HEPATOBILIARY STUDY

(Tc-99m-Trimethylbromo-Iminodiacetic Acid)

Overview

- The Hepatobiliary Study successively demonstrates hepatic perfusion, hepatocyte clearance, hepatic parenchymal transit, and biliary excretion as the radiopharmaceutical moves from the injection site to the intestine.

Indications

- Diagnosis of acute cholecystitis (1,2)
- Evaluation of extrahepatic biliary tract obstruction (3).
- Evaluation of the post surgical biliary tract (4).
- Detection of bile leaks (5).
- Diagnosis of biliary atresia and other congenital anomalies of the biliary tract (6).
- Evaluation of liver transplants (7).

Examination Time

- Routine study: 1 hour. (Delayed images may be needed.)

Patient Preparation

- If evaluation of the gallbladder is desired, the patient should have fasted between 2 and 14 hours (8,9):
  1. If the patient has fasted for less than 2 hours:
     a) delay the study until the patient has fasted for 2 hours.
  2. If the patient has fasted for more than 14 hours (10):
     a) give 0.02 μgm/kg of kinevac (analog of cholecystokinin) intravenously. [Note: There has been one report of a threatened abortion in conjunction with infusion of kinevac (11).]
     b) injection time: 30 minute infusion (12,13).
     c) wait at least 20 minutes before beginning the study (14).
- If evaluation of the gallbladder is not desired, no patient preparation is needed.

Equipment & Energy Windows

- Gamma camera: Large field of view. (A dual head camera with 90° capability is optimal).
- Collimator: Low energy, high resolution, parallel hole.
- Energy window: 20% window centered at 140 keV.

Radiopharmaceutical, Dose, & Technique of Administration

- Radiopharmaceutical: Tc-99m-trimethylbromo-iminodiacetic acid (15).
- Dose: 6 mCi (222 MBq).
- Technique of administration: Standard intravenous injection.

Patient Position & Imaging Field

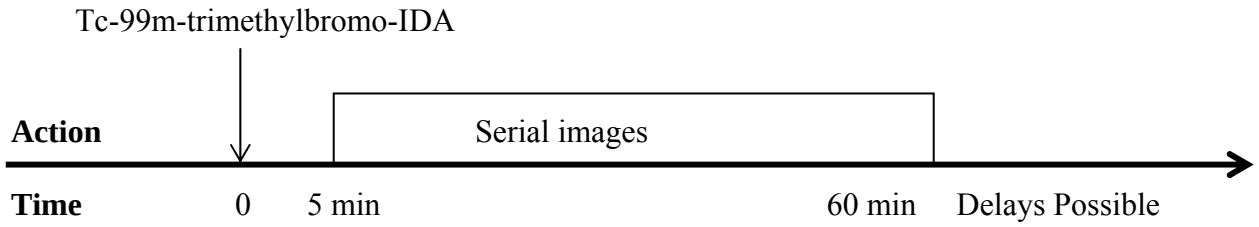
- Patient position: Supine.
- Imaging field: Upper abdomen, off centered to the right to include the entire liver.

Acquisition Protocol (9)

- Acquire ANT images only at 5 &10 minutes; then both ANT & R LAT images at 15, 30, 45, & 60 minutes.
- Acquire the first ANT image for approximately 750 K counts each and note the time; acquire all subsequent ANT and R LAT images for the same time as the initial ANT image.
- Check with the nuclear medicine physician to see if delayed images (paired ANT & R LAT) are needed.
- If the gallbladder has not been visualized by approximately 60 minutes, morphine may be given to hasten visualization of the gallbladder if the cystic duct is not obstructed (respiratory depression without a ventilator is a contraindication) (16-19):
  1. Inject 0.04 mg/kg of morphine diluted in 10 mL of saline intravenously over 3 minutes.
  2. Acquire additional ANT and R LAT images every 15 minutes through approximately 2 hours from injection of the radiopharmaceutical.
  3. Note: Outpatients may not drive for 2-3 hours following injection of the morphine.

- If the patient has a gallbladder, record the fasting time and whether the patient was given kinevac prior to injection of the radiopharmaceutical.

Protocol Summary Diagram



Data Processing

- None.

Optional Maneuvers

- Calculation of the gallbladder ejection fraction (13,20-23):
  1. At 60 minutes, acquire a 1 minute baseline digital image in the ANT projection.
  2. Infuse 0.02 μgm/kg per hour of kinevac over 30 minutes (12,23,24). (The patient does not need to be under the camera for the infusion.)
  3. Acquire a second 1 minute digital image at the end of the 45 minute kinevac infusion.
  4. For both digital images draw regions of interest over the gallbladder and adjacent background medial to the gallbladder.
  5. Background correct the gallbladder counts at baseline and following kinevac infusion on a per pixel basis.
  6. Calculate the gallbladder ejection fraction from:

$$\frac{GB_{0min} - GB_{imin}}{GB_{0min}} \times 100 = \%EF \text{ of } GB$$

imin = any time after 0min
0min = time just before CCK admin

  7. Normal ≥ 40% (23).

- A fatty meal may be substituted for sincalide to cause gallbladder contraction (25).

- Quantitative cholescintigraphy: Various parameters may be quantified (11,26).

- Reversing the effects of morphine: If the patient has recently received morphine and if the images suggest common bile duct obstruction, naloxone may be given intravenously to reverse the effects of morphine and relax the sphincter of Oddi (27).

- Phenobarbital for biliary atresia: May be helpful in the differentiation of biliary atresia and neonatal hepatitis (28,29).

- ANT images with the patient standing: May be used to help differentiate the

Principle Radiation Emission Data - Tc-99m (31)

- Physical half-life = 6.01 hours.

Radiation	Mean % per disintegration	Mean energy (keV)
Gamma-2	89.07	140.5

Dosimetry - Tc-99m-Trimethylbromo-IDA (32)

Organ	rads/6 mCi	mGy/222 MBq
Large intestine	2.84	28.4
Small intestine	1.79	17.9
Gallbladder wall	0.82	8.2
Ovaries	0.61	6.1
Liver	0.28	2.8
Bladder wall	0.17	1.7
Whole body	0.12	1.2
Testes	0.03	0.3
Red marrow	0.02	0.2

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Normal Findings

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