

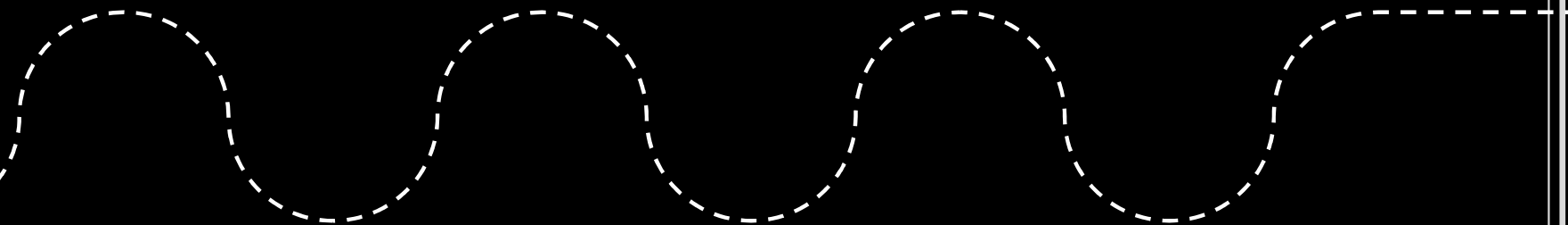


Canadian Association for
Interventional Radiology
Association canadienne pour
la radiologie d'intervention

Annual Scientific Meeting 2022

**Case Presentation : Alanna Supersad (PGY₃ University of
Alberta)**

One Patient's Multi-Procedure Procedural Path



Teaching Points

- ▣ Indications and Contraindications of TIPS
- ▣ Interventional approaches to managing varices including BRTO, BATO, PARTO, TIPS
- ▣ Intraprocedural complication during BRTO
- ▣ Delayed complications of embolization coils

Clinical History

51 year old female presenting with gastric variceal bleeding.

History of primary biliary cholangitis (PBC) and portal hypertension with gastric varices and splenomegaly.

Initial MRI workup in March 2020 reveals a diminutive portal vein, therefore is *not a candidate for TIPS*.

Over the course of 2 years, the patient undergoes multiple interventional radiology procedures for treatment of gastric varices which have bled.

This case study will provide an overview of the multiple interventional radiology procedures and discuss peri and post-procedural complications that arose specific to this patient scenario.

Pre-procedural Timeline

2009 - Penetrating injury to liver, incidental hemangioma identified at this time

2009 - US guided liver biopsy and immunological laboratory values lead to diagnosis of
PBC

2013 - Cross sectional CT imaging demonstrates small gastric varices

2015 - Cross sectional CT imaging shows larger gastric, splenic varices and
splenomegaly

2017 - Cross sectional CT imaging shows progression of varices, splenomegaly and small
volume ascites

2020 February - Admission for variceal bleeding

2020 March - MRI to work up for TIPS

TIPS

Transjugular Intrahepatic Portosystemic Shunt

Intrahepatic shunt is placed typically from the right hepatic vein to the right portal vein.

TIPS is intended to decrease portal pressures, which can help control variceal bleeding, also indicated to treat refractory ascites.

Patients with high MELD* scores > 17-19 have a significantly higher 3-month mortality rate than those with a lower MELD score.

**MELD (Model for End Stage Liver Disease)*

Indications for TIPS

- ▣ Secondary prevention of variceal bleeding
- ▣ Refractory acute variceal bleed
- ▣ Refractory ascites
- ▣ Budd Chiari Syndrome (if medical therapy fails)
- ▣ Portal hypertensive gastropathy
- ▣ Hepatopulmonary syndrome
- ▣ Hepatorenal syndromes
- ▣ Hepatic veno occlusive disease

Contraindication to TIPS

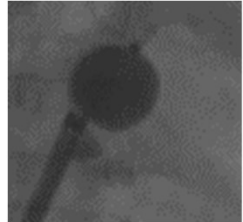
Absolute

- ▣ Non-compatible anatomy
 - Diminutive size of portal system
- ▣ Primary prevention of variceal bleeding
- ▣ Severe congestive heart failure or pulmonary hypertension
- ▣ Unrelieved biliary obstruction or uncontrolled/systemic infection
- ▣ Significant tricuspid regurgitation
- ▣ Uncontrolled infection/sepsis
- ▣ Multiple hepatic cysts

Relative

- ▣ Hepatocellular carcinoma
- ▣ Obstruction of hepatic veins
- ▣ Portal Vein thrombosis
- ▣ Moderate pulmonary hypertension
- ▣ Severe coagulopathy
- ▣ Thrombocytopenia
- ▣ Uncorrected coagulopathy
- ▣ Hepatic Encephalopathy

When TIPS is contraindicated, BRTO or PARTO is considered



BERTO

Balloon-Occluded Retrograde Transvenous Obliteration

Utilized to manage bleeding gastroesophageal varices

Most gastric fundal varices drain into left renal vein via a gastroduodenal shunt.

In BERTO, retrograde injection of a sclerosing agent into gastric varices occurs after balloon occlusion of the gastroduodenal shunt.

Originally proposed by *Kanagawa et. al.* in Japan, and was utilized more frequently there than in North America, but has gained popularity in North America over time with more familiarity.

Can be performed in patients with hepatic encephalopathy/at times this is the indication (whereas hepatic encephalopathy is a contraindication to TIPS).

BATO

Balloon-Occluded Antegrade Transvenous Obliteration

Alternative route to access gastric varices via **portal venous approach**

Either via percutaneous transhepatic obliteration (PTO) or via exiting intrahepatic portosystemic shunt (trans-TIPS).
Transileocolic vein obliteration (TIO) has also been described.



PARTO

Plug assisted retrograde transvenous obliteration

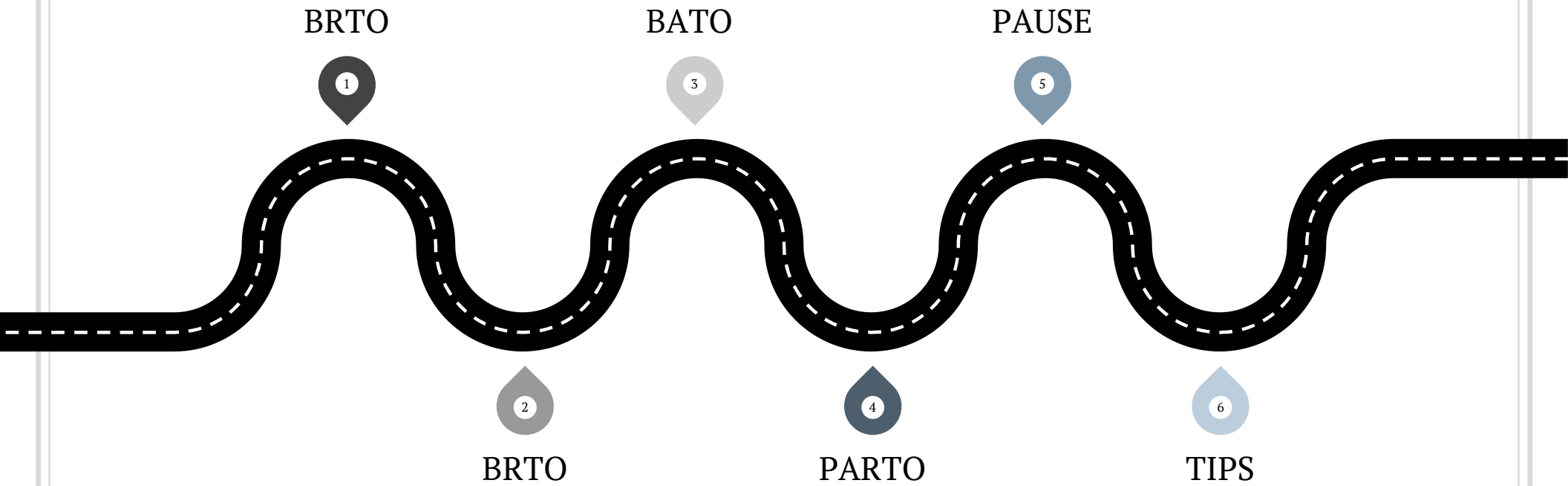
Modified version of BRTO, which utilizes a permanent vascular plug instead of an intra-procedural balloon.

Size of the plug is chosen based on the most narrow part of the shunt as measured on venogram.

Sizes range from 3-22 mm.

Should be 20-30% larger than the shunt size to avoid migration or reflux of sclerosing agent.

Procedure Pathway

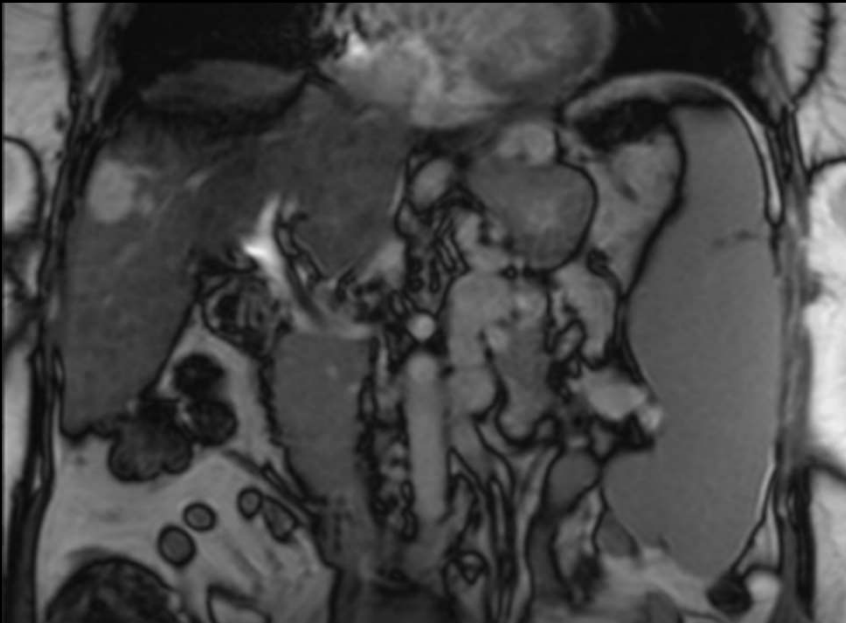


February 2020

Patient presents with abdominal pain and feeling unwell.

During admission, the patient has an episode of hematemesis secondary gastric variceal bleeding, endoscopy shows large extensive varices, not acutely bleeding at that time.

March 2020 MRI workup for TIPS

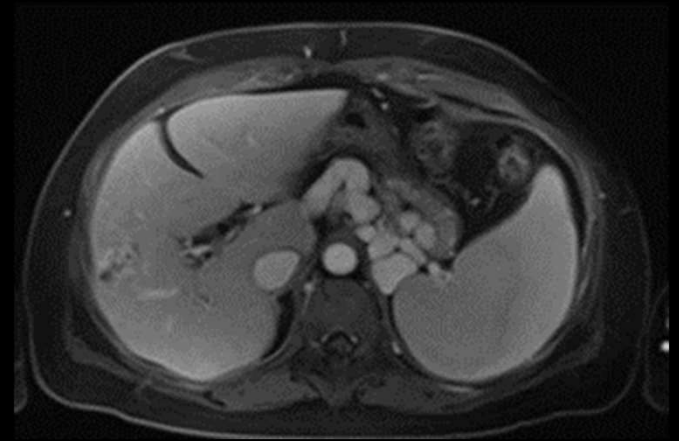


Main portal vein is diminutive
in size

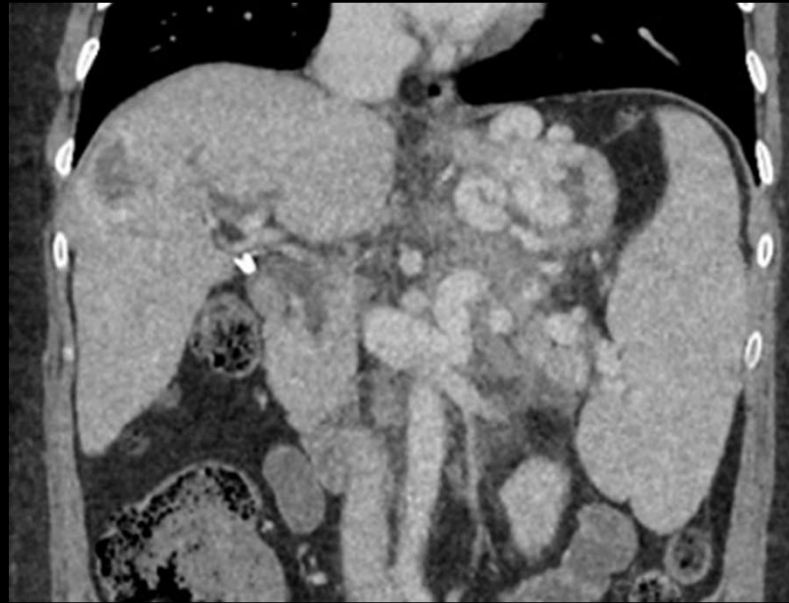
Extensive
splenic
and
gastric varices

Splenomegaly

Hemangioma



April 2020 CT Imaging



Extensive gastric and splenic
varices.

BRTO

1

BATO

3

PAUSE

5

2

BRTO

4

PARTO

6

TIPS

April 2020
First Interventional Radiology Procedure

Balloon Assisted Retrograde Transvenous Occlusion (BRTO) for management of gastric varices which bled one month prior

Procedure Details:

Access via right common femoral vein. Left renal vein selected, and then the splenorenal shunt. Glidewire and C2 catheter used to advance into the gastric varix. Wire inserted, exchange for a 12F vascular sheath and then the balloon was advanced over the wire.

When advancing balloon, tiny tear in varix occurred.

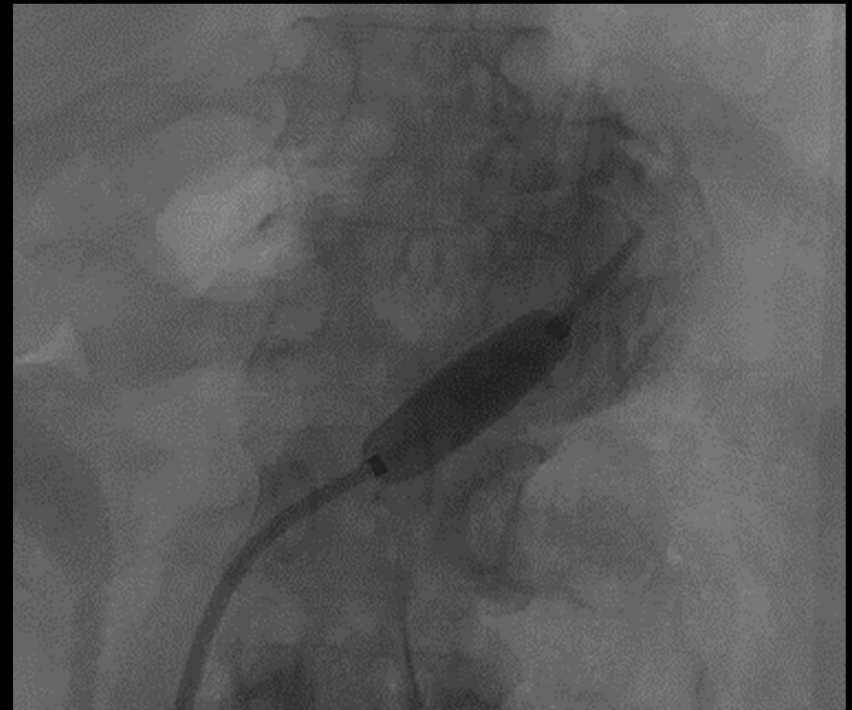
Procedure terminated.

Summary:

Unsuccessful BRTO



Gastric varix selected via left renal vein and then splenorenal shunt.



Complication:

When advancing the balloon, a small tear in the varix of the splenorenal shunt was made.

A small amount of contrast extravasation was noted.

BRTO



BATO



PAUSE



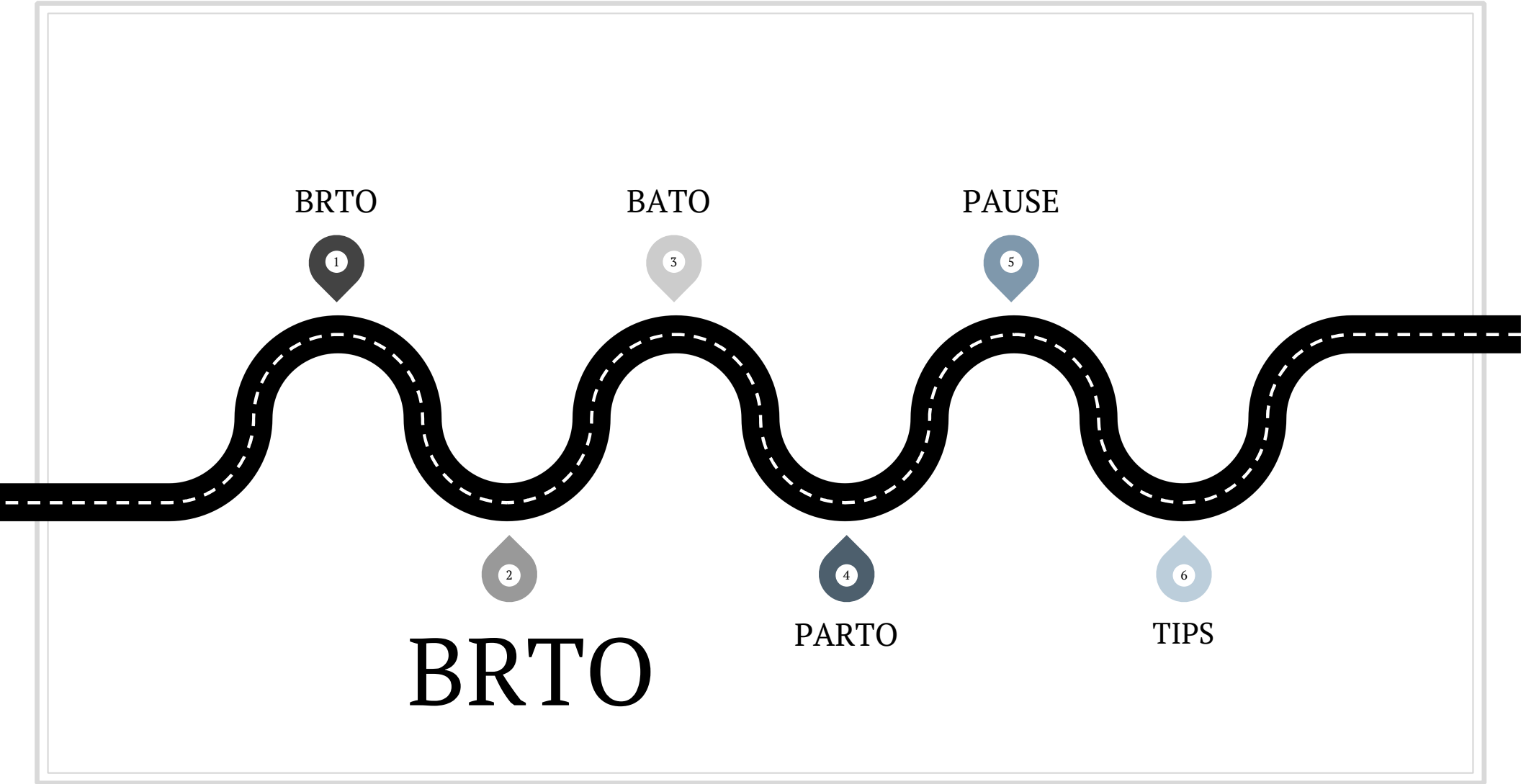
BRTO



PARTO



TIPS



May 2020

Second Interventional Radiology Procedure

Second attempt at Balloon Assisted Retrograde Transvenous Occlusion (BRTO) for management of gastric varices, failed BRTO 1 month earlier

Procedure details:

Right common femoral vein access.

Left renal vein selected. 5F glide catheter advanced into the superior aspect of the varix a sheath positioned in the proximal renal vein.

Balloon inserted over the wire and inflated.

Attempted but unable to advance into nidus of gastric varix.

Summary:

Unsuccessful embolization of massive gastric varices and splenorenal shunt

Left renal vein selected with a J wire, 6
French sheath, 5F C2 catheter

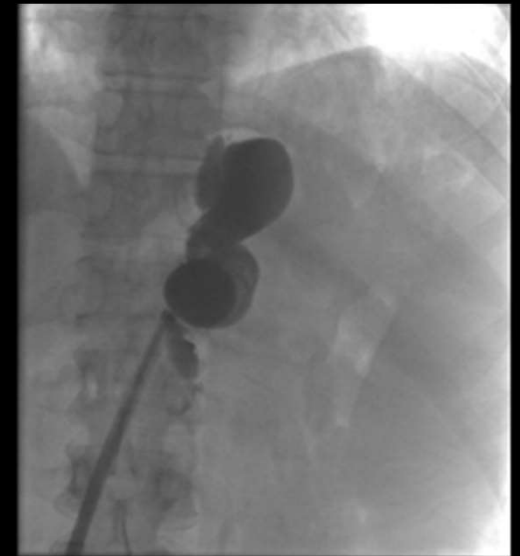


Selection: **Splenorenal shunt**
with a 5F Glide catheter, advanced
without guidewire into gastric
varix with sheath in the proximal
renal vein.

Rosen wire inserted

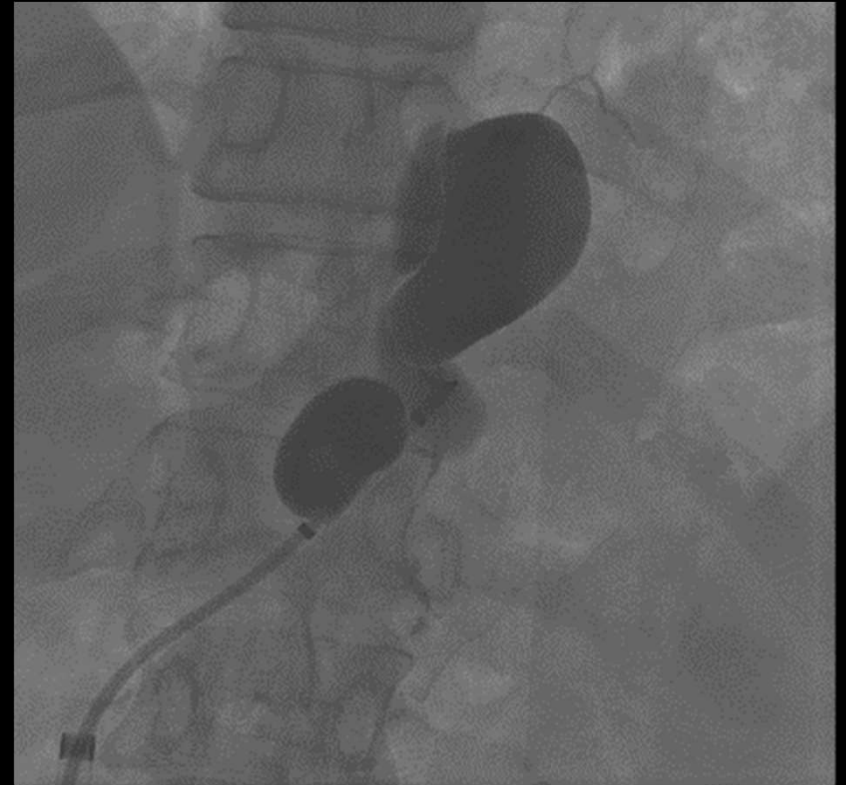
Exchange: 14 French 45 cm
vascular sheath advanced into the
splenorenal shunt

Balloon: 27mm balloon inserted
over wire and inflated (4-5cc of
contrast)



Stasis of contrast in the craniocaudal splenorenal shunt.

Unable to opacify the nidus of the gastric varices despite 30-40 cc of contrast and multiple attempts with different guidewires.



BATO

BRTO

1

3

PAUSE

5

BRTO

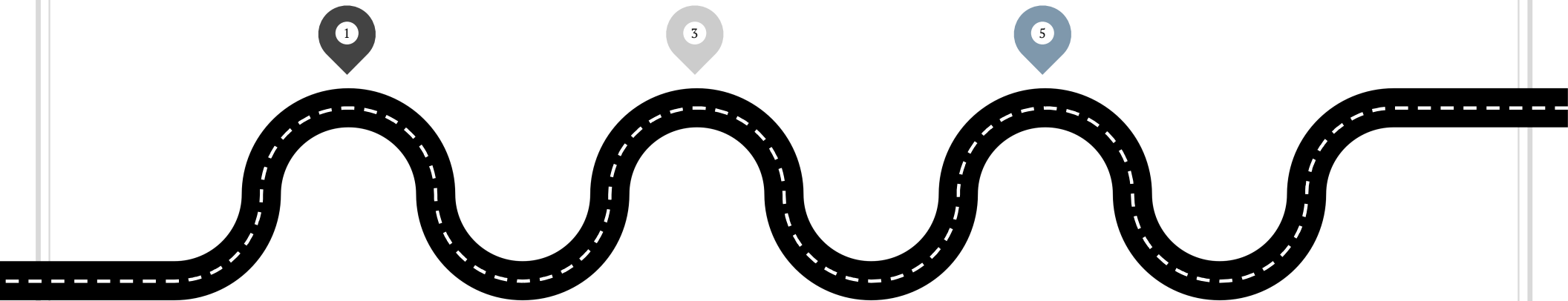
2

PARTO

4

TIPS

6



June 2020

Third Interventional Radiology Procedure

**Balloon Occluded Antegrade Transvenous Obliteration (BATO)
for management of gastric varices, 2 x failed BRTO 1 and 2
months earlier**

Procedure carried out under General Anesthetic

Procedure Details:

US guided access to peripheral portal vein in right lobe, showed a small portal vein collateral which was abandoned and embolized.

Access to inferior splenic vein with a Chiba needle was obtained, Neff set used to access portal system when demonstrated a **tiny main portal vein with hepatofugal flow**. Imaging in splenic vein showed massive gastric varices and splenorenal shunt with two main afferent veins from left gastric vein and posterior gastric vein and backflow into gastric varices and efferent gastrosplenic shunt into left renal vein.

Procedure Details continued:

Straight Amplatz into splenic vein, then 5F vascular sheath inserted.

US guided access to right femoral vein to access left renal vein and gastrosplenic shunt. Balloon advanced to afferent left gastric vein via trans-splenic portal venous access, balloon inflated at gastrosplenic shunt, catheter advanced into the nidus and embolization performed with sclerosant.

Catheter retracted then placed in afferent posterior gastric vein, then coil embolization and gelfoam were utilized.

Embolic materials let sit for **4 hours**.

Balloon deflated after 4 hours, some persistent enhancement of afferent left posterior gastric vein and through gastrosplenic shunt so additional coil and gelfoam embolization into posterior gastric vein.

Transsplenic portal venous access site embolized with embolizing paste.

Main portal vein is slightly increased in calibre and now has hepatopetal flow.

Ultrasound guided access to a peripheral portal vein in the right lobe, which showed a small collateral.

Tract was abandoned and embolized with a small amount of gelfoam.



Ultrasound guided access
to the inferior splenic vein
with a Chiba needle.



Neff set used, guidewire and
4F kumpe to advance into
the main portal vein.

Venography shows
diminutive portal system
with **hepatofugal flow**.



Massive gastric varices and
gastrorenal shunt.

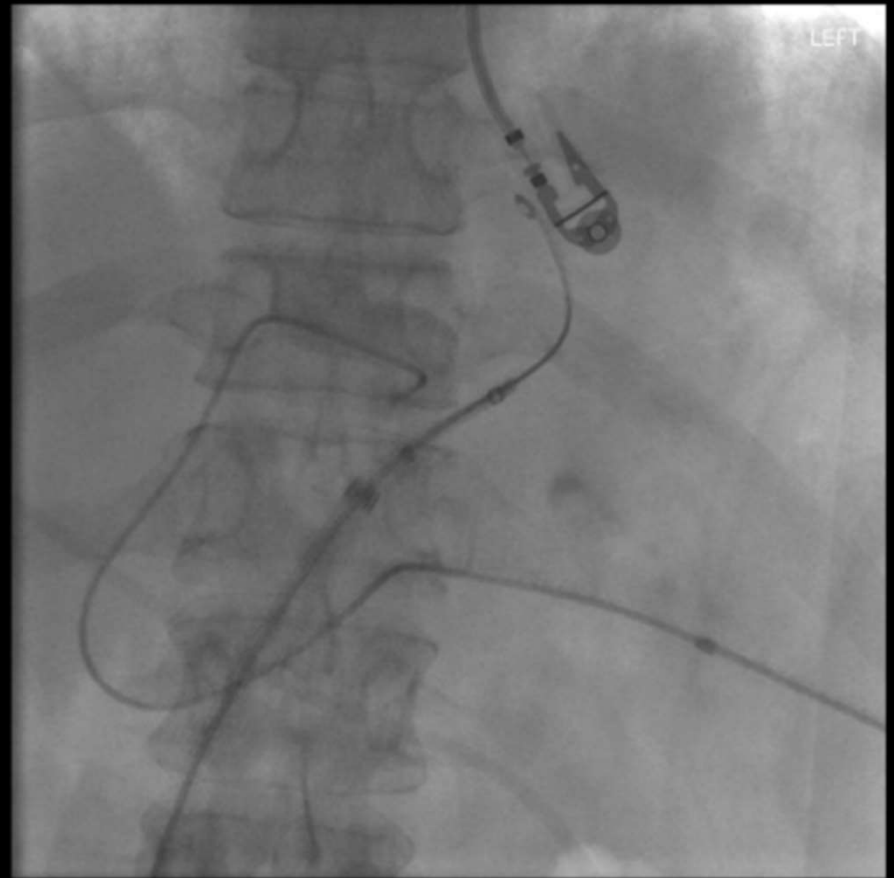
Two main larger afferent
veins from the left gastric
vein and posterior gastric
vein.

Both show brisk backflow
into gastric varices through
efferent gastrorenal shunt
into the left renal vein.



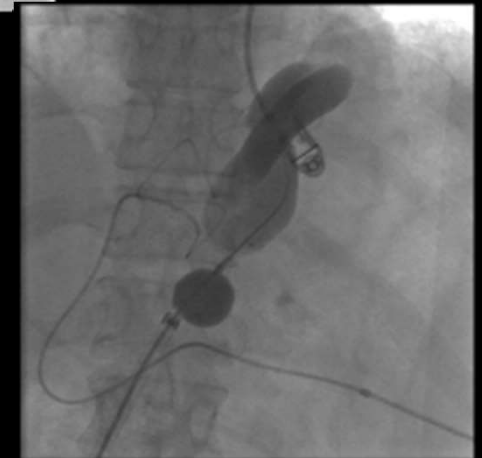


Ultrasound guided access
via right femoral vein, then
left renal vein and
gastrorenal shunt.



Rosen wire and 14F 45cm sheath advanced into the proximal splenorenal shunt and a 27mm balloon advanced into the afferent left gastric renal vein and out through the efferent gastorenal shunt, where it was inflated.

Embolization using 18 cc mixture of air/STS/lipiodol 3:2:1



Transsplenic catheter
retracted into splenic vein
then into afferent gastric
vein with a guidewire.



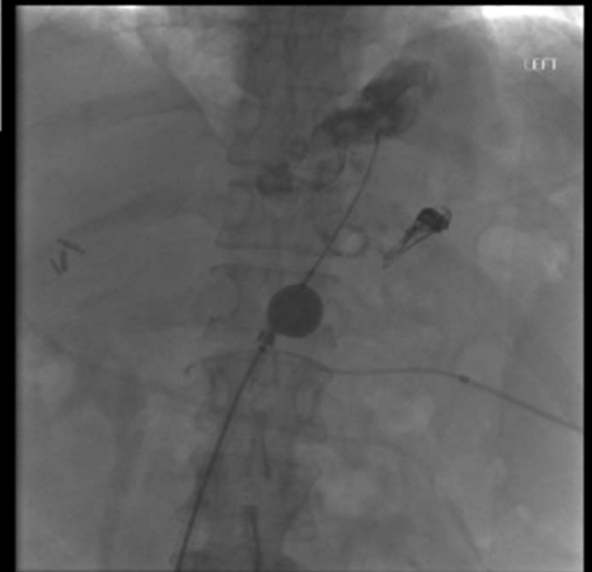
Afferent posterior gastric
vein drains into azygos
vein when occlusion
balloon is inflated.

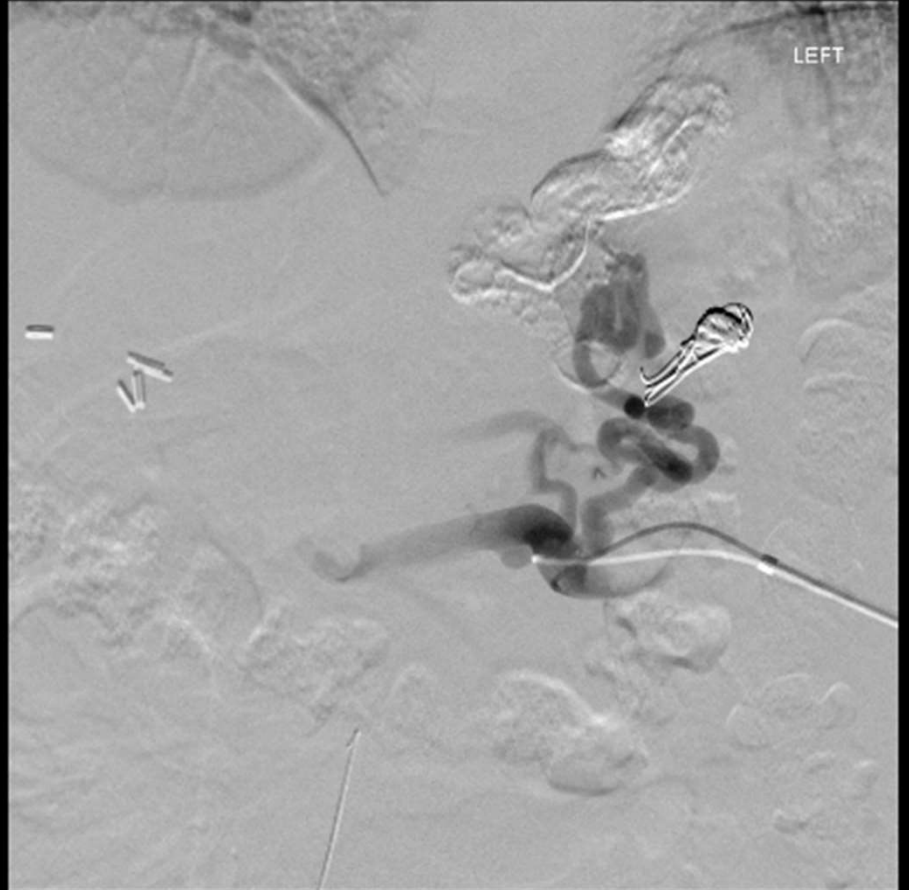


Coil embolization via microcatheter as well as a small amount of gelfoam within the proximal afferent posterior gastric vein.

Embolic agents sit for 4 hours. After 4 hours, balloon deflated.

Persistent enhancement of afferent left posterior gastric vein and gastrosplenic shunt.



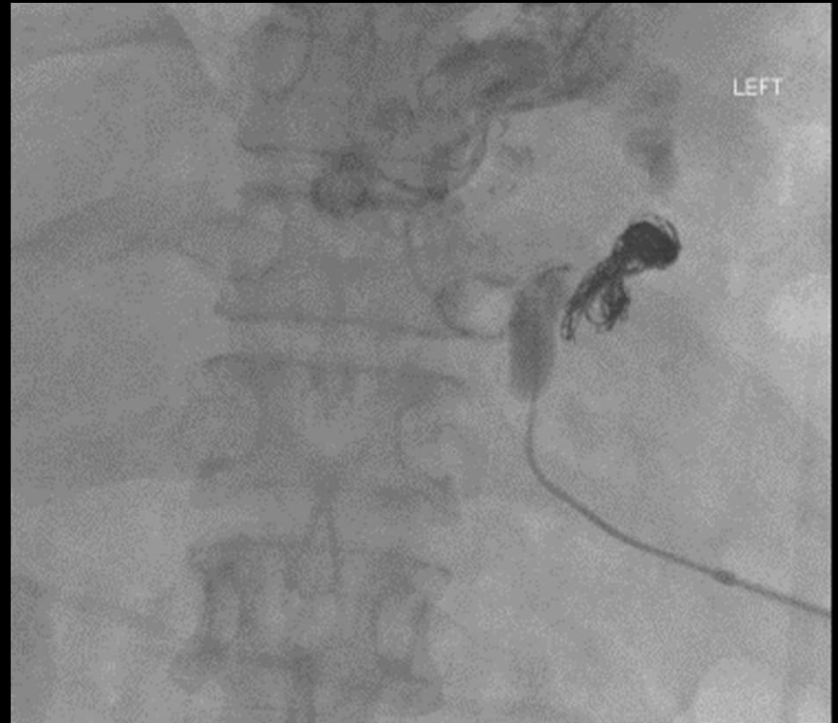


Additional coil and gelfoam embolization into posterior gastric vein.

Repeat injection shows near stasis of afferent left posterior gastric vein.

Portography in the splenic vein shows *slight increase in size of the main portal vein* at the end of the procedure and now *hepatopetal flow*.

No significant residual enhancement of massive varices and shunt.



PAUSE

BRTO



BATO



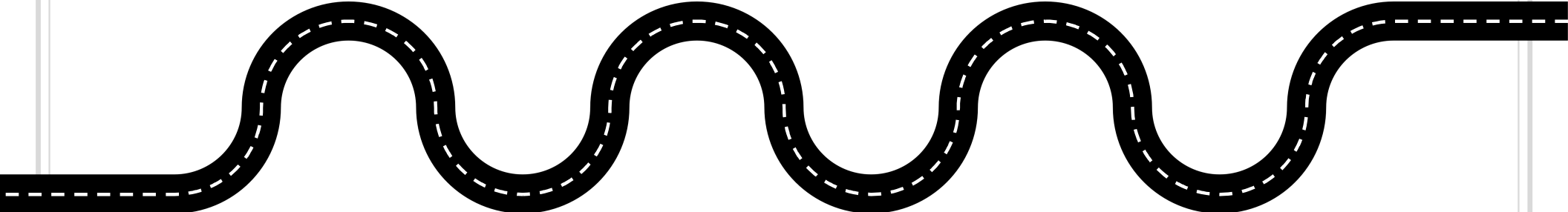
BRTO



PARTO



TIPS



January 2022

Patient is scheduled for a PARTO procedure

Due to bed constraints within the hospital

There is no post-procedure admission bed for the patient

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The patient is unable to have the procedure today

.

Gets rescheduled for 1 month later

BRTO

1

BATO

3

PAUSE

5

BRTO

2

PARTO

TIPS

6

4

February 2020

Fourth Interventional Radiology Procedure

**Plug Assisted Retrograde Transvenous Obliteration (PARTO) for
management of varices**

Procedure Details:

Left renal vein cannulated and then gastrosrenal shunt, then advanced to the proximal gastrosrenal shunt.

Venogram demonstrates aneurysmal segment of the proximal shunt outflow. Plug unsheathed in the proximal gastrosrenal shunt. Aneurysm coiled with multiple coils. Stasis of outflow tract achieved.

Gelfoam used to further embolize outflow.

Plug deployed.

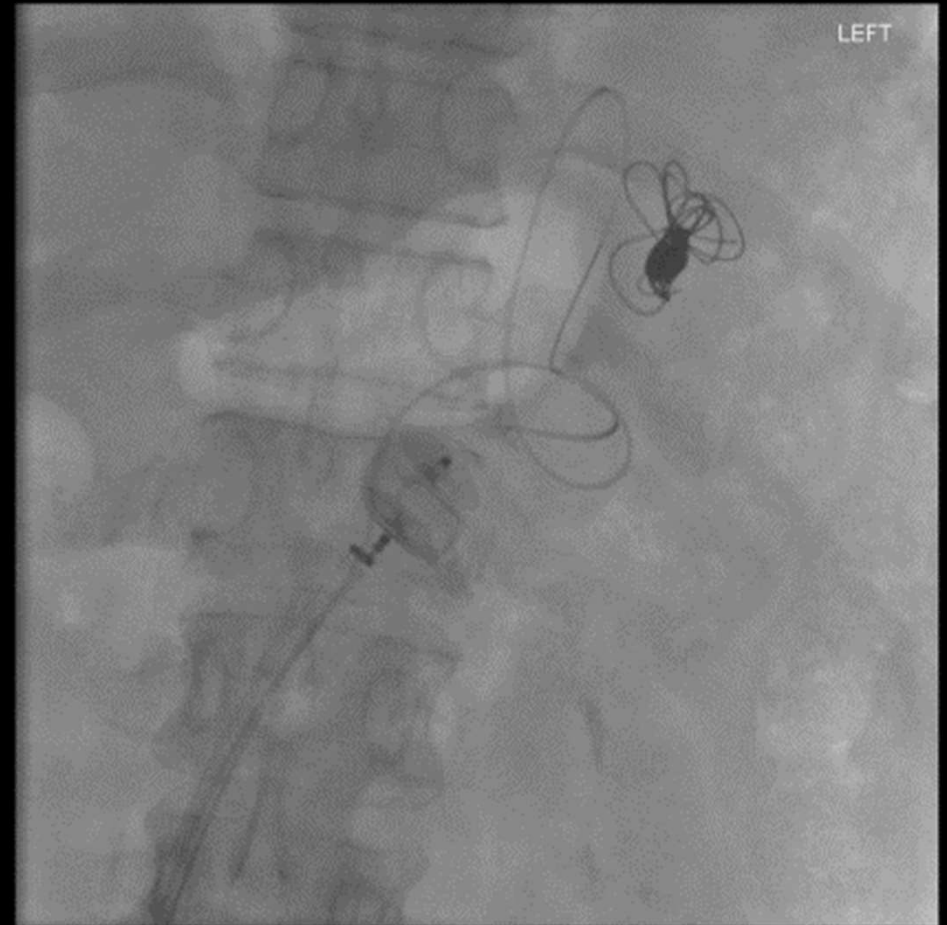
Gastrorenal shunt accessed
via left renal vein.

Proximal segment of the
shunt outflow is
aneurysmal.



2.8 French microcatheter is advanced through a 12F sheath within the outflow segment alongside a microcatheter

18 mm x 14 mm plug is unsheathed (not deployed) in the proximal gastorenal shunt, proximal to the aneurysmal segment.



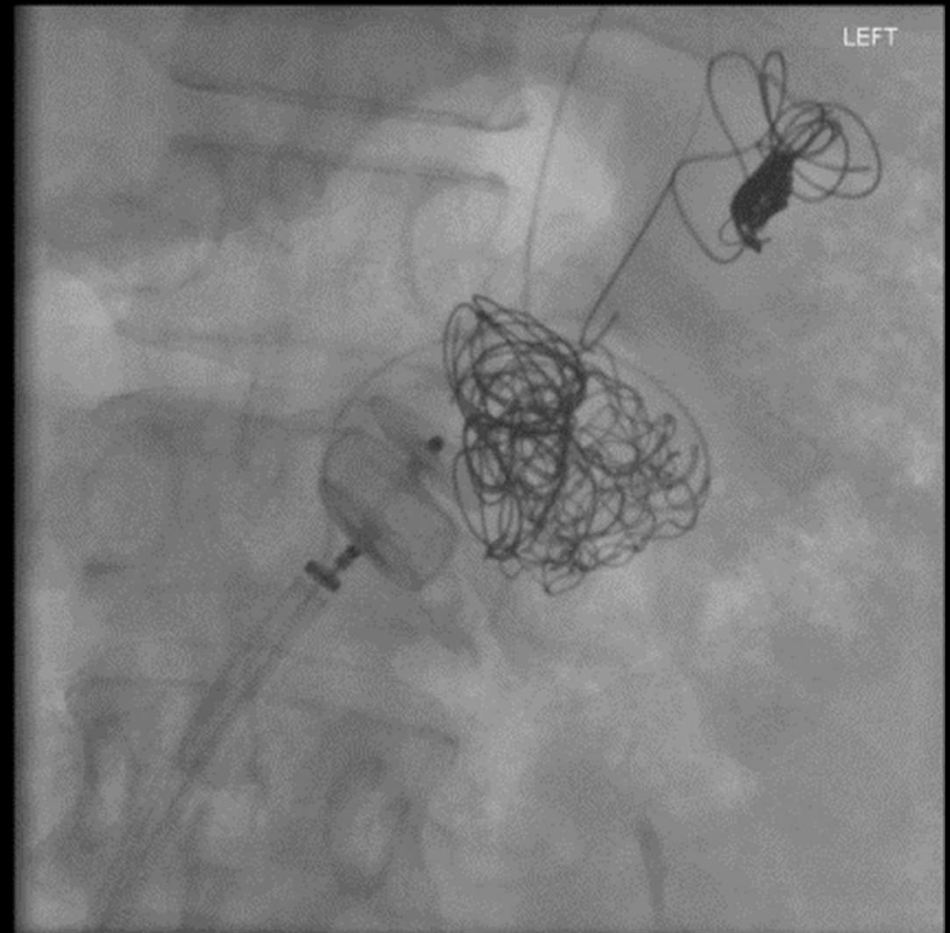
Aneurysmal segment is
coiled using the
microcatheter with:

45cm packing coil

60 cm packing coil

Two 14 mm x 30 cm coils

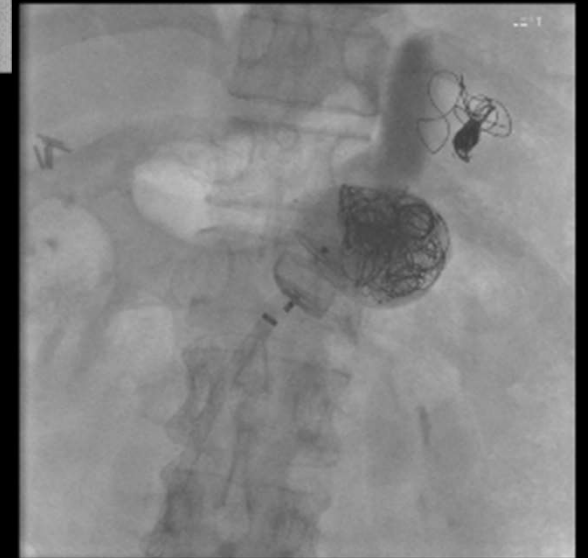
Seven 10 mm x 14 cm
micronester coils



Outflow segment further embolized with 4cc of thick gelfoam



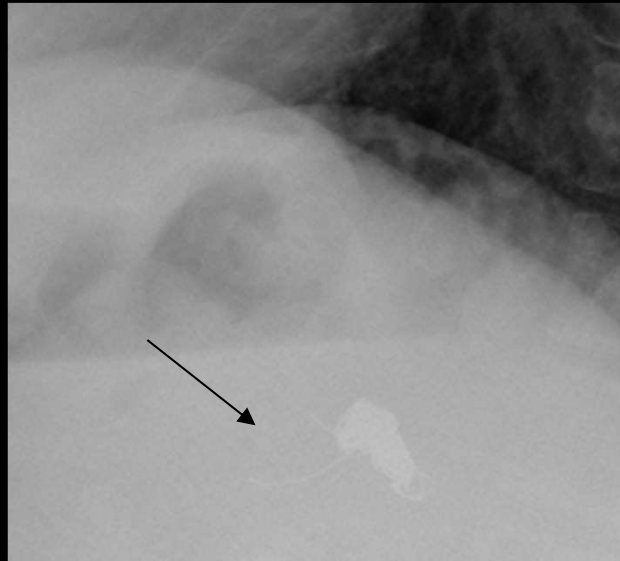
Stasis is achieved within the outflow segment



Delayed Complication of Embolization Coils

Patient has multiple presentations to hospital for abdominal pain and pancreatitis.

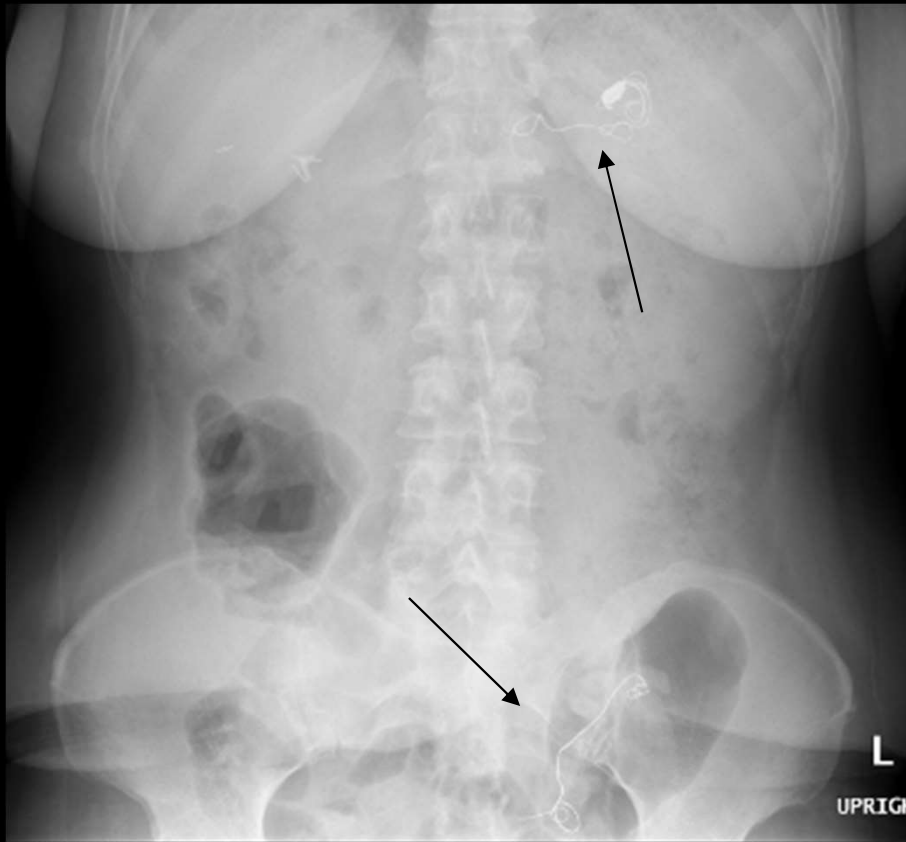
Interval imaging demonstrates a delayed complication of embolization coils ...



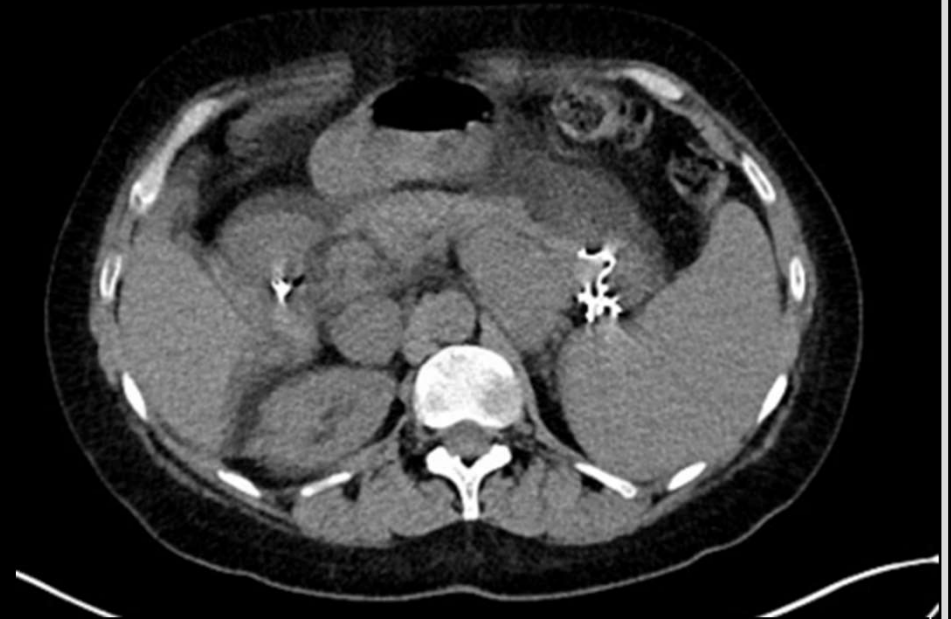
Lateral CXR November 2021
(changed since June 2021)

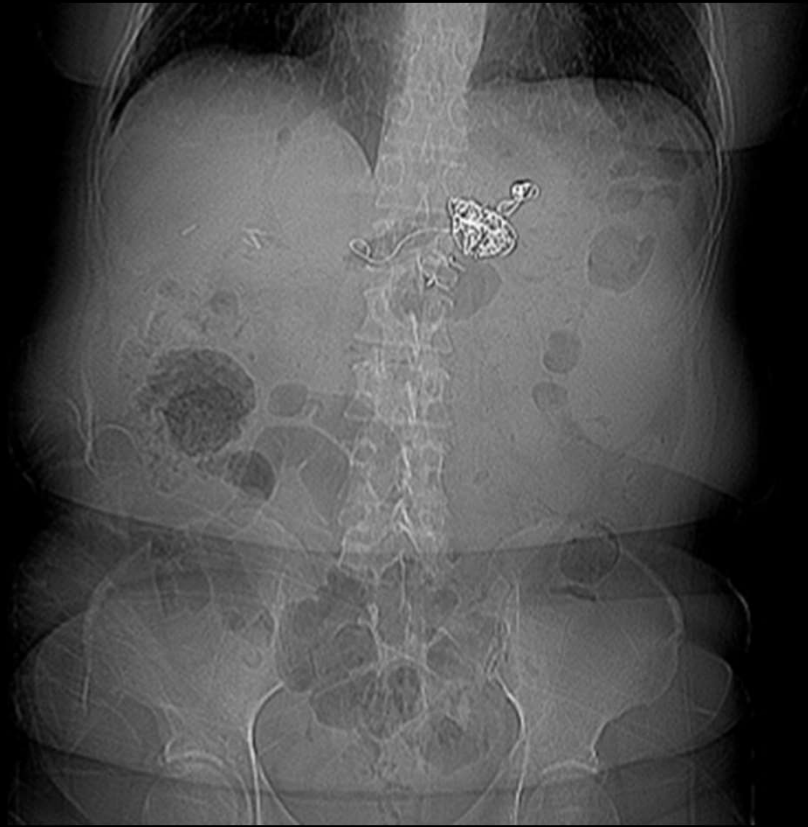
Abdominal X-ray January 2022

Partially migrated coil in the gastric region and fully migrated coil projecting over the left lower quadrant.

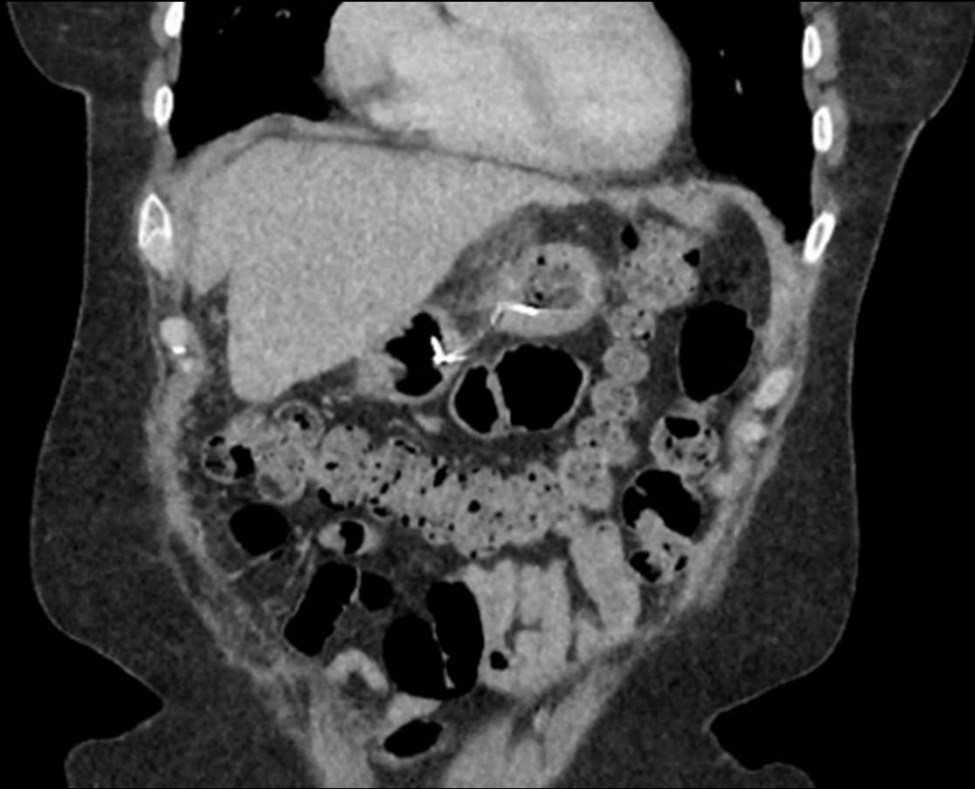


CT imaging Jan 2022 shows migrating coil in the stomach.





CT scout image in February 2022 shows migrating coil in the stomach and no longer shows a coil projecting over the left lower quadrant.



CT February 2022 shows migrating coil in the stomach, through the pylorus

BRTO



BATO



PAUSE



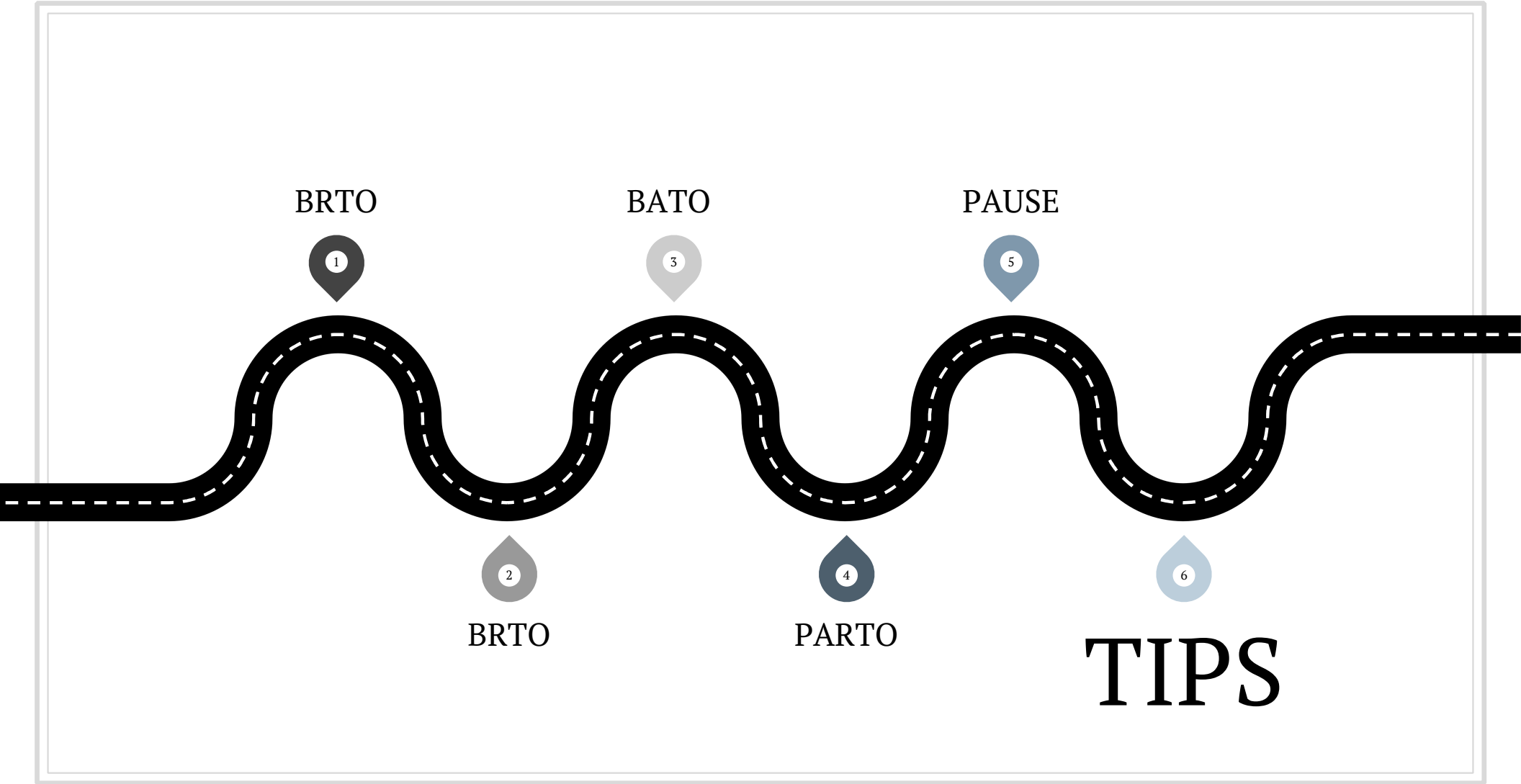
BRTO



PARTO



TIPS



February 2022

**Fifth Interventional Radiology Procedure
Transjugular Intrahepatic Portosystemic Shunt (TIPS) for
management of persistent varices and increased portal
pressures.**

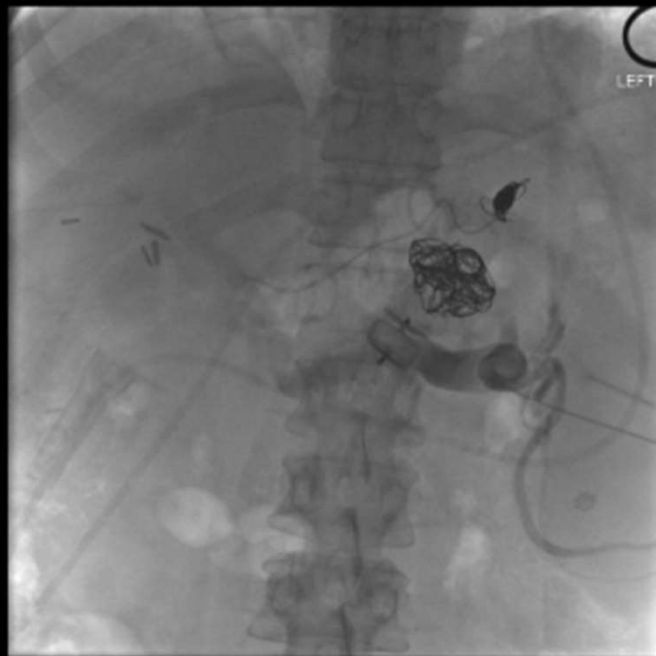
Procedure Details:

Percutaneous access to splenic vein via trans-splenic route with a Chiba Needle and Neff set, advancement into portal vein and exchange for gooseneck within main portal vein (MPV). Right internal jugular vein access, advance into IVC and then selection of right hepatic vein. Exchange for TIPS cannula, stylet and needle, within 3 passes, access to right portal vein obtained. Pressures obtained. Balloon dilation and TIPS stent deployment with post dilation. Further coil and gelfoam embolization of gastric varices.

Summary:

Ultimately successful TIPS insertion and post plasty, with embolization of inflow to gastric varices with complete stasis.

Ultrasound Guided access to
splenic vein via trans-splenic
route



Neff set to advance into portal
vein, glidewire exchanged for
10mm gooseneck snare within
MPV

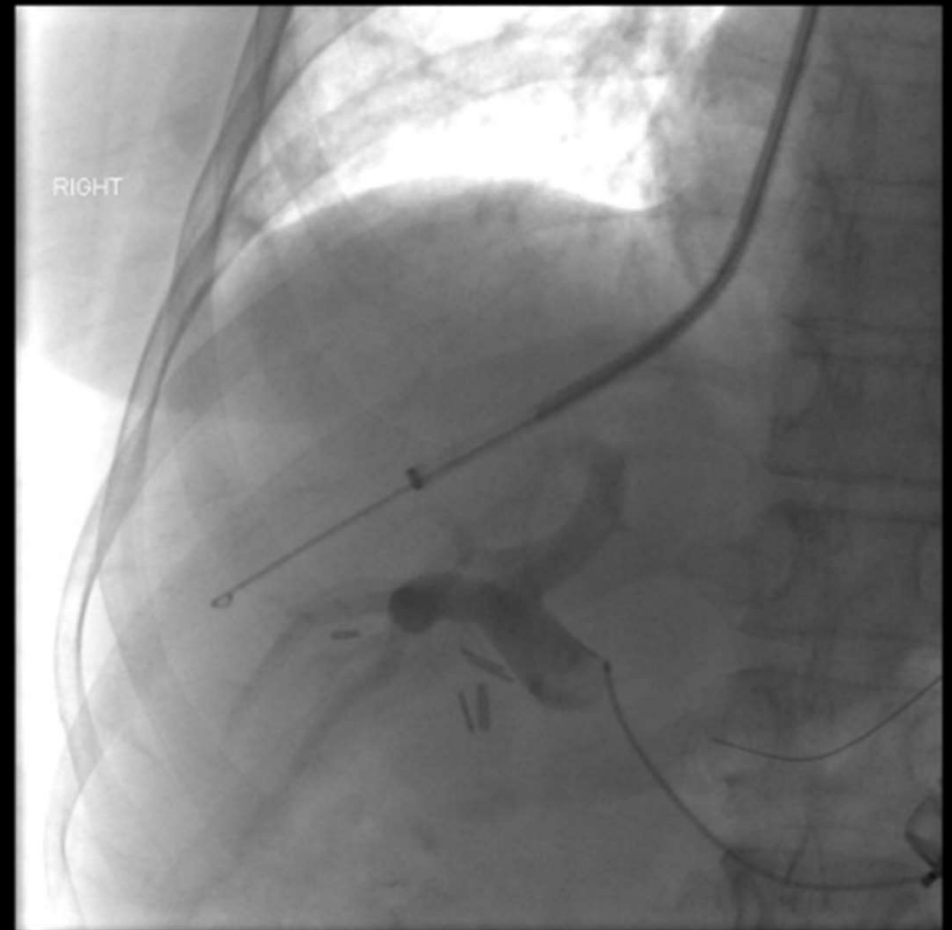


Right IJ access

MPB catheter to select
right hepatic vein



Catheter and wire
exchanged for TIPS
cannula, stylet and
needle



3 passes made to access right
portal vein

Targeting the snare placed in the
MPV

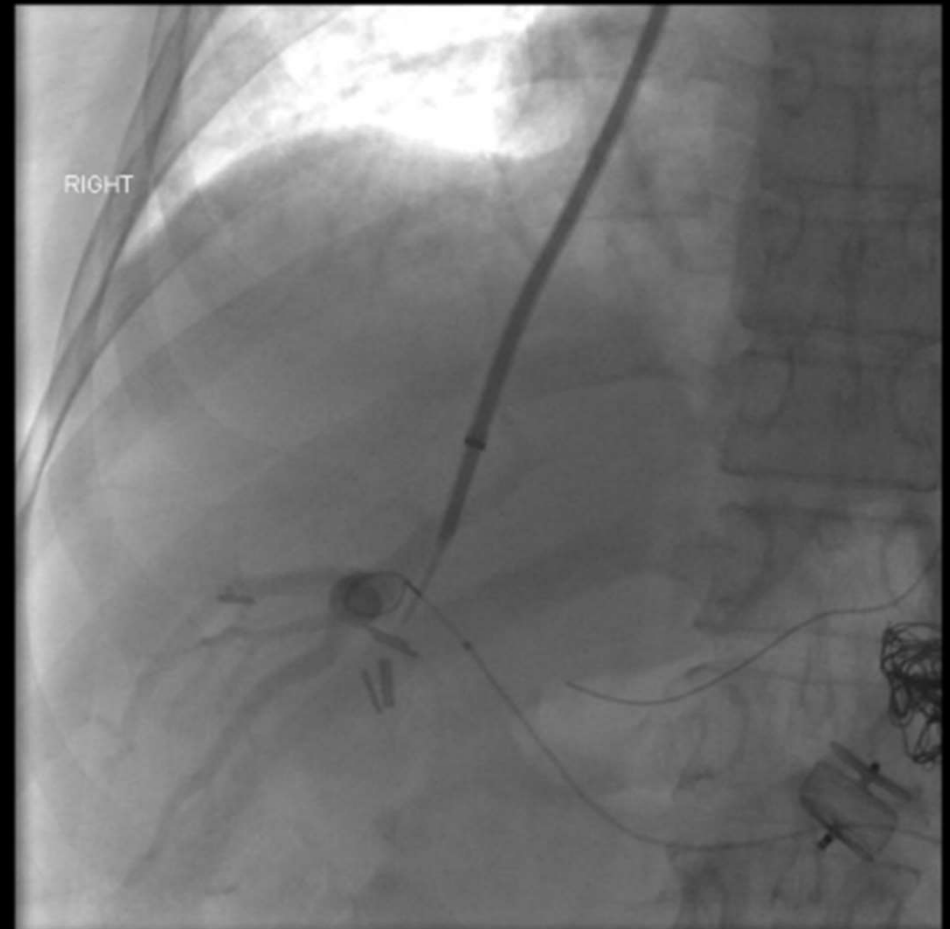
Pressures obtained:

Main portal pressure: 39 mmHg

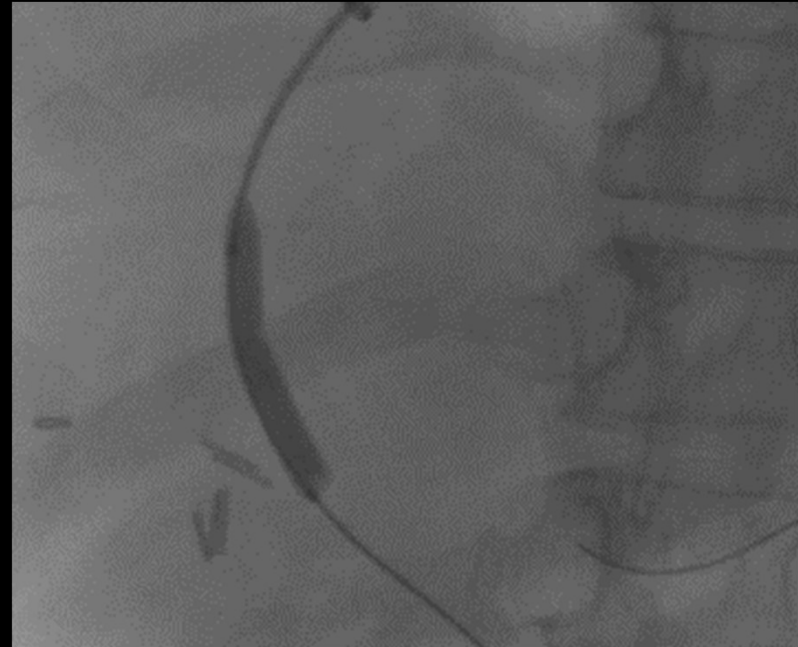
Right Atrial pressure: 3 mmHg

Pre TIPS Pressure Gradient

= 36 mmHg

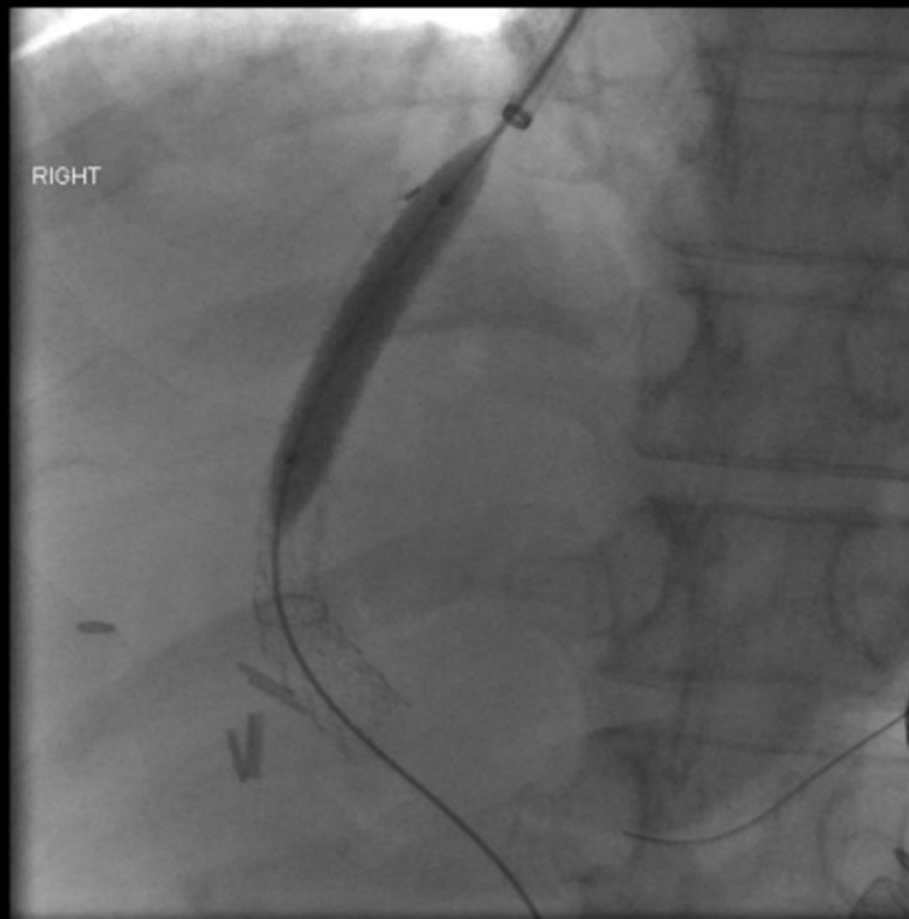


Balloon (6 mm x 4 cm)
to dilate tract



6 cm x 8-10mm TIPS stent
advanced
and deployed.

Dilated with 8 mm x 4 cm
balloon



TIPS stent in place



Portogram performed

Pressures obtained

Main portal pressure: 19 mmHg

Right portal pressure : 12 mmHg

Post TIPS pressure gradient

= 7 mmHg



Venogram performed shows inflow gastric varices. Via jugular access route, two 7 mm x 30 cm coils deployed and 1.4cc gelfoam used. Stasis of varices and brisk flow through widely patent TIPS





Successful TIPS and post plasty.

Reduction of portosystemic gradient from 36 mmHg to 7 mmHg.

Successful embolization of gastric varices

Ultrasound follow up just under 1 month later Patent TIPS



Thank You

Thanks to Dr R Samji and Dr A Moussa



Canadian Association for
Interventional Radiology

Association canadienne pour
la radiologie d'intervention

References

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5. Kim, D.J., Darcy, M.D., Mani, N.B. *et al*. Modified Balloon-Occluded Retrograde Transvenous Obliteration (BROTO) Techniques for the Treatment of Gastric Varices: Vascular Plug-Assisted Retrograde Transvenous Obliteration (PARTO)/Coil-Assisted Retrograde Transvenous Obliteration (CARTO)/Balloon-Occluded Antegrade Transvenous Obliteration (BATO). *Cardiovasc Intervent Radiol* 41, 835–847 (2018). <https://doi.org/10.1007/s00270-018-1896-1>
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