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CASE REPORT

Large-Bore Mechanical Thrombectomy for Subacute Portal Vein Thrombosis in Patient With Acute Bleeding

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Portal vein thrombosis remains a clinical challenge with limited treatment options. A patient was admitted with decompensated nonalcoholic steatohepatitis and a history of recurrent esophageal and gastric variceal hemorrhages. Contrast-enhanced computed tomography revealed hepatic cirrhosis with concomitant and extensive thrombosis of the portal, splenic, and superior mesenteric veins. The patient was treated with transjugular intrahepatic portosystemic shunt and mechanical thrombectomy with the FlowTriever System (Inari Medical, Irvine, CA). Post-thrombectomy venography and follow-up computed tomography demonstrated patency and brisk flow. This case report shows that mechanical thrombectomy with the FlowTriever System is promising for treating extensive and subacute portal vein thrombosis.

Keywords: Flowtriever; Inari; Mechanical Thrombectomy; Portomesenteric Vein Confluence

Introduction

Splanchnic vein thrombosis is a rare, life-threatening manifestation of venous thromboembolism and encompasses thrombotic obstruction of the abdominal veins. Portal vein thrombosis (PVT) is the most common presentation of splanchnic vein thrombosis and has been reported at 1% in the general population[1] and up to 26% in patients with liver cirrhosis[2–4] and awaiting transplant.[5] Although acute PVT can be treated with anticoagulation and thrombolysis, they have been associated with considerable complication rates (eg, major bleeding and acute kidney injury) and are contraindicated in cases with variceal bleeding.[6–11] On the other hand, subacute and chronic PVT involve cavernous transformation of the portal vein, require recanalization to re-establish in-line flow, and do not have established treatments. With this case, we show that combined transjugular intrahepatic portosystemic shunt (TIPS) creation and mechanical thrombectomy can effectively treat even subacute PVT by removing organized fibrinous clot.

The FlowTriever System (Inari Medical, Irvine, CA) is designed for nonsurgical, rapid removal of thromboembolism from peripheral vasculature without the need for thrombolytics, representing a viable treatment modality for this patient population.[12–14] The FlowTriever System includes a large-lumen Triever aspiration catheter (in 16, 20, or 24 French [F]) and a large-bore syringe designed to rapidly aspirate thrombus.

We describe the case of a critically ill patient with cirrhosis and extensive concomitant subacute thrombus.

Case Report

Patient History

A 61-year-old woman presented with severe abdominal pain and decompensated nonalcoholic steatohepatitis complicated by diabetes mellitus, anemia, thrombocytopenia, hepatic encephalopathy, and recurrent hospitalizations for esophageal and gastric variceal hemorrhage.

Initial Examination

Endoscopy demonstrated grade III varices in the distal esophagus with stigmata of recent bleeding. Variceal ligation achieved partial resolution.

Model For End-Stage Liver Disease was 18. Prior-admission contrast-enhanced computed tomography (CT) (Figure 1) demonstrated hepatic cirrhosis with occlusive thrombus in the right, left, and main portal veins (MPV) and continuation of nonocclusive thrombus into the portosplenic confluence, the splenic vein (SV) immediately adjacent to the confluence, and the cephalad aspect of the superior mesenteric vein (SMV). Evidence of portal hypertension was characterized by congestive splenomegaly, abdominal varices, and a spontaneous splenorenal shunt. Severe thickening of the ascending colon wall was interpreted as possible ischemia.

Care Plan and Management

Portal vein recanalization with TIPS was performed under general anesthesia. To remove the extensive and

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Figure 1. Axial CT images show thrombotic occlusion of the main portal vein (A) into the SMV (yellow arrow) (B) confluence with the splenic and superior mesenteric veins (yellow arrow demonstrating the thrombosis). (C) Thrombus in the intrahepatic portal vein.

subacute thrombus, same-session mechanical thrombectomy was pursued as anticoagulation and thrombolytics were contraindicated due to high bleeding risk.

Access Sites

Transjugular access to the right hepatic vein was obtained. Wedged CO_2 portal venogram and liver puncture demonstrated extensive collateralization (Figure 2A).

Transsplenic access to the SV, SMV, and MPV was obtained. The MPV was catheterized using a Kumpe catheter, and a 10-mm angioplasty balloon (Mustang balloon dilation catheter; Boston Scientific, Marlborough, MA) was inflated. An Amplatz wire (Boston Scientific, Marlborough, MA) was advanced from the SV access to the transjugular access using a through-and-through technique.

TIPS Complicated by Extensive Thrombus

Concomitant venography of the portal vein and splenomesenteric confluence demonstrated thrombus within the SV, SMV, and MPV (Figure 2C), with collateralization consistent with subacute thrombosis. An 8- to 10-mm diameter-controlled expansion Viatorr polytetrafluoroethylene–covered stent-graft (2 cm uncovered/8 cm covered) for TIPS (WL Gore & Associates, Flagstaff, AZ) was deployed and inflated to nominal diameter. Postdeployment venography (Figure 2C) confirmed extensive subacute thrombus in the portomesenteric system.

Mechanical Thrombectomy

The patient's history, CT findings, and extensive thrombus necessitated expedient intervention. Immediately, mechanical thrombectomy with the FlowTriever System was selected due to patient contraindications and the subacute nature of the thrombus. Thrombus was manipulated and removed (estimated 90%, Figure 3A and B) using a 20F Triever catheter inserted over the wire via the TIPS. An overlapping 12-mm bare-metal SMART stent (Cordis, Santa Clara, CA) was placed at the portal end of the TIPS to improve flow. Angioplasty of the MPV and the portomesenteric confluence (PMC) was performed. Further coil embolization of residual varices was performed around the left coronary vein. Several additional fundal short gastric varices were embolized.

Celiac angiogram with delayed venous phase demonstrated patency of the SV, TIPS, and PMC (Figure 3C). A direct portal venogram through the TIPS showed patency of

Figure 2. Initial CO_2 (A) and direct venogram (B) demonstrating extensive collateralization of the portal vein and thrombus at the portosplenic confluence. (C) Venogram following TIPS procedure demonstrating occlusive thrombus at the portosplenic confluence.

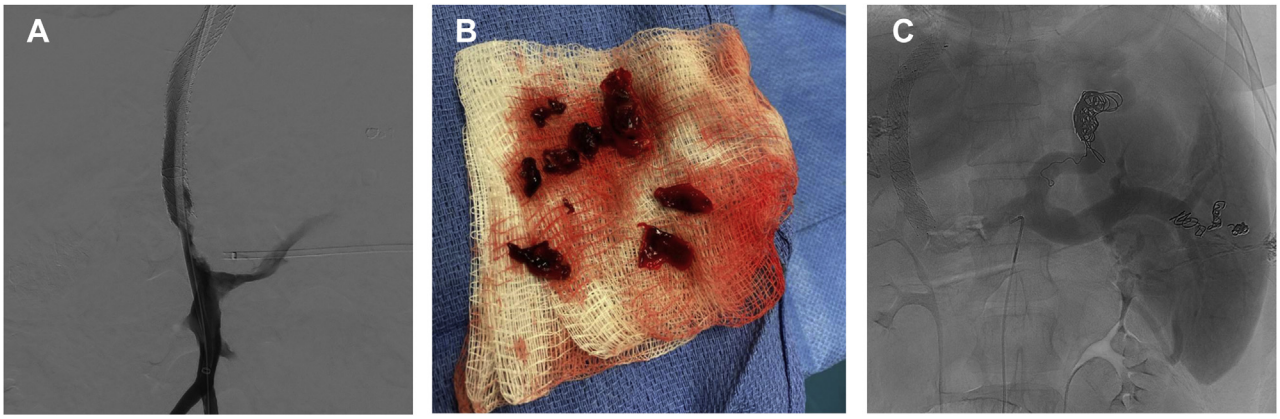

Figure 3. (A) Portogram with contrast injection into the SMV demonstrating the recanalized portal vein and portomesenteric confluence after mechanical thrombectomy with the FlowTriever System. (B) Subacute thrombus removed by the FlowTriever System. (C) Angiogram with delayed venous phase in celiac artery trunk demonstrating patency of portosplenic confluence.

the SMV and MPV with brisk flow. The patient developed a small amount of intrahepatic bleeding (related to cirrhosis-associated coagulopathy) that required embolization of a right anterior hepatic artery branch. No other complications were noted during the procedure. The patient improved clinically without further bleeding and was discharged on a regimen of enoxaparin at therapeutic doses for 3 months.

Thirty-Day Follow-up

Thirty-day follow-up CT venogram (Figure 4) and duplex ultrasound (Figure 5) demonstrated patency of the portosystemic shunt and PMC with resolution of colonic wall thickening and improvement of gastrointestinal bleeding.

Discussion

Reestablishing flow in an occluded portal vein is challenging due to thrombus age, size, location, and the degree of infiltration.[15] Therapeutic decision-making is also impacted by collateralization, bleeding, existing comorbidities, and contraindications or delayed response to anticoagulants and thrombolytics.[6–17]

This is the first case report to show successful treatment of extensive and subacute thrombus burden in the portomesenteric system with the FlowTriever System in a decompensating patient with limited treatment options. The authors show that the FlowTriever System provided a safe method to remove the more organized, fibrinous clot without fragmentation, without being concerned of a potential embolization. Other devices have been presented in the setting of PVT to treat acute, rather than subacute, thrombus.[12–20] One case report of collateralized, subacute PVT presented that mechanical thrombectomy with Angiojet (Boston Scientific, Marlborough, MA) alone was insufficient to restore flow and that additional thrombolysis was required.[18,19] The Indigo system (Penumbra, Alameda, CA) can also be used for direct thrombus aspiration, but rapid blood loss can be of concern. In this case study, the FlowTriever System led to optimal results with no substantial blood loss. The recent addition of the FlowSaver Blood Return System to the FlowTriever System should be investigated to further minimize blood loss during PVT recanalization.

This single-session procedure was safe and efficient with no associated clinical complications. While additional

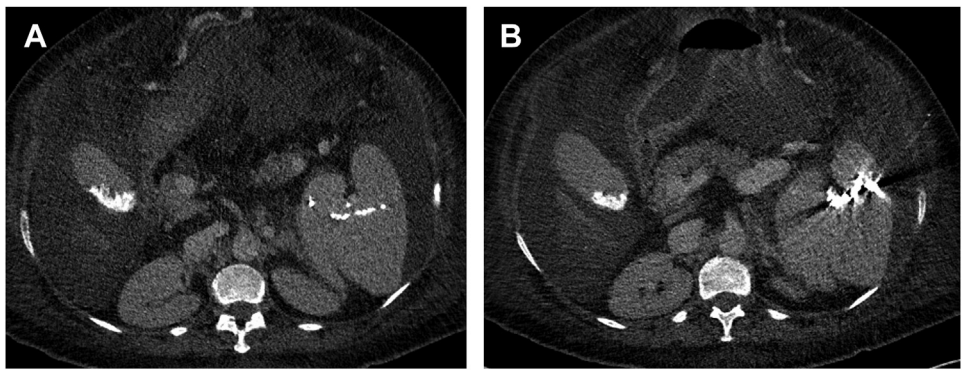

Figure 4. Follow-up axial CT imaging demonstrating resolution of thrombus in (A) the portal vein and (B) portomesenteric confluence.

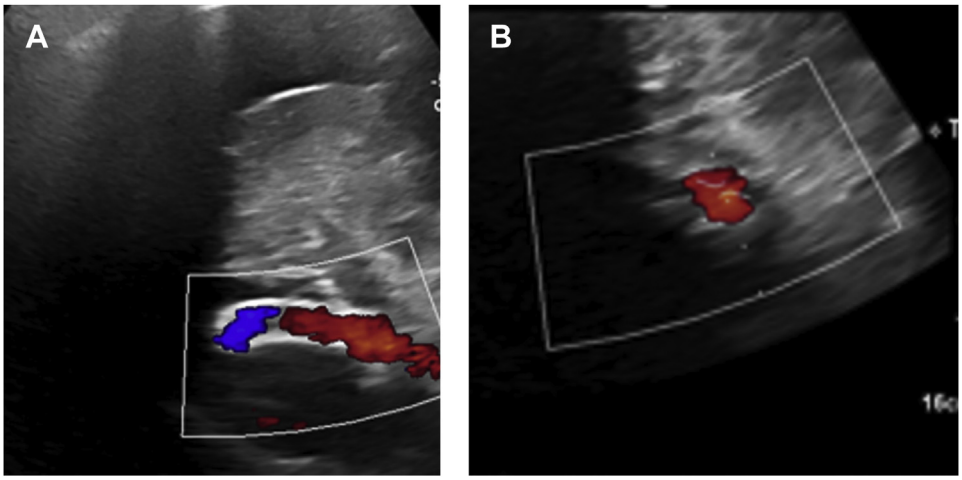

Figure 5. Thirty-day follow-up Doppler ultrasound showing patency of (A) TIPS at the Portal vein end and (B) restablished flow at the portomesenteric confluence.

studies are required, this report demonstrates that the FlowTriever System offers an effective technique to remove extensive and acute-to-subacute portomesenteric thrombus during TIPS procedures.

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The corresponding author, on behalf of all authors, jointly and severally, certifies that their institution has approved the protocol for any investigation involving humans or animals and that all experimentation was conducted in conformity with ethical and humane principles of research.