

# Hepatobiliary scintigraphy in surgical patients

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## Summary

Hepatobiliary scintigraphy as an investigative procedure has a definite role in the investigation of the surgical patient with various biliary problems. As it outlines the functional anatomy of the biliary tract, it has been employed for some time in the diagnosis of acute cholecystitis. In addition, it has a place in the investigation of patients with chronic cholecystitis, common bile duct obstruction and biliary leaks and in evaluating the integrity of biliary bypass procedures.

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Hepatobiliary scintigraphy (HBS) with technetium-99m ( $^{99m}\text{Tc}$ ) iminodiacetic acid (IDA) has become a valuable and reliable diagnostic modality in the surgical patient. Its reliability in the diagnosis of acute cholecystitis is undisputed.<sup>1-4</sup> There is growing evidence that it also has a valuable place in the diagnosis of chronic cholecystitis, common bile duct obstruction and biliary leaks and in evaluating biliary enteral bypass surgery.

HBS was introduced at Tygerberg Hospital, Parowvallei, CP, in January 1980; our experience and findings in adults over a 3-year period are reviewed.

## Material and methods

The majority of requests for HBS were made in order to confirm the diagnosis of acute cholecystitis. In addition, the examination was employed to demonstrate biliary leakage, to detect common bile duct obstruction before the onset of severe jaundice and to assess biliary enteral bypass procedures. Using HBS it was also possible to differentiate between acute and chronic cholecystitis.

HBS is usually performed after a patient has fasted for at least 2 hours, but in practice our examinations were often performed on patients suspected of having acute cholecystitis on the day after their admission and therefore after an overnight fast.

Approximately 185 MBq (5 mCi)  $^{99m}\text{Tc}$ -labelled di-isopropyl-IDA (DISIDA) was injected intravenously followed by imaging at 5, 15, 30, 45 and 60 minutes and occasionally at 3 and 24 hours (Fig. 1). There were no untoward side-effects in any of the patients. All the images were examined by staff trained in nuclear medicine and their pre-operative diagnosis was carefully correlated with the operative findings.

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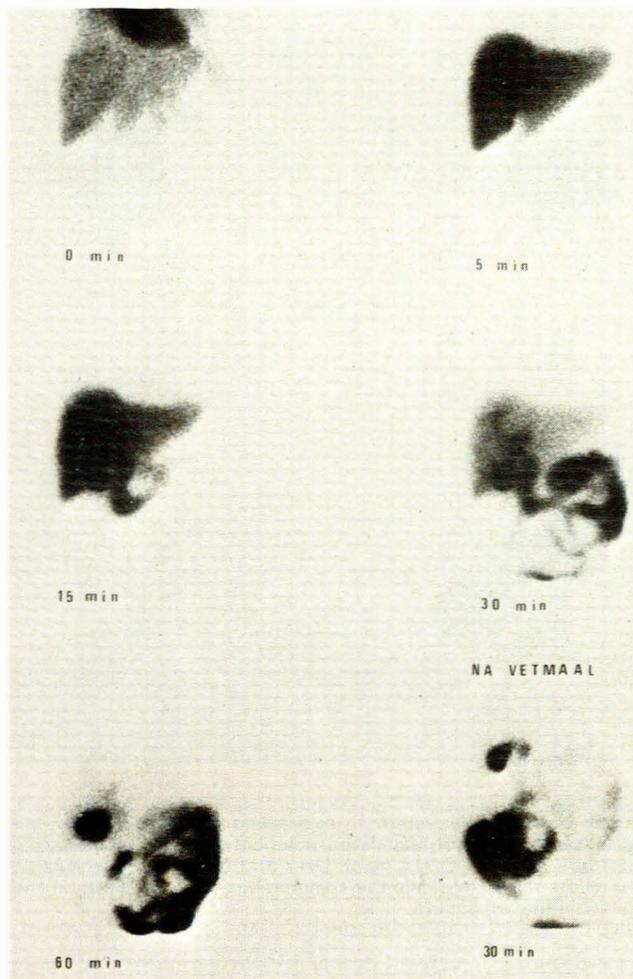


Fig. 1. A normal hepatobiliary scintigram performed with  $^{99m}\text{Tc}$ -DISIDA. The gallbladder can be clearly visualized from 15 minutes onwards and contracts after a fatty meal (na vetmaal). Note the presence of radioactivity in the common bile duct and duodenum on the 15-minute film and a fairly large amount of radioactivity in the bowel on the 30-minute film.

## Results

### Acute cholecystitis (Fig. 2)

Of the total number of requests for hepatobiliary imaging in the period under review 85 were for acute cholecystitis. There were 55 positive studies (diagnostic of acute cholecystitis because of cystic duct obstruction) and 2 negative scans diagnostic of a normal gallbladder with a patent cystic duct. Because of our protocol of early elective surgery in most patients with acute cholecystitis, all positive studies were confirmed at operation. There were 2 false-positive scans — 1 due to carcinoma of the head of the pancreas and 1 due to a gastric ulcer. The overall accuracy was therefore 96%. The negative studies were of great value. Important conditions in which surgery was contraindicated

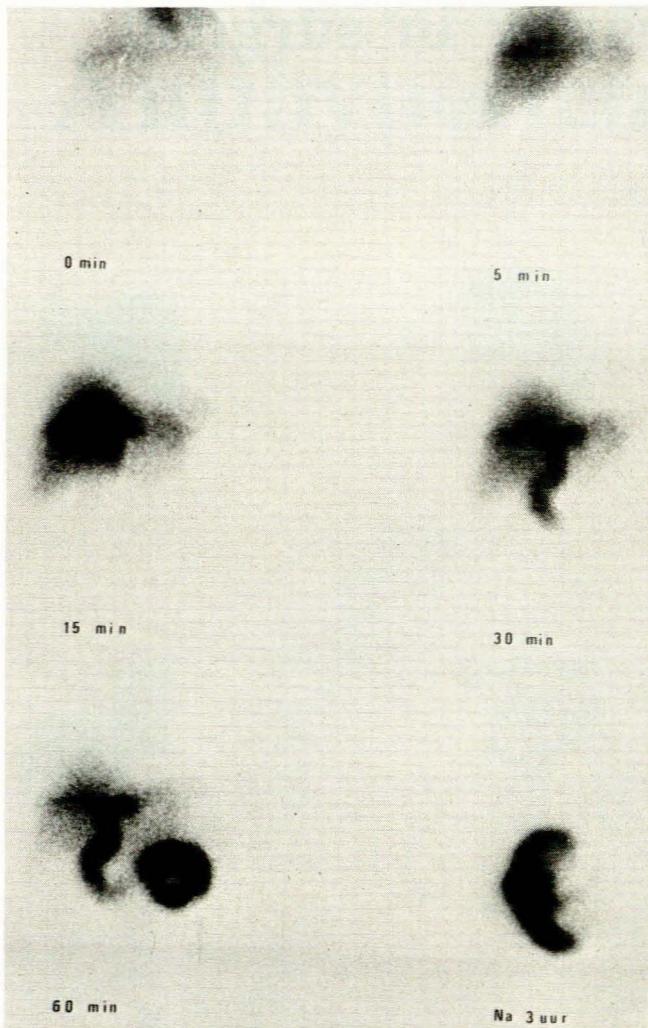


Fig. 2. Acute cholecystitis. In contrast to a negative study, the gallbladder was not visualized even after 3 hours, indicating obstruction of the cystic duct. Liver function is good and rapid excretion of the agent into the common bile duct (30 minutes) and gut (60 minutes) occurs.

were eliminated, such as 1 case of myocardial infarction, 2 cases of acute-on-chronic hepatitis and 2 cases of acute alcoholic pancreatitis. A negative study in 1 patient led to a more critical evaluation of the presumptive diagnosis and at laparotomy a loop of strangulated small bowel was found. In our experience a negative study virtually rules out acute cholecystitis.

**Chronic cholecystitis (Fig. 3)**

Patients with chronic cholecystitis form an important and familiar group often encountered by surgeons. Usually the patient has a history of biliary disease and the clinical features are such that a differential diagnosis between an acutely inflamed gallbladder and chronic inflammation has to be made. Typically, HBS in these patients shows delayed filling of the gallbladder, often as late as 3 hours and at times 24 hours. Seven patients fell into this category, which meant that either surgery was avoided or an alternative diagnosis had to be sought.

**Common bile duct obstruction**

It has been our experience that patients with common bile duct obstruction and with serum bilirubin levels as high as 200

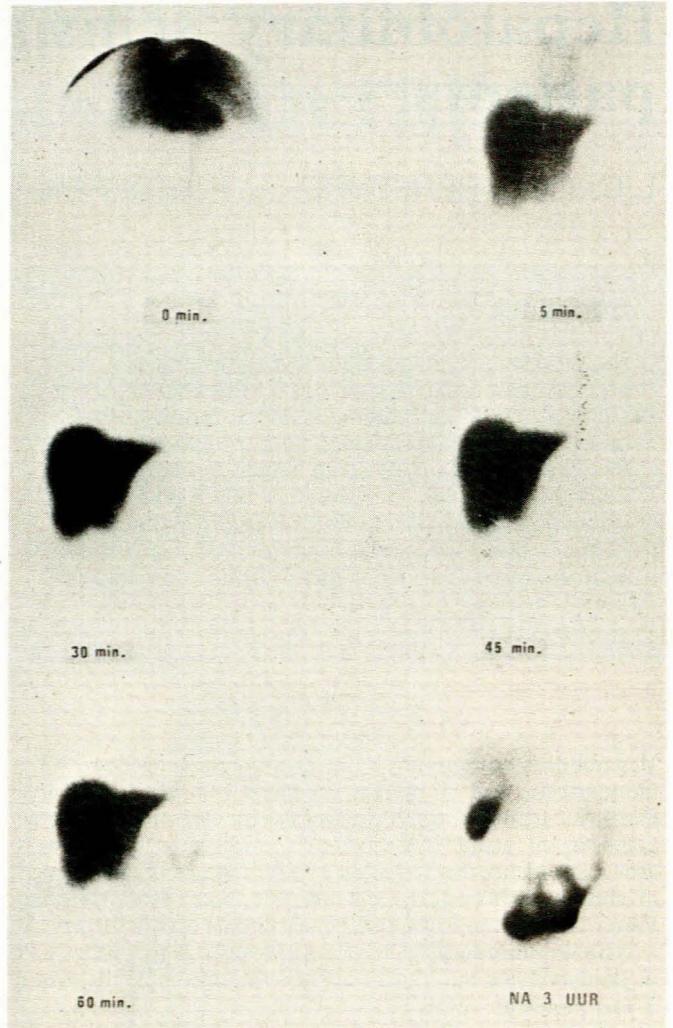


Fig. 3. Chronic cholecystitis. Visualization of the gallbladder is delayed; it is not seen on the 60-minute view, but can be clearly visualized on the 3-hour view.

mmol/l still qualify for this type of examination. In 2 patients with acute cholecystitis whose common bile ducts were not demonstrated at any time after the injection of the radioactive material, the operative findings were of acute cholecystitis associated with acute cholangitis caused by stones in the common bile duct (Fig. 4).

**Bile leakage**

Three requests were made for HBS in order to demonstrate bile leakage. In 2 cases there was no evidence of leakage. The patient in whom leakage was demonstrated had carcinoma of the lower end of the common bile duct which was found to be inoperable. The surgeon anastomosed a loop of jejunum to the proximal dilated duct. On the 4th postoperative day the patient's condition deteriorated and there was some degree of bile leakage from the drain site (Fig. 5).

**Biliary enteral bypass surgery**

The anastomotic site can be very adequately evaluated by HBS, e.g. after choledochoduodenostomy or choledochojejunostomy. Leakage at the anastomosis can be demonstrated and features such as widening of the duct or partial ductal obstruction

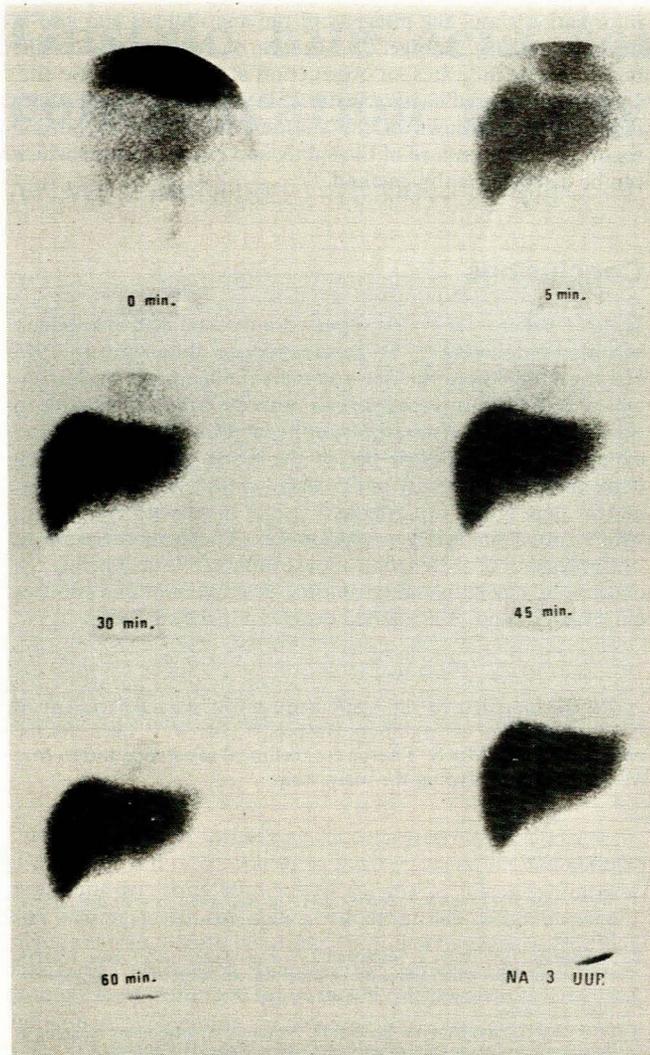


Fig. 4. Complete obstruction. The biliary tree is not visualized at any stage. With the agent used (DISIDA), kidney activity is only slight, even in cases of obstructive jaundice.

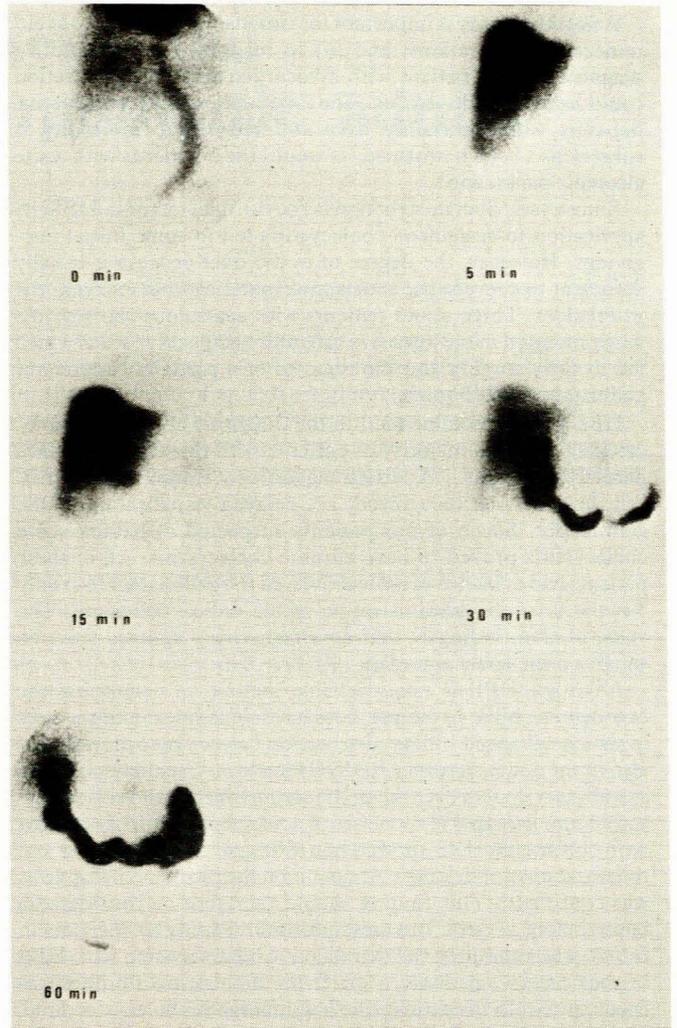


Fig. 6. Biliary enteral bypass surgery. Activity in the heart, aorta and liver is seen initially (0 minutes). From 30 minutes onwards activity passes freely from the biliary tree to the gut, which is adequately visualized.

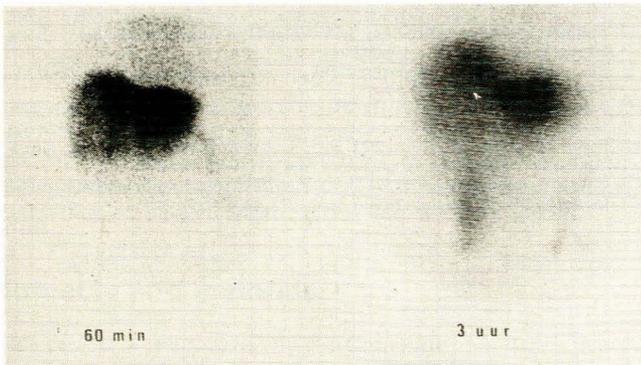


Fig. 5. Bile leakage demonstrated in the vicinity of the left lobe of the liver (60 minutes), spreading later into the paracolic region (3 hours).

can be demonstrated. An elderly patient underwent a resection of the suprajunal portion of the common bile duct for a constricting carcinoma. The gallbladder had previously been removed. An anastomosis was made between the hepatic duct and a Roux-en-Y loop of jejunum. The end of the jejunal loop was closed and the hepatic duct anastomosed to the antimesenteric

border just proximal to this closure in one layer with interrupted 3-0 Dexon sutures (Fig. 6).

## Discussion

The value of HBS in the diagnosis of acute cholecystitis is well established; it has a sensitivity of 95 - 96%,<sup>2,3</sup> a specificity of 97-100%<sup>4,5</sup> and an accuracy of 95 - 97%.<sup>1,6</sup> The need for early elective surgery in cases of acute cholecystitis is now generally accepted and with the advent of scintigraphy the diagnosis can be made with increased confidence. In elderly and often medically compromised patients, in whom the clinical features are unconvincing in up to 30% of cases, the added facility of this method has immense value. In a 3-year period from 1980 to 1982, 382 patients at our hospital underwent surgery for cholelithiasis and 208 (54,45%) of these were over the age of 60 years. For many years we have practised early elective surgery for acute cholecystitis and we now lean heavily on scintigraphy in the pre-operative evaluation of these patients, a large percentage of whom are elderly. Although we have not compared HBS with ultrasonography, our own accuracy of 98% in positive studies and 100% in negative studies has led us to employ HBS more and more as a primary special investigation in the diagnosis of acute cholecystitis.

A negative study is important for two main reasons: (i) to avoid unnecessary operations; and (ii) to reappraise a presumptive diagnosis. In the patient with myocardial infarction, operation could have been disastrous. The 2 patients with chronic active hepatitis would certainly have suffered severe morbidity if surgery had been performed, as would the 3 patients with acute alcoholic pancreatitis.

Since cystic duct obstruction is the cardinal factor in HBS, its application to acalculous cholecystitis led to some initial misgivings. However, the degree of cystic duct oedema is usually sufficient to prevent the radioactive material from entering the gallbladder. Three of our patients with acalculous cholecystitis who presented in the intensive care unit had positive scans which led to early surgery and the removal of a partially gangrenous gallbladder in all 3 cases.

HBS is not recommended in the diagnosis of chronic cholecystitis, since the majority of patients with this condition have normal scintigrams.<sup>3,7</sup> A pattern suggestive of chronic cholecystitis can, however, be recognized, i.e. delayed visualization of the gallbladder. Seven of our patients suspected of having acute cholecystitis proved to have chronic cholecystitis. All of these patients had evidence of radioactivity in the gallbladder, but only 3 hours after the administration of the radioactive agent. The value of this finding is that an alternative diagnosis must be sought in the acute situation.

Although HBS is not a reliable method of examining the extrahepatic biliary system it does have some value in those cases in which advanced biliary obstruction has not yet occurred and also in the acute situation.<sup>8</sup> DISIDA allows visualization of the extrahepatic system even when the serum bilirubin level is as high as 200 mmol/l. In 3 of our cases of acute cholecystitis associated with cholangitis HBS showed non-filling of the gallbladder and the extrahepatic bile ducts. At operation the provisional diagnosis was confirmed. This finding should therefore be considered a bonus before surgery. In a most informative study by Weissmann *et al.*,<sup>8</sup> who examined the extrahepatic biliary system with HBS in postoperative patients, a spectrum of abnormal findings was encountered. In the patient who has undergone cholecystectomy, dilation of the common bile duct cannot be equated with obstruction since ectasia may be secondary to the previous passage of stones or to surgical manipulation of the duct. Scintigraphy is most useful in determining whether a dilated common bile duct is functionally patent or obstructed. A normal-sized duct which empties within an hour rules out significant lesions in a high percentage of cases.

HBS is a simple and easy method for detecting bile leakage. One limiting factor is that the exact site of leakage cannot always be demonstrated after cholecystectomy, but this should not discredit what is one of the most sensitive methods of demonstrating this problem.

HBS in the evaluation of patients who have undergone enteric bypass is well established; it is especially useful for obtaining

information about the integrity of the anastomosis and also in detecting biliary leakage.<sup>9,10</sup> Absence of radioactivity in the bowel clearly indicates an obstruction at the anastomotic site. Leakage of the radioactive material into the abdominal cavity indicates a breakdown of the anastomosis. There are several reports in the literature of the subtle and minor changes which can be detected by this method.<sup>9,10</sup>

## Conclusions

In 1974 Baker *et al.*<sup>11</sup> first reported a method of hepatobiliary scanning employing <sup>99m</sup>Tc-pyridoxylidene glutamate. In 1975 Harvey *et al.*<sup>12</sup> were the first to report the use of <sup>99m</sup>Tc-HIDA, and since then this technique has proved extremely valuable in the diagnosis of certain aspects of hepatobiliary disease. In our experience over a 3-year period the worth of HBS has been demonstrated repeatedly in the diagnosis of acute cholecystitis, and we have found it particularly useful for the elderly patient, who is often medically compromised. The demonstration of biliary leaks or of obstruction of the common bile duct before the onset of advanced jaundice and the evaluation of choledochenteral anastomoses are added benefits for the surgeon.

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## REFERENCES

- Weissmann HS, Frank MS, Berstein LH *et al.* Rapid and accurate diagnosis of acute cholecystitis with Tc-99m HIDA cholescintigraphy. *AJR* 1979; **132**: 523-528.
- Weissmann HS, Badia J, Sugarwan LA *et al.* Spectrum of 99m Tc-IDA cholescintigraphy patterns in acute cholecystitis. *Radiology* 1981; **138**: 167-175.
- Freitas JE. Cholescintigraphy in acute chronic cholecystitis. *Semin Nucl Med* 1982; **12**: 18-26.
- Szlabick RE, Catto JA, Fink-Bennett D, Ventura V. Hepatobiliary scanning in the diagnosis of acute cholecystitis. *Arch Surg* 1980; **115**: 540-544.
- Stadlnik RC, Kraus JF, Matolo NM *et al.* The validity of technetium 99m-pyridoxylidene glutamate (P.G.) cholescintigraphy as a diagnostic test for cholecystitis. *Clin Nucl Med* 1978; **3**: 142-146.
- Matolo NM, Stadlnik RC, Dixon SM. Value and limitations of scanning of the biliary tract. *Surg Gynecol Obstet* 1980; **150**: 521-524.
- Gliedman ML, Wilk PJ. A surgeon's view of hepatobiliary scintigraphy. *Semin Nucl Med* 1982; **12**: 2-4.
- Weissmann HS, Rosenblatt RR, Susarman LA *et al.* Early diagnosis of acute common bile duct obstruction by Tc-99m-IDA (iminodiacetic acid) cholescintigraphy. *J Nucl Med* 1980; **21**(6): 41.
- Rosenthal L. Cholescintigraphy in the presence of jaundice utilizing Tc-IDA. *Semin Nucl Med* 1982; **12**: 53-63.
- Weissmann HS, Gliedman ML, Wilk PJ *et al.* Evaluation of the postoperative patient with 99m-Tc-IDA cholescintigraphy. *Semin Nucl Med* 1982; **12**: 27-52.
- Baker RJ, Bellen JC, Ronai PM. 99m-Tc-pyridoxylidene glutamate: a new rapid cholescintigraphy agent. *J Nucl Med* 1974; **15**: 476-479.
- Harvey E, Loberg MD, Cooper M. Tc-99mHIDA: a new radiopharmaceutical for hepatobiliary imaging. *J Nucl Med* 1975; **16**(6): 533.