Recanalising the SVC. Time for new tools.

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Background:
A 24-year-old man with cystic fibrosis was referred to our regional vascular unit for management of his worsening superior vena cava obstruction (SVCO) symptoms. Over the years, the patient had several tunnelled central venous lines for long-term intravenous antibiotics, the last of which was a Port-A-Cath inserted three years earlier. The Port-A-Cath had become increasingly difficult to flush and was removed after a venogram demonstrated SVC occlusion (**Fig 1**).

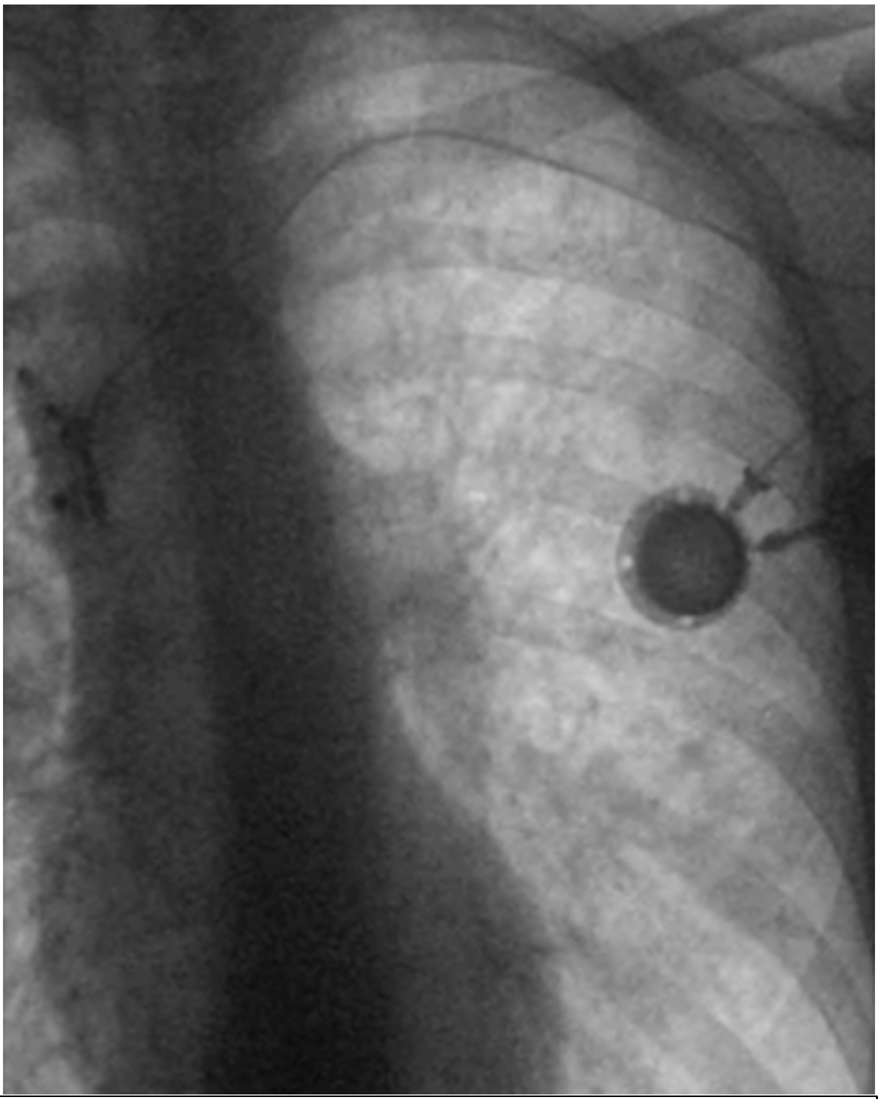

Figure 1: Fluoroscopic image following contrast injection into the Port-A-Cath demonstrating stasis of contrast in the SVC.

As the patient developed SVCO symptoms, a CT venogram was performed with a view to plan endovascular treatment. The CT demonstrated complete SVC occlusion with numerous superficial and deep collaterals. The neck and upper limb veins drained below the diaphragm via markedly dilated azygous and hemiazygous systems (**Fig 2**). SVC stenting was attempted at the referring hospital but the occlusion could not be crossed with conventional tools.

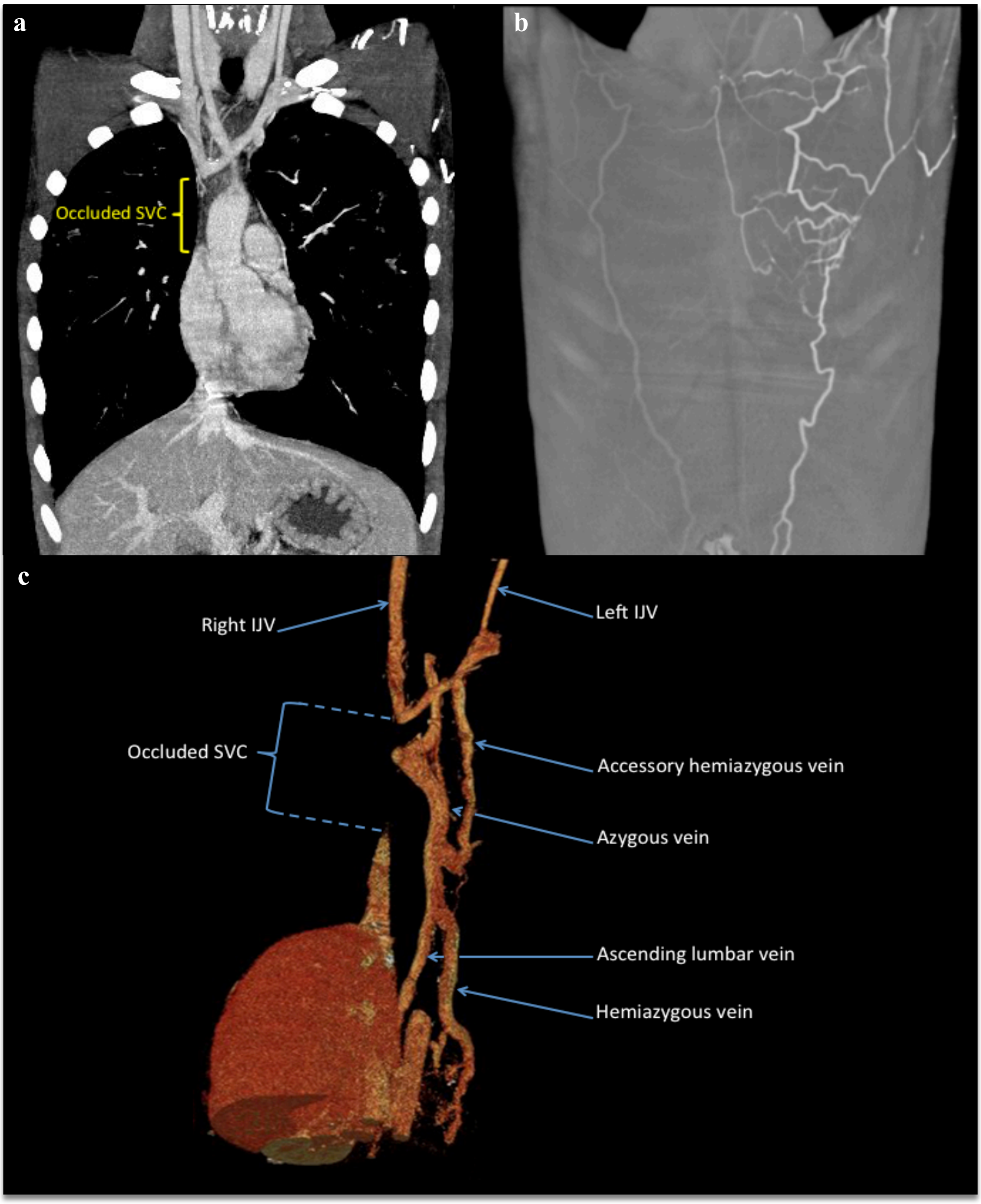

Figure 2: Coronal MIP images from a CT venogram demonstrating:
a: occlusion of the SVC & **b:** numerous superficial (anterior chest wall) dilated collateral veins. **c:** 3D render from the same CT showing large deep venous collaterals.

Procedure:
At our unit, the patient was admitted for a second attempt at SVC stenting under general anaesthesia.
7Fr and 10Fr venous sheaths were placed into the right internal jugular (IJV) and right common femoral veins (CFV) respectively. An angiogram confirmed the CT findings.
An attempt was initially made at crossing the SVC occlusion from below using a 0.035” Terumo hydrophilic wire, but endolumial position above the obstruction could not be re-established. Despite the use of a support catheter and platform change to an 0.014” system, the chronic venous occlusion could not be crossed with conventional methods **(Fig 3)**.

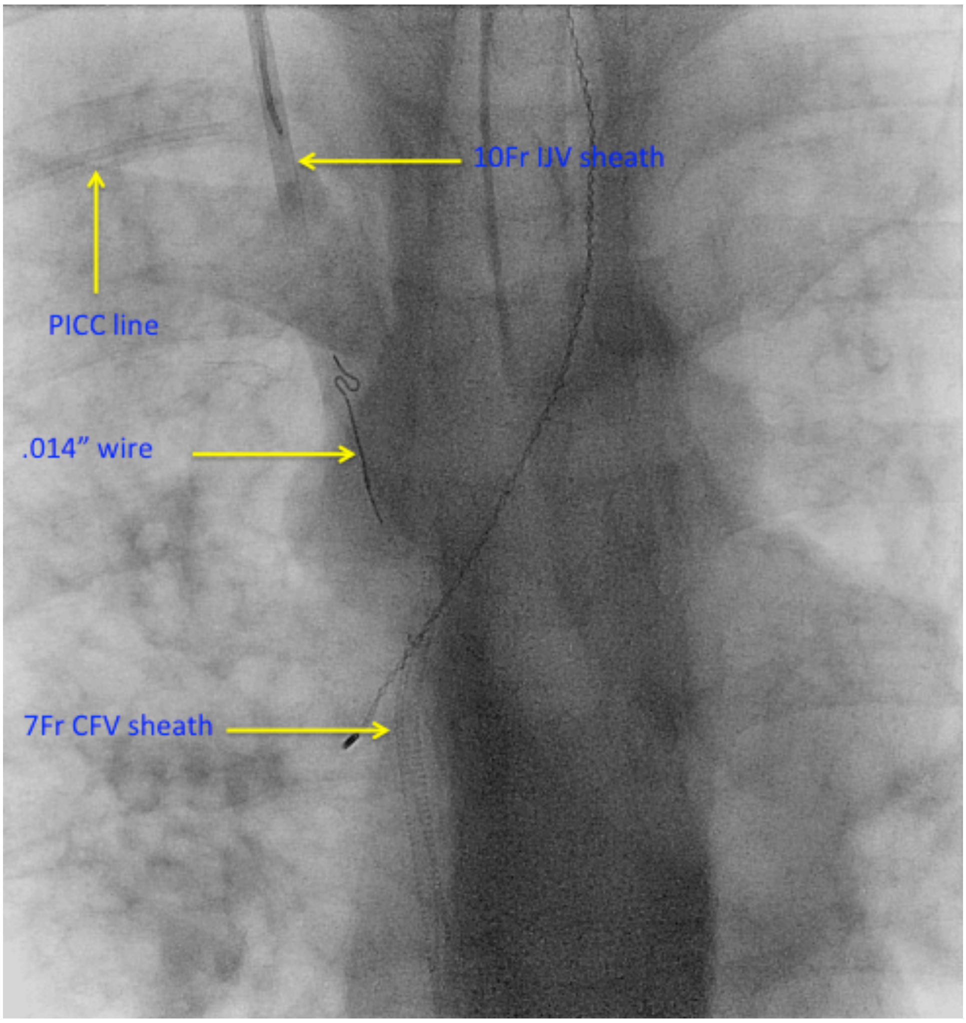

Figure 3: Fluoroscopic image demonstrating advancement of the .014” wire through the occluded SVC.

A Volcano Pioneer Plus re-entry catheter was inserted through the CFV sheath and advanced through the fibrous SVC occlusion over the 0.014” wire. The device’s intravascular ultrasound (IVUS) allowed accurate guidance of the re-entry needle to puncture the right brachiocephalic vein at first pass **(Fig 4)**. The wire was then advanced into the brachopcephalic lumen. Having confirmed its position, the wire was snared via the IJ sheath for definitive through-and-through access (**Fig 5)**.

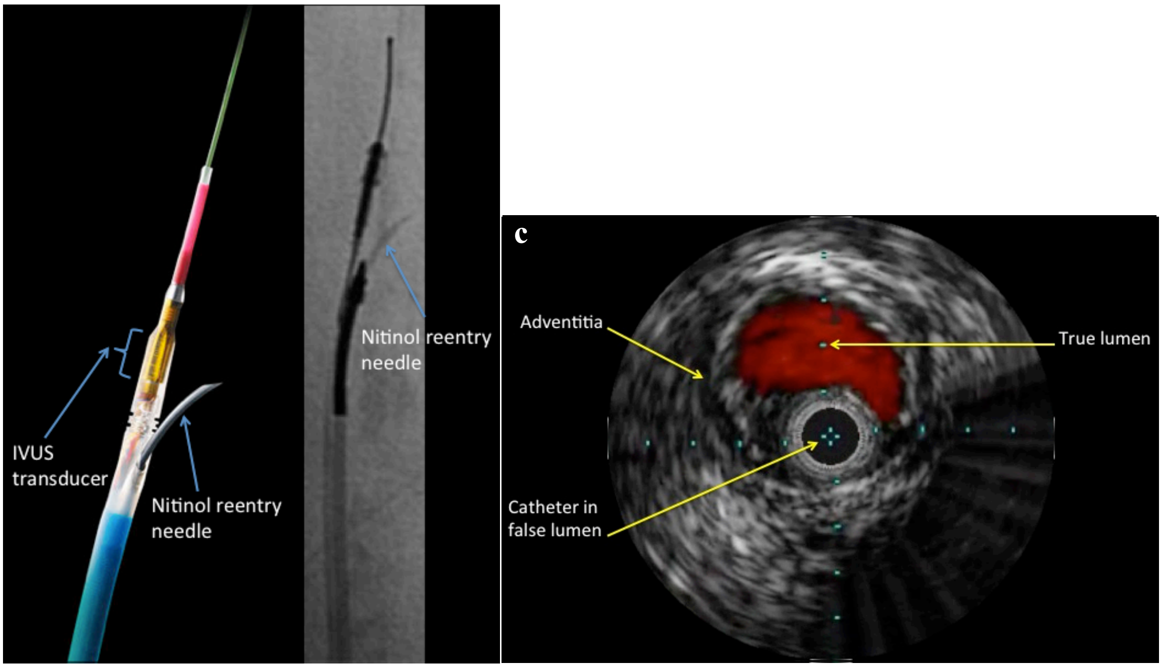

Figure 4: a: Photo & **b:** fluoroscopic image of the Volcano Pioneer Plus re-entry catheter with the needle extended. **c:** IVUS image demonstrating the target vessel lumen prior to US-guided puncture.

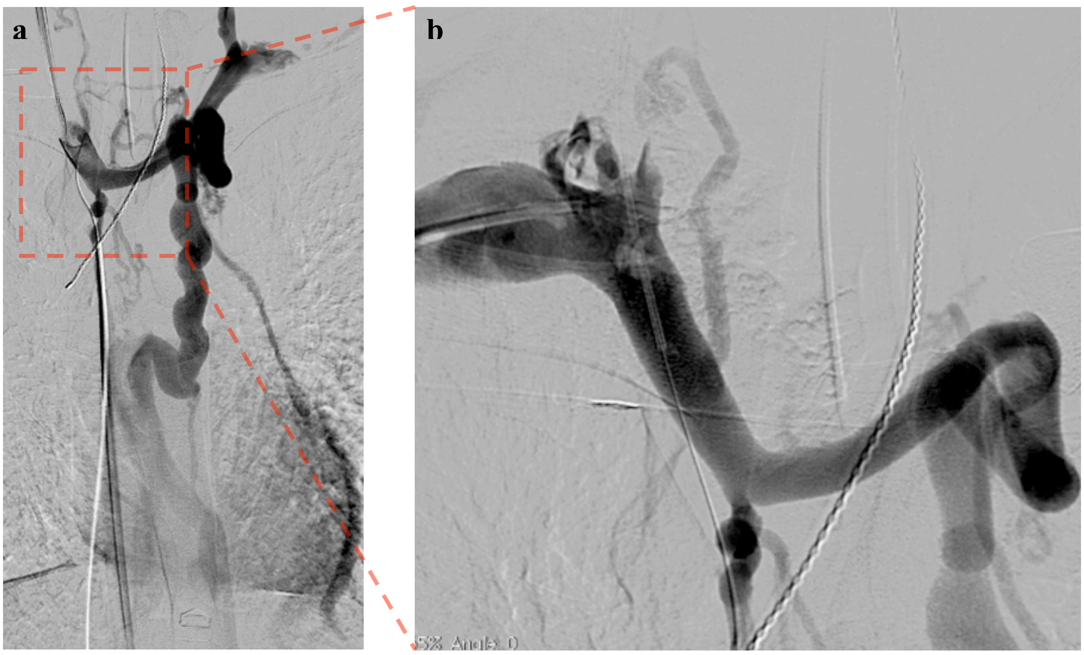

Figure 5: Venogram images demonstrating: **a:** initial advancement of the wire into the right brachicephalic vein following IVUS-guided puncture using the re-entry catheter. **b:** magnified image of the same region after snaring the wire and pulling it into the right IJV sheath.

A venogram via the right IJV sheath demonstrated minimal contrast extravasation.
The transgressed segment was subjected to conventional balloon dilatation using a Stirling™ SL 3 x 100 mm balloon **(Fig 6)**.

Figure 6: Venogram image obtained during balloon dilatation of the newly created tract.
There was no contrast extravasation.

Pre-dilation allowed for accurate positioning of a Wallstent, inserted via the IJV sheath and positioned bridging the inferior portion of the occluded SVC and the right brachiocephalic vein. Stent deployment was followed by balloon angioplasty to 10mm without complication **(Fig 7)**.

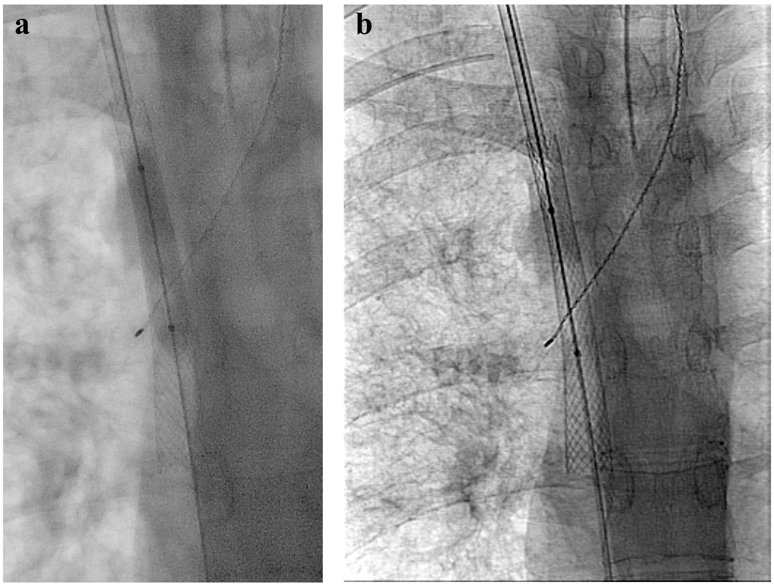

Figure 7: Fluoroscopic images demonstrating the covered stent in situ during and following balloon angioplasty.

A completion venogram demonstrated a patent stent with inline flow of contrast from the right IJV to the right atrium and no active bleeding **(Fig 8).** There were no post procedure complications and a CT venogram four months later demonstrated a patent SVC stent and a marked reduction in size of the superficial and deep venous collaterals **(Fig 9)**. This translated into resolution of the patient's symptoms of SVCO.

Figure 8: Completion venogram demonstrating a patent SVC stent in situ.

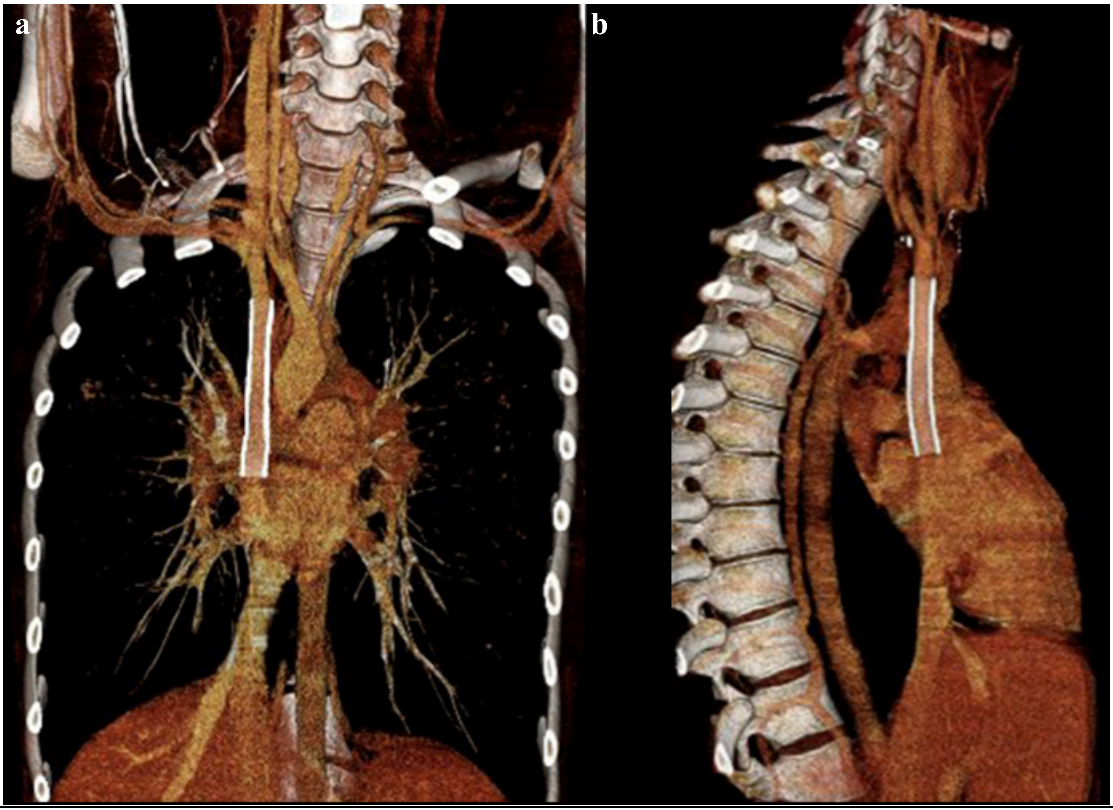

Figure 9: 3D volume render (coronal (**a**) & sagittal (**b**)) from a follow-up CT venogram, four months after the procedure demonstrating a patent stent and marked reduction in collateral blood flow.

Conclusion:
SVCO is traditionally associated with advanced mediastinal malignancy. Increasingly however, this is seen in patients with benign disease requiring multiple central venous lines during the course of their illness. While most patients with SVCO can be treated with conventional tools, re-entry devices may provide an additional tool in the interventional radiologist's armamentarium to deal with this complication. IVUS in particular, may reduce the risks associated with such procedures.