Pharmacomechanical thrombectomy for salvage of TIPSS via successful clearance of occlusive porto-splenic venous thrombosis

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Abstract

Transjugular intrahepatic porto-systemic shunt (TIPSS) is increasingly used to treat chronic portal vein thrombosis. However shunt thrombosis is a recognised early complication, particularly in those with thrombophilia. We outline a case of non-cirrhotic portal hypertension secondary to chronic portal vein occlusion where TIPSS was successfully performed but rapidly complicated by shunt thrombosis with extension into the portal and splenic veins. Mechanical thrombectomy and low dose systemic pharmacological thrombolysis were of limited benefit. Combined pharmacomechanical thrombectomy with the Trellis system restored patency of the TIPSS, portal and splenic veins, with resultant good flow into the TIPSS. The patient remains well three months post-procedure. We describe the first case where the Trellis system has been successfully used to clear occlusive porto-splenic thrombus and restore flow through a blocked TIPSS. (Acta gastroenterol. belg., **2016**, 79, **47-51**).

Key words : portal hypertension, thrombosis, TIPSS, pharmacomechanical thrombectomy, ascites, portal vein.

Introduction

Treatment options for portal vein thrombosis (PVT) are diverse but limited in efficacy (1). Transjugular intrahepatic porto-systemic shunt (TIPSS) is frequently used in symptomatic portal hypertension to treat refractory variceal bleeding and ascites, or as a bridge to liver transplantation. A growing indication is for the treatment of chronic portal vein thrombosis (PVT), including those patients who undergo cavernous transformation (2). Thrombosis of the shunt is an established early complication of TIPSS insertion, but is less frequent in covered stents in comparison to bare metal stents (3). Such occlusion can result in thrombosis of the portal, mesenteric and splenic veins due to reduction in flow through the liver, and by extension, the portal venous system. Whilst a variety of aetiologies may cause PVT, in non-cirrhotics, an underlying thrombophilia is often present (1), which may predispose to such thrombotic complications. Anticoagulation and pharmacological thrombolysis may be of benefit in treating post-TIPSS thrombosis, though little evidence exists to guide its use. More aggressive approaches using endovascular techniques may also be employed. The Trellis system, originally developed for treatment of deep vein thrombosis, combines pharmacological thrombolysis and mechanical clot disruption. It consists of a multi-hole infusion catheter bracketed by two occlusion balloons to create an isolated segment within which the thrombolytic is delivered. Within the infusion segment, a rotary motor is activated to drive an oscillating wire to help dispersal of the thrombolytic, and also to provide mechanical fragmentation. The Trellis avoids systemic exposure to thrombolytic agents and thus can have targeted higher doses in the isolated segment. Additionally fragmented clot is trapped between the balloons, avoiding embolisation.

We present what to our knowledge is the first case where the Trellis pharmacomechanical thrombolysis system has been used to restore flow through a thrombosed TIPSS inserted to treat chronic PVT ; via clearance of occlusive porto-splenic thrombus, where more established methods were unsuccessful.

Case Report

A 36 year old male with a past medical history of well controlled, uncomplicated Crohn's disease had developed idiopathic non-cirrhotic portal hypertension (based on clinical, imaging findings and transhepatic biopsy). A venous phase contrast-enhanced CT performed four years ago had demonstrated longstanding thrombotic portal vein occlusion and oesophageal varices, which were treated with banding that year due to symptomatic bleeding.

He presented to his local hospital in May 2013 with hematemesis and melaena. Upper gastrointestinal endoscopy demonstrated numerous unbandable varices with evidence of bleeding that were treated with sclerotherapy. Liver function tests were within local normal ranges. CT findings were unchanged demonstrating thrombosis of both the intra-and extra-hepatic portal vein with cavernous transformation and oesophageal varices (Fig. 1). The superior mesenteric vein and splenic vein were patent. Two days later he had a further massive upper GI bleed and was haemodynamically compromised and so was intubated and stabilised with insertion of a Sengstaken-Blakemore tube. He was transferred to our institution for emergent TIPSS insertion.

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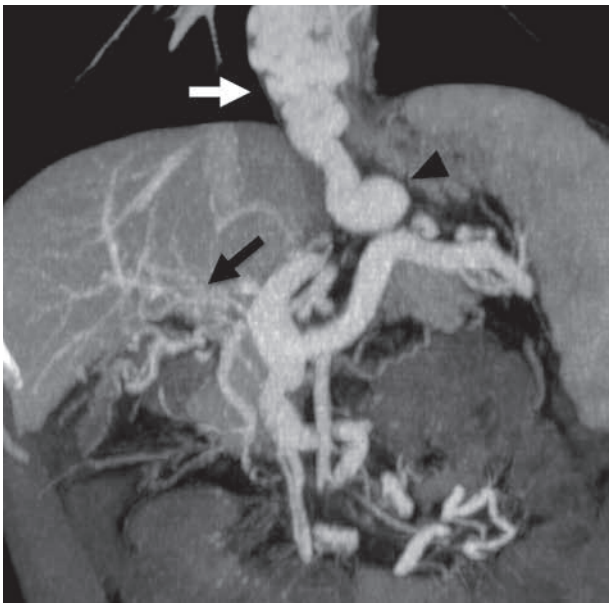

Fig. 1. — Maximum intensity projection coronal portal venous CT of the upper abdomen demonstrates cavernous transformation of the portal vein (black arrow), and profuse oesophageal varices (white arrow) supplied by an enlarged left gastric vein (black arrowhead). Splenomegaly is also present.

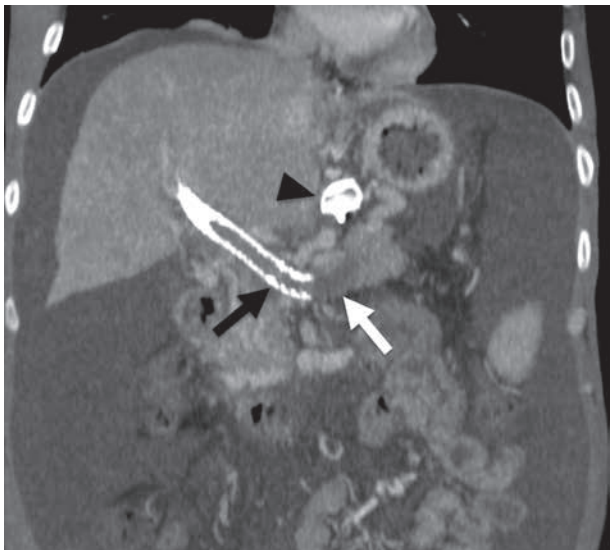

Fig. 2. — Coronal portal venous phase CT demonstrates extensive thrombus within the TIPSS (black arrow), portosplenic confluence and distal splenic vein (white arrow). Two Amplatzer II plugs have been used to embolise the left gastric vein (black arrowhead). Note the extensive ascites.

Under general anaesthesia the right internal jugular vein was punctured and a 10F Arrows sheath (45 cm) was inserted. The right hepatic vein was selectively catheterized using a 5F cobra catheter. The Rösch-Uchida access set (Cook Medical, Limerick, Ireland) was used to puncture a right portal venous collateral via the right hepatic vein under ultrasound guidance, and a wire was manipulated via this collateral back into the patent portal confluence. A small amount of superior mesenteric venous thrombus was present. An enlarged left gastric vein was identified supplying the large (volume) oesophageal varices. This was embolised using three Amplatzer II plugs (20 and 22 mm size) (St. Jude Medical, Minnesota, USA) deployed through a 6 Fr destination sheath through the original 10 Fr sheath. Two overlapping 10 mm (7 cm plus 2 cm – total intrahepatic tract length 8 cm) VIATORR stents (W.L. Gore & Associates, Newark, USA) were deployed. The Viatorr stent graft was post dilated with a 10 mm × 40 mm XXL balloon (Boston Scientific, Marlborough, USA). Due to the small calibre of the portal venous collateral the covered portion was landed in the portal confluence. The uncovered portion was across the superior mesenteric vein. The proximal end was sited in the mid right hepatic vein. Excellent flow was seen across the TIPSS at the end of the procedure without filling of the varices, with pressure gradient across the shunt of 10 mmHg. The patient was discharged 13 days post TIPSS, the additional delay due to hospital acquired pneumonia.

16 days later, the patient re-presented with abdominal distension. An ultrasound demonstrated absence of flow within the TIPSS and large volume ascites. A thrombophilia screen was negative. Four days later, venography was performed and confirmed minimal flow in the TIPSS, due to the presence of extensive thrombus. Balloon dilatation was performed through the length of the stent, combined with mechanical thrombolysis using a Cleaner device (Rex Medical, L.P., Conshohocken, USA) from splenic vein to hepatic vein, with minimal improvement. No portosystemic pressure measurements were deemed necessary given the frankly occluded portal system. The TIPSS was extended superiorly with a further 10 mm × 7 cm VIATORR stent to improve efflux of blood into the systemic venous system, and therefore flow through the TIPSS ; and repeat balloon dilatation and mechanical thrombolysis performed. Following this, flow was eventually re-established from splenic vein through the TIPSS. The patient was heparinized, firstly with unfractionated heparin (loading dose 5000 IU) and then converted to therapeutic dose subcutaneous low molecular weight heparin.

A CT scan was performed four days later due to persistent abdominal distension. This demonstrated occlusion of the entire TIPSS and portal vein, with occlusive clot within the distal portions of the splenic and superior mesenteric veins, near the portosplenic confluence, and gross ascites (Fig. 2). Cavernous transformation of the portal vein was again seen with numerous collaterals visible around the gallbladder and multiple other portosystemic collaterals. Low dose (0.04 mg/kg/hr) systemic thrombolytic therapy was commenced using intravenous alteplase (Actilyse ; Boehringer Ingelheim, Bracknell, UK) for two days.

Venography was performed under conscious sedation a day later. The TIPSS was cannulated via a 10 Fr sheath

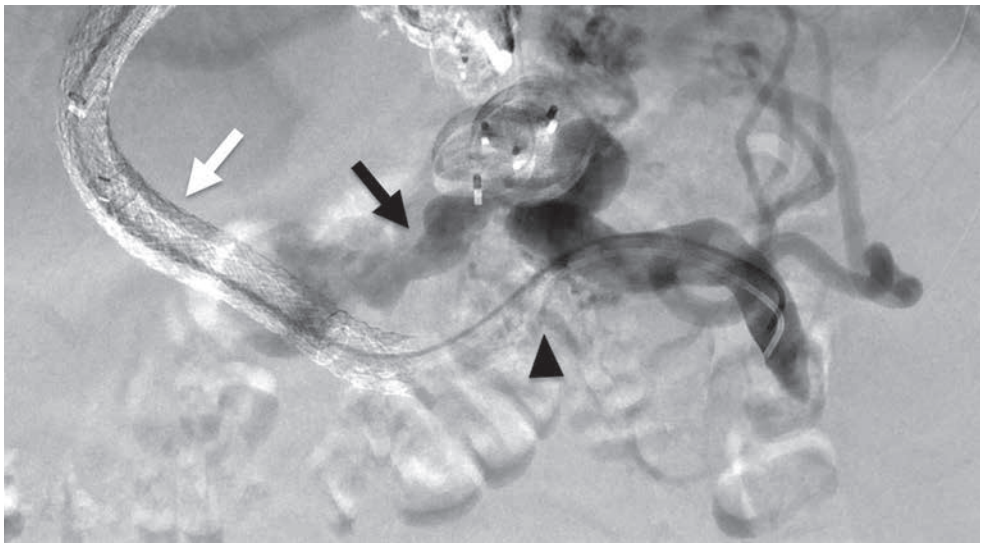

Fig. 3. — Venography shows occlusive thrombus within the distal splenic vein (black arrowhead) and no flow through the TIPSS (white arrow). A large collateral vessel has reopened (black arrow).

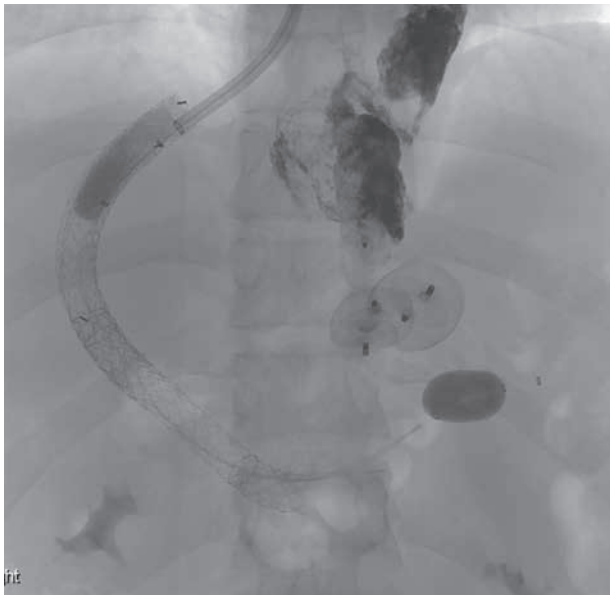

Fig. 4. — The Trellis device *in situ* with occlusion balloons in the TIPSS and splenic veins.

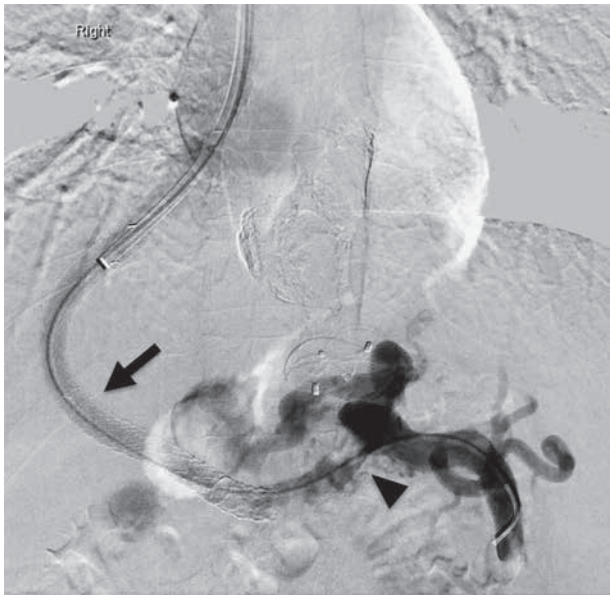

Fig. 5. — Post-pharmacomechanical thrombectomy there is restoration of flow through the TIPSS (black arrowhead) and significantly less flow through the collateral. Some non-occlusive splenic vein thrombi remains (black arrowhead).

in the right internal jugular vein and a catheter was advanced to the distal splenic vein. Contrast injection confirmed an occluded splenic vein with no flow to the TIPSS and drainage via a large collateral that had reopened (Fig. 3). A Trellis pharmacomechanical thrombectomy device with 15 cm infusion length (Covidien, Dublin, Ireland) was exchanged over a wire through the TIPSS and was placed such that the distal balloon was inflated in the distal splenic vein and the proximal balloon in the cephalad portion of the TIPSS (Fig. 4). A 5000 IU bolus of heparin was administered via the sheath. The oscillating wire component of the Trellis was activated (to aid dispersal of thrombolytic in the isolated segment) for two 10-minute runs with a total 20 mg tPA delivered locally between the occlusion balloons. Liquefied thrombus was aspirated via the Trellis. A further 2000 IU bolus of intravenous heparin was administered immediately post-procedure. A good venographic result was obtained with restoration of splenic flow, hepatopetal flow within the portal vein and good flow through the TIPSS (Fig. 5). The entire procedure took approximately 90 minutes to complete. The patient continued on an unfractionated heparin infusion (18 IU/kg/hour) and was warfarinised. An ultrasound two days post procedure showed good flow in the TIPSS and resolution of the ascites, and the patient was discharged. Similar sonographic findings

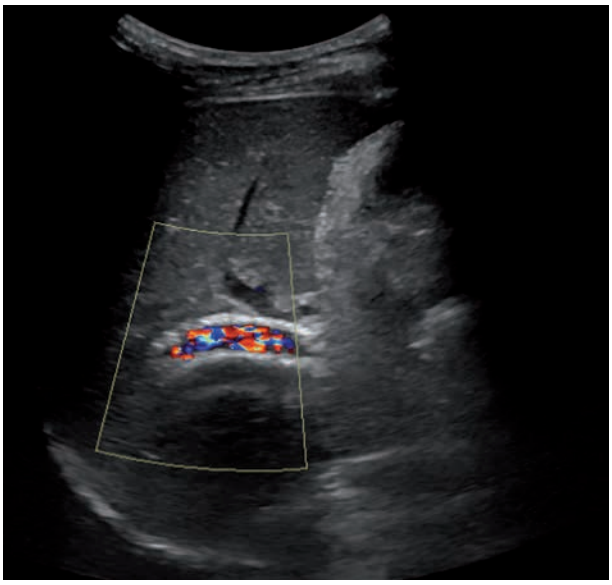

Fig. 6. — Colour Doppler ultrasound shows excellent flow through the TIPSS one-month post-Trellis thrombectomy.

were described a month post-procedure (Fig. 6). The patient remains well and free of ascites at his most recent outpatient follow up, three months post procedure.

Discussion

Management of PVT can be challenging and treatment options depend on the chronicity of the thrombosis. Medical therapies include anticoagulation and pharmacological thrombolytic therapy, which may not be successful in subacute or chronic cases, and entail risk of haemorrhage. Surgical shunt creation may also be employed in selected cases. The interventionalist has a role to play in treating PVT, with both catheter-directed thrombolysis and mechanical thrombectomy having been described (1). As well as established indications of refractory ascites and variceal bleeding, TIPSS is increasingly being used to treat chronic portal vein thrombosis (2,4). TIPSS is a particularly elegant method for recanalising the portal vein as the shunt to the systemic venous system ensures rapid efflux from the liver, encouraging brisk flow through the portal system, with improved rheology reducing the likelihood of re-thrombus. Nonetheless, shunt thrombosis is a recognised acute complication of TIPSS insertion, and in particular in those with thrombotic tendencies.

Small studies have demonstrated the efficacy and safety if systemic lysis in portal vein thrombosis. In our institution systemic thrombolysis has been used successfully in patients with mesenteric vein thrombosis. The recent TIPSS procedure probably increased the risk of haemorrhagic complications, but given the failed recent procedure and lack of other treatment options it was thought the potential benefits outweighed the risks.

The position of the initial TIPSS graft was thought to be satisfactory given the excellent flow and satisfactory gradient. In retrospect the position was sub-optimal and studies have shown that TIPSS extending to the junction of the hepatic vein and the inferior vena cava have longer lifespans than shunts terminating in the hepatic vein. Clark *et al*. demonstrated primary patency rates at 12 months were 36% ± 10% among patients with the outflow portion of the stent-grafts terminating in the hepatic vein and 58% ± 8% among patients with the outflow portion of the stent-grafts terminating at the hepatocaval junction (5).

The sub-optimal position of the initial TIPSS stent was remedied at the second procedure with superior extension to the hepatic vein/inferior vena cava confluence. The position may have predisposed the patient to delayed dysfunction due to outflow stenosis, however we feel the initial thrombosis is unlikely due to outflow stenosis due to the short interval to stent thrombosis.

The Trellis device has been successfully used in the treatment of both arterial (6) and venous thrombosis (7) in the upper and lower limbs, and within the aorta and inferior vena cava. Two reports have described the use of the Trellis system in portal venous occlusion. Darcy (8) performed a combined TIPSS and Trellis thrombectomy. Lorenz *et al*. (9) used a transhepatic approach to use the Trellis to clear portomesenteric thrombosis in a liver transplantee. Our case is the first described where recanalisation of an occluded TIPSS and clearance of occlusive portosplenic thrombus has been achieved using the Trellis. The Cleaner device solely perfoms mechanical maceration of thrombus. In contrast the Trellis system provides both mechanical thrombolysis and concentrated pharmacological thromlytic therapy. We hypothesise the reason why there was early and recurrent shunt thrombosis was the Cleaner procedure and not Trellis was insufficent thrombus clearance and thus insufficient flow to maintain patency.

Given our patient's recurrent and persistent thrombosis it was decided to perform two 10 minute runs (for a total of 20 minutes) with the Trellis system rather than a single 10 minute run as in the previously described similar cases (8,9). However longer treatment regimes such as ours have been described previously (4). Whilst a small amount of non-occlusive splenic thrombus remained after the Trellis runs (Fig. 5) it was thought that the increased flow through the portal system would clear this, and so further intervention was not performed. Equally it was decided that the TIPSS should not be extended further inferiorly as this would cover the portal confluence, leading to difficulties with mesenteric venous drainage and limiting access for further intervention if necessary.

In summary we have demonstrated the Trellis system can provide safe and effective clearance of refractory thrombus in an acutely occluded TIPSS and the downstream portal and splenic veins. Such aggressive management may be required in those with highly prothrombotic states, which are common in non-cirrhotic portal vein thrombosis (10).

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