Imaging Hepatocellular Carcinoma:
The Role of Radiology in Diagnosis & Treatment

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Clinical Presentation

50 year old man with chronic Hepatitis C & cirrhosis, awaiting transplant

What is the role of imaging in the pre-transplant patient?

Monitoring of a liver transplant candidate includes:

- Blood tests to determine liver & kidney function
- EKG, Echocardiogram, & Cardiac stress test to assess heart function
- Chest X-ray (CXR) and pulmonary function test to assess lung health
- Abdominal ultrasound (US) to view the liver & evaluate vessel patency
- Computed Tomography (CT) to assess liver size and anatomy
- Magnetic Resonance Imaging (MRI) to evaluate for lesions

http://www.bidmc.harvard.edu/display.asp?node_id=2014
Ultrasound (US)

- Best **FIRST** test in pre-transplant surveillance

- Performed every 3-6 months to look for new lesions or changes to vessel patency

**Advantages:**
- High availability
- Low cost
- Non-invasive
- High Specificity

**Limitations:**
- Operator experience
- Obese patients
- Low sensitivity
- Limited differentiation of soft tissue

Our Patient: Screening Liver Ultrasound

Sagittal View

Isoechoic mass in Segment VIII

PACS, BIDMC
A hypoechoic rim is visible around the mass.
Our Patient: Screening Liver Ultrasound

Doppler

Portal vein & major vessels are patent
Anatomy: Couinaud Classification

http://ourworld.compuserve.com/homepages/sbrillant
Differential diagnosis:

• Solitary liver mass in US

Benign:
Adenoma
Hemangioma
Hamartoma
Fatty Infiltration
Focal Nodular Hyperplasia
Regenerative nodular hyperplasia

Malignant:
Hepatocellular carcinoma
Hepatoblastoma
Hemangiosarcoma
Cholangiocarcinoma
Leiomyosarcoma
Hemangiopericytoma
Metastases

Differential diagnosis:

- **Solitary liver mass in US**
- **Isoechoic**

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Differential diagnosis:

- **Solitary liver mass in US**

- **Isoechoic**

- **Hypoechoic rim**

Benign:
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Malignant:
- Hepatocellular carcinoma
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Magnetic Resonance Imaging (MRI)

- **BEST** test for evaluating abnormal ultrasound in patients with known liver disease

- Useful in distinguishing benign from malignant masses using T2 non-contrast & T1 phase-contrast sequences

**Advantages:**

- High sensitivity (82-96)%
- High resolution

**Limitations:**

- Expensive
- Time Intensive
- Patient Dependent

Our Patient: Liver Mass on T1 Abdominal MRI

A cirrhotic liver, enlarged spleen, and ascites
Our Patient: Liver Mass on T2 Abdominal MRI

Non-contrast T2

Ill-defined round 5cm lesion with increased signal
Our Patient: 3 Phase Contrast Enhanced T1 MRI

Lesion demonstrates enhancement during the arterial phase and washout during the venous phase.
Comparison Patient: Focal Nodular Hyperplasia on MRI

Contrast our patient’s MRI with this patient’s. MRI demonstrating the typical appearance of FNH on C+ MRI.

![Non-contrast T2](image1)
Hyperintense
Enhancement of stellate scar

![Delayed phase T1](image2)
Hypointense
Enhancement of stellate scar

http://www.radiologyassistant.nl/
MRI Summary

- 5 cm mass in segment VIII of liver
- No lymphadenopathy or vessel involvement
- Increased signal intensity during arterial phase
- Decreased signal intensity during venous phase
- No evidence of stellate scar
- Patient history

Diagnosis: *Hepatocellular Carcinoma*

* Pathology confirmed diagnosis of HCC
Hepatocellular Carcinoma

Hepatocellular carcinoma (HCC) is a primary tumor of hepatocytes that develops in the setting of chronic liver disease.

- Median age group is 50-70 & predominates in men
- HBV & HCV cause > 90% of HCC's worldwide
- Patients with HCC usually have no physical symptoms
- Common sites of metastasis include lung & bone
- Median survival is 5% at 5 years
## Staging of HCC

### American Joint Committee on Cancer-TNM System

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<th>Stage</th>
<th>TNM</th>
<th>Scheme</th>
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<td>T1N0M0</td>
<td>Single tumor &lt;2cm</td>
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<td>II</td>
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<td>&gt;2cm or single tumor &lt;2cm + vascular invasion</td>
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<tr>
<td>IIIA</td>
<td>T3N0M0</td>
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<td>T1-3N1M0</td>
<td>Positive Regional Lymph Node</td>
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<tr>
<td>IVA</td>
<td>T4N0-1M0</td>
<td>Multiple tumors involving major vessels/multiple lobes</td>
</tr>
<tr>
<td>IVB</td>
<td>T1-4N0-1M1</td>
<td>Remote Metastasis</td>
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Our Patient: Normal CXR

“The lungs are clear.”

AP view of the thorax

Left lateral view of the thorax
Our Patient: Normal RN Bone Scan

“No evidence of MDP avid osseous metastases.”

Bone Scintigraphy: Technetium, $^{99}\text{Tc}^m$

PACS, BIDMC
# Staging of HCC

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<td>Liver transplantation</td>
<td>5 year survival 60-70%, limited to Stage I &amp; II HCC</td>
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<td>Surgical resection</td>
<td>5 year survival 40-50%, limited to single, well-demarcated, and anatomically accessible lesions</td>
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<td>Percutaneous destruction e.g. Radiofrequency ablation</td>
<td>5 year survival ~40%, limited to lesions measuring &lt;3cm</td>
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<td>Transcatheter Arterial Chemoembolization (TACE) <strong>OUR PATIENT</strong></td>
<td>Modest survival benefit, Treatment of choice for single intrahepatic lesions &gt;5cm</td>
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Hagop et al., MD Anderson Manual of Medical Oncology, 2006.
A catheter is inserted into the hepatic artery via the femoral artery.
Our Patient: Transcatheter Arterial Chemoembolization

Contrast is injected to confirm proper placement of catheter
Chemotherapy & embolic agents are mixed & injected together.
Our Patient: CT Post-procedure Imaging

Used within 24 hours of procedure to assess for effective delivery of chemotherapy to mass

“…successful chemoembolization of the…hypervascular mass”

Our Patient: CT at 3 Month Follow-up

**BEST** test for evaluation of known hepatic malignancy & for detecting extra-hepatic metastases

“Interval decrease in mass size…no new liver lesions.”

Summary

Radiology vital in the medical management, diagnosis, & therapy of Hepatocellular Carcinoma

- Ultrasound - Assessing for lesion & vessel patency
- Magnetic resonance imaging - Characterizing known lesion
- Nuclear Scintigraphy/Plain Film - Tumor staging
- Hepatic Angiography - Visualization for interventional therapy
- Computed tomography (CT) - Evaluation of tumor progression post-therapy
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References


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