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Case Note

Bile leak detection by radionuclide scintigraphy

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Abstract

Introduction: Bile leak after liver injury has been reported to be a complication associated with significant mortality. Tc99m-IDA (Tc: Technetium) nuclear scan allows rapid and noninvasive diagnosis of bile leak.

Objective: An accidental case was referred for the detection of suspicious bile leak.

Methods: The ultrasound could not detect any abnormality. Dynamic Hepatobiliary Scintigraphy (DHBS) using radiolabeled tracer was performed.

Results: DHBS promptly detected the site of leak.

Conclusion: This technique should be opted because it has been found to be quite sensitive, specific and accurate for detecting the bile leak. Whereas, Ultrasound and CT imaging are less sensitive and nonspecific. Though, they are initially helpful in determining the presence of abdominal fluid collections, they are unable to differentiate between a seroma, lymphocele, hematoma or bile leak. Hepatobiliary scintigraphy is more accurate because it can demonstrate continuity of these fluid collections with the biliary tree. Further, hepatobiliary scintigraphy can provide real-time assessment of hepatocytes function and bile progression from the liver to the intestine.

Key words: Tc99m-IDA scan, Hepatobiliary iminodiacetic acid [HIDA] scan, DHBS, Cholescintigraphy, Hepatobiliary trauma, scintigraphy

Bile leak is one of the serious complications resulting from hepatobiliary trauma and is associated with significant morbidity and mortality[1]. A significant drop in the incidence of morbidity and mortality can be achieved by timely detection of biliary tract disruption and prompt action before the condition is serious[2,3,4].

Case Report

A 35 year old male construction worker who had sustained blunt abdominal injury secondary to fall on a stone was referred to Nuclear Medicine department. On the day of injury, in the emergency department he was diagnosed to have bowel injury and was operated upon. Two days post-operative he developed fever with jaundice and complained of pain and swelling in the abdomen. The fluid in the drain, which was serosanguinous initially, turned bile stained. Ultrasound showed free fluid in the peritoneal cavity but its nature could not be ascertained. No other visceral abnormality could be detected. An injury to liver complicated by bile leak was suspected.

To confirm the presence of bile leak and to locate its site, Dynamic Hepatobiliary Scintigraphy (DHBS, also called Cholescintigraphy) was done after an intravenous injection of 185 MBq Tc99m-DISIDA. It showed a normal sized liver with good uptake of tracer. The imaging was performed in erect posture and bile leak was seen on the right lateral aspect of liver. Radiotracer containing bile was seen outside normal confines (of biliary tree and intestines) trickling down past the gall bladder and on posterior surface of liver (Fig. 1). CT scan showed that the liver was lacerated in upper right quadrant. The patient was managed conservatively. The drain fluid became bile free within a week.

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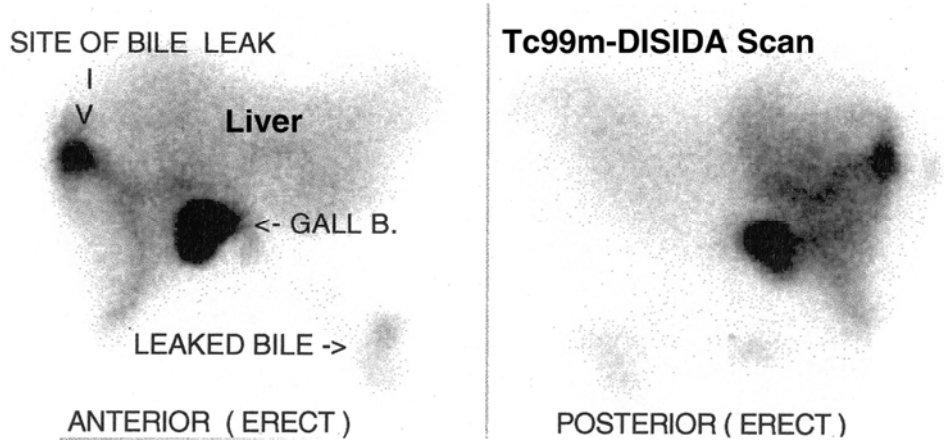
Fig. 1: Tc99m-DISIDA scan showing leakage of bile from the superolateral aspect of liver.



Discussion

Biliary leak can occur due to several causes like- blunt traumatic injury leading to liver parenchymal damage or biliary tree disruption[2], post-cholecystectomy[5,6], post liver transplant[7], spontaneously as in rupture of choledochal cyst[8] or even penetrating injury during liver biopsy[9]. Another important cause of bile leak is laparoscopic cholecystectomy which is gaining popularity and is replacing conventional laparotomy to minimize pain, recovery time and discomfort after surgery with the additional benefit of improved cosmetic results. But, the bile leaks are more frequent than in traditional cholecystectomy[4,6].

Iminodiacetic acid (IDA) analogs not only follow the same metabolic pathway as bilirubin, rather they also compete with it. On intravenous injection, IDA analogs are extracted by hepatocytes and then excreted in the biliary tree and finally drain into the intestines[10]. Based on the above qualities, DHBS employs Tc99m-labeled IDA analogs for the assessment of hepatocyte function, demonstration of biliary tract patency and studying gall bladder function. The commonly used IDA analog is DISIDA (Di-Isopropyl Iminodiacetic acid).

Sequential images of the hepatobiliary system are acquired after intravenous injection of radiotracer technetium99m-IDA. The scintigraphic finding diagnostic of bile leak is extravasation of tracer activity into the peritoneal cavity [10]. In the case presented here, the patient was imaged in upright position. The evidence for biliary leak was readily apparent early during imaging. Bile leak was suggested by appearance of radiotracer containing bile along the right lateral aspect of liver, its persistent and progressive accumulation in sub hepatic region not conforming to usual bowel morphology. The leaked bile also traveled freely along gravity and accumulated in the dependent parts.

Though many modalities have been used for the detection of biliary leak, like- Ultrasonography (US), Computerised tomography (CT), Endoscopic Retrograde Cholangio Pancreatography (ERCP), etc. However, DHBS is having an edge over them for various reasons as mentioned below.

In a study by Brugge et al, patient symptoms, laboratory testing and physical examination were found to be poor predictors for the presence of bile leaks. Cholescintigraphy was found to be quite accurate (83-87%) for predicting the presence of bile leaks after laparoscopic cholecystectomy, as well as other biliary surgeries. Whereas, Ultrasound and CT imaging were less sensitive and nonspecific[5].

In another study by Walker et al, in cases with disruption of the biliary tree after laparoscopic cholecystectomy, while sonography and CT were initially helpful in determining the presence of abdominal fluid collections, they were unable to differentiate between postoperative seroma, lymphocele, hematoma or bile leak. Hepatobiliary scintigraphy was useful in demonstrating continuity of these fluid collections with the biliary tree and guiding further therapy[6].

The invasive procedure ERCP when used to detect bile leak may be tedious. It can be associated with complications like- acute pancreatitis, cholangitis, allergic reaction to contrast or bleeding[11]. Hence, it is mandatory to perform pre-operative coagulation profile, contrast sensitivity test and administration of prophylactic antibiotics. Further, it may give false negative findings[7]. According to Kurzawinski et al, DHBS as a primary investigational tool has given good results. They opine that ERCP should only be necessary if DHBS is abnormal[7].

Taking up the case of latest imaging modalities, like one study reported the use of Spiral CT[12] another of using contrast-enhanced MR cholangiography to detect the presence and location of bile duct leaks in patients suspected of having such leaks after undergoing cholecystectomy[13]. However, number of patients was small; further the reported sensitivity and specificity were 86% and 83% respectively[13]. To date there is very limited experience with them to be accepted as a routine procedure in the workup of these types of patients.

DHBS, which has been introduced for detection of biliary leak in 1970s, has stood the test of time. In literature, for detecting bile leak, as high a 100% specificity and sensitivity has been reported by Mochizuki et al in liver transplant patients and in an another study by Kim et al[14,15]. The accuracy was also reported to be 100%[14].

DHBS is a physiologic, rapid, non-invasive, safe, simple procedure for the detection of presence, site and extent of the bile leak occurring due to various etiologies. Current gamma cameras offer high sensitivity for detecting even the very minute quantities of radioactivity (in this case radiotracer containing bile). This technique provides additional information about functional and morphological status of biliary tract as in the cases of trauma and transplanted liver[16]. Due to low level of radiation exposure involved, it can be repeated and hence, is useful in evaluating the response to medical or surgical treatment[3]. Further, a negative study for any suspected bile leak can assure the treating surgeon for conservative management.

Conclusion

DHBS is being used since late 1970s for diagnosis of biliary leakage but is an apparently underutilized technique for the evaluation of biliary leaks. It is a highly-sensitive and specific functional imaging modality for identification of bile leak. It also provides quantitative information on liver and biliary tract function.

Continuing Medical Education Box

Other Common Indications for DHBS:

* Diagnosis of Acute Cholecystitis
* Functional status of Gall Bladder in Chronic Cholecystitis
* Detection of Duodeno-gastric reflux
* Choledochal cyst
* Biliary atresia

Computer based 'Quantitative analysis' can help to know the:

* Gall baldder ejection fraction (GBEF)
* Gastric reflux of bile, if any

General Patient Preparation

* Fasting 6-12 h, to study Gall Bladder–Ejection Fraction

False negative test may occur:

If not fasting, as food intake will cause emptying of GB.

On the other hand, longer fasting of 24 h makes bile viscous; preventing IDA tracer to enter GB, thus, GB though normal may not be seen.

Normal Findings

* On a normal scan by about 5 minutes the liver radioactivity should exceed cardiac radioactivity.
* Biliary tree activity is typically seen by 15 minutes.
* In 85-90% of normal subjects gallbladder is seen within 30 minutes.
* In about 75-80% of normal subjects small bowel activity is seen within 60 minutes.

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