with IVC filters over the long term, preferably using CT scanning, and to consider filter migration as a possible cause of upper gastrointestinal bleeding.

J Endovasc Surg 1995;2:372-375

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Vena caval interruption is an accepted alternative treatment for deep venous thrombosis (DVT) or pulmonary embolism (PE) in patients in whom anticoagulation therapy is risky, contraindicated, or a failure.¹ A variety of percutaneously inserted inferior vena caval (IVC) filters have been used over the years for this purpose. The most popular among these are the stainless steel and titanium Greenfield filters (Medi-tech/Boston Scientific, Watertown, MA, USA); the Vena Tech-LGM filter (B. Braun Medical, Evanston, IL, USA); the Simon nitinol

filter (Nitinol Medical Technologies, Woburn, MA, USA); and the bird's nest filter (Cook, Bloomington, IN, USA). However, none of these devices has met all the criteria of a perfect filter.^{2,3}

Ideally, an IVC filter should be nonmagnetic, nonthrombogenic, and suitable for percutaneous introduction through an acceptably small catheter. Its design should prevent migration, perforation, and embolization while achieving a high clot-trapping capacity with little or no turbulence. Research continues today to construct a new filter or refine current models in line with these goals.⁴

The Gianturco-Roehm bird's nest filter was introduced in 1982 and released for commercial use in 1989. In its original design,⁵ it con-

Address for correspondence and reprints: Hasan Ali Al Zahrani, FRCS, Medical Director, Al Noor Specialist Hospital, PO Box 2716, Makkah Al Mukarramah, Kingdom of Saudi Arabia. Fax: 966-2-5575908.

sisted of two rigid 0.25-mm-diameter V-struts between which were attached four 25-cm-long, 0.18-mm-diameter stainless steel wires configured into a mesh resembling a bird's nest. Subsequent redesign to increase the strut diameter to 0.46 mm was necessary because the original dimension did not afford sufficient rigidity to prevent migration.³ Although this appears to have solved the migration problem, the modified bird's nest filter has a higher rate of vena caval occlusion than other models.⁶ However, it remains the only device currently available for insertion in venae cavae \geq 29 mm diameter.^{3,7}

Several other complications with the bird's nest filter have been described: sheath kinking,⁸ femoral vein thrombosis,⁹ filter wire prolapse,^{8,10,11} and structural failure.¹² To the best of our knowledge, this is the first reported case of wire fracture in a bird's nest filter with subsequent migration into the duodenum and upper gastrointestinal hemorrhage. The possible mechanisms of injury and its management are described.

CASE REPORT

A 55-year-old Saudi male was admitted to a local hospital after an acute attack of massive melena and hematemesis. He was discharged after 7 days. Subsequently, he experienced nausea and vomiting followed by massive hematemesis estimated at 2 to 3 L. He was admitted to our hospital in hypovolemic shock.

Following resuscitation, the patient underwent an upper gastrointestinal endoscopic study, which found a metallic object protruding from the posterolateral wall of the duodenum, penetrating the mucosa near the ampulla of Vater and causing multiple ulcerations and bleeding.

Review of the patient's medical history revealed an episode of DVT in the left iliac vein, complicated by PE, in 1989. The patient was fully anticoagulated, but PE recurred, so a bird's nest vena caval filter was inserted by physicians in the United States. According to the patient's personal account, the filter was successfully positioned after three unsuccessful insertion attempts. The patient had no history of peptic ulcers, so migration of a filter wire into the duodenum was suspected. Ur-

gent computed tomography (CT) visualized one filter wire projecting from the IVC and penetrating the duodenum. Furthermore, a hook was seen penetrating the right psoas muscle.

An emergency laparotomy was performed on the night of admission. The abdomen was opened via a midline incision. Many adhesions were encountered among the duodenum, gallbladder, and transverse colon; these were lysed, and the duodenum was mobilized with a Kocher maneuver. The duodenum was then incised and examined. Three round, 2- to 3-cm-diameter, actively bleeding ulcers were seen near the ampulla of Vater. One of these communicated with the IVC, which had been penetrated by a hook. The wire protruding into the duodenum was transected with a wire cutter, the ulcers were oversewn in standard fashion, and the duodenotomy was closed in two layers. The vena cava was not opened, but the hook projecting from the IVC was cut flush with the vena caval wall using the wire cutter. A large omental pedicle was transposed between IVC and the displaced duodenum. Morrison's pouch was drained, and the abdomen was closed in layers in standard fashion. The patient received transfusions of fresh blood and packed cells to correct his anemia.

The postoperative period was stormy. The patient developed swelling of both lower limbs; IVC thrombosis was suspected, compounding an existing thrombosed left iliac vein and a small right iliac vein. Heparin was administered to maintain the APTT at 1.5 times control, and a graduated compression stocking was applied. With these measures, he gradually improved. Mild pain (venous claudication) developed in the right lower limb due to clinically diagnosed DVT.

He eventually recovered from the multiple complications and was discharged on warfarin anticoagulation. A subsequent nuclear venogram showed a patent deep system on the right side but occluded iliac veins with development of good collateral circulation. The distal IVC was also thrombosed. Over the next 3 months, the right lower limb swelling improved. The patient continued to be well and asymptomatic 1 year after surgery. A follow-up CT scan (Fig. 1) confirmed no further migration of the filter.



Figure 1 ♦ (A) Follow-up CT scan of the abdomen 1 year after surgery to repair duodenal perforation caused by migration of a bird's nest filter. The remnant of the wire (arrow), which had penetrated the inferior vena cava (V), can be seen. (B) The same scan showing the filter hook (arrow) embedded in the psoas muscle. D = duodenum.

DISCUSSION

The bird's nest IVC filter has several advantages compared with other designs, notably its lower cost and suitability for transfemoral venous insertion from either side.¹² Furthermore, it is the only filtering device available for patients with an oversized IVC.⁷ To date, the main disadvantage of this filter has been its vena caval occlusion rate, which has been reported as high as 19% by one author,⁶ who also identified a significant perforation of the caval wall in his series of 40 patients undergoing radiologic follow-up. Another case of vena caval occlusion with phlegmasia cerulea dolens resulted in the patient's death.¹³

Until now, the other complications documented for this filter have been considered minor; however, our case of hypovolemic shock resulting from duodenal wire penetration represents a notable exception. This is perhaps the first report of a hook migrating through the IVC wall and a broken wire entering the second part of the duodenum, causing multiple traumatic ulcers.

Vesely et al.⁸ encountered two cases of IVC

wall perforation by a hook during device delivery due to excessive traction on the wire guide pusher. More recently, Perry and Wells¹² reported structural failure of the hooks in a bird's nest filter. In none of these cases, however, was there any clinical sequela. Unfortunately, CT scans were not obtained in these patients to exclude injury to adjacent structures. In our case, however, the CT image confirmed that the filter's hook and wire had penetrated not only the duodenum but also the psoas muscle.

The four wires composing the bird's nest pattern are manufactured with square bends in an alternating pattern that allows the filter to coil into its characteristic configuration. Pro-lapse of these wires in a cephalic direction has been encountered.¹⁰ Because these fine wires cannot be effectively visualized by plain X ray, it is difficult to diagnose their prolapse or migration. In our case, diagnosis was facilitated by endoscopic examination with CT documentation.

Wire breakage in this situation may have resulted from improper device selection because the patient had only a 17-mm-diameter IVC, a relative contraindication to bird's nest

filter insertion.^{7,10} Further, during the initial device placement in 1989, multiple attempts were required to correctly position the filter, which had just been released to market. This may indicate limited operator experience for a device that was subsequently found to be more operator dependent to deploy than other types of IVC filters.^{3,8} To correct this problem, the bird's nest filter has recently been modified with an improved deployment system.

In treating this patient, there was no need to remove the filter or insert a second device after cutting the prolapsed wire, as the device's efficacy in clot trapping was not affected. The IVC thrombosed proximal to the filter's nest, and there was no evidence of PE 1 year after our procedure.

This report reinforces the need to follow patients with these filters carefully in the long term and to consider wire fracture and migration of a bird's nest filter as a possible cause of upper gastrointestinal bleeding. Abdominal CT scanning rather than X ray would appear to be the preferred surveillance method for long-term follow-up.

Acknowledgment: I would like to thank Sitti Sarah Sampang for her help in typing this manuscript.

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