Large Nonmalignant Hepatic Mass and Role of Pediatric Interventional Radiology

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15 year-old asymptomatic female without any significant past medical history presenting with hepatomegaly on routine physical examination

- OSH outpatient ultrasound exam demonstrated a large, isoechoic liver mass exerting mass-effect, including compressing adjacent hepatic veins
- Subsequent MRI showed a large, well-circumscribed, T2-weighted hyperintense, arterially-enhancing liver mass with arteriovenous shunting and retention of contrast material on delayed imaging (a hepatocyte-specific contrast agent was used) --- differential diagnosis included atypical focal nodular hyperplasia and fibrolamellar hepatocellular carcinoma
- Patient subsequently referred to pediatric interventional radiology for ultrasound-guided percutaneous core needle biopsy
Relevant History

- Past Medical History
  - None

- Past Surgical History
  - None

- Family & Social History
  - Hypertension and hypercholesterolemia

- Review of Systems
  - Unremarkable

- Medications
  - None

- Allergies
  - No known drug allergies
Diagnostic Workup

- **Physical Exam**
  - Hepatomegaly without splenomegaly

- **Laboratory Data**
  - Unremarkable without transaminitis or hyperbilirubinemia

- **Non-Invasive Imaging**
  - Outside hospital ultrasound exam demonstrating a large, isoechoic liver mass exerting mass-effect, including compressing adjacent hepatic veins
  - MRI demonstrating a large, well-circumscribed, T2 hyperintense, arterially-enhancing liver mass with arteriovenous shunting and retention of contrast material on delayed imaging (a hepatocyte-specific contrast agent was used). Mass-effect was, again, noted on the hepatic veins and IVC
Non-invasive imaging
Non-invasive imaging
Non-invasive imaging (Eovist)
Diagnosis

- Differential diagnosis
  - Focal nodular hyperplasia (FNH)
  - Hepatic adenoma
  - Fibrolamellar hepatocellular carcinoma (FLHCC)
  - Metastatic disease
  - Hepatoblastoma
- Patient referred to pediatric interventional radiology for US-guided core needle biopsy
  - Biopsy performed using an 18-gauge core biopsy device with acquisition of six 2 cm specimens
Intervention

- Histopathological findings from core needle biopsy tissue were compatible with focal nodular hyperplasia (FNH).
- Patient was seen by pediatric surgery for possible liver mass resection due to the compressive effect on the adjacent structures.
- Given the benign nature of the mass and the presence of involved portions of both the right and left hepatic lobes, the patient and her family were given the option of watchful observation vs. embolization of the mass by pediatric interventional radiology to disrupt blood supply and thereby shrink the tumor (with resultant decrease in mass-effect).
- Patient and her family chose the latter option.
Intervention

- Using the right femoral arterial access, the celiac artery and subsequently the proper hepatic artery were selected with a 4Fr Cobra catheter.

- Arteriograms revealed an enlarged proper hepatic artery with large caliber branches supplying a large lobular hypervascular mass in the central liver.

- Additionally, small aneurysms with neovascularity were noted within this mass.

- However, no arteriovenous shunting was seen on angiographic images.
Intervention

▪ A coaxial catheter system with a 2.8Fr ProGreat microcatheter system was advanced into a large branch supplying the left side of the hypervascular mass.

▪ Following another arteriogram, particle embolization of this branch was performed using 300-500 micron size embospheres until stasis was achieved.

▪ Similar embolization was subsequently performed in a different branch supplying the right side of the hypervascular mass.
Intervention

- The subsequent arteriogram in the common hepatic artery demonstrated residual slow flow in the proximal branches supplying the mass.
- These branches were then selected with the coaxial catheter system and embolized with gelfoam slurry and torpedoes instead of particles (to avoid liver ischemia).
- No coils were used due to the possibility of repeat embolization.
- Patient tolerated the procedure well without any immediate complications or complaints.
Intervention

Before

After
Follow-up imaging
Clinical Follow-Up

- Significant interval reduction in size as seen on MRI
- Patient followed up with both pediatric interventional radiology and pediatric surgery on an outpatient basis
- However, due to a moderate amount of residual mass seen on follow-up MR imaging, patient and family chose to undergo a repeat embolization
- Following the repeat embolization, pediatric surgery will plan to take the patient to the operating room for en bloc non-anatomic resection
1) The definitive treatment for focal nodular hyperplasia is:

A: Chemotherapy and/or radiation therapy.
B: Transarterial bland embolization.
C: Surgical resection.
D: Hormone therapy.
1) The definitive treatment for focal nodular hyperplasia is:

A: Chemoradiation. FNH is not a malignancy and thus no chemoradiation therapy is needed.

B: Transarterial bland embolization. While transarterial embolization, as shown here, can reduce the size and symptoms of FNH, it does not always completely eradicate the mass.

C: Surgical resection. En bloc surgical resection remains the definitive treatment for complete resolution. As shown here in our patient’s post-embolization MR images, transarterial embolization does not completely eradicate the mass (although its size is substantially reduced).

D: Hormone therapy. No data exists supporting the use of hormone therapy in treatment of FNH.

Return to Case
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C: Surgical resection. En bloc surgical resection remains the definitive treatment for complete resolution. As shown here in our patient’s post-embolization images, transarterial embolization does not completely eradicate the mass.

D: Hormone therapy. No data exists supporting the use of hormone therapy in treatment of FNH.
2) Which of the following is NOT a hypothetical complication related to the transarterial embolization of FNH?

A: Post-embolization syndrome.
B: Hemorrhage.
C: Hematoma formation.
D: Bowel ischemia.
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A: **Post-embolization syndrome**. The syndrome consisting of transient post-procedural fever, nausea/vomiting, and pain can occur. This usually resolves within 2-3 days and only requires symptomatic treatment.

B: **Hemorrhage**. Arterial punctures can lead to significant hemorrhage in the absence of adequate hemostasis.

C: **Hematoma formation**. Access site complications can occur as with any other transarterial procedures.

**D: Bowel ischemia. In the event of good selection of the feeding arteries, no branches supplying the bowel should be affected.**
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Focal nodular hyperplasia (fnh)

- FNH is a common benign hepatic neoplasm, more commonly seen in women and often asymptomatic.
- Hyperplasia of hepatocytes and Kupffer cells is likely secondary to a preexisting vascular abnormality.
- Central scar seen on imaging is due to a large feeding artery with radial branches.
- Mass-effect on adjacent structures may be present when the size approaches 4 cm or greater.
Focal nodular hyperplasia (fnh)

- Typical imaging features (>4cm):
  - Ultrasound:
    - Usually hypo- or isoechoic; rarely hyperechoic (in the presence of fibrosis, hemorrhage, or abundant intralesional lipid)
    - Doppler shows multiple well-defined vessels radiating from the center to the periphery
  - CT:
    - Non-contrast: homogeneous and either hypodense or isodense; although density may increase in the presence of hemorrhage or abundant lipid
    - Arterial phase: rapid homogeneous enhancement with a hypodense central scar
    - Portal/delayed phase: Isodense with possible late enhancement of the central scar
  - MR:
    - T2WI: hyper- or isointense compared to normal hepatic parenchyma. Hyperintense central scar.
    - Pre- and post-contrast T1WI: hypo- to isointense pre-contrast with intense early arterial enhancement homogeneous enhancement. Isointense of delayed images. Hypointense central scar. Retains contrast material when using hepatocyte-specific contrast agent.
Treatment of Focal nodular hyperplasia (fnh)

▪ Overwhelming majority of patients are asymptomatic requiring no treatment
▪ In cases of symptomatic patients, unclear diagnosis, or compressive effects, surgical resection is the most common course of action
▪ However, resection may not be ideal in cases of an unusually large mass or unfavorable anatomic location
▪ In these cases, embolization can be performed to induce arterial starvation of the mass and subsequently decrease the size of the lesion
  ▪ Given the combination of a large central feeding artery and dystrophic venous channels, selective embolization can effectively decrease the arterial inflow
  ▪ Embolization can reduce not only the size of the mass, but also expected blood loss at subsequent surgery
  ▪ All different types of particulate embolic agents can and have been used
▪ Hypothetical risks associated with FNH embolization may include post-embolization syndrome (transient post-procedural fever, nausea/vomiting, pain), infection, bleeding, non-target embolization leading the hepatic damage, renal dysfunction due to contrast usage, and access site complications.
For many patients, radiology can provide the “complete package” from making the initial diagnosis to providing the actual treatment.

FNH has characteristic cross-sectional imaging findings that are important for an interventional radiologist to recognize.

These lesions, when symptomatic, can undergo trans-arterial embolization prior to, or instead of, surgical resection for reduction in size and symptoms.

Such embolization procedures are effective, and the rate of complications is low.
References & Further Reading


