Correlation of liver-spleen scan findings with modified Child-Pugh classification

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INTRODUCTION

Years ago, liver spleen scans were commonly requested in search of metastases, primary lesions, or inflammatory processes, or in preparation for needle biopsy examination. Remarkable advances in the field of ultrasonography, CT scanning and magnetic resonance imaging, weakened the role of conventional 99mTc-sodium pertechnetate liver/spleen scans. However, because of its physiologic basis, this imaging technique can not be forgotten easily: recently, Zuckerman et al. conducted a study to evaluate quantitative single photon emission computerized tomography (SPECT) of 99mTc-phytate colloid uptake by the liver as a test for hepatic function in cirrhotic patients. The basis of their research was that...
accurate quantitative determination of liver function is critical in cirrhotic patients in order to predict outcome, particularly in patients who undergo hepatic resection or non-hepatic surgery. Therefore, the authors hypothesized that as colloid uptake by perfused Kupffer cells is proportional to perfused hepatocyte mass, quantitative liver spleen scan may be used as an index of perfused hepatocyte mass.

On the other hand, the Child-Pugh classification has been used widely as a simple and useful index for assessing liver function. As assessment of hepatic functional reserve of patients with cirrhosis is critical in order to predict prognosis, post-operative outcome in those who are candidates for nonhepatic surgery or liver resection for hepato-cellular carcinoma (HCC), or to determine the timing for liver transplantation in patients with advanced cirrhosis, clinical assessment of liver function based on the Child-Pugh scoring was established and is frequently used\(^1\). However, this clinical classification is not free of drawbacks: a considerable number of Child-Pugh class A cirrhotic patients with HCC or those who undergo non-hepatic surgery develop post-operative liver failure\(^2,4-6\).

Therefore, the need for another reliable and simple scoring method is felt and numerous trials have been performed to make another classification: quantitative tests of hepatic function are thought to assess the functional hepatic mass by measuring the blood flow-dependent hepatocyte function, such as indocyanine green (ICG) clearance, lidocaine clearance and galactose elimination capacity, or blood flow-independent hepatocyte functional capacity, such as aminopyrine breath test\(^7\). However, they have their limitations and in fact, there is no single gold standard test to assess hepatic functional reserve.

Because the extraction capacity of the individual Kupffer cell is excellent and perfusion of hepatocytes and Kupffer cells is similar, sulfur colloid uptake by the liver reflects the perfused Kupffer cell mass which is proportional to perfused hepatocyte mass\(^8,9\). The aim of the present study was to examine the relationship between the modified Child score and sulfur colloid liver-spleen scintigraphy (with a similar simple classification method) in patients with histologically confirmed liver cirrhosis.

### METHOD

The study was performed between January 2001 and January 2002. The study was approved by the committee on ethics at the faculty of medicine, university of Tehran.

Patients were administered 185 MBq of \(\text{Tc}^{99m}\)Technetium-sulfur colloid intravenously. Anterior and posterior images of the liver and spleen were obtained at 30 minutes for a pre-set count of 500,000. A large field of view camera equipped with a low energy all purpose parallel hole collimator (Sopha \(\gamma\)-camera, SMV International, France) was used for acquisition.

Liver-spleen scintigraphy pattern was divided by the consensus of two blinded nuclear medicine physician visually into three categories (by considering both anterior and posterior views) in a similar manner as the Child-Pugh classification: A (liver uptake \(\geq\) spleen uptake, without visualization of the ribs and vertebrae), B (spleen uptake > liver uptake without visualization of the ribs and vertebrae), and C (remarkable visualization of the ribs and vertebrae).

We examined the concordance between liver-spleen scintigraphy and modified Child-Pugh classification. The definition of the modified Child-Pugh score\(^10\) is present in the table 1. The \(\kappa\) statistic was used to assess agreement. A \(\kappa\) value of 0.8 or above indicated excellent agreement; 0.6-0.8, good agreement; 0.4-0.6, fair agreement; and less than 0.4, poor agreement. All statistical evaluations were performed running SPSS statistical package (Version 11, SPSS, Chicago, IL, USA) on a personal computer.

### RESULTS

A total of 36 patients were assessed. Of these, 50% were female and 50% were male, with a mean age of 51.2 ± 7.8 years (range, 15-74 years). Table 2 summarizes the findings of \(\text{Tc}^{99m}\)-sulfur colloid scan,
compared with modified Child classification. With respect to the patient distribution, 14 (38.8 %), 19 (58.8 %) and 3 (8.3 %) patients were categorized into Child-Pugh grades A, B and C, respectively, whereas 13 (36.1 %), 12 (33.3 %) and 11 (30.6 %) patients were categorized into scintigraphic grades A, B and C, respectively (table 2). Data showed that in 14 patients (38.8 %) the results of Child classification and liver-spleen scan are in complete agreement, but in the remaining 22 patients the results were discordant. Kappa value as a measure of agreement was calculated and was equal to 0.072. Therefore, the agreement between scintigraphic results and Child classification was poor.

**DISCUSSION**

In an old study done by Habibian et al, 50 patients with proven Laennec’s cirrhosis were analyzed and six laboratory tests of liver function were compared with spleen/liver activity ratios obtained by densitometric analysis of $^{99m}$Tc-Technetium-sulfur colloid scans. In this series, the liver scan not only disclosed the liver gross anatomy and structural abnormality and established the best possible site for biopsy examination, but also, the increased splenic activity served as a useful diagnostic indication of Laennec’s cirrhosis. Of 50 proven cases of Laennec’s cirrhosis, 41 (82%) had abnormal spleen/liver ratios. It was concluded that an abnormal spleen/liver ratio in combination with abnormal results from any one or two other tests was relatively effective in the detection of cirrhosis. However, it was stated that the accuracy is improved if the other laboratory tests are chosen from among tests for serum albumin, serum bilirubin, and SGOT. Despite these advantages, it was emphasized that liver abnormalities other than cirrhosis can also present an abnormal spleen/liver ratio.

As mentioned earlier, more recently, Zuckerman et al using quantitative SPECT liver-spleen scan with Tc-$^{99m}$-phytate colloid, tried to test and quantify the liver function in cirrhotic patients. In this study, quantitative SPECT was used to measure liver volume, quantitative colloid uptake by the liver and percentage of injected dose/ml of liver tissue in cirrhotic patients ($n = 75$), non-cirrhotic patients with chronic liver disease ($n = 52$) and patients without liver disease ($n = 36$). It was found that although liver volume was similar among the three groups, the cirrhotic patients had significantly lower total quantitative uptake and quantitative uptake/ml compared to other two groups ($p < 0.001$). Interestingly, quantitative liver uptake in the cirrhotic patients was highly correlated with Child-Pugh score ($r = −0.64$, $p < 0.0001$) and with indocyanine green retention at 15 min ($r = −0.84$, $p < 0.0001$). The authors concluded that quantitative SPECT of the liver may be an additional, useful, non-invasive quantitative test for assessment of hepatic function and severity of liver disease in cirrhotic patients. These findings differ from our study finding and needs further evaluation in future studies.

Previous studies have concluded that radioactive colloid distribution has out-performed other tests in assessing liver disease severity. The basis of our study was that in liver cirrhosis, both hepatocytes and Kupffer cells are affected equally by the fibrotic process and it has been stated that Kupffer cell mass, as determined by the relative hepatic and splenic uptake of the radiocolloid, correlates with disease severity and hepatic function in cirrhotic patients. However, our study findings show that there is no correlation between scintigraphic severity of liver cirrhosis and clinical and laboratory data (as reported by Child-Pugh classification). If Child-Pugh classification is considered as a validated classification of disease severity, it should be concluded that scintigraphic classification is not a useful marker of severity of the disease. Although in the previous studies it was found that the patients with more advanced liver disease (i.e. Child-Pugh Class C) had a significantly smaller liver, the visual and gross classification of sulfur colloid liver-spleen scintigraphy does not show the similar correlation. On the other hand, it should be noted that the use of Child-Pugh classification as the ‘gold standard’ is not suitable to compare the impact of our classification in the authors’ opinion.

### Table 2

<table>
<thead>
<tr>
<th>Scintigraphic classification</th>
<th>Child-Pugh A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6 (16.7 %)</td>
<td>5 (13.9 %)</td>
<td>2 (5.6 %)</td>
</tr>
<tr>
<td>B</td>
<td>5 (13.9 %)</td>
<td>7 (19.4 %)</td>
<td>0 (0 %)</td>
</tr>
<tr>
<td>C</td>
<td>3 (8.3 %)</td>
<td>7 (19.4 %)</td>
<td>1 (2.8 %)</td>
</tr>
<tr>
<td>Total</td>
<td>14 (38.8 %)</td>
<td>19 (52.7 %)</td>
<td>2 (5.6 %)</td>
</tr>
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</table>
scintigraphic classification may present a useful marker of body reactions to the disease, independent of Child-Pugh modified classification. Further prospective clinical studies are needed to determine which one of these classifications has better concordance with the patient’s outcome and to determine the clinical impact of this simple classification in the management of patients.

REFERENCES