Intervention in the Hepatic Portal Venous System

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Definition

Portal venous system – Venous vasculature fed and drained by capillary vessels.

Hypophyseal portal system

Hepatic portal system

What do we want to do?

- Look at it – diagnostic imaging
- Improve flow – plasty, stents, lysis, thrombectomy
- Impede flow - embolization
- Divert flow – shunts
- Make the liver grow
- Grow islet cells

Diagnostic methods

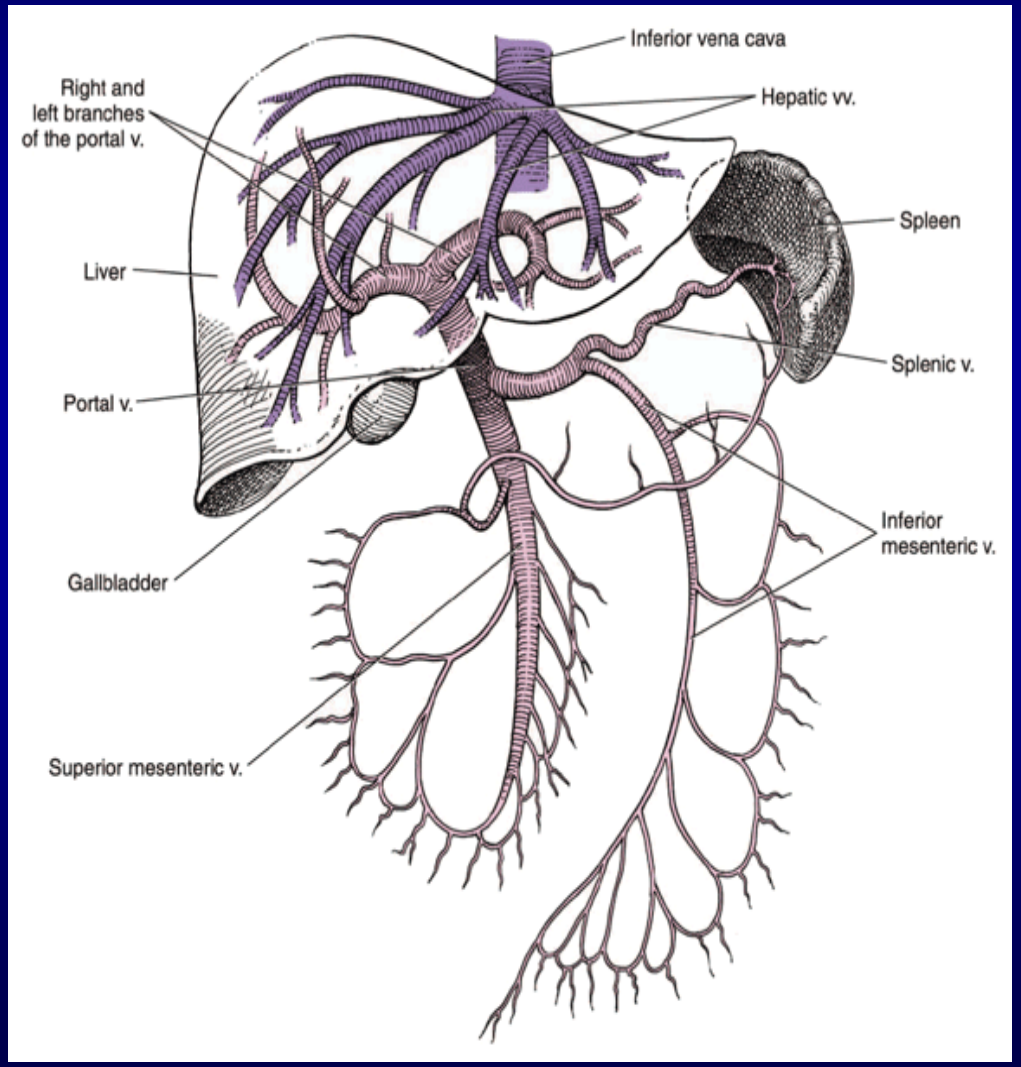
- Conventional radiological techniques – U/S, CT, MR

- Catheter directed techniques

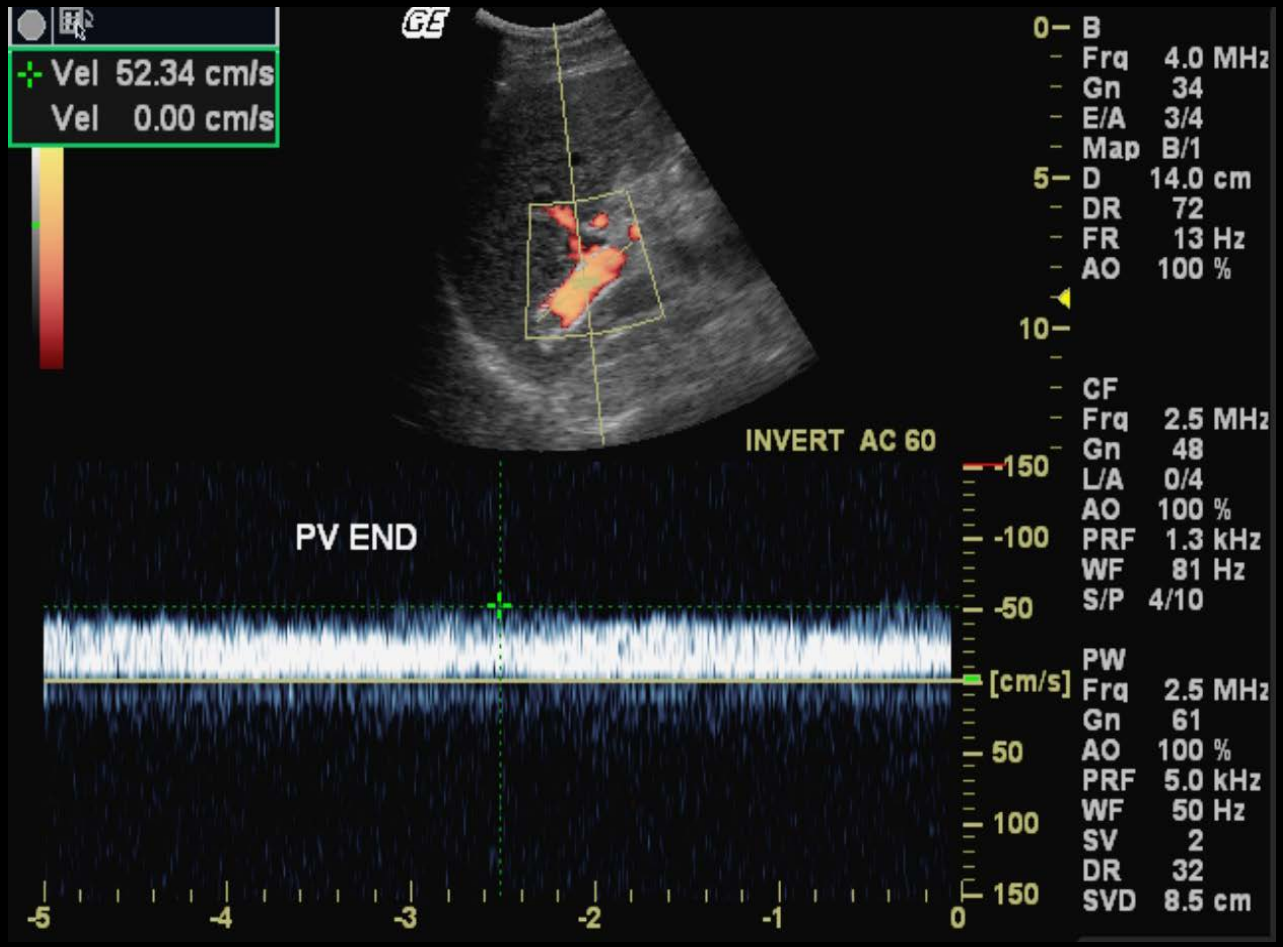
  Indirect – Late phase visceral angiography, wedged hepatic venography

  Direct – Transjugular or percutaneous transhepatic portal access

Anatomy


Inferior vena cava
Right and left branches of the portal v.
Hepatic vv.
Spleen
Liver
Splenic v.
Portal v.
Inferior mesenteric v.
Gallbladder
Superior mesenteric v.

Ultrasound


Vel 52.34 cm/s
Vel 0.00 cm/s
INVERT AC 60
PV END
0
5
10
B
Frq 4.0 MHz
Gn 34
E/A 3/4
Map B/1
D 14.0 cm
DR 72
FR 13 Hz
AO 100 %
CF
Frq 2.5 MHz
Gn 48
L/A 0/4
AO 100 %
PRF 1.3 kHz
WF 81 Hz
S/P 4/10
PW
Frq 2.5 MHz
Gn 61
AO 100 %
PRF 5.0 kHz
WF 50 Hz
SV 2
DR 32
SVD 8.5 cm
-150
-100
-50
[cm/s]
50
100
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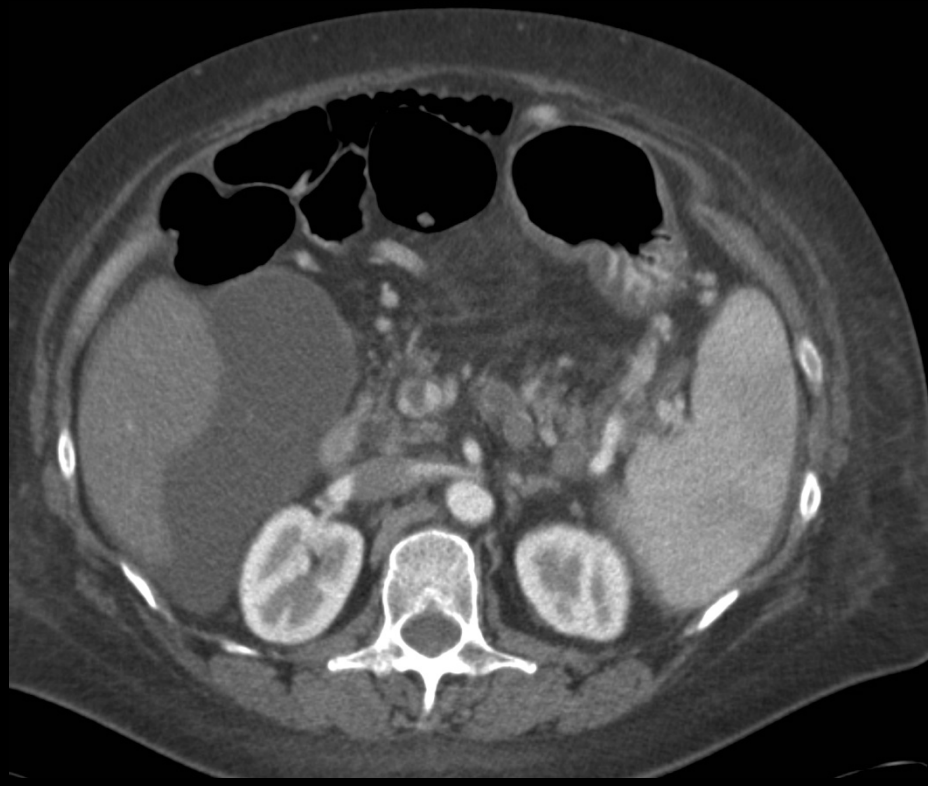
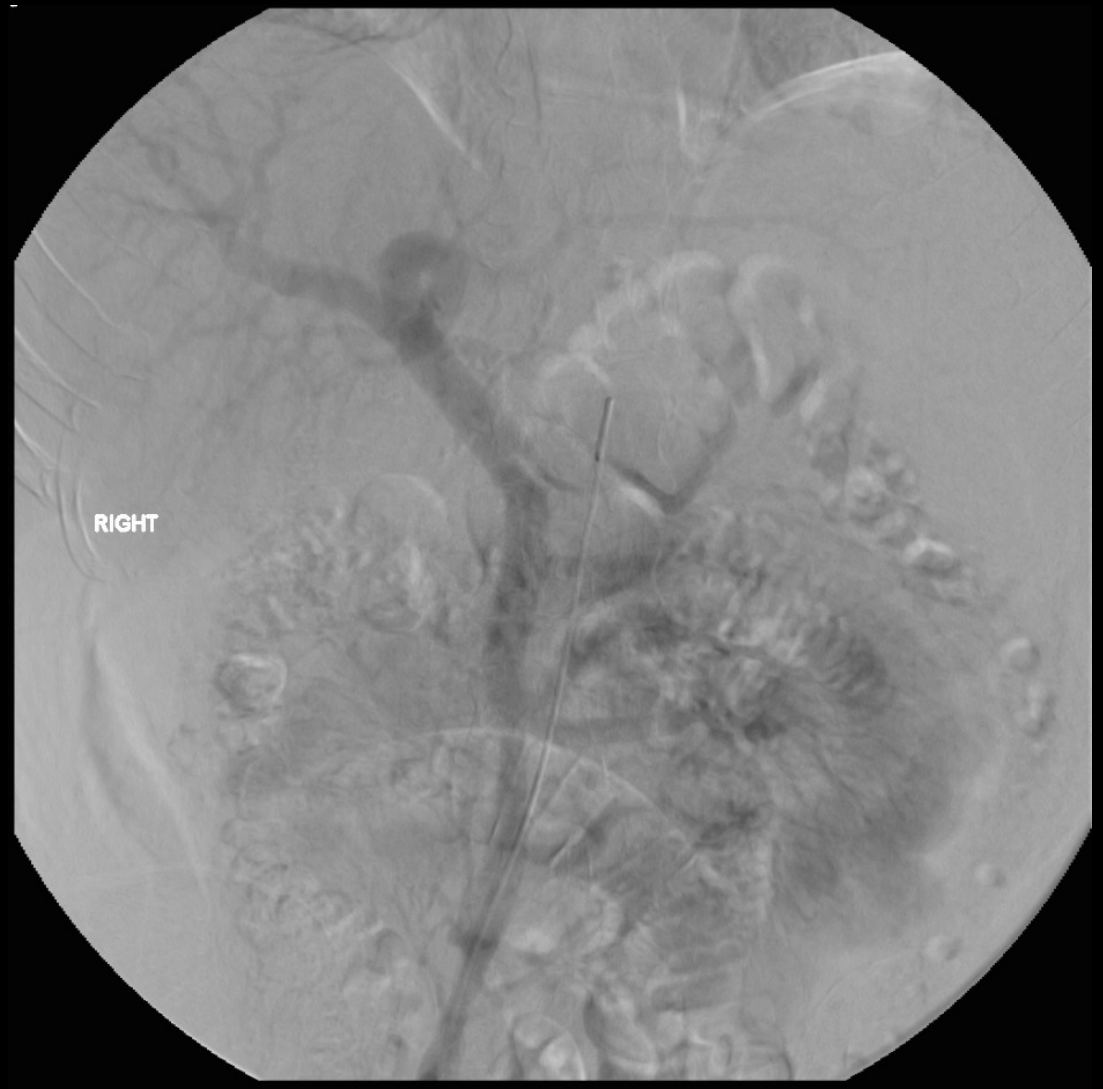
-5
-4
-3
-2
-1
0

Computed Tomography



Magnetic Resonance

Late phase visceral angiography

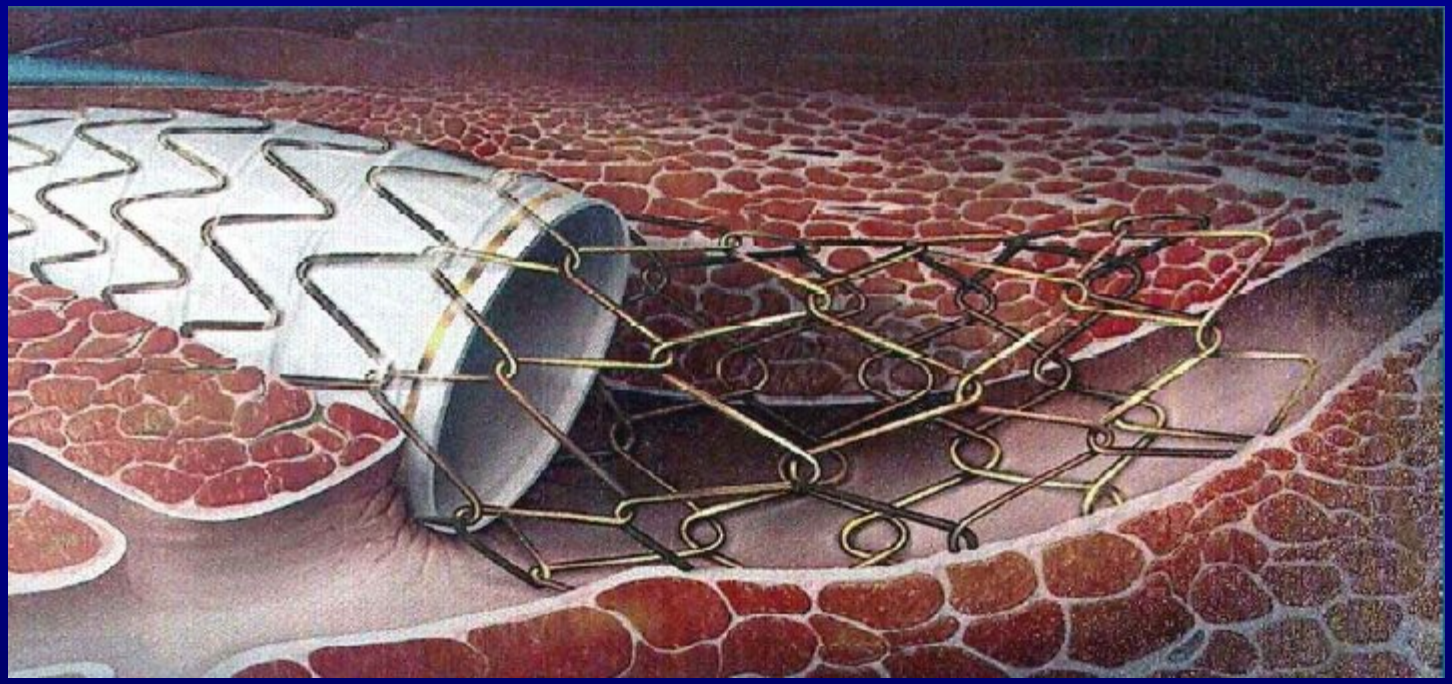


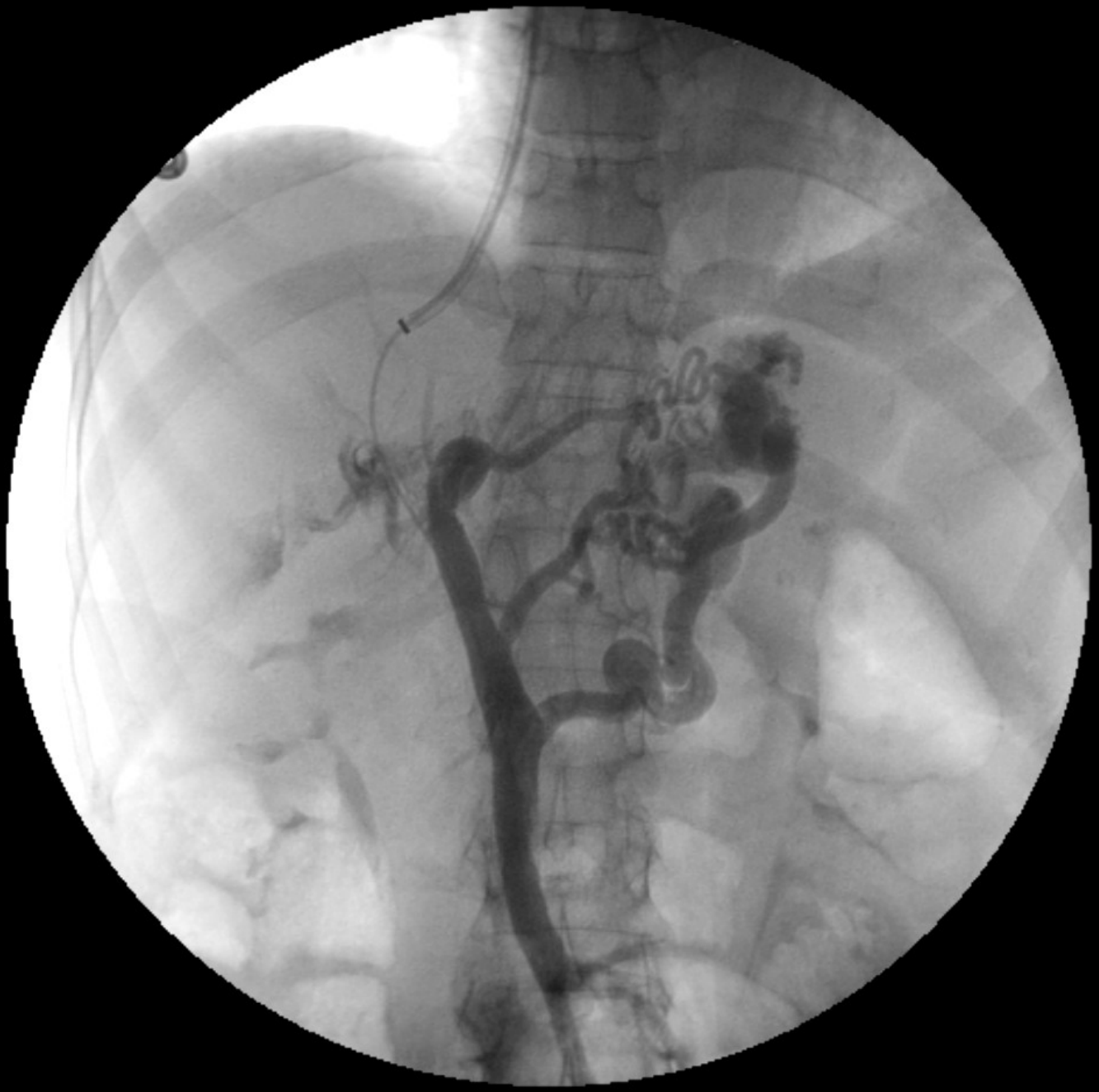
Wedged hepatic venography

Quick review TIPS

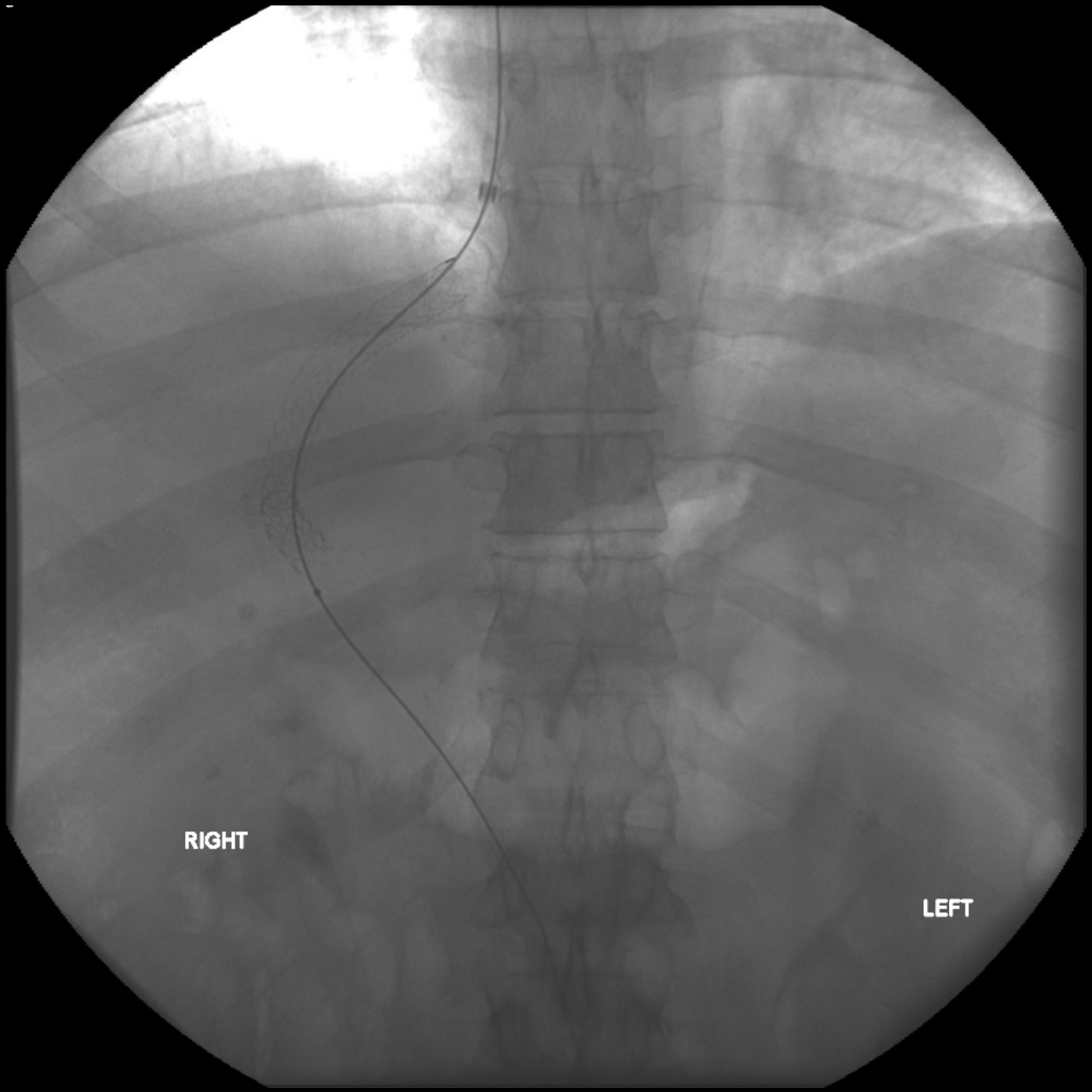
- Decompress symptomatic hypertensive portal system after failed medical management.
- Mainly used to treat bleeding varices and refractory ascites.
- Reduce portal systemic gradient below 12 mmHg to minimize risk of bleeding. Lower for ascites.
- Contraindicated in coagulopathy, biliary obstruction, severe liver disease, encephalopathy and right heart failure.

Gore Via-Torr Stent






GORE VIATORR
10 MM 8 CM 2 CM
RIGHT


RIGHT
LEFT


RIGHT


RIGHT

TIPS reversal

- Worsening encephalopathy
- Onset right heart failure
- Worsening hepatic function

Methods

- Occlusive devices
  - Coils, plugs, excluders
- Reduced diameter stents
  - Maintain shunt with smaller diameter


RIGHT


14mm Vascular Amplatzer Plug
RIGHT

Varix embolization

- Common in the pre-Tips era for controlling variceal bleeding.
- Now performed after TIPS in patients that continue to have bleeding episodes or in patients with competing portal systemic shunts inducing TIPS failure.
- BRTO

Am J Roentgenol 129:237–241, August 1977

Transhepatic Obliteration of Gastroesophageal Varices: Results in Acute and Nonacute Bleeders

MANUEL VIAMONTE, JR.,[1] RAUL PEREIRAS,[1] EDWARD RUSSELL,[1] JAMES LE PAGE,[1] AND DUANE HUTSON[2]

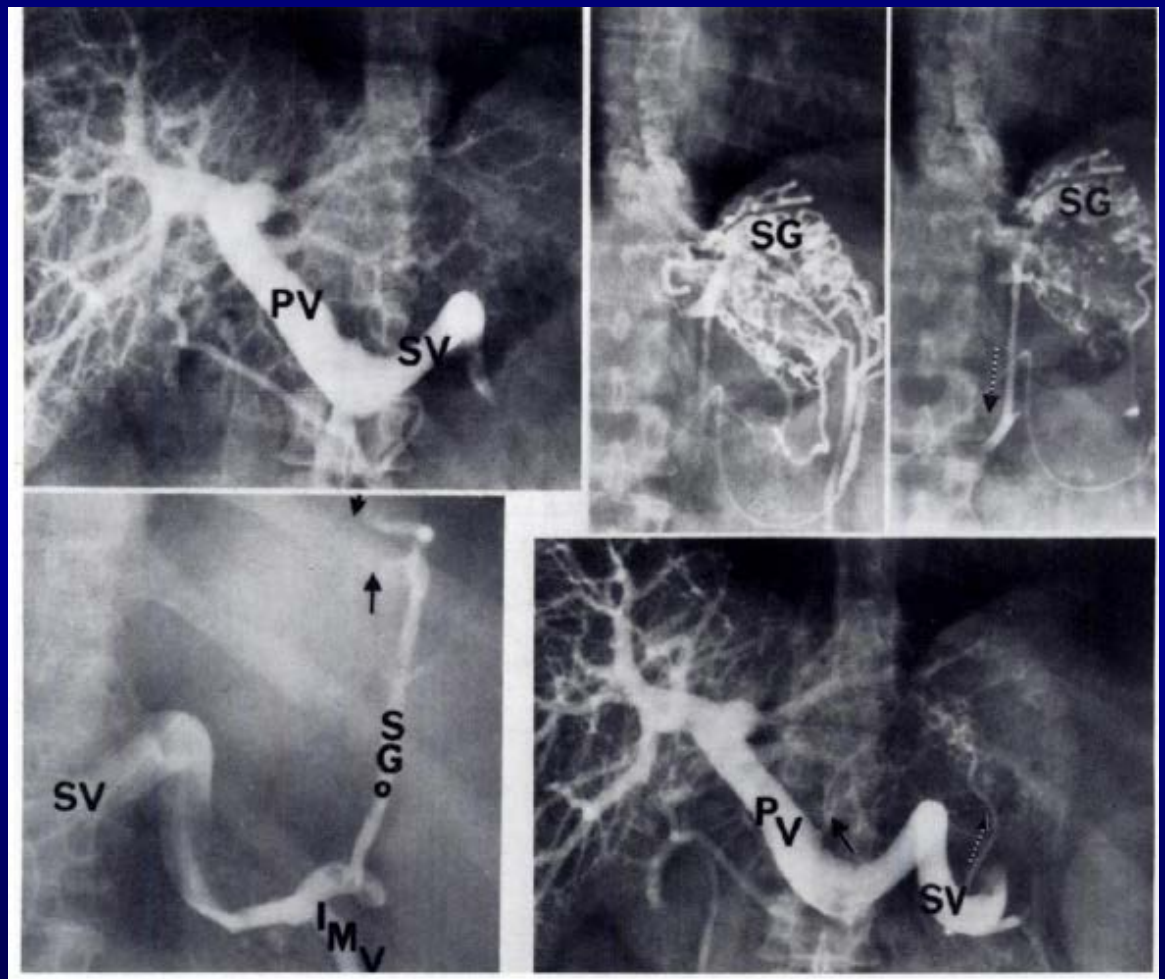
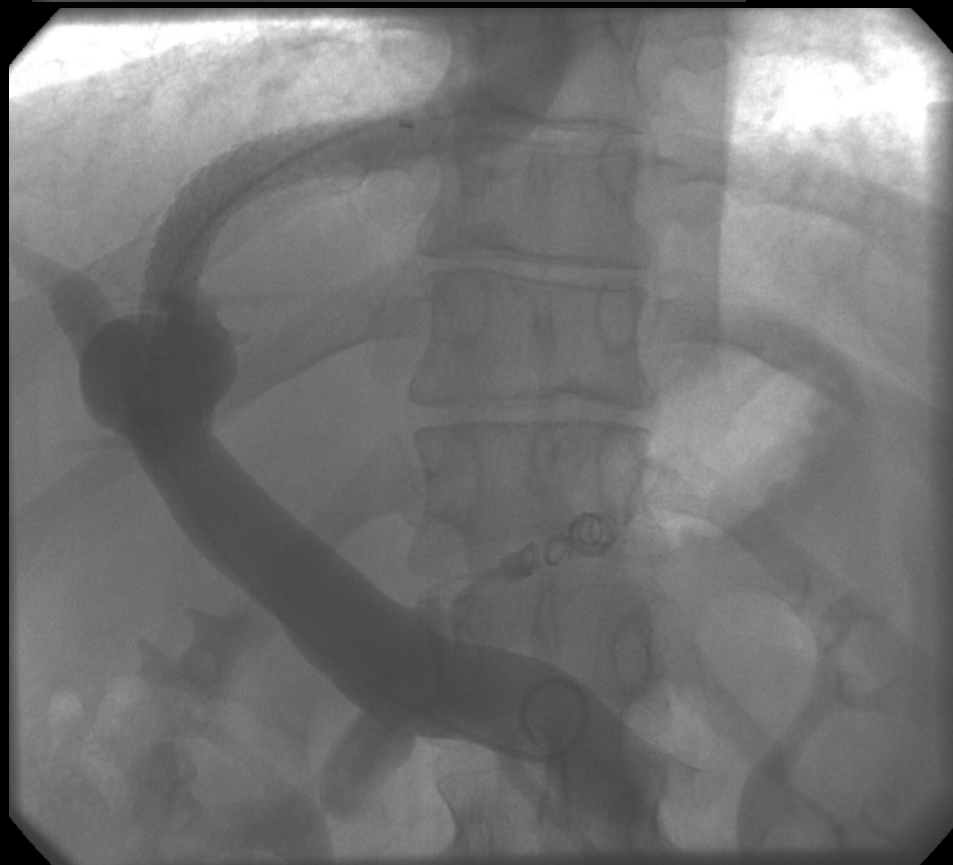


Fig. 1.—Patient with cirrhosis and portal hypertension, not bleeding at time of study. *Top left*, Direct portogram showing no tributaries or collateral circulation. *Top right*, Selective catheterization of short gastric veins (SG) not visualized on direct portogram. Gastroesophageal varices may be overlooked unless superselective catheterization of tributaries of portal vein is attempted. *Bottom left*, Selective splenic venogram following embolization of short gastric veins. Note varices no longer fill (*arrows*). *Bottom right*, Control portogram showing reversal of flow in small gastric vein (*broken arrow*) and in coronary vein (*solid arrow*). IMV = inferior mesenteric vein, o = catheter tip, PV = portal vein, SG = short gastric vessels, SV = splenic vein.


RIGHT
embolization
5X8 3X8
LGV



BRTO

Balloon occluded retrograde transvenous obliteration

- Less invasive than TIPS
- Useful in gastric varices with patent gastrorenal shunt
- No encephalopathy
- Doesn’t compromise hepatic function
- May exacerbate gastroesophageal varices and ascites

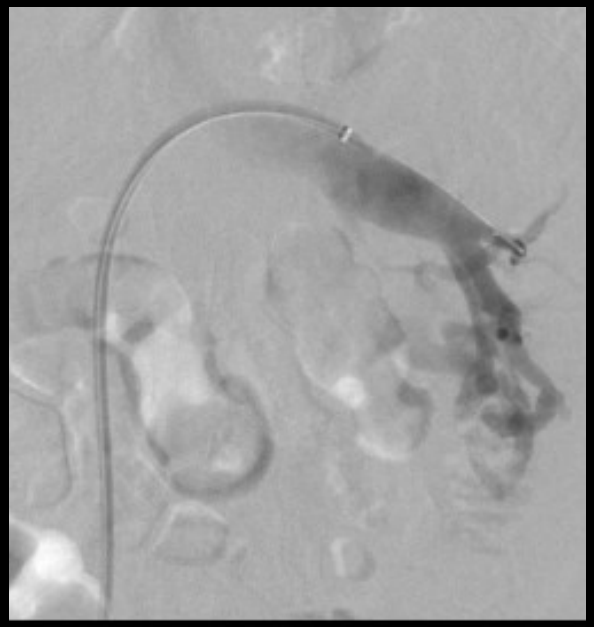
BRTO method

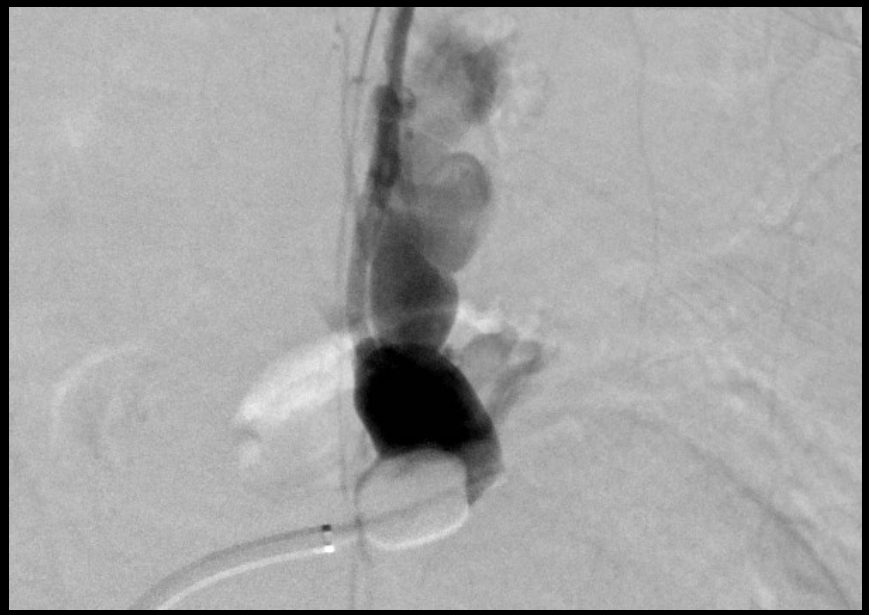
- Access portal system via splenorenal collateral
- Occlude flow with occlusion balloon
- Embolize collateral outflow veins
- Inject sclerosant

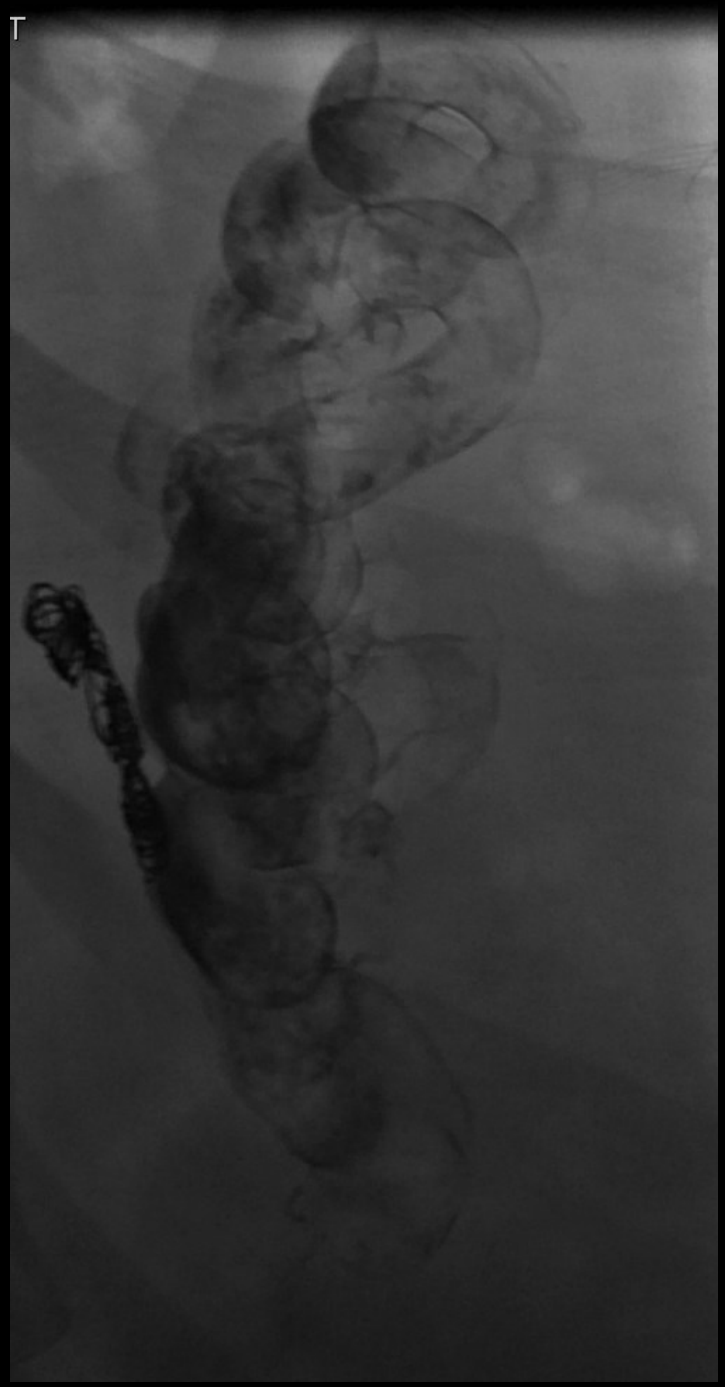
  ethanolamine oleate iopamidol with IV haptoglobin to prevent ARF from hemolysis (Asia)

  Sotradecol, lipiodol, gas 2:1:3 (America)

- Remove balloon after 12 hours








post 16 hours

BRTO

- Technical success 85 – 100%
- Rebleeding gastric varices uncommon
- Worsening gastroesophageal varices up to 68%

Portal recanalization

- Balloon/Stent
- Mechanical thrombectomy
- Fibrinolysis
- Often a combination of these

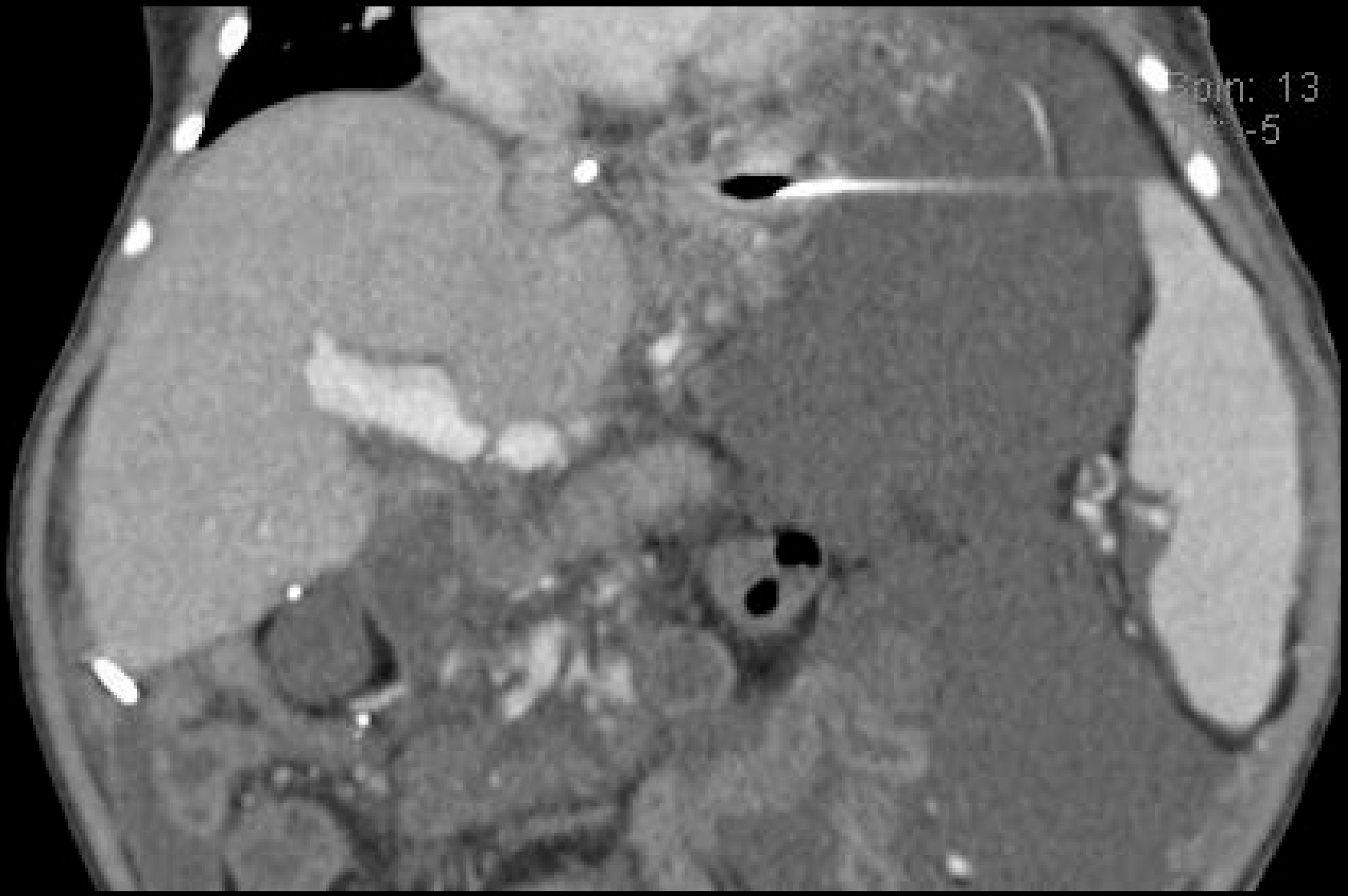
Transplant patients

- Stenosis- 0.5 – 3%, Plasty treatment of choice
- Thrombosis can be catastrophic

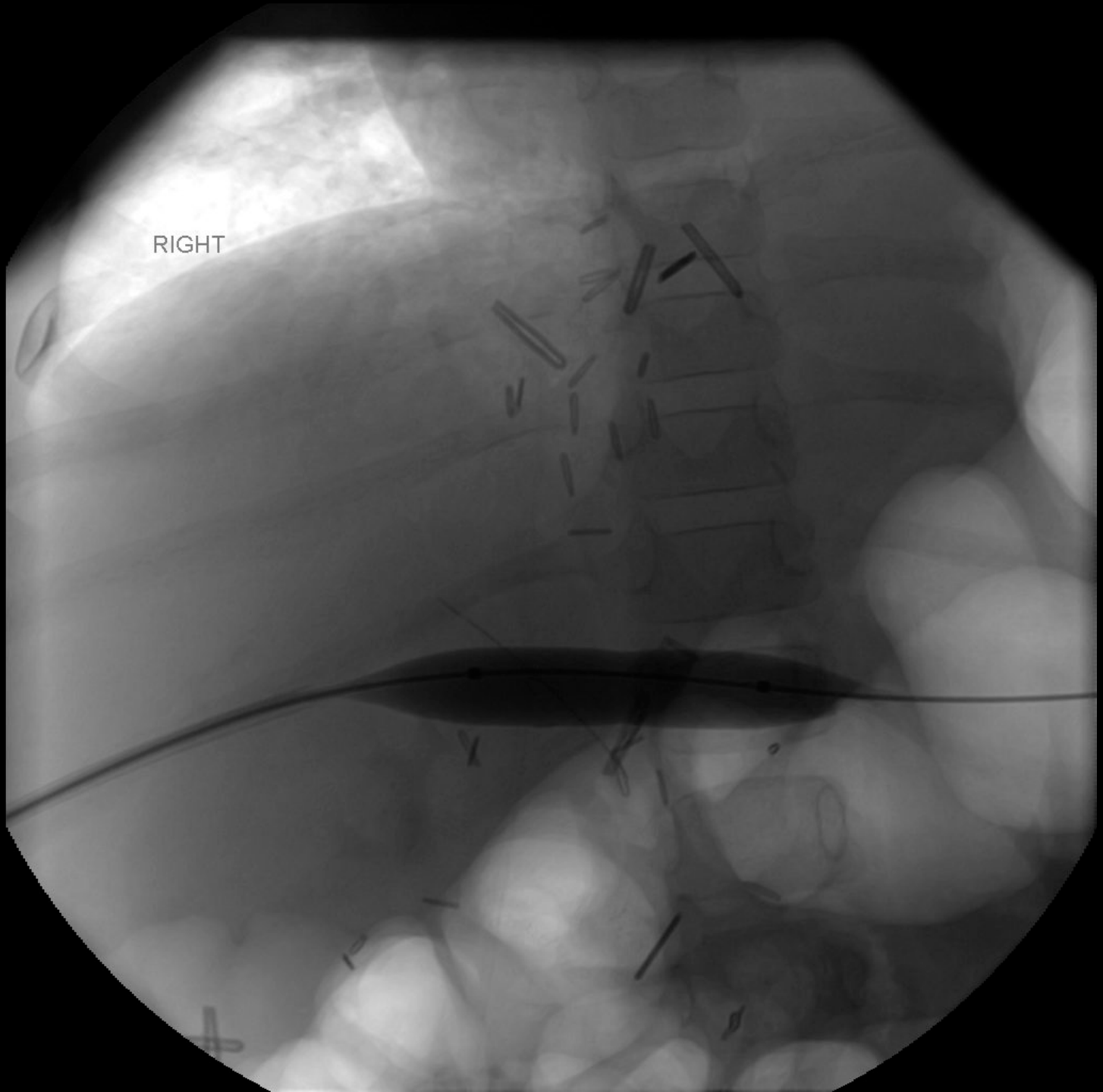
  Direct, indirect lysis, mechanical thrombectomy
- Thorough planning of potential catheter directed therapies vital for determining access options (transjugular vs. transhepatic)

- 4 yo female one month post transplantation with gastric varix bleeding.

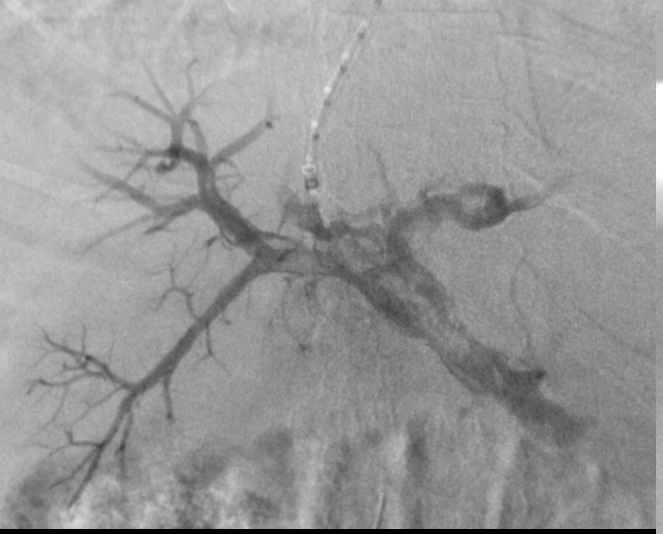
- Question portal stenosis

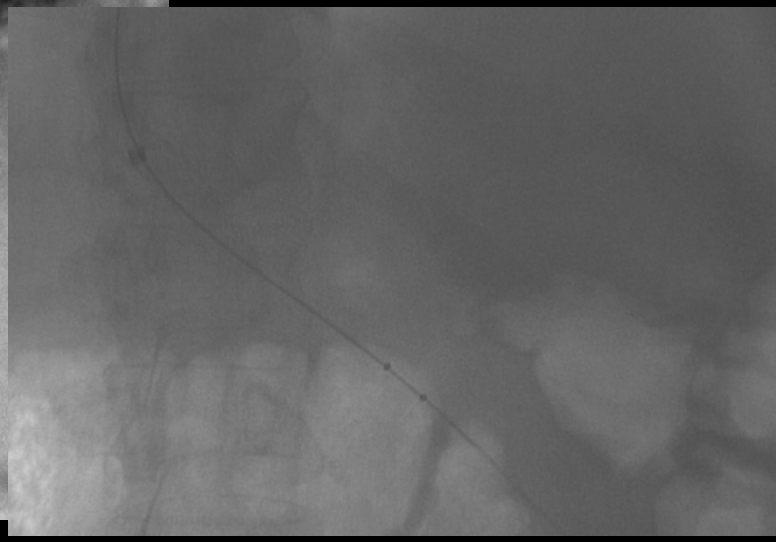

Scan: 13
-5


RIGHT


RIGHT

- Portal vein thrombosis with worsening abdominal pain





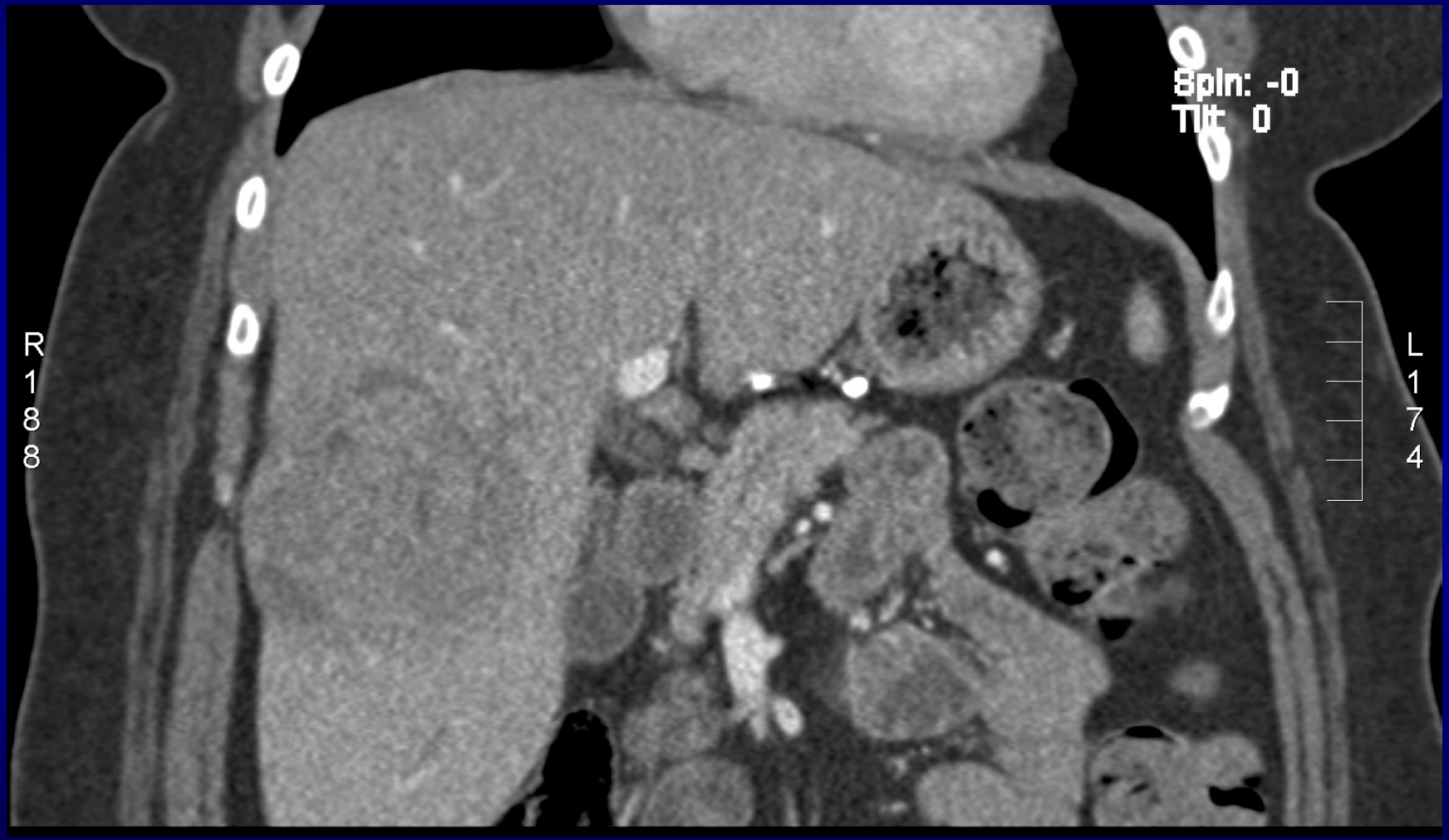
Portal Lytic Therapy

- JVIR 2005 May, Hollingshead et.al.
- 20 patients treated with 15 having some degree of thrombolysis
- 17 had resolution of symptoms
- 12 developed a major complication along the way.
- Conclusion - Beneficial, but high complication rate suggests this should be reserved for patients with severe disease

Lysis rule of thumb

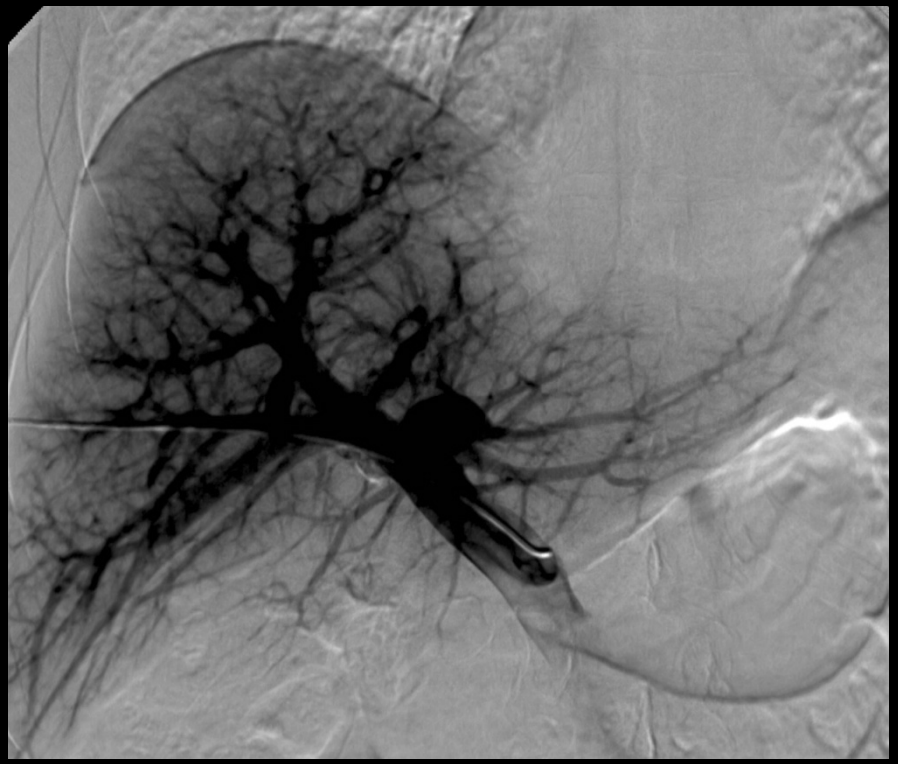
- Know high risk situations
  - GI bleed
  - recent stroke
  - recent surgery or trauma
- ICU during t-PA infusion
- Follow fibrinogen during infusion
  - adjust dose when drops below 200
- Follow H/H
  - consider scan to assess for bleeding at access site

Planned extended right liver resection



Presurgical portal embolization for induction of remnant hypertrophy

- Makuuchi, et.al. 1990 Surgery – Portal vein embolization (PVE) to induce future liver remnant (FLR) hypertrophy increases safety of major hepatectomy.
- Kubota et. Al. Hepatology 1997 >40% FLR required in compromised livers
- Abdalla, et.al.Arch Surg 2002 - >20% FLR required in healthy remnants.



Islet cell transplantation

- Patients with chronic panceatitis unable to achieve pain control.
- Acute pancreatitics with multiple episodes not successfully treated by other methods
- Total pancreatectomy with reimplantation of isolated islet cells into liver via portal vein infusion.

Islet cell transplantation

- Catheter placed at surgery or via transhepatic approach
- Pressures obtained stepwise during infusion
- Infusion halted when portal pressure exceeds 30 mmHg to prevent portal thrombosis
- Catheter removed surgically if placed in OR or with tract embolization if placed by IR

MATERIAL AND METHODS-**PROCEDURE**

Total pancreatectomy

Pancreas

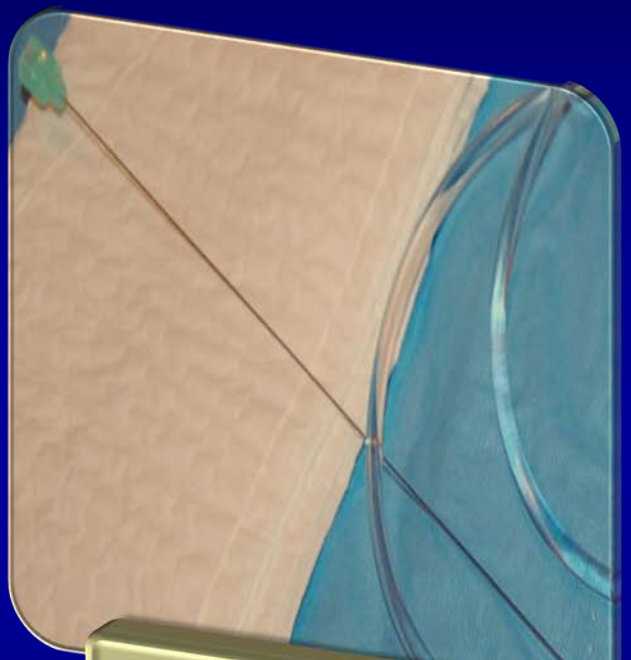
MATERIAL AND METHODS-**PROCEDURE**

Pancreatic tissue

Mechanical and enzymatic digestion

Harvested Islets

MATERIAL AND METHODS-**PROCEDURE**

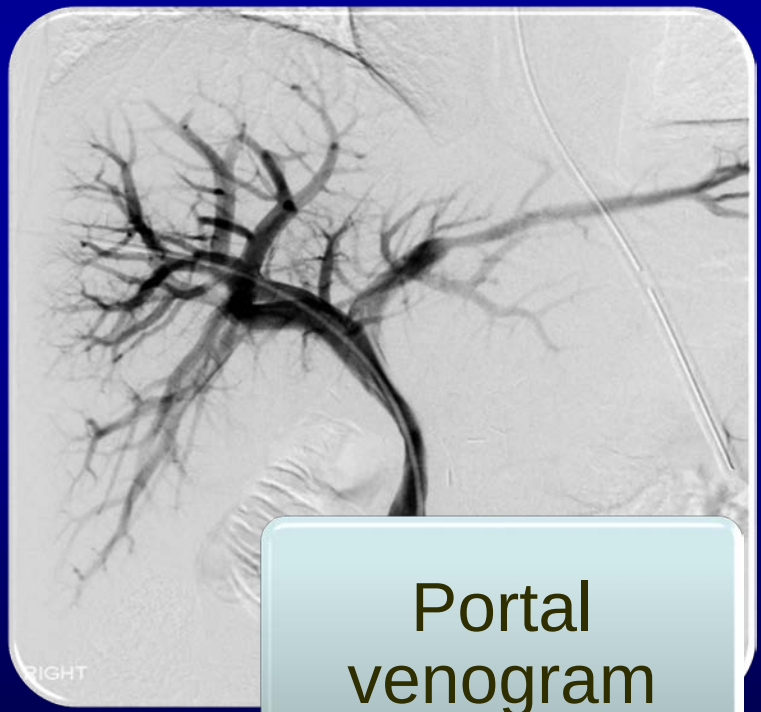


Chiba needle

Portal vein percutaneous access

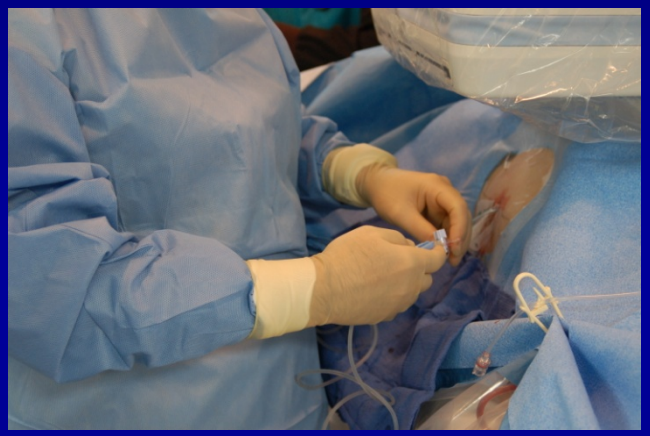
MATERIAL AND METHODS-**PROCEDURE**

percutaneous access



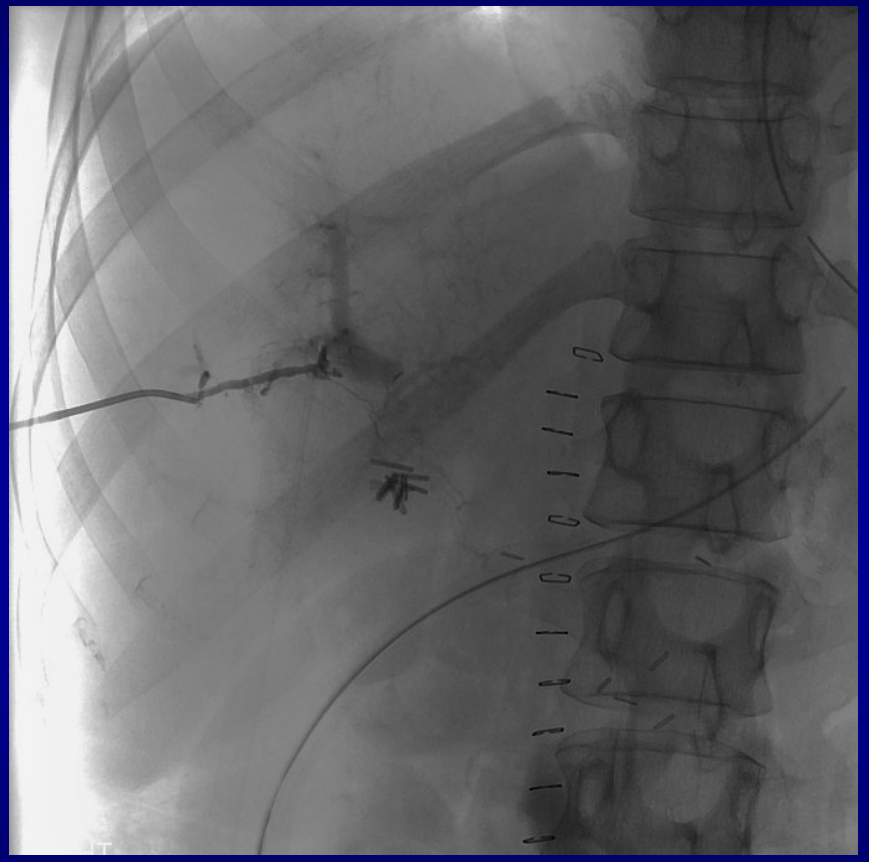
Portal venogram

MATERIAL AND METHODS-**PROCEDURE**



Islet cells infusion by gravity

MATERIAL AND METHODS-**PROCEDURE**



Final portogram
Tract embolization

Complications (First 50 patients)

- 10 Pneumonia
- 3 DVT
- 2 Hepatic Artery Pseudoaneurysm
- 2 Bile Leak
- 2 Cardiac Arrest requiring CPR
- 1 Death within 30 days
- 1 Portal Vein Thrombosis
- 1 Hepatic Abscess
- 1 Biliary Anastamotic Stricture

Outcomes

- Approximately 10% insulin free with 40% requiring less than 10 U / day
- Statistically significant improved physical and mental quality of life scores at six and twelve months postop
- Decreased narcotic requirement

Thanks