

## Results of Hepatobiliary Scintigraphy in Jaundiced Patients using Tc-99m EHIDA

Selim Md. Ansari<sup>1</sup>, Quaji Monwar Jahan<sup>2</sup>, Lipika Saha<sup>2</sup>, Ashoke K. Paul<sup>3</sup>

*For correspondence: Selim M. Ansari, Nuclear Medical Centre, P.O.Box 61, Bogra 5800, Bangladesh*

*1. Principal Medical Officer, Nuclear Medical Centre, Bogra,*

*2. Scientific Officer, Nuclear Medical Centre, Bogra,*

*3. Senior Medical Officer, Nuclear Medical Centre, Khulna*

### ABSTRACT

**H**epatobiliary scanning was performed in 754 jaundiced patient using Tc-99m EHIDA (2, 6 - diethyl phenyl carbamoyl methyl iminode acetic acid). Serum bilirubin level of the patients were ranged between 2.6 - 27 mg % with clinically evident of hepatobiliary damage. There were 684 patients with hepatocellular disease and 70 patients with obstructive jaundice Overall accuracy was about 89 %. However the result of the radioisotope cholescintigraphy was inversely related to the level of serum bilirubin concentration The accuracy of the imaging was 98 % when the serum bilirubin level was within 5 mg%, but it drops to 69 % when the serum bilirubin level crossed 15 mg%. The sensitivity for obstructive jaundice was 87 % and for hepatocellular jaundice was 89 %. Tc-99m EHIDA has been used extensively to demonstrate its reliability in differentiating the obstructive jaundice from hepatocellular jaundice as long as the bilirubin remains below 15 mg%.

### INTRODUCTION

Jaundice is a very common problem in Bangladesh. The main problem during management of jaundice patient is to determine whether the icterus is of hepatocellular or of mechanical origin. Clinical and biochemical data help the clinician mostly in determining the cause. In the past, a non-invasive method for detection of hepatobiliary disorder, ultrasonography, was not available in this area. So radionuclide scintigraphy technique for detection of the cause of jaundice, was widely used and selected by the local clinicians.

In early days of radionuclide cholescintigraphy, I-131 rose bengal was the radiop-

harmaceutical of choice<sup>(1)</sup>. After the introduction of Tc-99m, various Imminodi acetic acid compounds have been used for investigation of hepatobiliary disorders<sup>(2)</sup>. The main advantage of this compound is its rapid uptake and excretion by the liver<sup>(3)</sup> Varieties of IDA derivatives have been introduced and evaluated in various hepatobiliary disturbances<sup>(4-7)</sup>

The purpose of this study is to evaluate the ability of Tc-99m EHIDA to differentiate hepatocellular from obstructive jaundice and to establish the Tc-99m EHIDA hepatobiliary scan as a routine test for the jaundice patients in our hospitals.

## MATERIALS AND METHOD

754 jaundice patients were investigated during 2 years period from 1995 to 1997. The final diagnosis as obtained by several diagnostic methods was shown in Table 1.

The labelling of tracer was done by adding Tc-99m pertechnatate solution into a vial containing 2,6-diethylphenyl-carbamoylmethyl iminodiacetic acid (EHIDA) from Amersham Inc., U.K. Each patient was injected 4 - 6 mCi of Tc-99m EHIDA intravenously after an overnight fast.

Using a scintillation gamma camera with low energy all purpose (LEAP) collimator, sequential anterior views of the abdomen were obtained. Images were taken immediately after injection and at 10 minutes interval upto 1 hour. If there was still non - visualization of gall bladder and / or gut, imaging were done at 15 minutes interval upto 2 hours and if necessary at 24 hours after injection.

## RESULTS

By using the following criteria: hepatic uptake of the tracer, discharge of the tracer from the hepatic parenchyma, visualization of the intestine and visualization of gall bladder,

the scintigraphic findings were classified into three groups as followed:

- a) Hepatocellular Diseases
- b) Complete Extrahepatic Billiary Obstruction
- c) Incomplete Extrahepatic Billiary Obstruction

The results of different disease groups are summarized in the Table 2

The results of scintigraphic findings in each disease groups are shown in Table 3.

The comparative results of scintigraphic findings and final diagnosis are shown in Table 4.

**Table 1** Final Diagnosis in patients with jaundice :

Scintigraphic Findings	Final Diagnosis	No.
Hepatocellular Disease	Viral Hepatitis **/**	462
	Amoebic Hepatitis **	106
	Ch. Liver Disease **	85
	Hepatic Metastasis ***	31
Complete Extrahepatic Billiary Obstruction	Ca Head of Pancreas */**	7
	Stone in CBD */****	13
	Stricture CBD *	5
	Ca Gall Bladder */**	29
Incomplete Extrahepatic Billiary Obstruction	Ca Head of Pancreas *	3
	Stone in CBD * / ****	1
	Stricture CBD *	11
	Cholangitis **	1

\* Confirmed by surgery

\*\* Confirmed by laboratory / clinical diagnosis

\*\*\* Confirmed by biopsy

\*\*\*\* Confirmed by ultrasonography

**Table 2** Different disease groups according to serum bilirubin level.

Final Diagnosis	Serum Bilirubin		
	< 5 mg %	5 - 15 mg %	> 15 mg %
Hepatocellular Disease	278	251	155
Complete Extra Hepatic Obstruction	17	29	8
Incomplete Extra Hepatic Obstruction	4	11	1

**a) Hepatocellular Disease:**

In 278 patients the serum bilirubin level was below 5 mg%. In these cases there was mild to moderate degree of impairment of tracer uptake by the liver parenchyma. There was also evidence of delayed ex-

cretion of isotope through biliary tree into the intestine with or without visualization of GB. In cases where the bilirubin level was between 5 - 15 mg %, the parenchymal tracer uptake was moderately preserved, but biliary tree and intestine were nonvisualized in most cases (Table 5).

**Table 3** Summarized Scintigraphic Data of all patients.

Final Diagnosis	No. of pts.	Hepatic Uptake	Gut visualization	GB visualization	Biliary tree visualization
<b>Hepatocellular disease</b>					
a) Viral hepatitis	462	0 - A	0	0 - A	A - B
b) Amoebic hepatitis	106	A - B	A	0 - A	A - B
c) Ch. Liver disease	85	0 - A	A	0 - A	0 - A
d) Hepatic metastasis	31	A - C	A	0 - A	A - B
<b>Complete Obstructive jaundice</b>					
a) Ca Head of the pancreas	7	0	0	0 - A	0
b) Ca Gall bladder	29	A	0 - A	0	0
c) Stone in CBD	13	A - B	0 - A	0	0
d) Stricture in CBD	5	A - B	0 - A	0	0
<b>Incomplete Obstructive jaundice</b>					
a) Ca Head of the pancreas	3	B	0 - A	A	A
b) Cholangitis	1	B	0	0	0
c) Stone in CBD	1	B	0	A	A
d) Stricture in CBD	11	B	A	A - B	0 - A
<b>Summary of visualization criteria</b>					
Hepatic Uptake of tracer	Gut visualization	GB visualization	Biliary tree visualization		
O Very poor (Liver could not be well outlined)	Not visualized	Not visualized	Not visualized		
A Poor uptake (Liver was barely outlined)	Barely visible	Poorly visualized	Poorly visualized		
B Moderate uptake (Liver was outlined clearly, but tracer uptake was delayed)	Visualized	Visualized	Visualized		
C Good uptake	Visualized	Visualized	Visualized		

**Table 4** Comparative results of Scintigraphic diagnosis and final diagnosis according to Disease group and Serum bilirubin level.

	Final diagnosis									Total
	Hepatocellular Disease			Complete Extrahepatic Obstruction			Incomplete Extrahepatic Obstruction			
	Serum bilirubin (mg %)			Serum bilirubin (mg %)			Serum bilirubin (mg %)			
Cholescintigram diagnosis	<5	5-15	>15	<5	5-15	>15	<5	5-15	>15	
Hepatocellular disease	271	239	105	00	00	00	00	00	00	615
Complete extra-hepatic obstruction	3	8	6	17	28	00	00	2	00	64
Incomplete extra-hepatic obstruction	4	4	44	00	1	8	4	9	1	75
<b>Total</b>	<b>278</b>	<b>251</b>	<b>155</b>	<b>17</b>	<b>29</b>	<b>8</b>	<b>4</b>	<b>11</b>	<b>1</b>	<b>754</b>

**b) Complete Extrahepatic Obstruction:**

Tracer uptake by the liver parenchyma was more or less preserved. But there was no evidence of concentration of tracer in the intestine or biliary tract upto 24 hours after injection with or without visualization gall bladder (Table 2 & 3).

**c) Incomplete Extrahepatic Obstruction:**

There was moderate to good uptake of isotope by the liver. Gall bladder and biliary tree were visualized in all cases within 2

hours, except in 1. In this case, the gall bladder was not visualized. There was evidence of delayed tracer excretion into the intestine in 9 cases. In 12 cases, the gall bladder was visualized within 4 - 24 hours where excretion was markedly delayed. In 3 cases the common bile duct was dilated.

**DISCUSSION**

Tc-99m EHIDA uptake by the liver has been shown to compete with the bilirubin level in the circulating blood stream. Increased serum bilirubin level decreased the

**Table 5** Scintigraphic findings : Serum Bilirubin Vs. Biliary tree visualization.

Diagnosis	Serum Bilirubin			
	<5 mg %	5-10 mg%	10-15 mg%	>15 mg%
Hepatocellular Disease	B	A	A - O	O
Complete Obstruction	O	O	O	O
Incomplete Obstruction	B	A	A	O

O = Not visualized A = Poorly visualized B = Normal

uptake of EHIDA by the liver. When the serum bilirubin level is above 15 mg%, the information obtained is of limited value in the diagnosis of gall bladder disease but may be predictable in the diagnosis of obstruction. Several authors<sup>(8-10)</sup> investigated di-ethyl - IDA compound in the evaluation of jaundice patients.

In our study, there is a clear relationship between the hepatic uptake of the tracer and the level of serum bilirubin. The same result was reported by Pawels and his colleague<sup>(10)</sup>. Tc-99m EHIDA imaging enabled us to give an accuracy of 87 % in cases of obstructive jaundice and 89 % in case of hepatocellular jaundice with an overall accuracy of 89%. The results show that the overall accuracy was much better when the serum bilirubin level was 5 mg% or less (98 %), but is gradually decreases with the increase of serum bilirubin level. It goes down to 69 % when the serum bilirubin was above 15 mg%.

In case of obstructive jaundice, 61 out of 70 patients were reported of true positive (Sensitivity = 87 %) and in hepatocellular disease 612 out of 684 patients were reported of true positive (Sensitivity = 89 %).

8 cases of obstructive jaundice were reported false negative whose serum bilirubin level was above 15 mg%. In these cases there was very poor uptake of tracer by the liver and there was no gut visualization (Table 3). It could be concluded from this study that Tc-99m EHIDA imaging differentiate obstructive jaundice from hepatocellular jaundice if the serum bilirubin level remains less than 15 mg %.

In most patients with serum bilirubin level above 15 mg%, the liver shows very poor uptake and was barely outlined and hence the gut and we found most of these cases was hepatocellular jaundice. We also found that when the serum bilirubin level is less than 10 mg %, the imaging allowed us a comfortable range for a reliable result.

Finally it may be concluded that, Tc-99m EHIDA, like other hepatobiliary imaging radiopharmaceuticals, has proved to be a reliable hepatobiliary imaging agent to differentiate the obstructive and hepatocellular jaundice if the serum bilirubin level does not exceed 15 mg %. Beyond this level, as the hepatic uptake of tracer gradually declines, the output of imaging is unreliable. In such the cases other non-invasive method like ultrasonography is preferable.

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