Suprahepatic Inferior Vena Cava Recanalization: A Case Report

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Abstract

Background:

Sharp recanalization for crossing short segment suprahepatic inferior vena cava (sIVC) occlusion using an endovascular route has been previously described and can be challenging. However, there are no modifications to the technique described in the literature, in case of unsuccessful attempt at endovascular recanalization.

Case Presentation:

Here, we describe the use of percutaneous direct transhepatic access into the sIVC under ultrasound guidance with eventual sharp recanalization of the occluded segment of the sIVC, in a woman with Budd-Chiari syndrome with chronic blood loss anemia.

Conclusions:

This novel approach has not been described in the literature and can serve as an important addition to guide complex sIVC recanalization.

Background

Chronic or subacute occlusion of suprahepatic inferior vena cava (sIVC) is often asymptomatic or minimally symptomatic prior to disease progression. These patients typically have large hepatic vein collaterals. Disease progression sequelae include portal hypertension causing abdominal pain, hepatomegaly, jaundice, ascites, varices, and more rarely gastrointestinal bleeding [1,2]. Medical management including anticoagulants, diuretics, and endovascular recanalization with stenting and venous bypass surgery are the treatment options for a clinically symptomatic short-segment occlusion of the sIVC [3,4]. Patients undergoing IVC stent placement have shown improvement in venous outflow [5]. This case report describes a transhepatic approach to aid sIVC occlusion recanalization in a patient after a failed transfemoral approach.

Case Presentation

A 51-year-old female with a past medical history of fibromyalgia, iron deficiency anemia, hypertension, and obesity presented to an outside hospital for evaluation of protruding veins on her abdomen and chronic blood loss anemia. Endoscopy revealed grade 1 esophageal varices and liver biopsy was consistent with Budd Chiari syndrome (BCS). Inferior vena cava (IVC) venogram confirmed occlusion at the level of the sIVC (Fig. 1) with multiple retroperitoneal and abdominal wall collaterals draining the suprarenal IVC. IVC pressure was 23 mmHg and right atrial pressure was 12 mmHg. She had undergone unsuccessful attempts at sharp recanalization of the sIVC through transfemoral route at an outside hospital and was referred to our institution for recanalization of the sIVC for portal decompression.
Initial attempt at sharp recanalization through a transfemoral approach was pursued. A Rösch-Uchida transjugular liver access set (Cook, Inc.) was advanced and localized in the intrahepatic IVC using a curvilinear probe. Under continuous sonographic and fluoroscopic guidance, a 21-gauge Chiba needle was advanced through the cannula and used to puncture the sIVC. Subsequently, a V-14 wire was advanced through the needle into the right atrium. Cone beam CT was performed demonstrating the wire coursing through the IVC, hepatic parenchyma, and into the right atrium. Subsequently, a 4-French glide catheter was advanced over the V-14 guidewire into the right atrium. The catheter was then retracted and an over the wire tractogram was performed demonstrating contrast pooling into the pericardial space on cone beam CT (Fig. 2), consistent with a trans-pericardial course into the right atrium. This was attributed to the relative anatomy of the sIVC, which was short and in the same horizontal plane as the intrahepatic IVC (iIVC) segment. Hence to target the sIVC for sharp recanalization, the initial thought was to place a Fogarty balloon in the sIVC via a percutaneous direct transhepatic approach. Under sonographic guidance, a 21-G Chiba needle was advanced through the hepatic parenchyma into the patent sIVC. The needle traversed the overlying middle hepatic vein (MHV) into the sIVC (Fig. 3). A 0.018 inch micro-guidewire was advanced into the right atrium and the needle was exchanged for a 6-French Neff set (Cook, Inc.). A 4-French glide catheter was then advanced coaxially into the right atrium and used to perform an over the wire tractogram to exclude an inadvertent trans-pericardial course. Tractogram confirmed a non-trans-pericardial course and also showed opacification of the infrahepatic IVC from the MHV (Fig. 4A). Given this finding, attempts to snare the wire in the MHV from a transfemoral approach was performed to pursue stenting extending from the iIVC across the MHV and into the sIVC. However, instead of a straighter course, the wire and the catheter looped around the hepatic dome, to ultimately grasp the wire coursing through the MHV (Fig. 4B). Cone beam CT was performed demonstrating the wire and catheter passing through intrahepatic collaterals bridging the right hepatic vein (RHV) and MHV with complete occlusion at their confluence. Considering this complete occlusion, recanalization of the sIVC from transjugular approach was pursued. The wire which was placed through the direct percutaneous transhepatic approach into the sIVC was snared through the right jugular access and a 5 Fr Kumpe catheter was advanced over the wire into the MHV through the sIVC. Multiple attempts at crossing the occlusion between the MHV and the RHV using catheter wire combination were performed but were unsuccessful. Finally, the Kumpe catheter was exchanged for a Rösch-Uchida TIPS cannula and the 21 G-Chiba needle was used for sharp recanalization between the MHV and the RHV. A glidewire was then advanced into the infrahepatic IVC. Thereafter, angioplasty of the recanalized intrahepatic segment was performed to 10 mm. No extravasation was identified. A 14 mm x 60 mm Zilver Vascular Self-Expanding stent (Cook Inc.) was deployed across the areas of occlusion extending from the infrahepatic IVC into the MHV and into the sIVC with good flow thought the stent. There was no gradient across the IVC, post stenting. The patient demonstrated clinically improvement with decreased size of her varices, is experiencing no symptoms post-procedure, and has had no complications secondary to the endovascular procedure. Her post procedure CT 8 months later shows a patent IVC stent with interval decompression of the venous collaterals (Fig. 5).

**Discussion**
BCS is a rare disorder characterized by hepatic venous outflow obstruction and can include the sIVC, hepatic vein, or a combination of both \[6\]. Like many cases presented previously, the technical challenge to endovascular management of BCS is recanalization of the hepatic vein or suprahepatic IVC \[7\]. Our case demonstrated the multiple areas of obstruction involving the IVC and the hepatic veins and also the relative anatomy of the sIVC with respect to the iIVC preventing a direct connection from an endovascular approach. The use of transhepatic access into the sIVC via the MHV provided a bridge between the MHV and sIVC and was also helpful for sharp recanalization between the MHV and the RHV via a transjugular approach aiding this complex recanalization.

**Conclusion**

BCS can present with various levels of obstruction, sometimes causing symptomatic portal hypertension. Careful assessment of the level of IVC and intrahepatic obstruction, on cross sectional imaging and preprocedural venograms can aid the planning for recanalization. Transhepatic approach, in appropriate cases, can be used as a viable addition to a bidirectional approach for recanalization of complex sIVC occlusion.

**Abbreviations**

sIVC – suprahepatic inferior vena cava  
IVC – inferior vena cava  
BCS – Budd-Chiari syndrome  
iIVC – intrahepatic inferior vena cava  
MHV – middle hepatic vein  
RHV – right hepatic vein  
TIPS – transjugular intrahepatic portosystemic shunt

**Declarations**

**Ethics approval and consent to participate:** Ethical approval for this case report was waived and informed consent was obtained from the patient presented here.

**Consent for publication:** Consent for publication was obtained from the patient presented in the above report.

**Availability of data and material:** Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.
Competing interests: The authors declare that they have no competing interests.

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Authors’ contributions: PS: Performed preliminary chart review and writing of abstract and case presentation. DW: Writing of discussion and conclusion sections and responsible for final editing and submission. IM: Responsible for preliminary chart review. EK: Responsible for preliminary chart review. RV: Performed procedure and overseeing all writing and editing of manuscript.

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Compliance with Ethical Standards

This study was not supported by funding. The authors declare that they have no conflicts of interest. For this type of study, formal consent is not required. Consent for publication was obtained for every individual person's data included in the study.

References


Figures
Figure 1

IVC venogram during attempted sharp recanalization shows complete occlusion of the iliVC and a patent RHV (arrow)
Figure 2

Cone beam CT during recanalization from transfemoral approach shows contrast in the pericardial space (arrow) confirming trans-pericardial course
Figure 3

Ultrasound guided percutaneous access into the sIVC (black arrow) and right atrium (asterisk) with needle through the MHV (white arrow)
**Figure 4**

*Figures 4A, B* Pull-back tractogram through the transhepatic catheter (white arrow) shows **Fig 4A** MHV (white asterisk) draining through a large intrahepatic collateral (white arrow) into the RHV (black arrow) and finally to the iIVC (black asterisk); **Fig 4B** Corresponding fluoroscopic image during snaring of the transhepatic wire (white arrow) in the MHV through the IVC (black arrow), demonstrates the course of the wire connecting the MHV and RHV through intrahepatic collaterals (asterisk)
Figure 5

Follow-up CT shows patent stent (arrow)