Hepatic Artery Stenosis after liver transplantation:

Diagnosis and Intervention

Vascular Interventional Radiology

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Advanced Radiology Clerkship

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Objectives

- Common vascular complications after liver transplantation
- Causes of these vascular complications
- Review Liver Transplant Anatomy
- Learn about Vascular Interventional treatment for Hepatic Artery Stenosis.
- Learn terminology like selective catheterization, angioplasty and stenting
- Interventional treatment outcomes
- Interventional treatment complications
Vascular complications after liver transplantation are a major cause of morbidity and mortality.

**Hepatic artery stenosis** is the second most common vascular complication. (hepatic artery thrombosis is the most common.)

The estimated incidence for hepatic artery stenosis can be as high as 13%.

Hepatic artery stenosis can have an acute (days) or insidious (several months) course and be the cause of graft ischemia, hard to distinguish from graft rejection.

Surgical intervention with possible retransplantation is usually required.

As we will see, minimally invasive options are developing.
What Causes H.A.S.? 

Hepatic artery stenosis can be caused by:

- clamp injury
- intimal injury
- anastomotic ischemia
- rejection
40 y/o female patient with past medical history of **cirrhosis due to schistosomiasis** and **hepatic failure**. Patient received a liver transplant 3 months ago. She now presents with increasing liver enzymes and general malaise. Liver biopsy showed findings consistent with rejection. CT Angiography showed findings consistent with hepatic artery stenosis. Ischemia induced rejection of allograft was considered.
Menu of Tests

● **Doppler Ultrasound** *(Screening)*

● **CT Angiography** *(Screening? Diagnostic? A topic of its own!)*

● **Catheter Angiography** *(Diagnostic “Gold Standard”)*
Screening

- Doppler US as Screening Modality
  (Up to 70% Sensitive when 2 of the following criteria are abnormal)
  - Diagnosed if peak systolic velocity exceeds 200-300 cm/s at anastomotic site
  - RI (Resistive Index) greater than 0.5
  - SAT (Systolic Acceleration Time) of 0.08 second or longer

Confirmation by Arteriogram is still required due to the low specificity of ultrasound in this setting!
Diagnosis: Ultrasound

- typical rounded tardus parvus waveform morphology, which is indicative of severe stenosis or thrombosis.

Differential Diagnosis

- Hepatic artery thrombosis
- Hepatic artery stenosis
- Hepatic artery pseudoaneurysm
Notice there is no stenosis in the common hepatic artery on this 3D reformat of our patient’s pre-operative CT Scan.
Diagnosis: CT Angiography

Common Hepatic Artery “band-like” stenosis

Aorta

Celiac Trunk
Diagnosis: CT Angiography

Illustrated above: Common Hepatic Artery “band-like” stenosis
Diagnostic: Angiography

Celiac Trunk Anatomy

- Left gastric artery
- Splenic artery
- Common hepatic artery stenosis
Hepatic Artery Angioplasty and Stenting:

- HAS angioplasty and stenting is a minimally invasive endovascular procedure which can be performed as an alternative to open surgical revision. It can be performed through the same vascular access used for the confirmatory diagnostic catheter angiography.
1. Femoral Artery Access Catheterization
2. Guide-wire through femoral artery access
3. Celiac trunk catheterization and angiography
4. Selective Catheterization of Hepatic Artery
5. Hepatic Artery Angiography and visualization of band-like stenosis
6. Hepatic Artery Balloon Angioplasty with Stenting
7. Guide-Wire through femoral vein access
Liver Transplant Anatomy

http://emedicine.medscape.com/article/375855-overview
Mechanism of Stent Placement

A guide wire with a deflated balloon is passed through the catheter in the narrowed artery.

The balloon is then inflated to open the narrowed artery and the stent expands around the balloon.

The balloon is removed and the stent is left in place to keep the artery open.

http://hcd2.bupa.co.uk/fact_sheets/html/coronary_angioplasty.html
Celiac angiography: Both for diagnosis and for guidance of therapy

Sometimes an image like this one is saved for “road mapping” technique during the procedure. The radiologist then navigates under active fluoroscopy but with the help of a road map, therefore the name of this technique.

Angiogram showing celiac trunk anatomy with band-like stenosis of common hepatic artery and biliary drainages to the right (Patient’s right).
Selective Hepatic Artery Angiography

- Common hepatic artery
- Splenic artery
- Tip of catheter
Hepatic artery stent placement
Post Procedure Angiography
Post Procedure Angiography
Comparison

Before

After

PACS/BIDMC

PACS/BIDMC
Comparison

Before

PACS/BIDMC

After

PACS/BIDMC
Stent placement in hepatic artery
Companion Patient 1: Hepatic Artery Stenosis Angiogram

http://emedicine.medscape.com/article/375855-overview
Companion Patient 1: Inflating Balloon Angioplasty

http://emedicine.medscape.com/article/375855-overview
Questions

- What are the short-term outcomes?
- What are the long-term outcomes?
- What are the complications?
Outcomes

- In a study by Da Sylva, et al. 253 liver transplant patients were evaluated.
- Nine patients with HAS were identified. One had severe hepatic artery spasm which prevented treatment in two separate attempts.
- All others were treated with angioplasty with or without stenting. Parameters improved in all those that were treated.
- Four patients (w/ stents) required retreatment. Two underwent angioplasty and two thrombolytic therapy.
- At an average follow-up of 31 months there was no mortality nor graft loss.

There is no real consensus of opinion regarding the treatment of vascular complications after liver transplant.
For early HAS: liver retransplantation is recommended.

For late HAS (if there is no irreversible liver damage or bile duct ischemia): interventional treatment is appropriate.
Complications

- local thrombosis
- dissection
- rupture
- pseudoaneurysm formation
- distal embolization

Companion Patient 2:
58-year-old woman with stenosis of transplanted hepatic artery detected on Doppler sonography.
Complications

- local thrombosis
- dissection
- rupture
- pseudoaneurysm formation
- distal embolization

Companion Patient 2:
Rupture was repaired with a covered stent and continued patency at 13 month follow-up without any further intervention to hepatic allograft.

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