Journées Francophones d'Imagerie Médicale

DIAGNOSTIC AND INTERVENTIONAL RADIOLOGY OF LIVER TRANSPLANTATION

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INTRODUCTION

Hepatic transplantation = standard of reference for the treatment of severe and terminal liver diseases

Complication rate of liver transplantation is decreasing:
-Improvement of treatment (immunosuppression, new surgical techniques)
-Early detection of complications

RADIOLOGY

Doppler US : depiction

New CT and MR techniqu

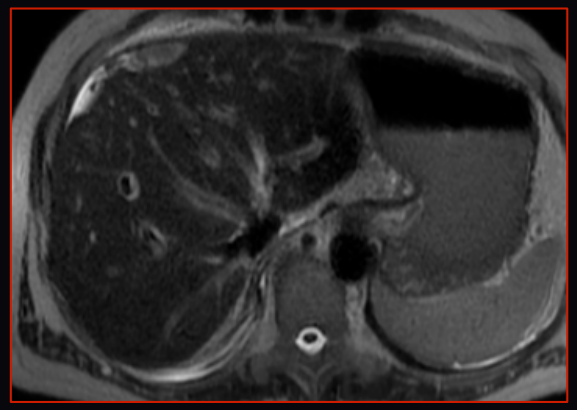
INTERVENTIONAL RADIOLOGY

NORMAL APPEARANCE

DIFFERENT TECHNIQUES OF LIVER TRANSPLANTATION

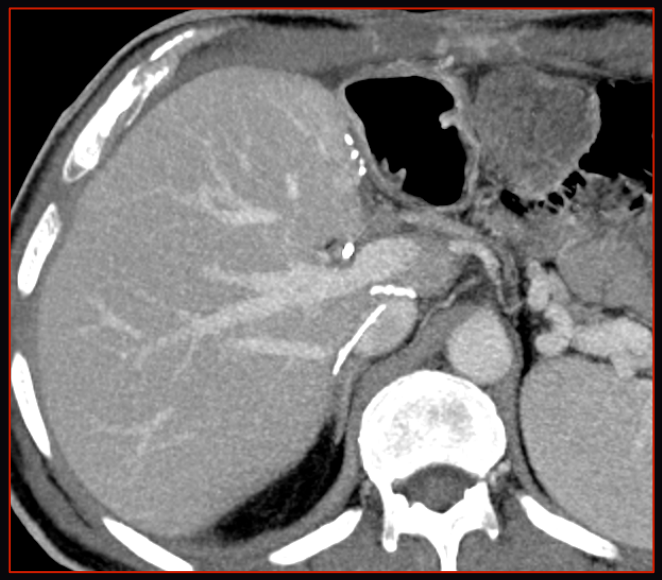
ORTHOTOPIC LIVER TRANSPLANTATION

Entire liver from a donor (brain or cardiac death)

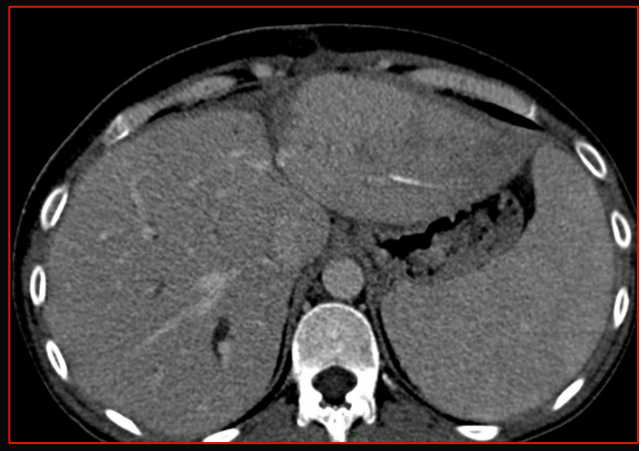


SPLIT LIVER TRANSPLANTATION

- The liver is divided
- Living donor or deceased donor



AUXILIARY TRANSPLANTATION Temporary transplantation of a liver part while remaining recipient native liver

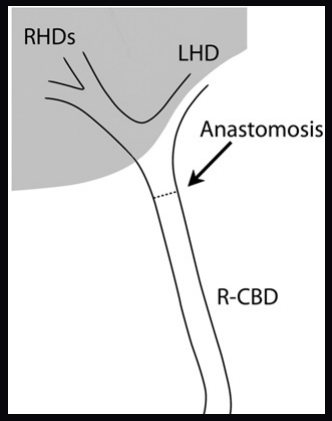


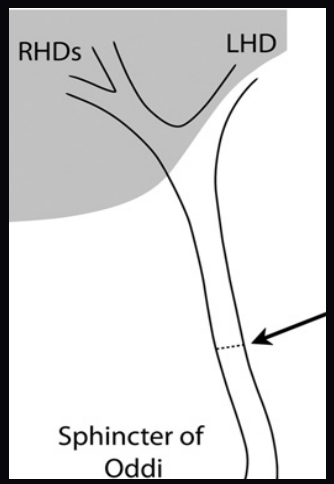
BILIARY ANASTOMOSIS

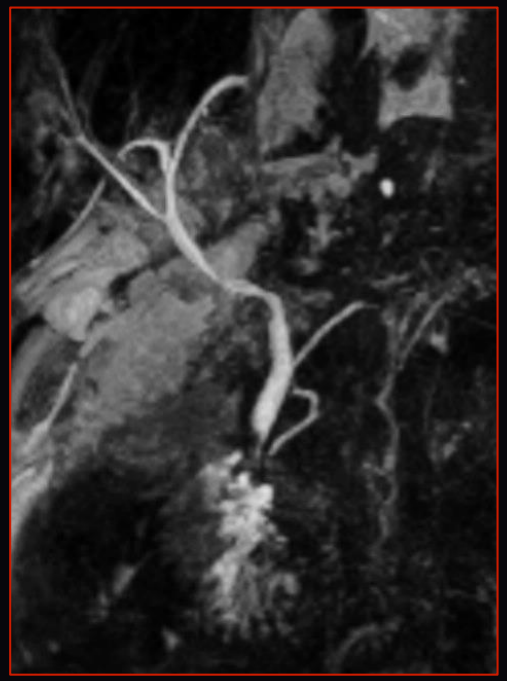
BILIARY

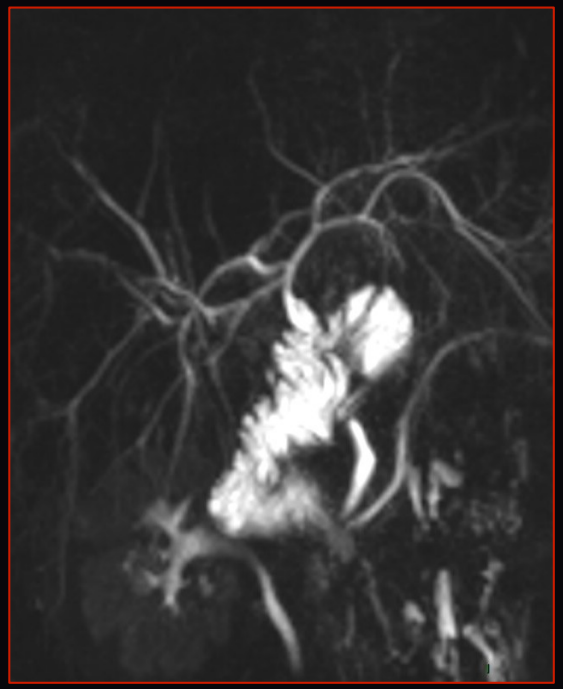
BILIARY ANASTOMOSIS

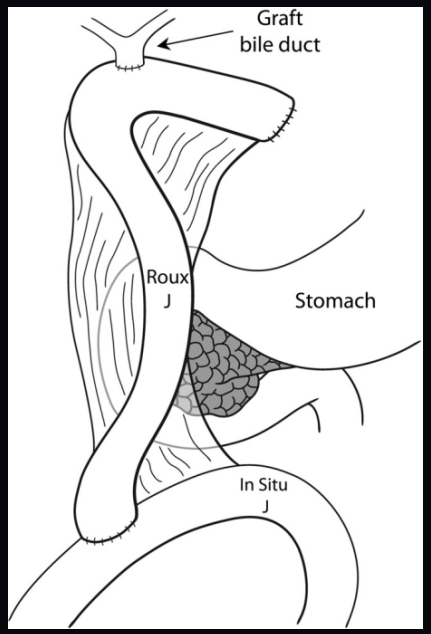
BILIARY ENTERIC ANASTOMOSIS





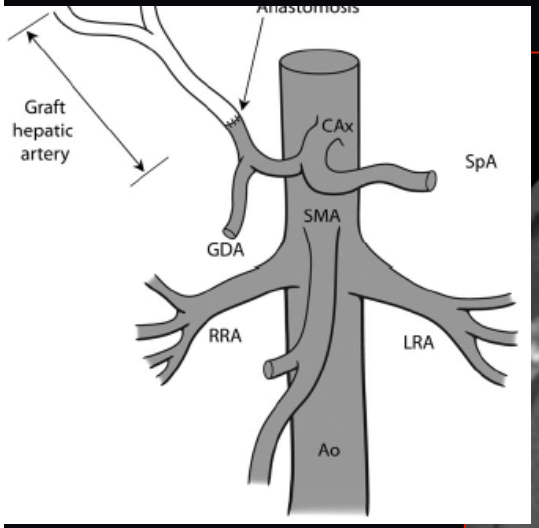


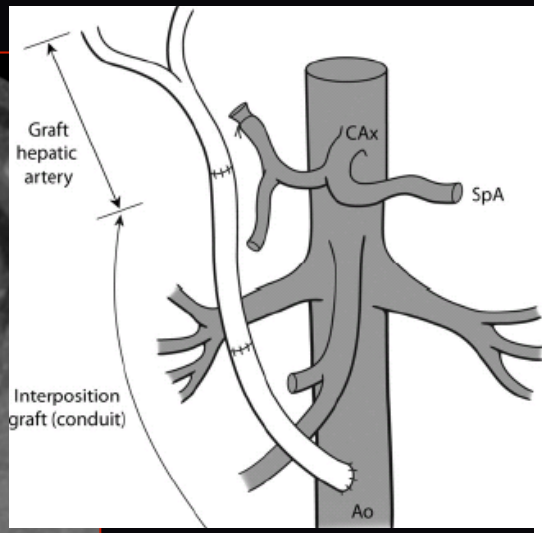




ARTERIAL ANASTOMOSIS

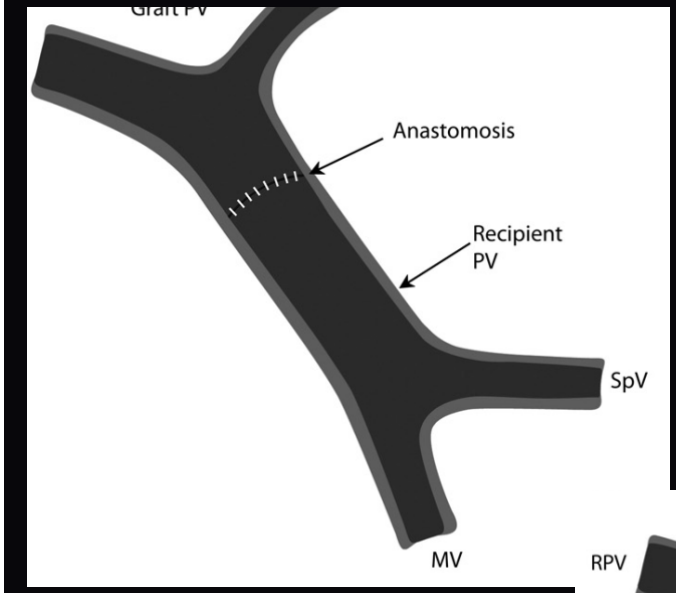
Possible graft interposition

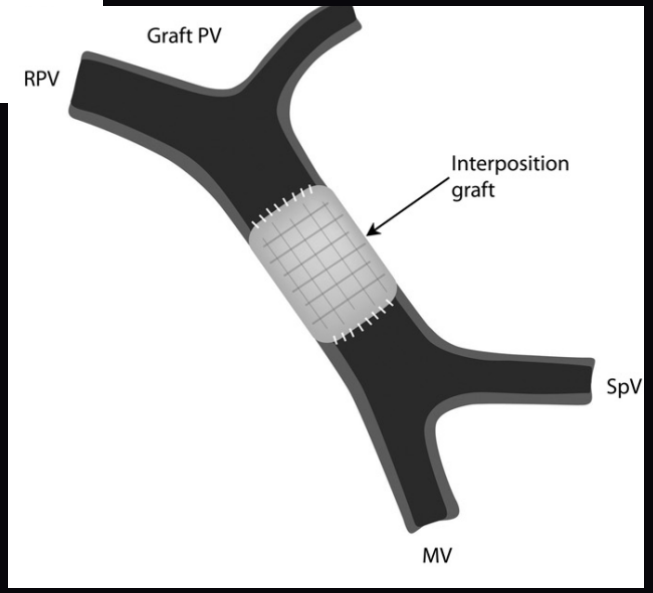


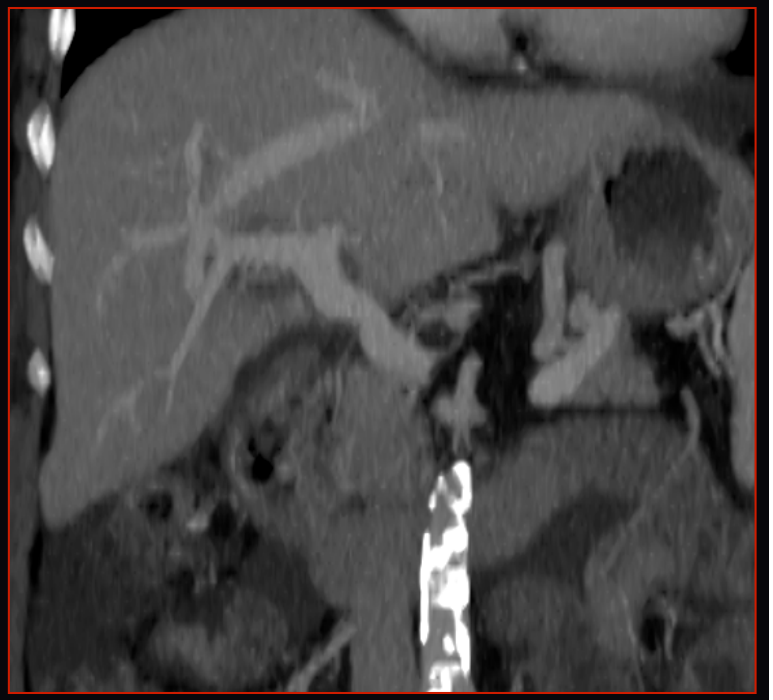


PORTAL ANASTOMOSIS

Termino-terminal anastomosis
Possible graft interposition (PV thrombosis)



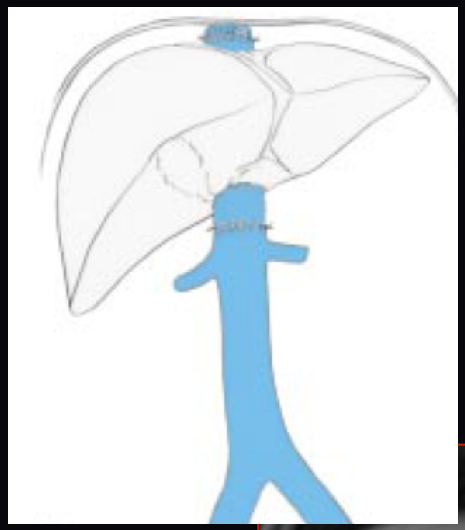




HEPATIC VEINS AND IVC

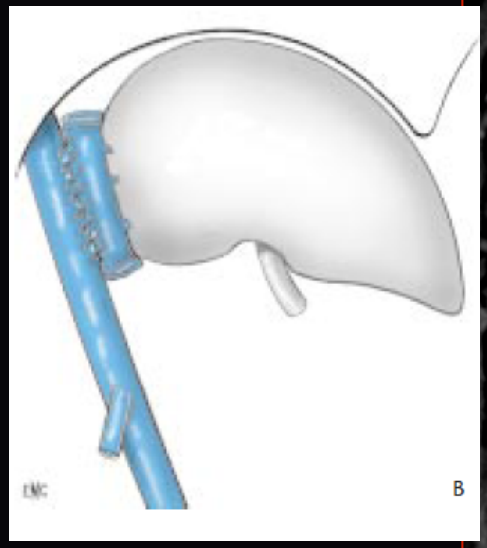
CLASSICAL ANASTOMOSIS

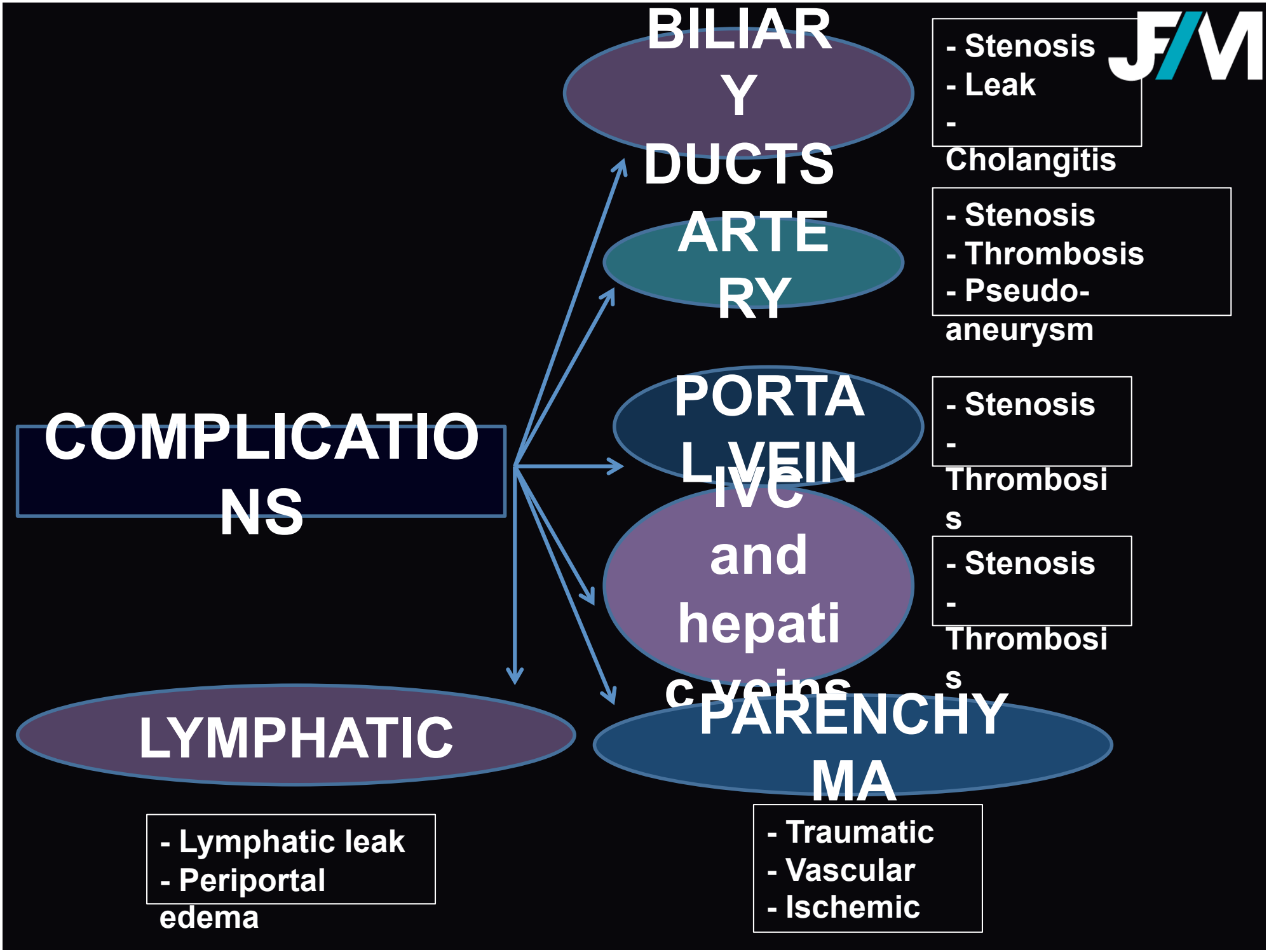
donor IVC with two upper and lower anastomoses



PIGGYBACK

Anastomosis between retrohepatic donor IVC to native IVC




COMPLICATIONS
BILIARY DUCTS
- Stenosis
- Leak
- Cholangitis
ARTERY
- Stenosis
- Thrombosis
- Pseudo-aneurysm
PORTAL VEIN
- Stenosis
- Thrombosis
IVC and hepatic veins
- Stenosis
- Thrombosis
LYMPHATIC
- Lymphatic leak
- Periportal edema
PARENCHYMA
- Traumatic
- Vascular
- Ischemic

BILIARY COMPLICATIONS

10 to 40% of liver transplantation
Second cause of liver dysfunction after rejection

- Biliary leak and anastomotic stenosis

Treatment:
45% endoscopy
22% percutaneous interventional radiology
29% surgery

ANASTOMOTIC BILIARY STENOSIS

4 to 9% of liver transplantation

3 first months

No difference according to:
-Bilio-biliary, bilio-enteric anastomosis, transcystic tube

MECHANISM
-Peri-anastomotic fibrosis (local ischemia related to microvascular injuries)
-Thrombosis or stenosis of hepatic artery
-Surgical cause

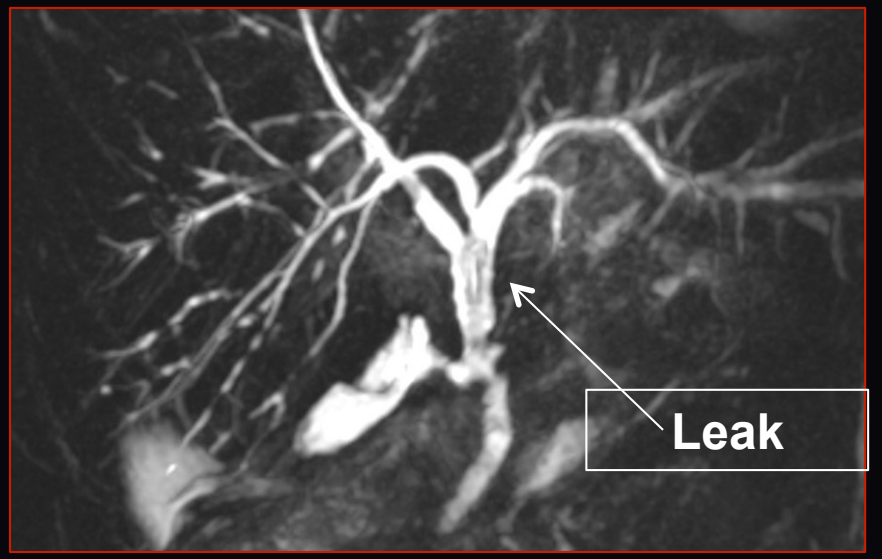
Biliary tests abnormalities
Biliary ducts dilatation at US

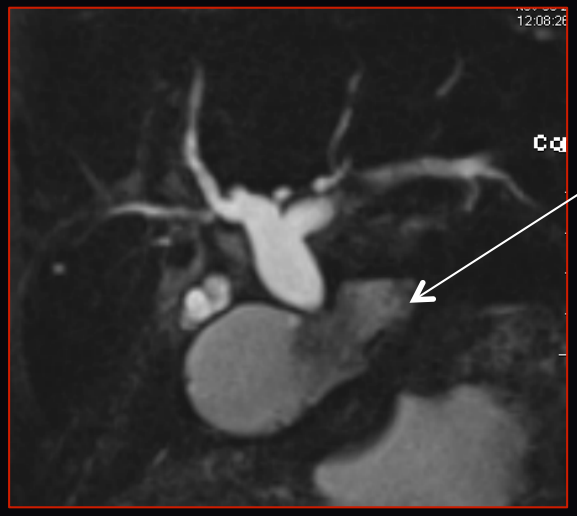
3D MRCP :
- **Biliary cartography**
- **Analysis of stenosis**

BILIARY LEAKS

1 to 3 months after liver transplantation
1 to 10% of transplantations

CAUSES:
- Anastomic biliary variants
- Hepatic artery thrombosis
- Post-biopsy leak
- Infection
- Technical failure
- Anastomotic dysfunction



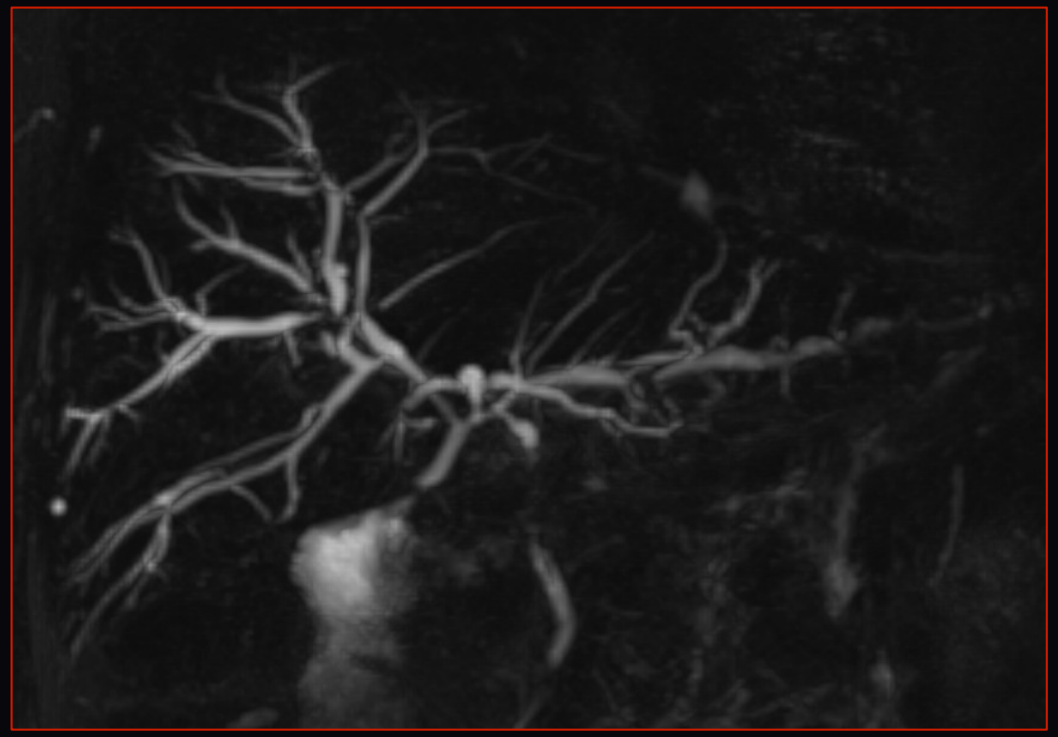


MRCP: Visualization of the leak

ISCHEMIC CHOLANGITIS

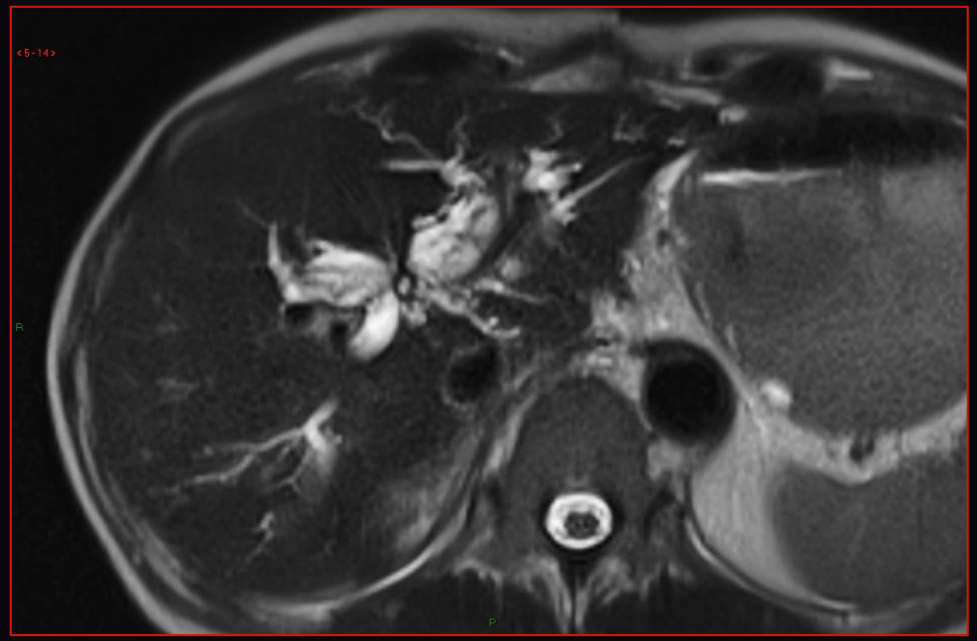
Secondary to stenosis or thrombosis of hepatic artery

Ischemia and necrosis of biliary ducts



MRCP:

- Multiple biliary stenoses
- Biliary leaks
- Biliary casts
- Biliary abscesses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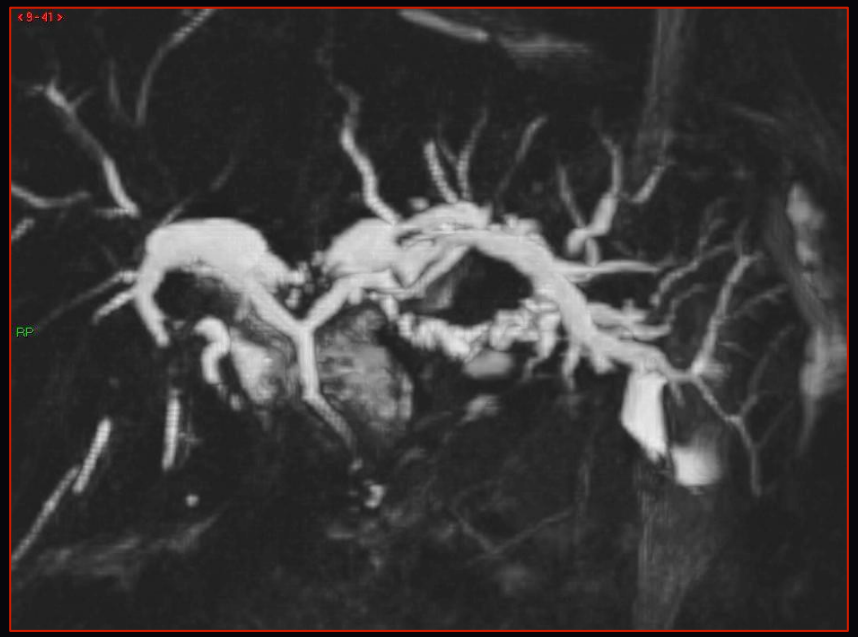
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ISCHEMIC TYPE BILIARY LESIONS

-Biliary abnormalities similar to ischemic cholangitis without hepatic artery abnormality

-Unknown cause
-Predisposing factors:

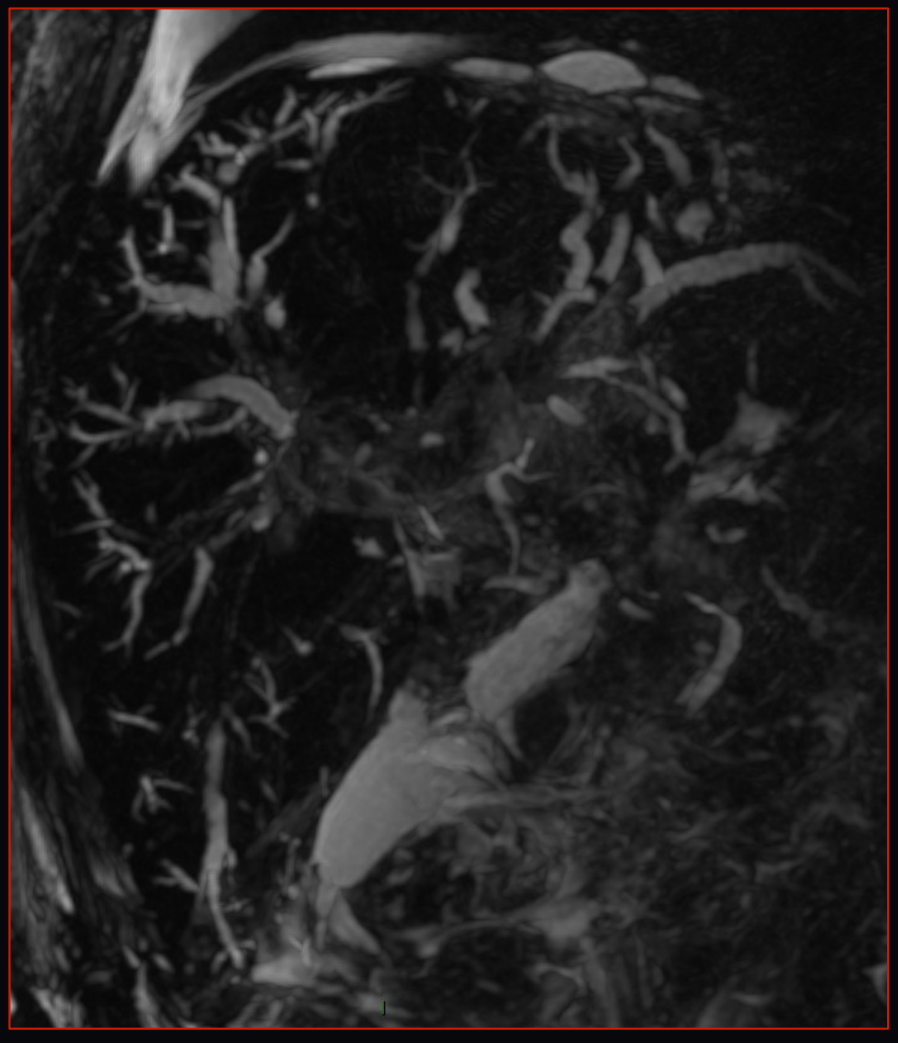
•Long duration cold ischemia (> 10 to 12h)
•Endothelial abnormalities related to reperfusion
•Preservation liquides

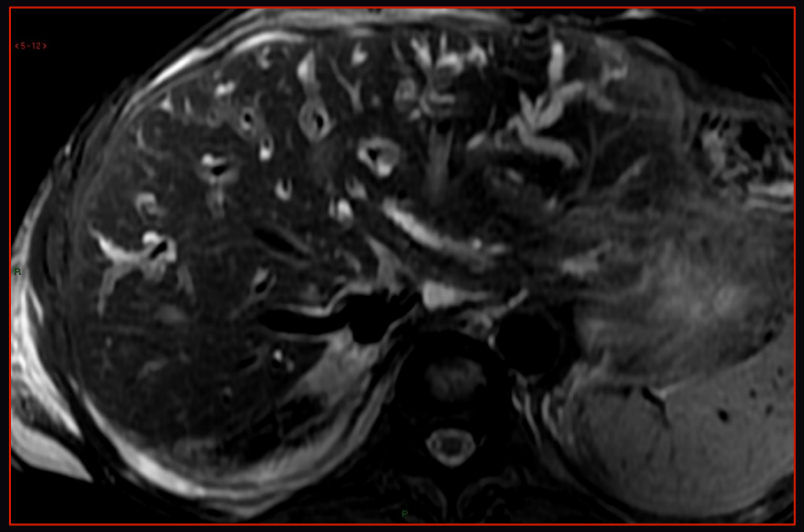
MRCP:
-Multiple biliary stenoses
-Biliary duct dilatation
-Biliary abscesses

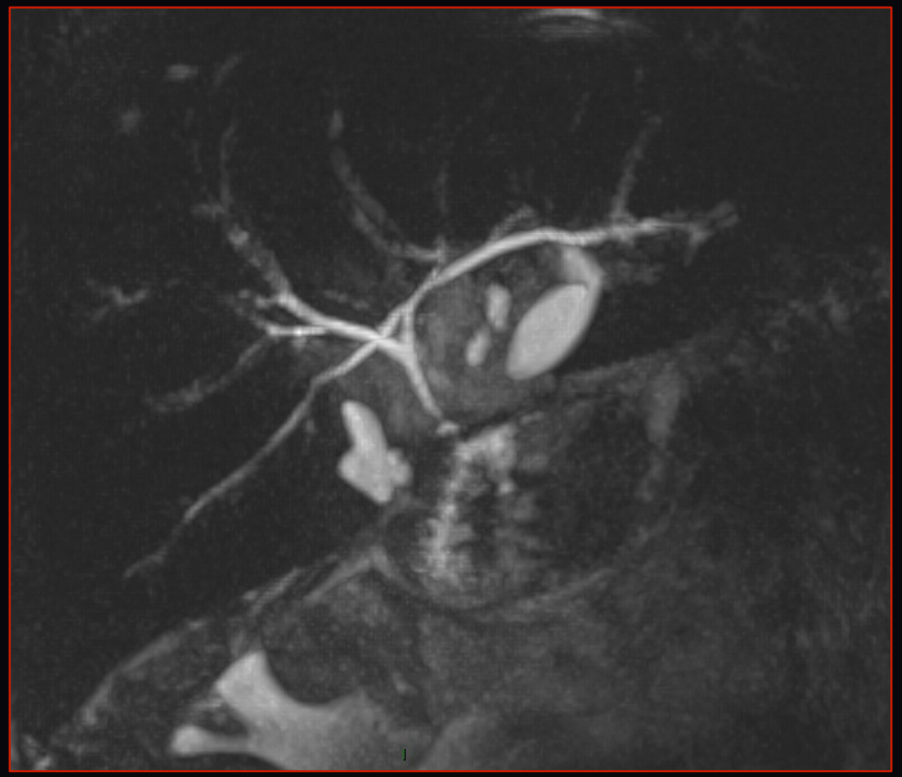
-NORMAL HEPATIC ARTERY

ABNORMAL CONTENT OF BILIARY DUCTS

BLOOD



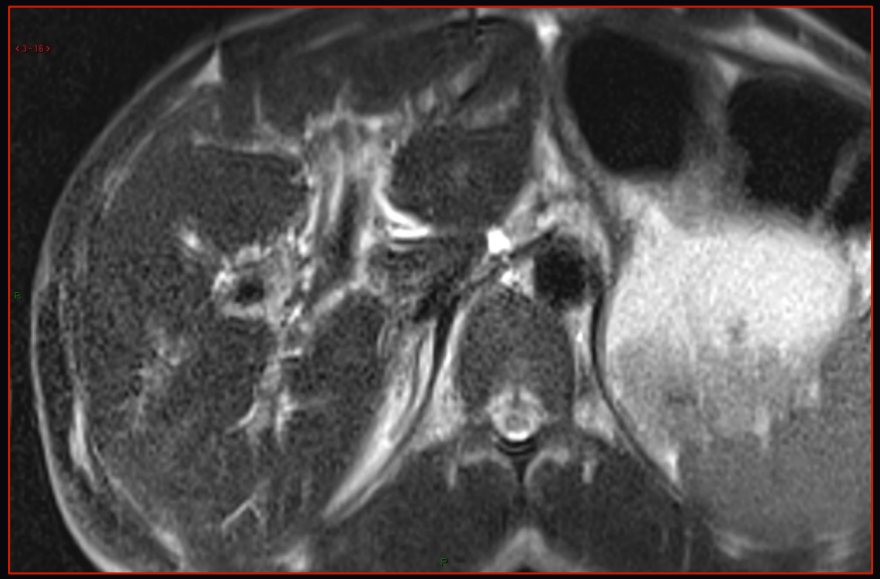


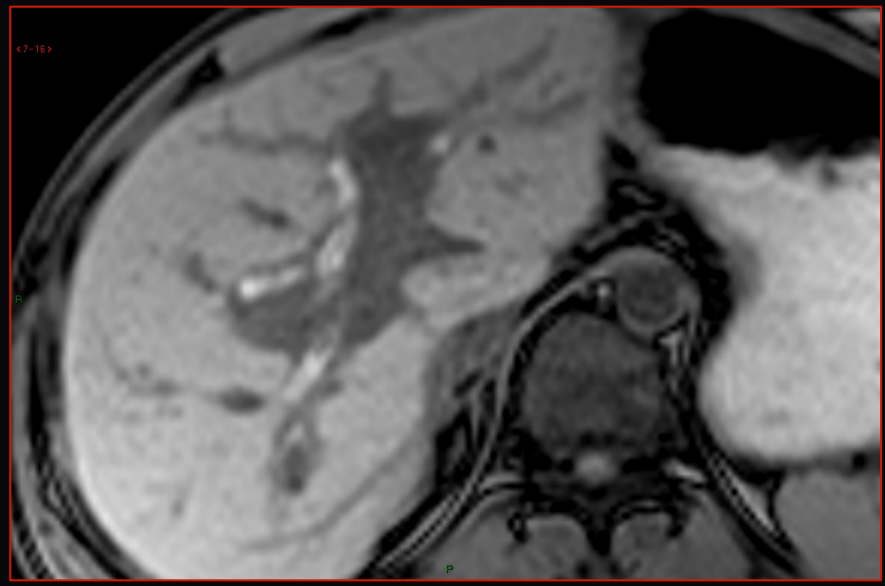


ABNORMAL CONTENT OF BILIARY DUCTS

CASTS

Ischemic cholangitis (biliary cast syndrome)





SLUDGE

STONES

Bile content alteration related to medical treatment (cyclosporin)

VASCULAR COMPLICATIONS

HEPATIC ARTERY

Severe complications

9% of liver transplantation
Associated biliary complications in more than 2/3 of cases
Retransplantation 50%

HEPATIC ARTERY STENOSIS

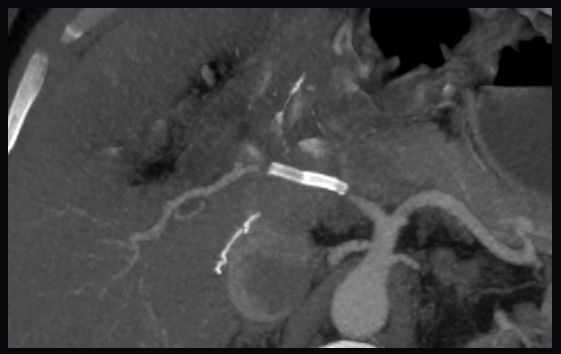
5 to 11%
First 3 months
Anastomotic stenosis

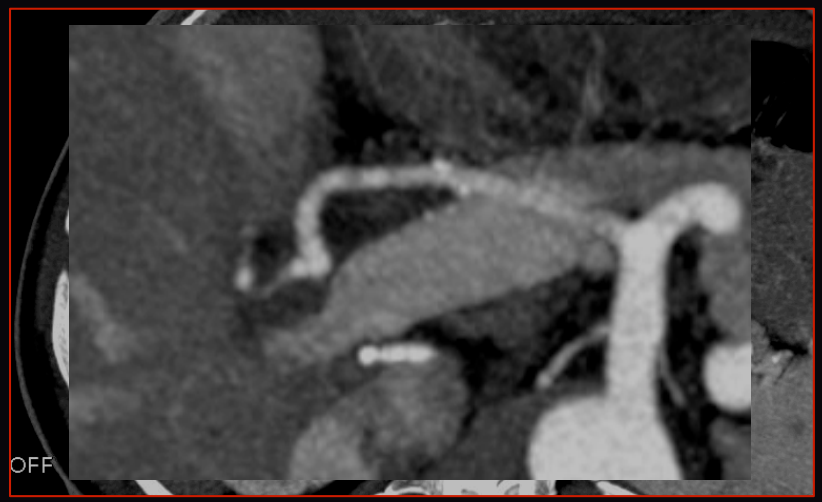
CAUSES:

-Surgical injury
-Arterial intima injury during reperfusion
-Loss of vasa vasorum

Depiction at Doppler ultrasound and CT angiography

Treatment: angioplasty plus stent > surgery





HEPATIC ARTERY THROMBOSIS

4-12% of liver transplantations

CAUSES:
-Difference of artery diameter between donor and receiver
-Anastomotic graft
-Coeliac trunk stenosis
-Long duration cold ischemia
-ABO incompatibility
-CMV infection
-Acute rejection

RISK:
Ischemic cholangitis
Acute liver necrosis
Retransplantation

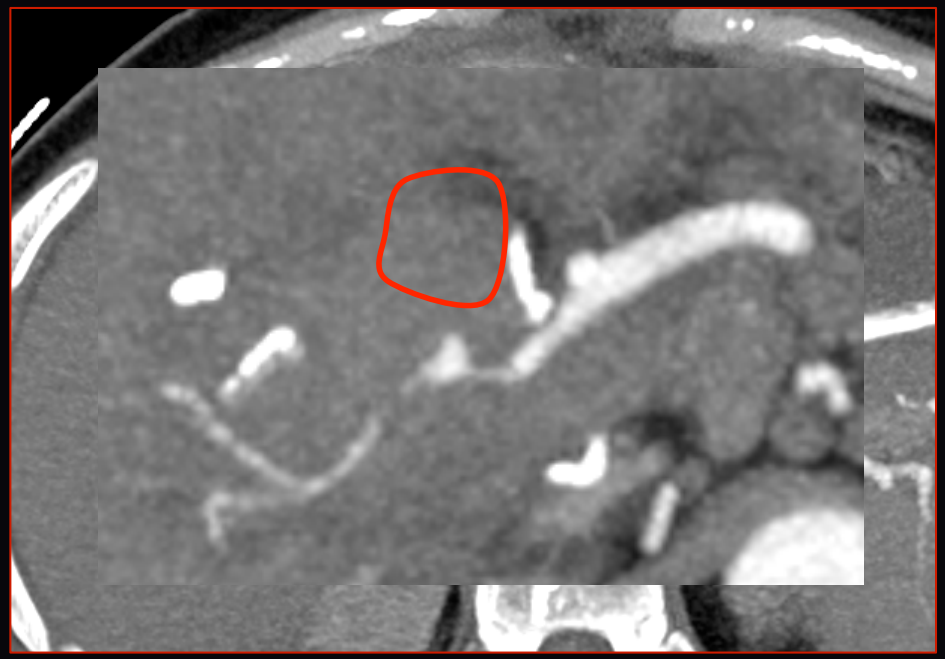
Early depiction with Doppler ultrasound

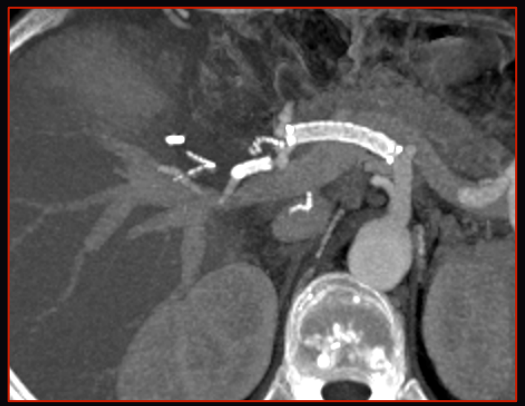
PSEUDO-ANEURYSM

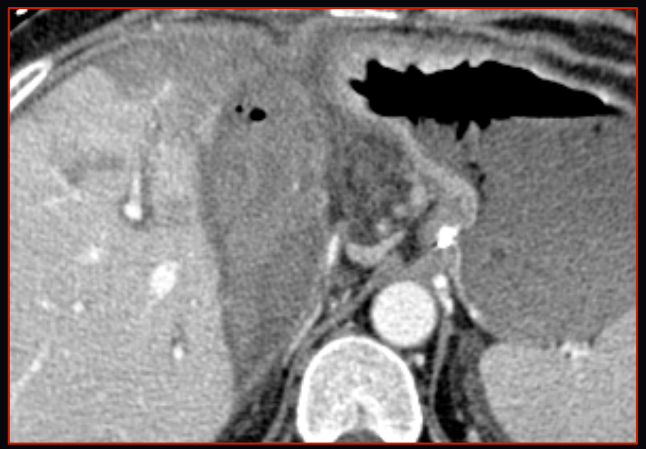
<1% of liver transplantation
Anastomotic pseudo-aneurysm or after angioplasty, biopsy or liver infection

Asymptomatic
If ruptured pseudo-aneurysm: hemobilia, bowel hemorrhage, collapsus

CT-scan
Extravasation of contrast media
Location of hematoma







Treatment:
Embolization,
stent
surgery

VASCULAR COMPLICATIONS

PORTAL VEIN

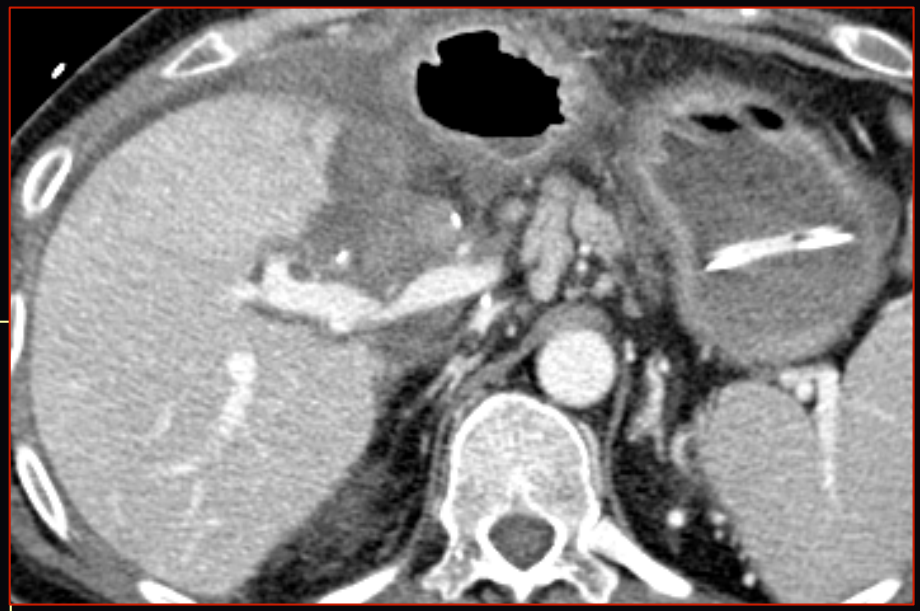
PORTAL VEIN STENOSIS

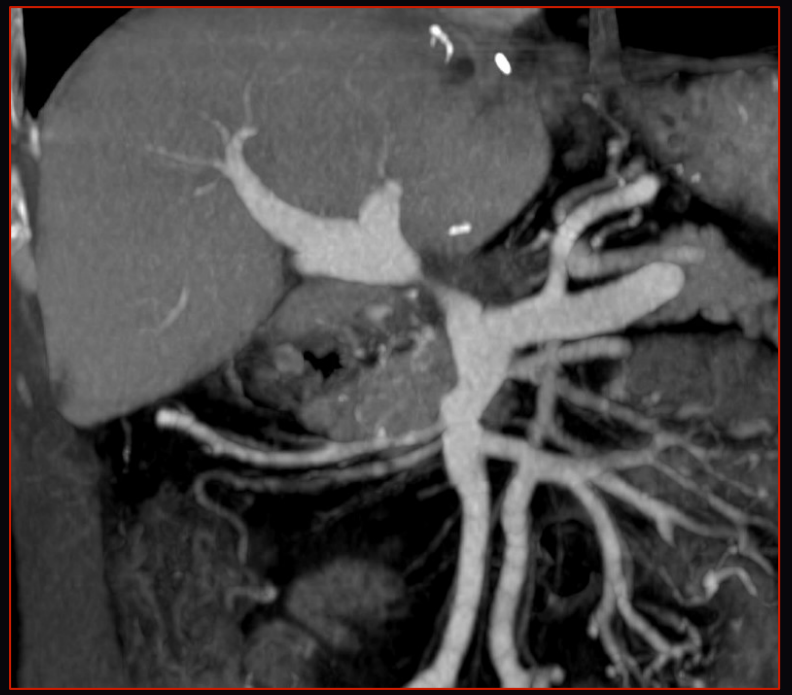
- Incidence: 1 to 2%
- Anastomotic stenosis
- Detection with Doppler ultrasound

  Speed >125 cm/s or ratio anastomotic/prenastomotic > 3

  CT, MR: Anastomotic stenosis
- Phase imaging

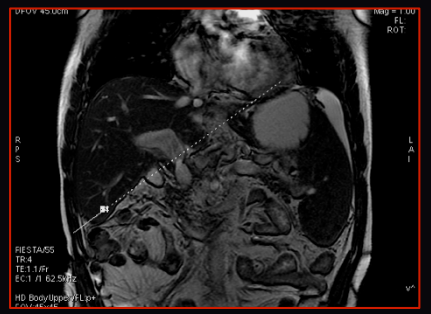
  Quantitative evaluation of stenosis

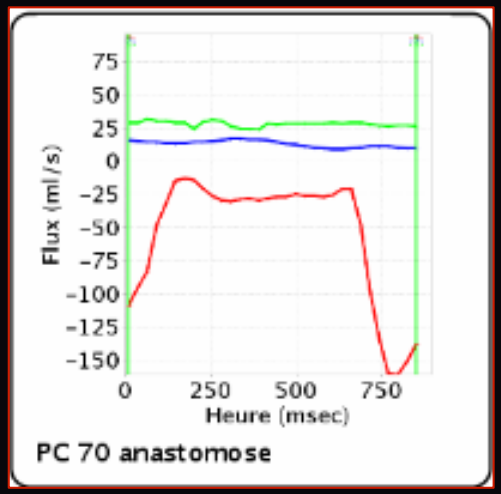




PHASE IMAGING

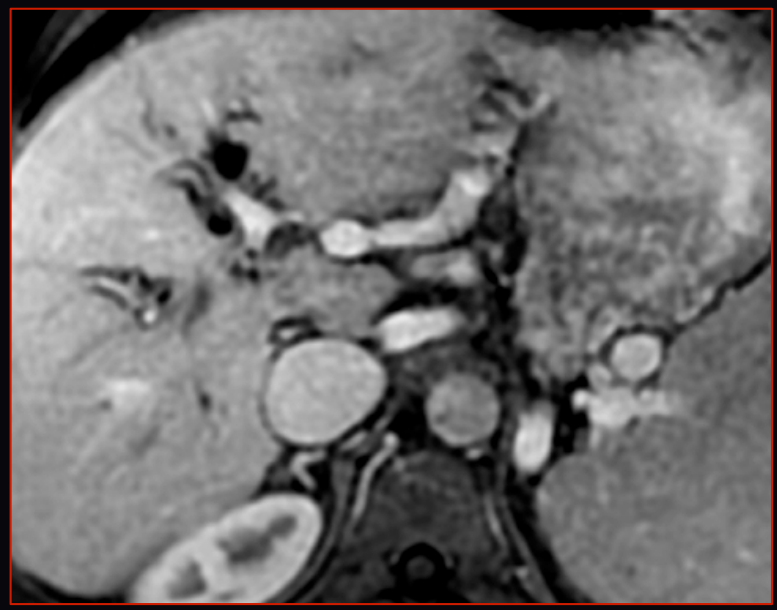
- Phase mapping
- Portal flow encoding with 2 bipolar gradients





PORTAL THROMBOSIS

- 1 to 3%
- Partial or total
- Causes:
  - Surgical failure
  - History of portal thrombosis, hypercoagulation
  - Slow portal flow



VASCULAR COMPLICATIONS

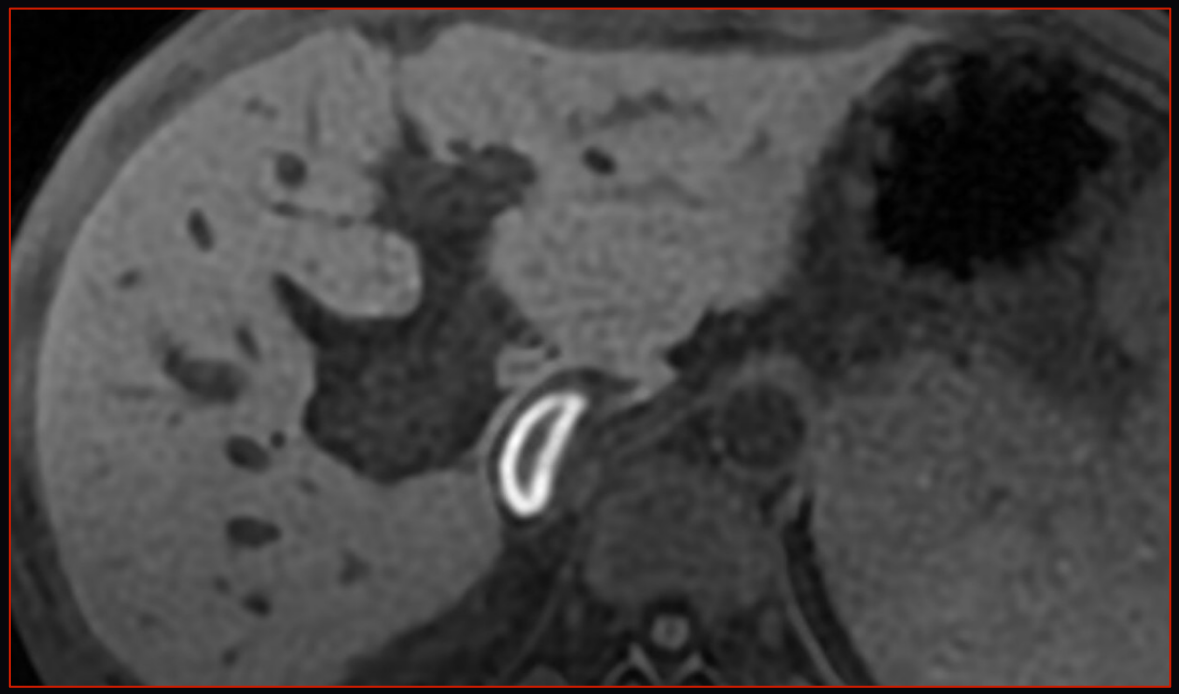
HEPATIC VEINS AND IVC

Uncommon: <1%

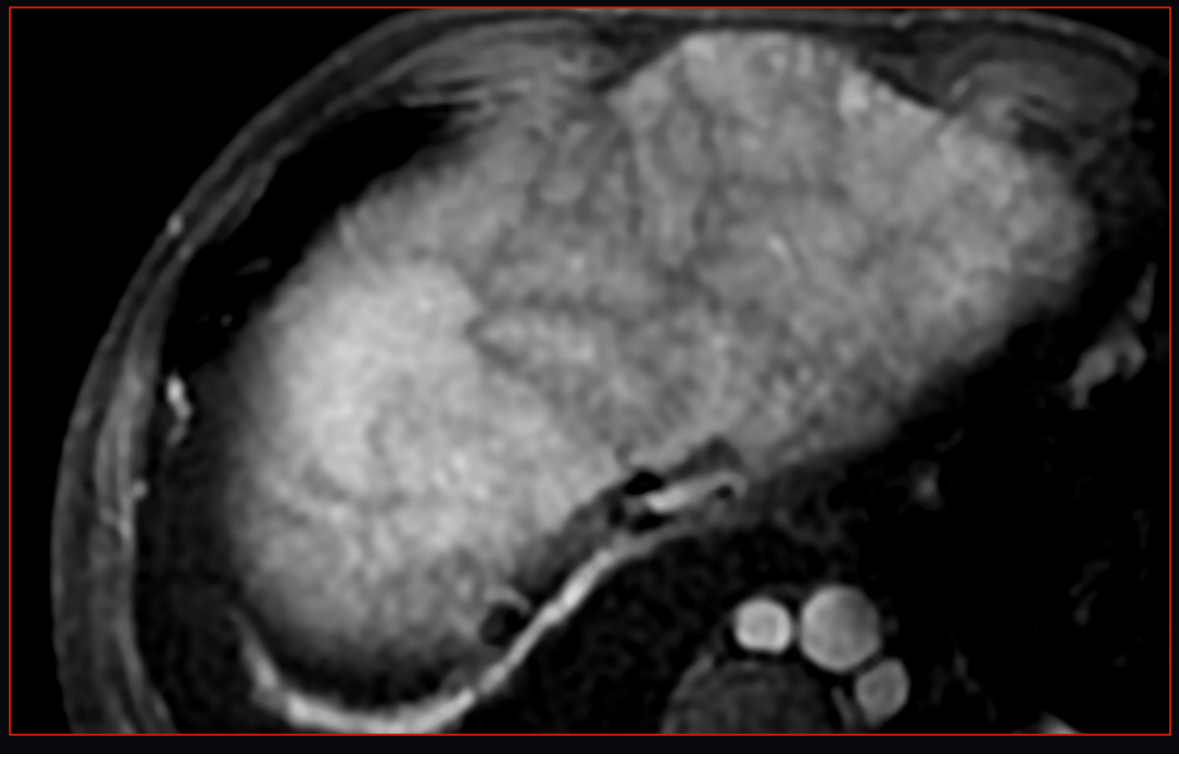
- IVC stenosis and IVC thrombosis
- Causes: different diameters between donor and receiver IVC
- IVC stenosis related to fibrosis, thrombosis or intimal hyperplasia

PIGGYBACK: :

- Hemorrhage: Incompetent anastomosis
- Budd-Chiari syndrome: 0,3 to 1,5% of cases

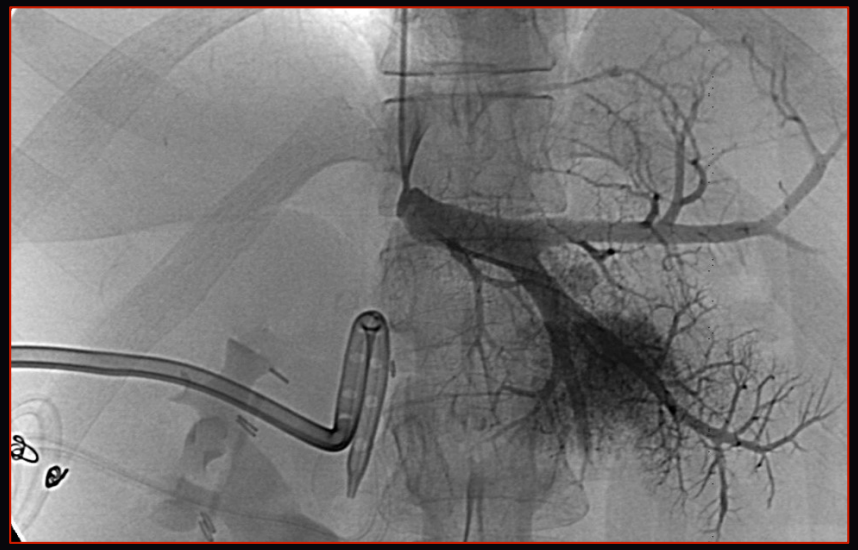


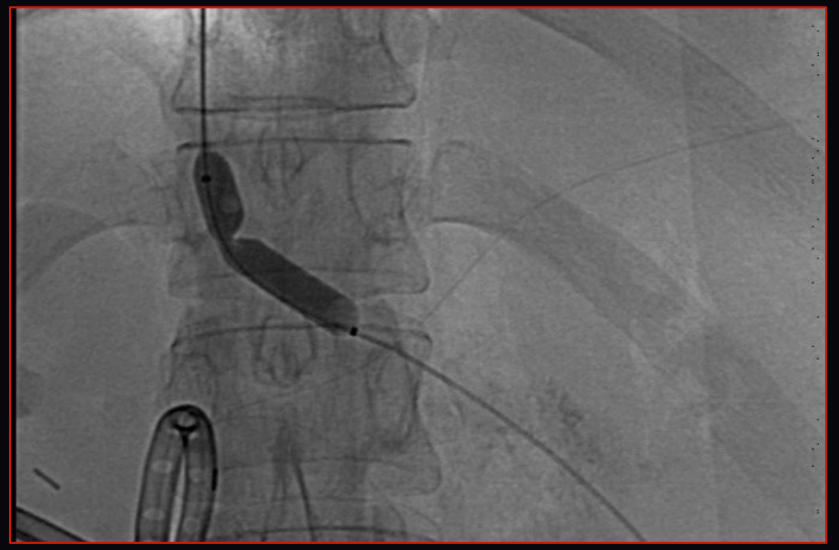
PIGGYBACK RELATED HEMATOMA



IVC STENOSIS

Stenosis of left hepatic vein complicating auxiliary liver transplantation





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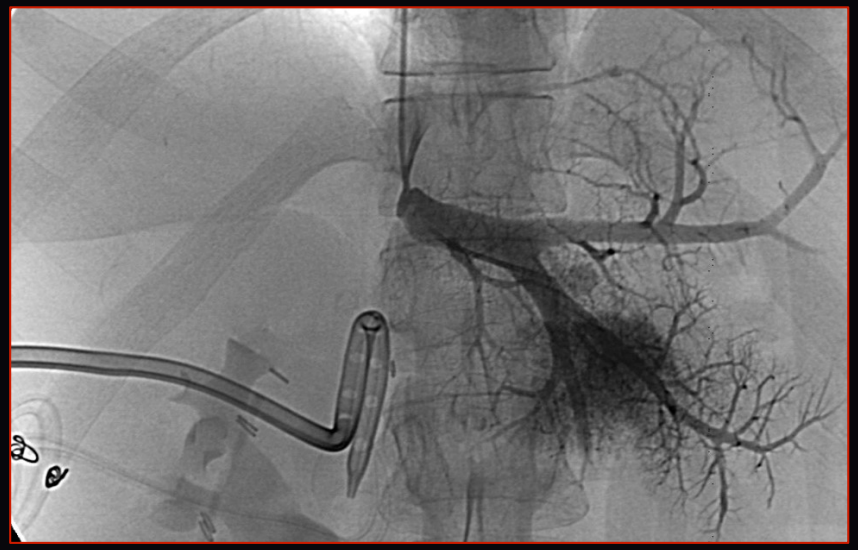
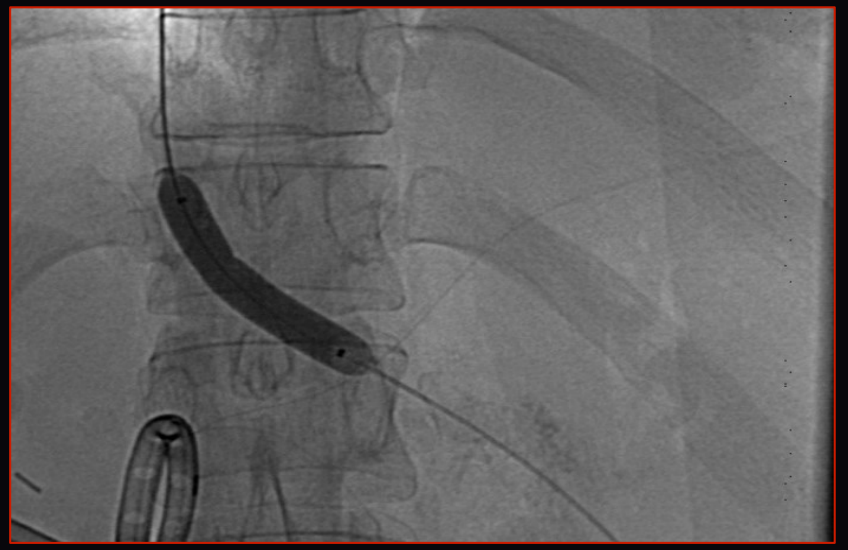




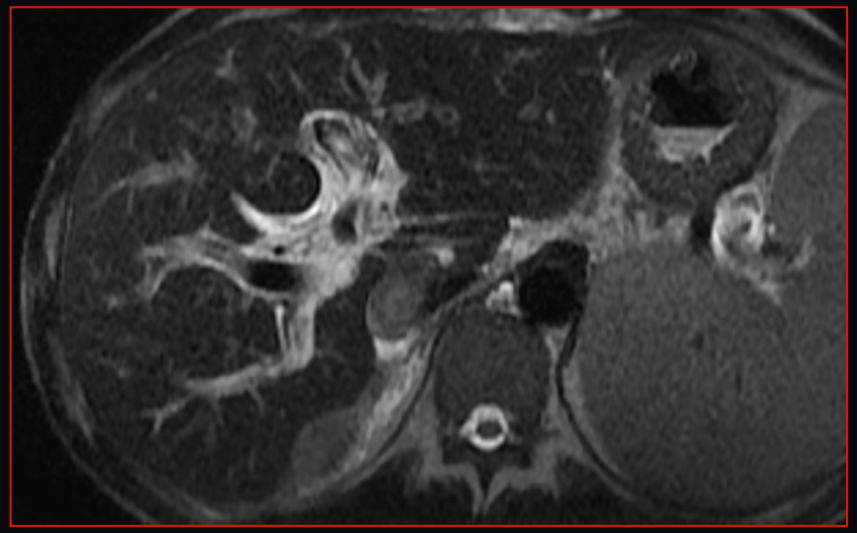
LYMPHATIC COMPLICATIONS

LYMPHATIC VESSELS OF LIVER ARE INCOMPLETELY KNOWN

During liver transplantation ligation of liver lymphatic vessels within porta hepatis

MOST COMMON COMPLICATIONS:

- Chylous ascitis
- Perihepatic lymphatic collection
- Periportal edema



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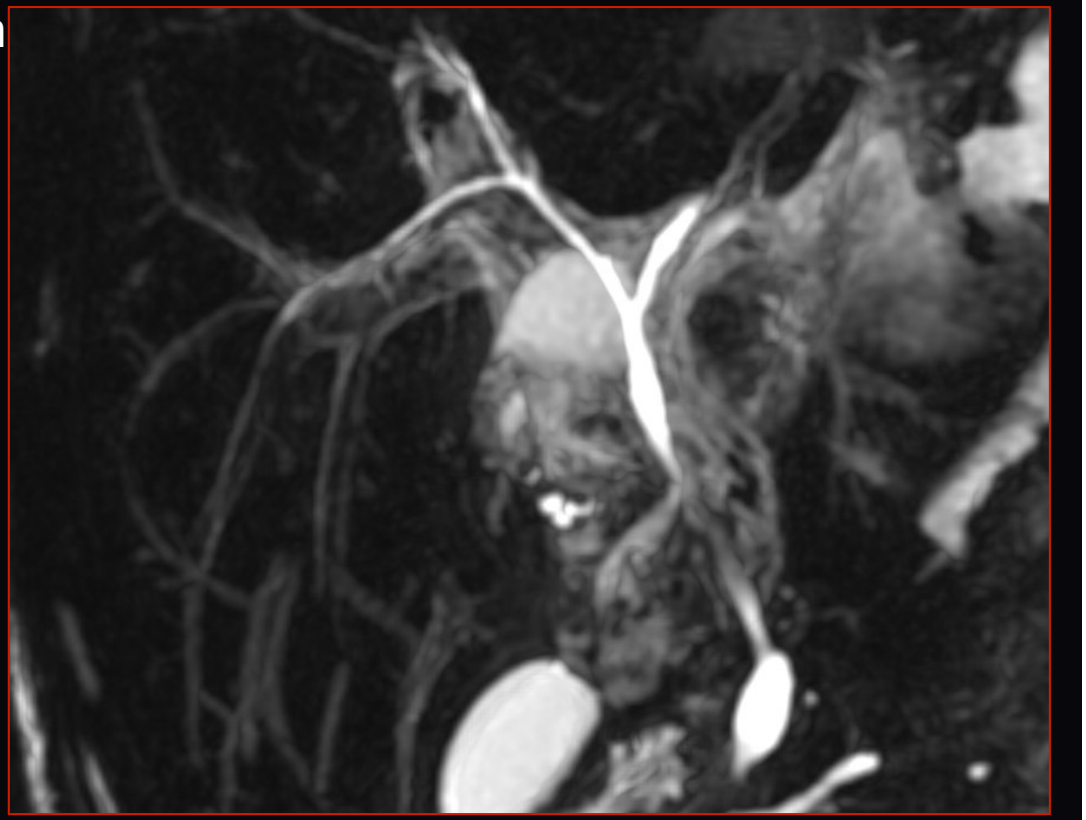

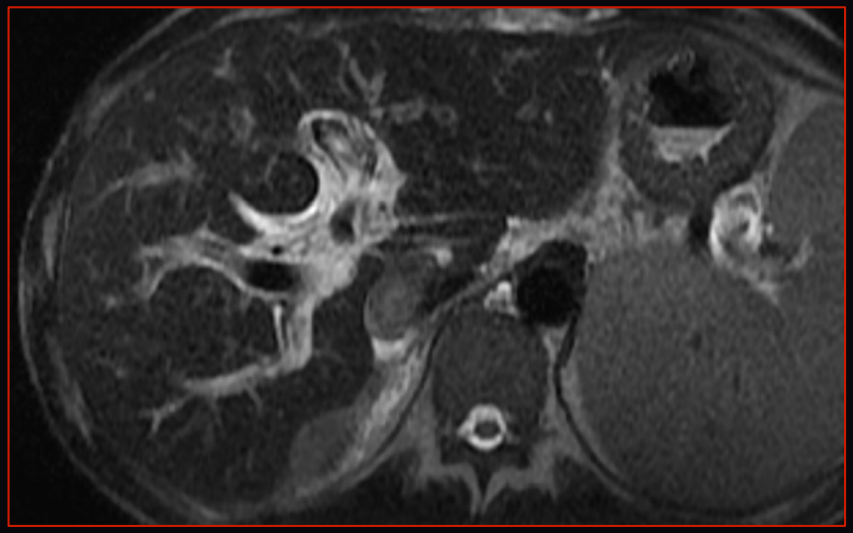

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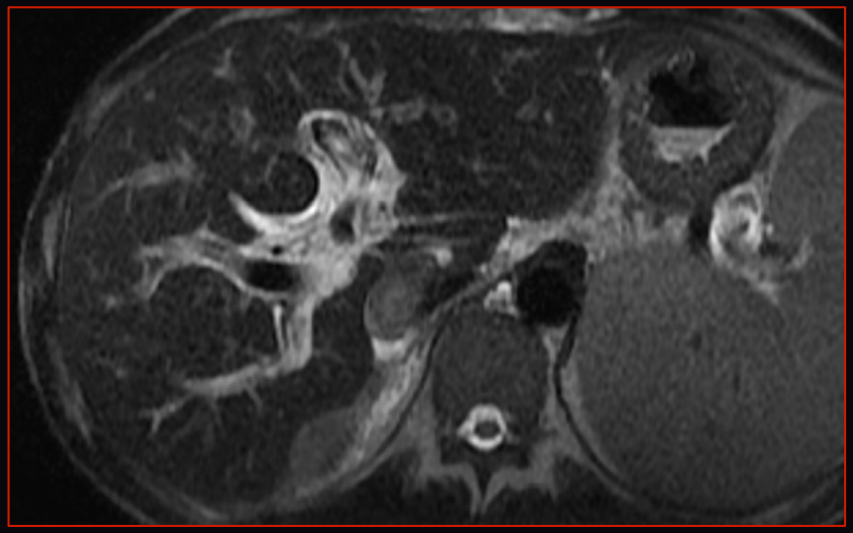
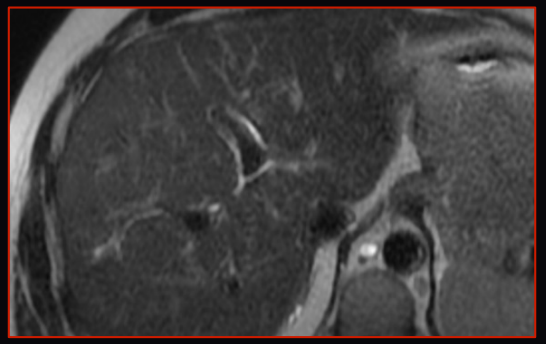
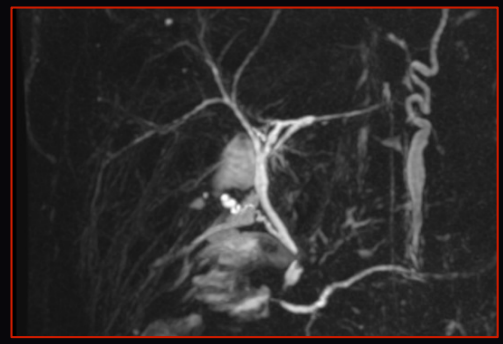


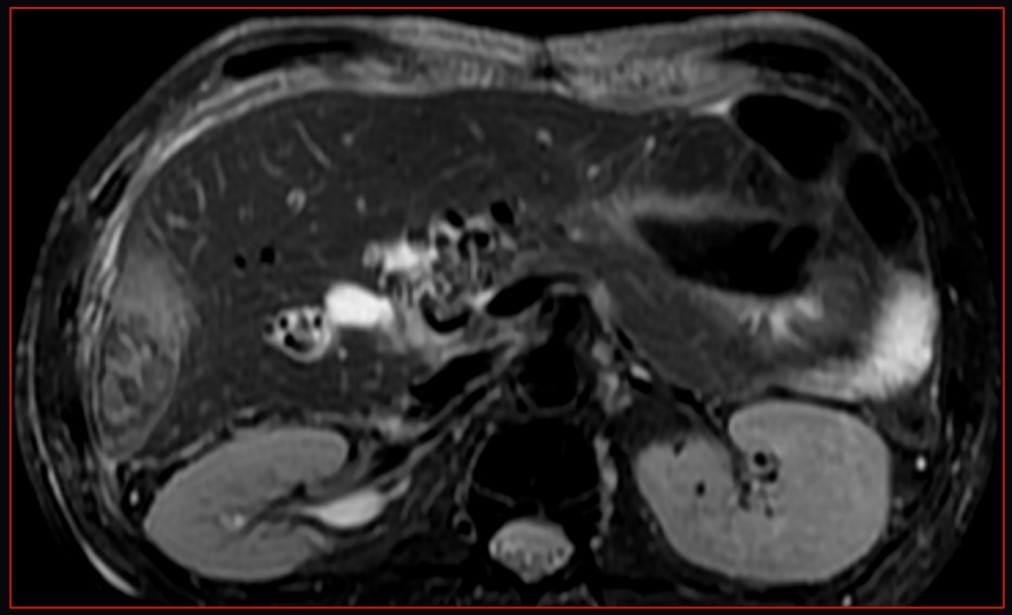


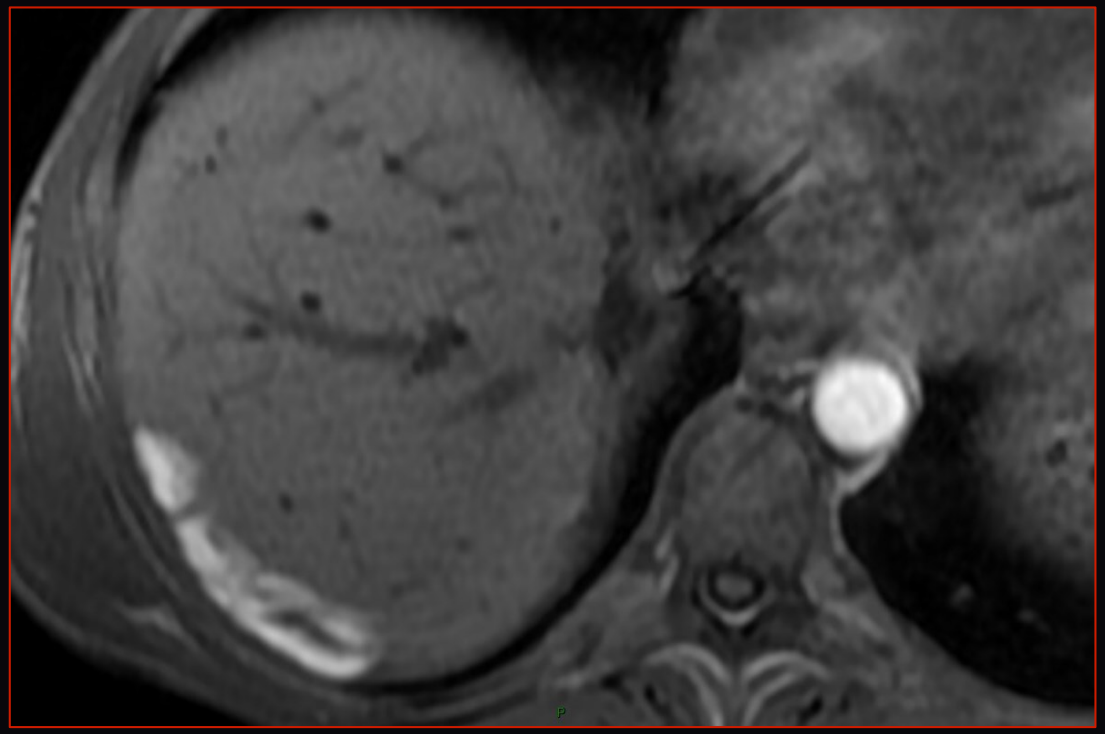


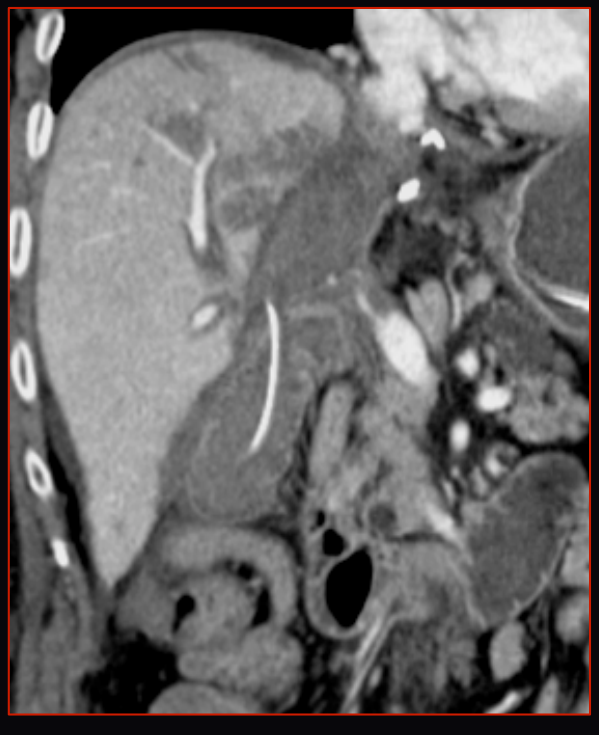
GRAFT ABNORMALITIES

TRAUMATIC LESIONS

Intra or extrahepatic hematoma

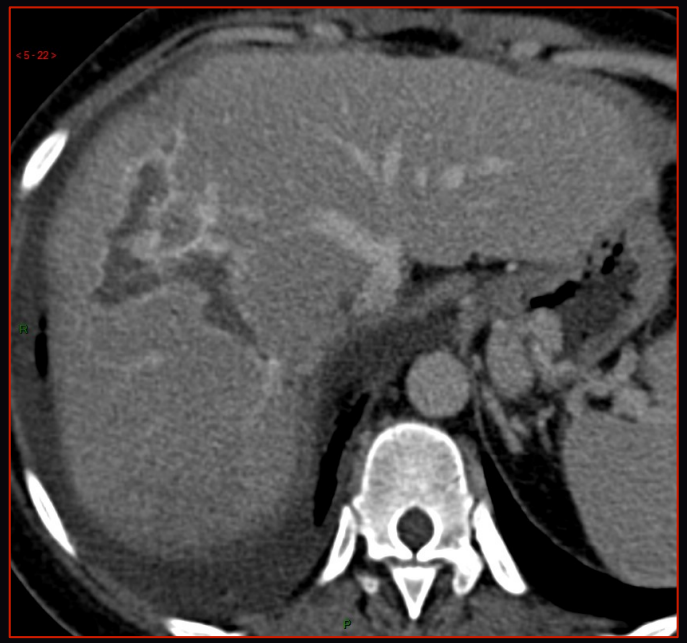






TRAUMATIC LESIONS

CONTUSION



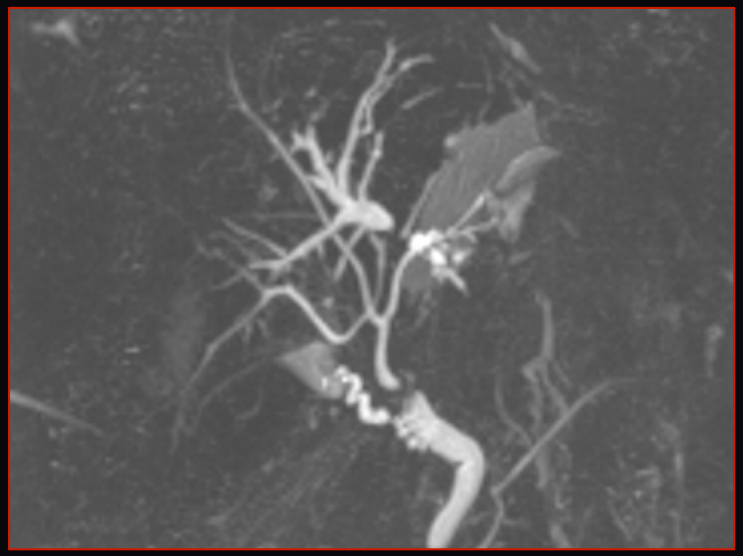
VASCULAR LESIONS

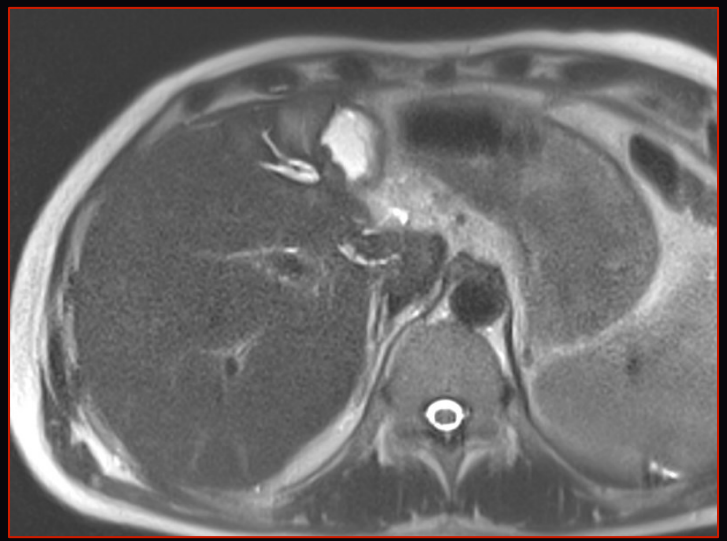
ISCHEMIA

Liver parenchyma ischemia after liver transplantation is related to arterial complication in 85% of cases.
It may be complicated of necrosis or infection.

Split liver

Biliary drainage

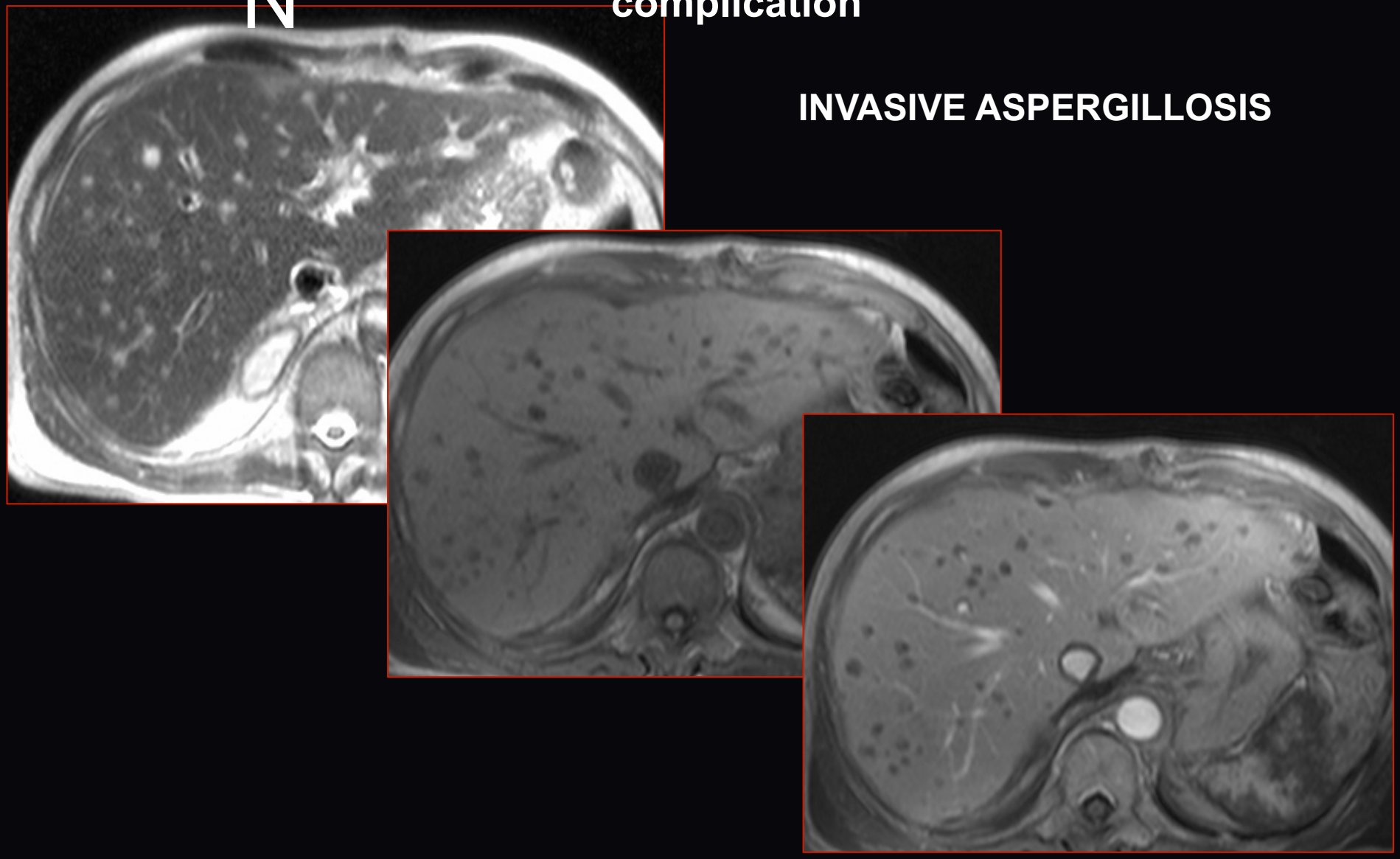




INFECTIOUS COMPLICATION

Related to:
- Immunosuppression
- Arterial or biliary complication

INVASIVE ASPERGILLOSIS



CONCLUSION

Different normal appearances after liver transplantation (orthotopic, split, auxiliary…)
Biliary complications and MRCP

Vascular complications and CT angiography

Interventional radiology can be performed for all complications