Overview

□ Biliary tract scintigraphy can be performed with either Tc-99m disofenin or Tc-99m mebrophenin. Both agents are iminodiacetic acid derivatives that are cleared rapidly from the blood by the hepatocytes and excreted in the bile in high concentrations. In normal fasting subjects, peak liver uptake occurs about 10 minutes after injection, with visualization of the hepatic duct and gallbladder after 20-40 minutes. In normal subjects, about 9% of the disofenin and 1% of the mebrofenin are excreted in the urine in the first 2 hours. Increased serum levels of bilirubin increase renal excretion and may lead to visualization of the kidneys in some patients.

Indications

□ Hepatobiliary scintigraphy with Tc-99m iminodiacetic acid (IDA) compounds is useful in evaluation the patency of the common bile duct and the cystic duct. This test is very sensitive and specific for acute cholecystitis. Because IDA compounds are extracted by hepatocytes and excreted unconjugated into the bile, hepatocyte function and biliary drainage can be evaluated. This test may also be helpful in evaluating patients with jaundice or abdominal pain and after hepatic/biliary operations. This in not a test for cholelithiasis (gallstones), because many patients with cholelithiasis have normal hepatobiliary function.

Examination Time

□ Approximately 2 ½ to 3 hours. (Delayed images may be needed.)

Patient Preparation

□ If evaluation of the gallbladder is desired, the patient should have **fasted for a minimum of 4 hours prior to administration of the radiopharmaceutical**. A false-positive study (non-visualization of the gallbladder) may result if the patient has eaten recently.

If the patient has received morphine/opiates within 4 hours before the HIDA study, the study must be delayed 4 hours from the dosing as morphine/opiates may result in delayed visualization of the bowel due to constriction of the sphincter of Oddi.

If evaluation of the gallbladder is not desired, no patient preparation is necessary. Patient must be off all opiate drugs for 4 hours, this includes Dilaudid. (Be sure to specifically ask the nurse if patient is on Dilaudid, as most do not know it is an opiate!)

If necessary, the effects of morphine may be reversed with the IV administration of 0.8 mg naloxone hydrochloride (naloxone is a competitive opiate antagonist).

If the patient has fasted for less than 4 hours:

a) Delay the study until the patient has fasted for at least 4 hours.

If Patient has been NPO for more than 18 hours, the patient may need to be pre-treated with CCK to empty gallbladder prior to the exam. CCK may be administered over 30min using an infusion rate of 0.02 mcg/kg per hour of sincalide over 30minutes. Start exam routine exam 30min post completion of CCK.
Equipment & Energy Windows

- Gamma camera: Large field of view.
- Collimator: LEHR, VXGP
- Energy window: 20% window centered at 140keV.

Radiopharmaceutical, Dose & Technique of Administration

- Radiopharmaceutical: Tc-99m Choletec or Tc-99mHepatolite
- Dose: 5-7 mCi Tc-99m Choletec

  Technique of administration: Standard intravenous injection.

Patient Position & Imaging Field

- Patient position: Supine with upper abdomen and entire liver in the field of view.

Acquisition Protocol

- **Standard Exam.**
  - a) Acquire dynamic LAO images at 128 x 128, 60 sec/frame for 60 frames.
  - b) Obtain ANT, LAO and R LATERAL static images at 60 minutes if needed to establish validation of GB fill.
  - c) Once the gallbladder is full, order the sincalide.
  - d) At 60 minutes post injection, start the CCK infusion imaging with the camera head in the LAO position visualizing the gallbladder in center of field. CCK will be administered over 30min using an infusion rate of 0.02 mcg/kg per hour of sincalide over 30minutes.
  - e) **If CCK is unavailable, heavy whipping cream, half and half or Ensure plus may be used in its place.**
  - f) If using whipping cream, half and half or Ensure Plus, imaging will be acquired as follows:
    - o Initial imaging for 1 minute/frame for 60 frames
    - o Give patient whipping cream, half and half or Ensureplus
    - o Scan an additional 60 minutes at 1 minute/frame

  **NORMAL VALUE EF: >35 %**

- **If the gallbladder has not been visualized by 60 minutes.**
  The Technologist will rescan at both 120 minutes and 180 minutes after injection. At both 120 and 180 minutes a five-minute LAO projection of the Liver and Gallbladder bed is taken to evaluate for visualization of the Gallbladder.

  If the gallbladder eventually fills a GBEF can be performed if it was originally ordered or requested.

  a) Have radiologist or attending physician approve recommend any further imaging required.

Optional Maneuver:

a. Morphine may be given to hasten visualization of the gallbladder if the cystic duct is not obstructed. Upon verification with the attending Radiologist, give 2mg Morphine Sulfate I.V., once only. Image immediately after, at 60sec/fr for 60min. **Contraindications to the use of morphine include respiratory depression in non-ventilated patients (absolute), morphine allergy (absolute) and acute pancreatitis(relative).**

  - Have radiologist or attending physician approve the order for the morphine per HIDA protocol and administer per facility protocol.

b. 1-3 mCi of Choletec may be reinjected I.V. if no activity remains in the liver at the time Morphine
is to be given. Verify with the radiologist if booster dose is needed.

*Note:* Outpatients are not given morphine.

**Data Processing**

☐ Per processing protocol

**Optional Maneuvers**

- Quantitative cholecintigraphy: May be used in the evaluation of sphincter of Oddi dysfunction or cystic duct dysfunction.

- Carbonated beverage can be administrated for duodenum and proximal small bowel clearance. Occasional isotope concentration at duodenum or proximal small bowel may lie across gallbladder activity. Drinking warm 7-UP/Sprite (4 to 8 oz.) will stimulate gas movement rapidly and disperse the concentrated activity.

- Anterior images with the patient standing: May be used to help differentiate the gallbladder and bile leaks from the duodenum.

- Duodeno-gastric reflux evaluation: The hepatobiliary study may be modified to quantitatively evaluate duodeno-gastric reflux.

- Other hepatobiliary parameters may be quantitated.

**Principle Radiation Emission Data - Tc-99m**

☐ Physical half-life = 6.01 hours.

<table>
<thead>
<tr>
<th>Radiation Energy (keV)</th>
<th>Mean % per disintegration</th>
<th>Mean energy (keV)</th>
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<tbody>
<tr>
<td>Gamma-2</td>
<td>89.07</td>
<td>140.5</td>
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**Dosimetry - Tc-99m-Trimethylbromo-IDA**

<table>
<thead>
<tr>
<th>Organ</th>
<th>rads/6 mCi</th>
<th>mGy/222 MBq</th>
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<tbody>
<tr>
<td>Large intestine</td>
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<tr>
<td>Small intestine</td>
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<td>Gallbladder wall</td>
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<td>Ovaries</td>
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<td>Whole body</td>
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<td>Testes</td>
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<tr>
<td>Red marrow</td>
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</table>

**References**


Normal Findings

Hepatobiliary


