Accurate Demonstration of Hepatic Infarction in Liver Transplant Recipients

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Serial HIDA scanning has proven to be a valuable tool in the postoperative management of liver transplant patients. Previous reports have documented its efficacy in detecting biliary leakage, abscess, and rejection. We have also found HIDA scanning to be a sensitive method for detecting early hepatic infarction before ultrasonographic changes occur. Two cases are presented to demonstrate the characteristic findings seen with hepatic infarctions.

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The usefulness of serial dimethyliminodiacetic acid (HIDA) scans in the postoperative evaluation of liver transplant recipients is well documented in the literature. Previous reports have shown its efficacy in detecting biliary leaks, abscess, and rejection (*1–7*). We have also found HIDA scanning to be useful in the detection of hepatic infarcts. A characteristic HIDA scan in combination with a normal ultrasound has been virtually diagnostic of hepatic infarction in our series.

Two cases are presented to illustrate the fundamental differences between anatomic and physiologic imaging modalities, and their complementary roles in the evaluation of hepatic dysfunction.

MATERIALS AND METHODS

Thirty-three patients received liver transplants at the UCLA Medical Center over an 18-mo period extending from February, 1984 through July, 1985. Twenty-eight of these patients were studied with HIDA scans when clinical evidence suggested hepatic dysfunction. Patients reviewed had between one and six HIDA scans during the course of the study. The patients ranged in age from 2–54 yr. There were 19 females and 14 males.

HIDA studies were performed using a large-field-of-view scintillation camera* with a low-energy, all-purpose collimator. After the intravenous administration of 2 mCi of [^{99m}Tc] 2,6 diisopropyliminodiacetic acid (DISIDA) images were obtained sequentially for 60 min following injection. The images were acquired and displayed in 2-min frames. Ultrasound examinations were performed by an experienced staff radiologist using a Phillips 3000 scanner and a 5.0 mHz real time transducer.

The HIDA scans were reviewed in the Division of Nuclear Medicine and when abnormalities were detected, correlation with ultrasound was obtained. Ultrasound examinations were initially performed and interpreted in the Department of Radiological Sciences. In two of the cases the ultrasounds did not detect space occupying lesions after a defect was detected on the HIDA study. In both these cases the studies were then jointly reviewed by the Nuclear Medicine and Ultrasound staffs. The diagnosis of hepatic infarction was made in both cases. Surgical resection of the involved areas subsequently confirmed the diagnosis. Both these cases are presented.

CASE REPORTS

Case 1

A 15-mo-old Vietnamese female underwent liver transplantation for end stage biliary atresia. The operation went well and her postoperative course was uneventful until 2½ wk when she presented with the sudden onset of fever, leukocytosis, and respiratory failure. Resuscitative measures were taken and laboratory as well as radiologic studies were performed in an effort to determine the source of her systemic sepsis. HIDA scan demonstrated a large nonfunctioning area in the left lobe of the liver (Fig. 1). Ultrasound examination showed some increased echogenicity in the left lobe (Fig. 2); however, the defect appeared much more extensive on the HIDA study. On the basis of these studies a hepatic infarction was suggested. The patient continued to deteriorate despite systemic antibiotics. On subsequent exploration a large infarct of the left lobe of the liver was confirmed. The infarct was

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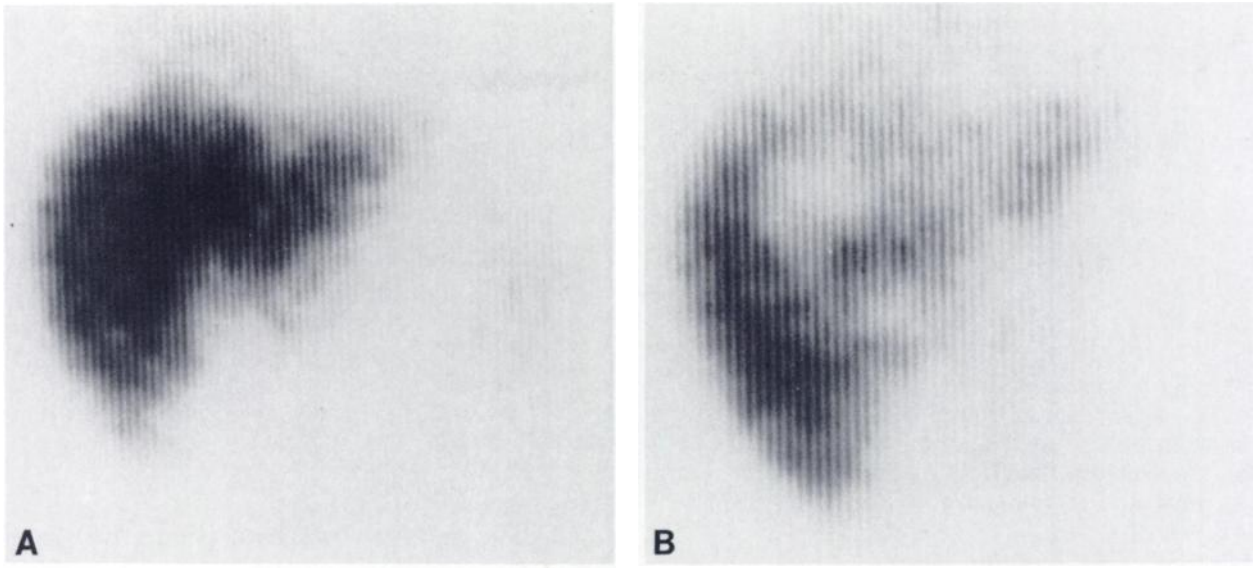

FIGURE 1
A: HIDA scan in Patient 1 performed several days postoperatively. Liver contour was normal. B: HIDA scan done 2 wk later on same patient. Entire left lobe as well as superior medial aspect of right lobe have markedly decreased uptake. Infarction was subsequently confirmed surgically

demonstrated to be the septic source when the same organism was found in the blood and the infarcted portion of liver. She responded well to debridement and left hepatic lobectomy and was subsequently discharged home.

Case 2

Orthoptic liver transplantation was performed on a 12-yr-old female with endstage cirrhosis due to biliary atresia. The operation was technically difficult secondary to the child's severe coagulopathy, portal hypertension, and multiple previous abdominal operations. Blood loss exceeded 200 units and at one point the patient experienced a brief (<30 sec) hyperkalemic cardiac arrest. Despite this, her early postoperative course was remarkably stable with gradual improvement in her clinical and laboratory parameters. Her serum hepatic enzymes, however, remained elevated, undoubtedly reflecting the ischemic insult that the liver had received as a consequence

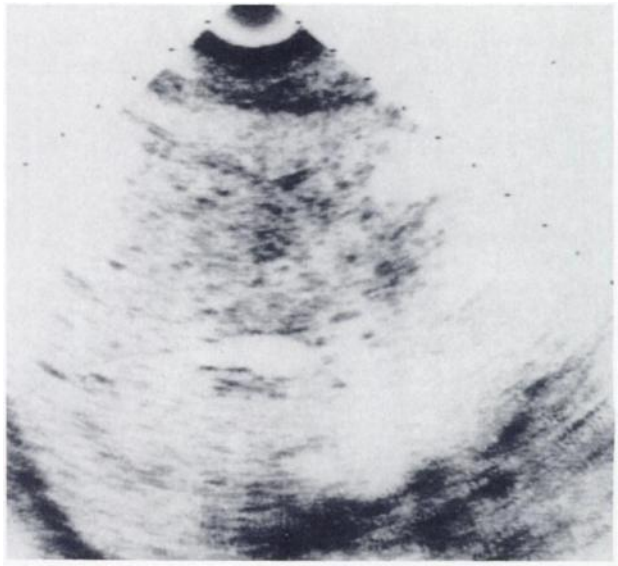

FIGURE 2
Transverse hepatic ultrasound of left lobe performed same day as HIDA scan in Fig. 1B. There is area of increased echogenicity in left lobe; however, defect appears less extensive than on HIDA scan

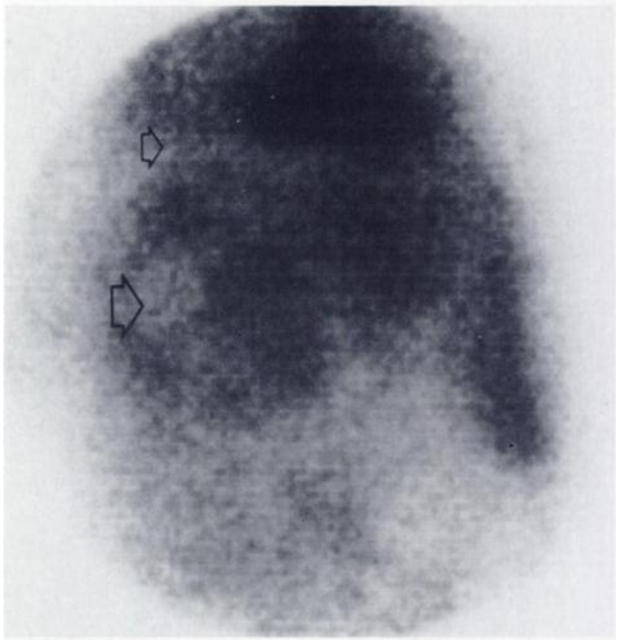

FIGURE 3
Forty-five-minute anterior image from HIDA scan performed on patient eight days after liver transplantation. There is extensive blood pool activity over heart (small arrow) consistent with poor hepatocyte function. Large photopenic defect is also present in right lobe (large arrow)

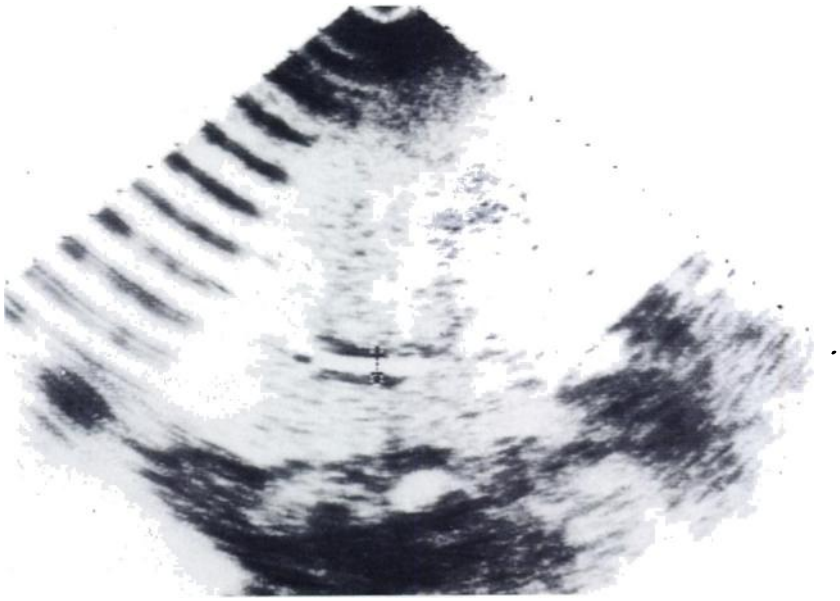

FIGURE 4
Hepatic ultrasound of right lobe of liver performed one day after HIDA scan in Fig. 3. Entire study was interpreted as normal

of prolonged intraoperative bleeding, hypotension, and arrest. A biopsy done 5 days postoperatively revealed ischemia with subscapular necrosis.

On postoperative Day 8, the patient's biliary output ceased and increasing evidence of hepatic insufficiency became evident. HIDA scan demonstrated a large central defect in the right lobe of the liver which was not identified on ultrasound (Figs. 3 and 4). Attempts to locate another donor liver for retransplantation were made, but sepsis intervened and the patient subsequently died of systemic candidiasis. Postmortem examination demonstrated massive hepatic infarction with secondary fungal and bacterial infection (Figs. 5 and 6).

DISCUSSION

The postoperative management of liver transplant patients is complicated by the fact that the various causes of hepatic dysfunction result in a similar clinical picture. Since the treatment of hepatic infection, rejection, obstruction, and ischemia are markedly different, HIDA scans have been invaluable in aiding the transplant surgeon in making the correct diagnosis. Ischemia and infarct are particularly important hepatic findings in that secondary liver failure and sepsis occur if appropriate therapy—partial resection or retransplantation—is not performed quickly.

HIDA scanning is noninvasive and well tolerated by patients. Only viable hepatocytes take up the isotope and excrete it into bile. Demonstration of an area of focal diminished or absent hepatic uptake of tracer indicates either the presence of a space occupying lesion (tumor, abscess) or nonviable hepatocytes. Correlation of an abnormal HIDA scan with an anatomic imaging modality such as ultrasound or computed tomography allows more precise diagnosis of the defect. Absence on

FIGURE 5
Gross specimen demonstrating extensive infarct in antero-lateral aspect of right lobe of liver. Lesion corresponded to abnormality detected on HIDA. Section is oriented axially with top of image representing anterior aspect of liver

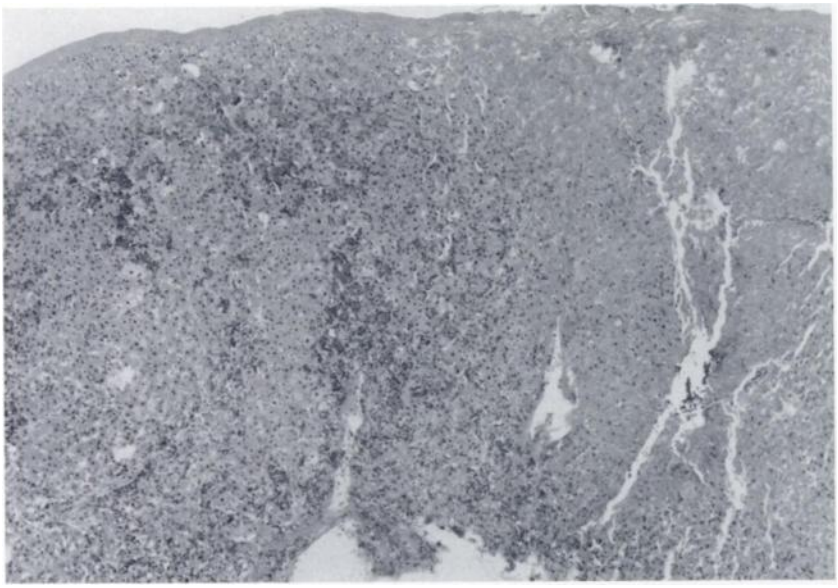

FIGURE 6
Microscopic specimen from infarct demonstrated in Fig. 5. This Figure shows evidence of hemorrhagic necrosis with associated inflammatory infiltration

ultrasound of a defect visualized on HIDA indicates that infarct is the most likely diagnosis in the appropriate clinical setting.

In both the cases presented here, sepsis and hepatic dysfunction resulted in marked clinical deterioration which demanded immediate and accurate diagnosis and treatment. In the second patient, who had sustained significant ischemia as a consequence of bleeding and hypotension, the demonstration of hepatic infarction was not surprising. The first child, however, had no such preceding history and presented a diagnostic dilemma to the clinicians. Clinical signs were nonspecific as to etiology, and the source of clinical dysfunction in both cases. Hepatic lobectomy was successfully performed in one case. Because of the large area of ischemia in the second patient, liver retransplantation was required. This unfortunately was not possible before the child succumbed to hepatic necrosis and systemic sepsis.

Earlier studies described altered echogenicity as an ultrasonographic finding in hepatic arterial infarction (*8,9*). We believe these most likely represent later stages in the process. Increased echogenicity may be seen with fatty infiltration fibrosis and decreased echogenicity is also a nonspecific finding. When both ultrasound and scintigraphy are combined the diagnosis can be made with a higher degree of certainty. It is obvious that the physiological changes of decreased function should preceed the anatomic changes. The absence of portal or hepatic venous dilatation argue against thrombosis of these vessels and therefore make both these cases more consistent with arterial infarcts.

In our experience, serial HIDA scanning has been instrumental in making the correct diagnosis of multiple caues of hepatic dysfunction occuring postoperatively in liver transplant recipients including biliary leakage, abscess, and rejection. The demonstration of hepatic infarction represents another area in which the HIDA scan is useful, and as illustrated in the two cases presented here, shows the fundamental differences between physiologic and anatomic imaging.

FOOTNOTE

* Elscint, Inc., Boston, MA.

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