Central venous recanalisation: a pictorial review on tips and tricks

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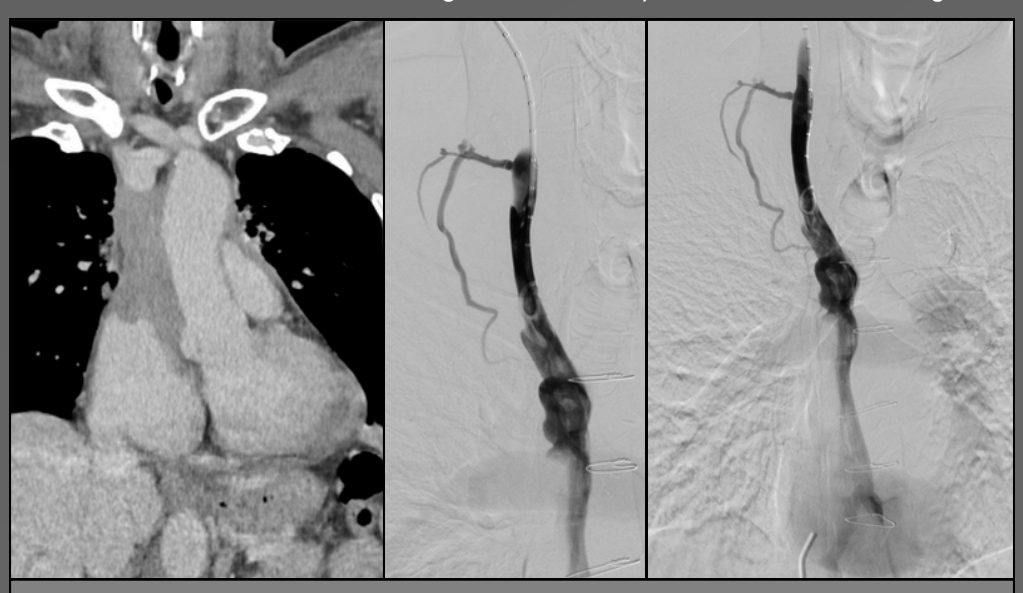
Introduction:

Central vein stenosis and occlusion have diverse causes, ranging from extrinsic compression by neoplasm or nodal metastasis to local venous injury related to indwelling devices, such as haemodialysis catheters or port-a-catheters. These lesions can cause significant symptoms due to obstruction of venous return, ranging from soft-tissue swelling in the early stage to cerebral oedema in advanced superior vena cava obstruction, or venous ulceration in inferior vena cava obstruction. Endovascular treatment is now a cornerstone in the management of central venous disorders. This pictorial review aims to highlight adjunctive measures that increase the success of recanalisation of central venous stenosis or occlusion, from diagnostic imaging to the choice of devices and interventional techniques.

Case 1: Pre-procedural cross-sectional imaging is mandatory

A patient with recurrent thymic carcinoma presented with subjective shortness of breath and facial puffiness. Contrast-enhanced CT (CECT) of the thorax demonstrated severe narrowing of the lower superior vena cava (SVC) due to mediastinal tumour invasion. Retrograde cannulation of the SVC from a femoral approach was unsuccessful. SVC venography performed via a right jugular approach demonstrated opacification of a venous structure draining the right internal jugular vein, which resembled the SVC but was discordant with the CT findings. On further evaluation with venography using a wider field of view (FOV), the drainage pattern was atypical, with an oblique course crossing the midline, corresponding to collateral drainage into the azygos vein.

This case illustrates that cross-sectional imaging is essential for treatment planning and for interpreting intraprocedural venography, including assessing the degree of stenosis or occlusion and establishing the correct endpoints for venous stenting.



SVC obstruction from tumour invasion. Coronal reformatted contrast-enhanced CT image (left) showed long-segment severe narrowing of SVC due to tumour invasion. SVC venogram acquired with a small field of view (middle) showed moderate narrowing at the presumed lower SVC. SVC venogram acquired with a large field of view (right) showed that the presumed lower SVC is actually the azygos vein, with only minimal opacification of the true SVC. The diagnostic catheter with tip at RA also inferred the expected course of IVC. This finding indicates that the severity of SVC obstruction was underestimated on the small field-of-view venogram.

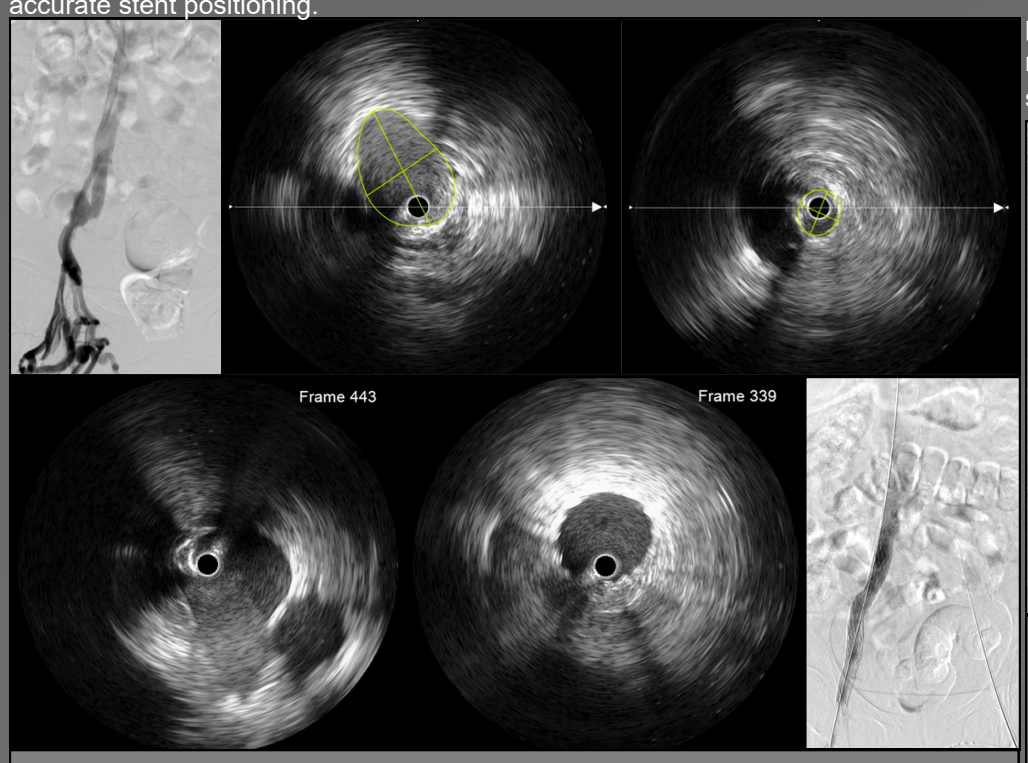
Case 2: An internal look for the landing zone—IVUS

A patient with a prior right femoral haemodialysis catheter insertion complicated by haematoma was referred for symptomatic right lower-limb swelling and CT findings of severe stenosis of the right iliac venous system. The left iliac venous system was uninvolved.

Intraprocedural venography showed a long segment of severe narrowing extending from the proximal right common femoral vein to the right common iliac vein. The superior extent of disease was not clearly defined on venography.

Intravascular ultrasound (IVUS) was used to further evaluate the extent of disease for treatment planning. It demonstrated disease extension from the right proximal common iliac vein to the right distal external iliac vein. The decision was made to stent from the right common iliac vein to the right common femoral vein without covering the left common iliac vein.

IVUS is critical in complex venous reconstruction. It allows accurate assessment of the venous lumen for stent sizing, as well as mapping of disease extent to enable accurate stent positioning.



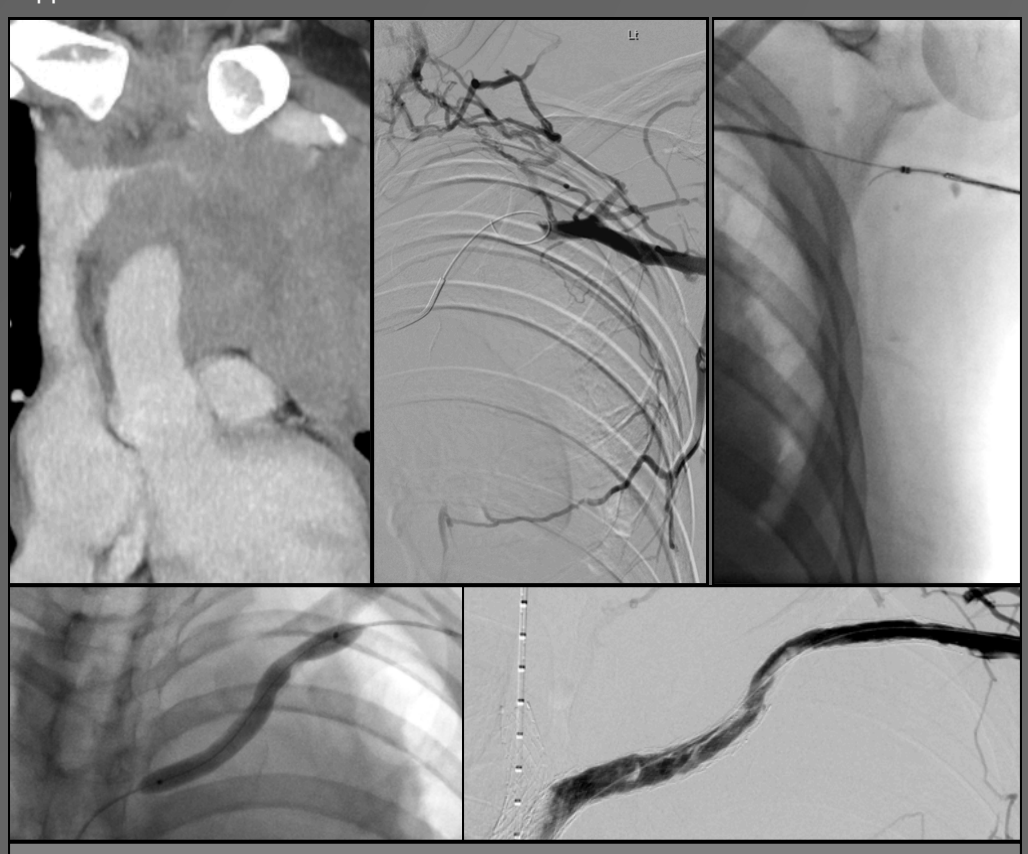
Right femoral venography and IVUS-guided right iliocaval venous stenting. Initial right femoral venogram (top left) shows severe right iliac venous stenosis with collateral drainage; the origin of the left common iliac vein is not visualised. IVUS confirms a normal-calibre IVC (top middle), marked right common iliac vein narrowing (top right), and a normal-calibre right upper common iliac vein at the iliac confluence (bottom left), permitting stent deployment without coverage of the left common iliac vein. Post-stenting IVUS (bottom middle) demonstrates satisfactory stent-wall apposition. Completion venography (bottom right) shows satisfactory antegrade flow with resolution of venous collaterals.

Case 3: Another helping hand for difficult cases—the rendezvous technique

A patient with a mediastinal tumour and severe SVC syndrome was referred for venous stenting. Intraprocedural venography demonstrated long-segment disease involving the entire left brachiocephalic vein. Cannulation of the left brachiocephalic vein from a right femoral approach was successful after a prolonged attempt, but the support was insufficient to safely deploy the venous stent, despite exchange for stiff hydrophilic guidewires.

Therefore, additional left brachial access was obtained, and the guidewire from the right femoral approach was snared, achieving through-and-through access. Venous stents were successfully deployed over this wire.

The rendezvous technique with through-and-through access provides additional stability for intervention when conventional stiff guidewires fail to provide sufficient support.



CT and venographic findings before and after left brachiocephalic vein recanalisation. Coronal contrast-enhanced CT (top left) shows near-total obliteration of the left brachiocephalic vein, confirmed on left brachial venography (top middle). Through-and-through guidewire access is established using a snare (top right). Balloon venoplasty is performed (bottom left), followed by stent deployment. Completion venography (bottom right) shows successful recanalisation with mild residual intraluminal thrombus.

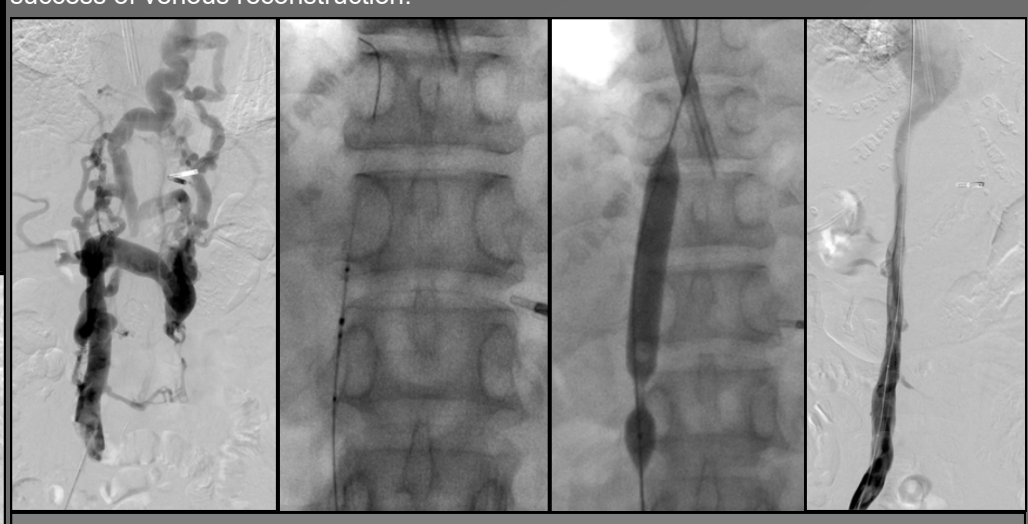
Case 4: The right armamentarium for the right procedure

A patient with end-stage renal failure was referred for inferior vena cava (IVC) recanalisation to optimise venous drainage before renal transplantation. Pre-procedural CECT and IVC venography showed critical stenosis of the suprarenal IVC. The initial attempt to cross the stenosis using a standard diagnostic catheter and a 0.035-inch hydrophilic guidewire was unsuccessful. A triaxial crossing catheter system with a 0.018-inch guidewire was then used, providing better support, and the severe stenosis was crossed with ease. The stenosis was treated with angioplasty using balloons up to 16 mm in diameter. Completion venography demonstrated a satisfactory result, with resolution of the venous collaterals.

After discussion with the urology and nephrology teams, the joint decision was not to perform stenting during the same procedure to avoid the need for anticoagulation at that juncture. The treated segment of the IVC remained patent on 6-month follow-up venography without additional anticoagulation.

This case illustrates two important considerations in venous reconstruction. First, operators should be prepared to use dedicated equipment for venous procedures, such as crossing catheters, dedicated guidewires, or even chronic total occlusion wires, to cross high-grade venous stenosis or occlusion. Sharp recanalisation can be the last resort if these measures fail.

Second, contrary to standard practice for iliocaval venous reconstruction, we opted not to stent this patient, with sustained satisfactory results. We believe that preservation of venous inflow from the bilateral iliac veins maintained patency of the recanalised IVC. This illustrates that securing venous inflow is essential to the success of venous reconstruction.



IVC recanalisation. Initial IVC venogram (leftmost) shows suprarenal IVC obliteration with prominent venous collaterals. The occlusion is crossed using a triaxial crossing catheter system and microguidewire (middle left). The occluded/critically stenosed segment is sequentially dilated with an angioplasty balloon (middle right). Completion IVC venogram (rightmost) shows successful recanalisation with resolution of the venous collaterals.

Conclusion:

Central venous recanalisation is challenging due to its diversity and complexity. Proper pre-procedural cross-sectional imaging, intraprocedural imaging with IVUS, and the use of dedicated equipment and techniques help improve technical success and sustain clinical response.

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