Filter Placement in Duplicated Inferior Vena Cava

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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 iliofemoral 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 cavae 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 veins 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 withazygos 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 cavae 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
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.

References

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**Capsule**

**Cultural influences on reading**

Dyslexia is a complex disorder that causes different degrees of impairment in reading and that also varies in prevalence across cultures. Pauls et al. have undertaken a cross-cultural study of dyslexic individuals in Italy, France and the United Kingdom by utilizing behavioral tests and brain imaging scans. They confirm earlier findings that languages with shallow orthographies (where letters map onto sounds in a one-to-one manner), such as Italian, result in less severe impairment. Nevertheless, the underlying neural activation patterns are consistent across dyslexic subjects in all three countries. There is reduced activity in the left temporal cortex, which suggests there may be fewer or less stereotyped connections among brain regions than is observed during reading in normal individuals.

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**Capsule**

**Exposure of cells to antigens**

Rapid clonal expansion is used to generate sufficient numbers of antigen-specific lymphocytes to deal with pathogens. For T cells, this expansion originates through contact with antigen-presenting cells in the lymph nodes, from where dividing antigen-primed T cells move rapidly to contain infection at peripheral sites. Two studies, by Kaech and Ahmed and by van Stipdonk et al. (Nat Immunol 2001;2:415; 423), now suggest a means by which CD8+ T cells balance the need for antigen-driven expansion with the need for rapid deployment to sites of infection. It might be predicted that the dose and length of exposure to antigen would dictate the extent of cell division and differentiation undertaken by naive CD8+ T cells. Instead, however, a short initial encounter with antigen was sufficient to induce naive T cells to commit to a differentiation program including a minimum of seven cell divisions, resulting in the acquisition of effector and memory cell characteristics. Similar results were found when the length of antigen exposure was carefully regulated. This programming of CD8+ T cells to expand and differentiate independently of antigen-presenting cells after a fleeting first encounter with antigen makes much immunological sense as a strategy for coping with infection.