Filter Placement in Duplicated Inferior Vena Cava

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Key words: duplicated inferior vena cava, deep vein thrombosis, pulmonary embolism

IMAJ 2001;3:459–460

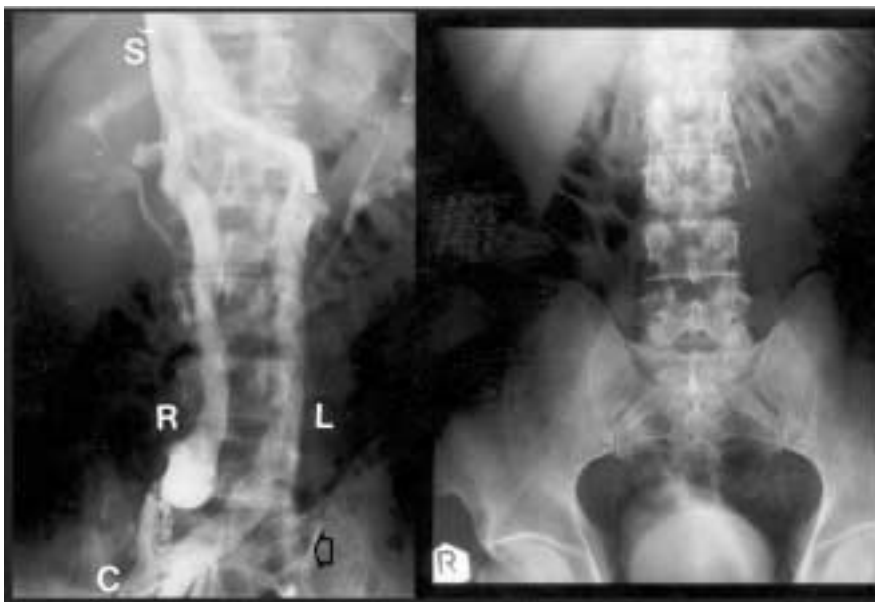
A 51 year old man treated with warfarin for recurrent pulmonary embolism was admitted for chest pain, dyspnea and right calf pain. His past medical history included chronic myelocytic leukemia, splenectomy, Factor XI deficiency, and anti-protein C resistance. The right calf was swollen, reddened and tender, and Homan's sign was elicited. The INR was 1.8. Isotope venography revealed deep vein thrombosis in the right calf and bilateral pulmonary emboli. Doppler ultrasound showed patency of the right ileofemoral veins. The patient was referred to angiography for placement of an inferior vena cava filter.

Right transfemoral inferior venacavography [left panel] reveals duplication of the inferior vena cava. The two vena cava are similar in caliber, and originate from the right common iliac vein [C]. The right IVC [R] arises indirectly via enlarged iliolumbar branches. The left IVC [L] ascends as the direct continuation of the right iliac vein to the left of the spine, after receiving the left common iliac vein (open arrow). No thrombus is detected in the pelvic veins, iliac veins or in either IVC. No communicating branches are demonstrated between the two IVCs. After receiving the renal vein at their respective sides the two IVCs join. The suprarenal IVC [S] is of normal caliber.

In view of the presence of deep vein thrombosis in the right calf, and the venous outflow that included both IVCs, it was decided to place a filter in each vena cava. The right image demonstrates the position of the Kimray Greenfield filters immediately below the level of the renal veins. The post-procedure course was uneventful and the symptoms of chest pain and dyspnea subsided.

Congenital anomalies of the IVC and its branches are extremely diverse, reflecting the complexity of the embryological development of these structures. These include duplication, transposition, interruption with azygos continuation, agenesis and anomalous drainage into the left atrium, retrocaval ureter, circumaortic and retroaortic left renal vein. The variants must be differentiated from pathology on imaging studies (particularly adenopathy), and their presence can affect surgical and interventional procedures such as abdominal aortic aneurysm repair, nephrectomy, therapeutic spermatic/ovarian vein embolization, renal/adrenal vein sampling, and inferior vena cava placement.

The most common congenital anomalies of the IVC are duplication and transposition (0.3% and 0.5% incidence, respectively) [1]. Duplication results from failure of regression of the left-sided supracardinal vein. The right IVC is usually larger, although the pair may be of equal size. The two vena cava most commonly join at the level of the left renal vein. When the entire supracardinal system persists, the right and left IVC may drain into equally sized



ICV = inferior vena cava

azygos and hemiazygos veins. Persistence of the most caudal portion of the supracardinal veins may manifest as infrarenal communicators between the two IVC, through which emboli could pass particularly if the IVC on one side is occluded cephalad to the communication.

Three previous reports have described patients with duplicated IVC requiring the placement of two filters [2–4]. The aim of treatment is to place the filter in the caval outflow of the involved extremity above all clots and below the entrance of the renal veins. Suprarenal placement of a single filter, although not recommended as a first option due to the added risks of renal vein thrombosis and filter migration, is an option in the presence of thrombus in the relevant IVC extending up to the level of the renal veins, as described by Sugimoto et al. [5].

This case demonstrates the importance of attaining high quality venacavography prior to filter placement to assess the presence of anomalies, as well as excluding the presence of thrombi along the planned course of filter placement. Failure to recognize the presence of such an anomaly could result in inadequate protection from pulmonary emboli.

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