Hepatobiliary scintigraphy: an old but not forgotten resource in the biliary pathology assessment.

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Learning objectives

The objective of this Educational Exhibit is to:

- Illustrate and describe the most common imaging findings of hepatobiliary pathology in Hepatobiliary Scintigraphy (HS) based on a case series.
- Expose a concise review of this technique.
Background

Chile holds the highest frequency of biliary pathology worldwide; and is one of the most important public health problems in our country. Therefore a special approach is needed, aiming for a fast and accurate diagnose and treatment.

There are several imaging techniques available to evaluate the biliary tree and gallbladder, some of the principal study approaches that we could use are:

1. **Ultrasound** examination of the gallbladder is accepted as the primary imaging modality in the assessment of gallbladder disease and allows a good first approach for the bile duct pathology, this method have inherent superiority in comparison to other imaging modalities (1).

2. **Magnetic resonance (MR)** imaging and magnetic resonance cholangiopancreatography (MRCP) can be used to evaluate inconclusive findings in the ultrasound and provide a more complete evaluation of the biliary tree (2).

3. **Hepatobiliary scintigraphy (HBS)** is a radionuclide imaging study that provides information regarding hepatocellular function, gallbladder and biliary system by tracing the production and flow of bile from the liver to the small intestine.

The HBS has been used in the last four decades, and still is a very useful study, that have some advantages over the others techniques mentioned before, like providing functional information of the liver and biliary system.

The technique use a radiopharmaceutic specific for biliary system and the interpretation should be made considering the extraction of the tracer by the liver, the parenchymal clearance and the time of excretion to the biliary tree; the gallbladder activity, the time of the visualization of the tracer in the choledoco and small intestine.

Some of the clinical indications include: acute cholecystitis, chronic acalculous gallbladder disease, high-grade and partial biliary obstruction, neonatal hyperbilirubinemia (biliary atresia versus neonatal hepatitis) and assessment of biliary enteric bypass (3-5).
Findings and procedure details

A retrospective review of cases at our institution was performed over a period of five years, 13 cases were found. 62% of cases were women and 38% men. 10 of the patients were adults (aged 22 - 52, average: 32 years old) and 3 were children (between 17 days - 2 years, average: 1 year old).

All of the procedures were made using diisopropyl-iminodiacetic acid-Tc99m (DISIDA) as radionuclide and the same examiner classified the results.

Serial continuous anterior images were obtained over a period of 60 minutes or until both the gallbladder and upper small bowel are clearly identifiable. Occasionally a patient was required to return for a delayed picture after a 3 to 4 hour break when gallbladder or small gut didn’t appear.

The most common pathologies were: bile leak (31%), chronic cholecystitis (15%), and sphincter of Oddi dysfunction (15%). Cases of neonatal hepatitis syndrome, biliary atresia, gastroduodenal reflux, post-surgical stenosis and liver transplant anastomosis stenosis were also found.

Normal HBS:

The tracer reaches the parenchymal liver in a few minutes with a maximum whiting 5 minutes. The gallbladder is visualized after 10 minutes and the bowel is seen in 20-40 minutes after the injection (Figure 1).

Neonatal jaundice:

Neonatal jaundice may be caused by many pathologies. In biliary atresia the tracer shows a normal hepatocytes function, with non-visualisation of the gallbladder, common biliary duct and small gut. Always consider that this findings can also be caused by a severe hepatocellular disease. Renal or urinary excretion of the tracer (especially in a diaper) may be confused with bowel activity and is a potential source of erroneous interpretation (Figure 2).

Bile leak:

A bile leak is present when tracer is found in a location other than the liver, gallbladder, bile ducts, bowel, or urine (Figure 3 and 4).
**Duodenogastric reflux:**

During a HBS bile may reflux from the duodenum into the stomach. Many times patients have epigastric discomfort and symptoms of bile gastritis. This pathology is more frequent after bilo-enteric surgery (Figure 5).

**Acute and chronic cholecystitis:**

Chronic cholecystitis and other clinical settings produced failure of the gallbladder to fill with the radiotracer within the first hour (prolonged fasting for 24-48 hours or postoperative hospitalized patients). In chronic cholecystitis, the gallbladder will usually be seen within 4 hours delayed images or within 30 min of morphine or other cholecystokinin analogues administration (improve biliar excretion). A gallbladder that is not visualized until after the time that the bowel is visualized correlates significantly with chronic cholecystitis (Figure 6).

Whereas acute cholecystitis (acalculous as well as calculous) will result in persistent gallbladder nonvisualization after 4 hours of passive imaging or 30 min after morphine administration. A pericholecystic hepatic band of increased activity (rim sign) is a sign of severe acute cholecystitis like gangrenous acute cholecystitis.
Fig. 1: Selected images from Hepatobiliary Scintigraphy. 40 year-old male patient post-cholecystectomy. The liver parenchyma is homogeneous, direct passage of bile into the common bile duct and duodenum is seen, there is no representation of the gallbladder.

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**Fig. 2:** Selected images of Hepatobiliary Scintigraphy. 1-month-old female with jaundice. The images show normal hepatic captation without representation of the biliary tree or intestine 4 hours after injection of the radionuclide, findings suggestive of biliary atresia.

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Fig. 3: 38-years-old female with right upper quadrant pain onset 15 days post cholecistectomy. The images show normal parenchymal uptake, increased tracer uptake in relation to the gallbladder bed, with passage of bile from the hepatic hilum through the inner edge of the right lobe and ascending to the liver dome in later acquisitions. CT shows subhepatic collection compatible with a bilioma.

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Fig. 4: Selected images from a Hepatobiliary DISIDA scan. 38 year-old female patient with abdominal pain after cholecystectomy. Early representation of the main intrahepatic bile ducts, with no representation of the extra-hepatic ducts. There is accumulation of radiotracer in the gallbladder fossa and subhepatic bilioma. These findings are suggestive of a main bile duct fistula.

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**Fig. 5:** Selected images from a Hepatobiliary DISIDA Scintigraphy, in a 52 year-old male patient with abdominal pain after hepatic surgery. Early reflux of bile from duodenum to gastric fundus, suggestive of severe duodenal-gastric reflux.

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**Fig. 6:** Selected images from a Hepatobiliary DISIDA scan, in a 44 year-old female patient. There is slowed representation of the gallbladder, and lack of bile excretion during the exam. These findings are compatible with a chronic inflammatory process in the gallbladder.

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Conclusion

Despite the infrequent use of this technique in our country, the functional approach of this method make it useful in the examination of the hepatobiliary pathology when there is not anatomical alteration.

Physicians must considerate this imaging method in difficult cases.
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