Ultrasonographic Findings of Liver in Chronic Liver Disease and its Complications and Their Association with the Duration of the Disease

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ABSTRACT
Objective: To evaluate the ultrasound abdomen findings in patients having viral chronic liver disease (CLD) and build correlation of these findings with the duration of disease.
Study Design: Cross-sectional analytical study.
Place and Duration of Study: Department of Medicine, Liaquat University Hospital, Hyderabad and Jamshoro, Pakistan, from February to July 2016.
Methodology: Known cases of CLD were inducted. Data was collected using a standardized form which included details of patients, duration of disease and their ultrasound abdomen findings, like liver size, echo pattern and echogenicity, nodularity, intrahepatic vessel (IHV) obliteration, ascites and splenomegaly. Data were analyzed using SPSS version 16. The association of duration of the disease on ultrasound findings was studied by means of chi-square test.
Results: A total of 193 subjects (92 males, 101 females; age range 14-80 years) were taken. The average measured liver span was 13.99 ±3.14 cm, with most coarse echo pattern. About a quarter, i.e. 26.94% of the cases, had no complications; 17.62% only had ascites and 16.06% presented with IHV obliteration, and ascites with splenomegaly. The duration had no significant association with liver size, echo pattern and echogenicity, and nodularity of the liver (p-values of 0.182, 0.331 and 0.268), respectively or complications (p=0.164).
Conclusion: The duration of CLD had no significant association with the ultrasound findings of liver.

Key Words: Chronic liver disease. Liver echogenicity. Liver size. Ultrasound.

INTRODUCTION
A disease of the liver that involves a process of progressive destruction and regeneration of the liver parenchyma leading to fibrosis, cirrhosis and carcinoma, resulting from an inflammatory, infiltrative, immunological, mechanical or metabolic injury, persisting for 6 months or more, without its complete reversibility to normal is known as chronic liver disease (CLD). Hepatitis B virus (with or without hepatitis D virus), hepatitis C virus (HCV) and alcohol are known to be the leading causes. Almost 170 million of the world’s population is affected with hepatitis C virus chronically with its greatest burden in the developing countries like Egypt (22%), Pakistan (4.8%), and China (3.2%). Actual prevalence in Pakistani population is still unknown, but data from regional studies have shown that approximately 5% and 13% of Pakistanis are hepatitis B and hepatitis-C seropositive, respectively. Few other inflammatory causes include cytomegalovirus, Epstein Barr virus, shistosomiasis and toxoplasmosis. Rest of the causes are drugs, toxins, hereditary or metabolic in origin. More than a third of the CLD patients are asymptomatic and are incidentally caught on physical examination, abnormal liver function test (LFT), imaging studies or even at autopsy. The imaging methods and ultrasonography (US) in particular, play an important role as non-invasive diagnostic methods. US has the advantage of being cost-effective, patient-friendly and readily available modality. On the other hand, due to recent advances in digital technology and US imaging software, various new computer protocols have been incorporated in the US equipment, which has improved image quality and image resolution, such as incorporation of advanced transducer materials, array designs and digital signal processing. In general, it has enabled the sonographers to identify subtle changes in the liver texture and delineate smaller masses in the liver.

Diagnosis by using ultrasound technique is best done by using a 3.5 to 8 MHz curvilinear probe in regular patients. Evaluation of chronic liver disease by using abdominal ultrasound technique involves the assessment of the size of the liver, the echo texture and echogenicity of the liver parenchyma, nodularity of the liver surface, intrahepatic vessels, portal vein diameter and its complications such as splenic size, ascites and collaterals.
The purpose of this study was to evaluate the association of ultrasonographic findings of CLD and its complication with the duration of the disease.

**METHODOLOGY**

After obtaining ethical approval from the Ethical Committee of the Hospital and informed consent from the patients, this cross-sectional analytical study was performed in the Department of Medicine, Liaquat University Hospital (LUH), Hyderabad / Jamshoro from February to July 2016. Diagnosed CLD patients were included in this study. Sample size calculation was performed using Rao soft calculator, with population size of 384, response distribution of 50% and confidence interval of 95%. The data was collected prospectively by purposive sampling using a structured proforma. Sample selected included all those CLD patients who had HbsAg (hepatitis B surface antigen) and/or anti-HCV (hepatitis C virus) positivity with their ultrasound abdomen done at Department of Radiology, LUH, Hyderabad and Jamshoro. Patients with non-viral hepatitis and fatty liver disease were excluded from this study.

The duration of the disease was determined from the time at which the first symptom relevant to the disease, appeared. Ultrasound abdomen reports included only those that were obtained by Toshiba Famio-5 SSA-510A and Mind ray diagnostic ultrasound system DC-3 scanners with convex probes at 3.5-8 MHz frequencies done by the radiologist on duty in the Radiology Department, LUH, who at least had 2 years of experience in performing abdominal ultrasound; the patient had fasted overnight, with scan performed over the patient in the supine, right or left side position, to obtain an optimal view of the abdominal viscera. The size of the liver was measured in the right mid-clavicular line (MCL). Echo pattern of the liver parenchyma, nodularity of liver surface, intra-hepatic vessel obliteration and ascites were also documented.

Data was entered and analyzed using SPSS windows package version 16.0. Frequencies were calculated, and proportions reported for categorical variables like nodularity, echogenicity, presence of ascites, splenomegaly and IHV obliteration. Mean and standard deviations calculated for quantitative variables like size of liver and duration of the disease. Test applied for checking association between variables is chi-square test. Significance was presumed for p<0.05.

**RESULTS**

Data was collected prospectively over a period of 6 months from medicine wards (all units) of Hyderabad and Jamshoro branches of LUH, Sindh. A total of 193 ultrasound abdomen reports were checked with all cases meeting the inclusion criteria.

The mean age was 49.41 ±13.73 years ranging from 14 years to 80 years, with 92 males [47.7%] and 101 females [52.3%]. Majority of the patients, i.e. 115/193 [59.6%] belonged to rural areas. Duration of the disease was recorded in months with median duration of 7.00 months, interquartile range 33, overall ranging from 1 month to 240 months. For convenience, duration has been divided into 4 groups. Generally, 47.7% patient in our study [92/193] were those who presented with duration of 6 months or less of the disease.

The mean liver size was 13.99 ±3.142 cm. It was found normal in 101/193 (52.3%) patients; 54/193 (28%) patients had enlargement, and 38/193 (19.7%) had small size. The most common [72/193 (37.3%)] echo pattern seen was coarse. Patchy and increased echo pattern was seen in 36/193 (18.7%). The least common was decreased echopattern [13/193 (6.7%)].

### Table I: Duration of CLD compared with size, nodularity and echogenicity of liver.

<table>
<thead>
<tr>
<th>Duration in categories</th>
<th>Total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size of liver</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>51</td>
<td>(55.43%)</td>
</tr>
<tr>
<td>Small</td>
<td>16</td>
<td>(17.39%)</td>
</tr>
<tr>
<td>Enlarged</td>
<td>25</td>
<td>(27.17%)</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>46</td>
</tr>
<tr>
<td><strong>Nodularity of liver surface</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present</td>
<td>38</td>
<td>(41.30%)</td>
</tr>
<tr>
<td>Not present</td>
<td>54</td>
<td>(58.69%)</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>46</td>
</tr>
<tr>
<td><strong>Echopattern and echogenicity of liver</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased coarse</td>
<td>9</td>
<td>(9.78%)</td>
</tr>
<tr>
<td>Only coarse</td>
<td>32</td>
<td>(34.78%)</td>
</tr>
<tr>
<td>Only increased</td>
<td>15</td>
<td>(16.30%)</td>
</tr>
<tr>
<td>Decreased</td>
<td>7</td>
<td>(7.61%)</td>
</tr>
<tr>
<td>Uniform</td>
<td>8</td>
<td>(8.70%)</td>
</tr>
<tr>
<td>Patchy</td>
<td>21</td>
<td>(22.83%)</td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td>46</td>
</tr>
</tbody>
</table>
the liver surface was observed in 68 (35.2%) cases only. Ascites was present in 34/193 (17.62%), while 31/193 (16.06%) had ascites along with splenomegaly and IHV obliteration. Fifty-two (26.94%) of the cases had no such complications.

There was no statistically significant association between the duration of CLD and the size of liver (p=0.203), nodularity on the liver surface (p=0.280), and the echo pattern and echogenicity of the liver (p=0.348, Table I).

When duration was compared to the presence of complications then the association was found to be insignificant (p=0.184, Table II).

**DISCUSSION**

Chronic liver disease is a spectrum of disease that shows disturbance of echo texture and echogenicity, nodularity of the liver surface, portal hypertension and its consequences. The ultimate fate of CLD is either hepatocellular carcinoma or cirrhosis. Cirrhosis of liver is irreversible disease, and treatment focusses primarily on preventing progression and complications. Hence, world has a need of prompt diagnosis of CLD, to identify asymptomatic patients in a population that is at high risk, due to high prevalence of viral hepatitis, and provide a better patient outcome. Accurate estimation of the level of damage done to the liver and its fibrosis before any compensatory change being visualized clinically is crucial for prompt treatment and better prognosis of the disease. Clinical examination and noninvasive methods like serologic fibrosis markers, i.e. fibro test, aspartate aminotransferase-to-platelet ratio index (APRI), and radiologic imaging all together help in assessing the degree of CLD, and among these, the diagnostic imaging techniques are superior to clinical examination done for its diagnosis.

In this study common ultrasonographic findings seen in CLD patients were evaluated which are size of liver, echo pattern and echogenicity of liver parenchyma, nodularity of the surface and complications like IHV obliteration, ascites and splenomegaly. The mean liver size was 13.99 ±3.142 cm. The most common echo pattern seen was coarse with 37.3% [72/193]. Patchy and increased echopattern was seen in 18.7% [36/193]. The least common echo pattern seen was decreased echo pattern, i.e. 6.7% [13/193] cases. Nodularity on the liver surface was observed in 35.2% [68/193] of the cases. Ascites was present in 17.62%, while 16.06% presented with ascites along with splenomegaly and IHV obliteration. About 26.94% [52/193] of the cases had no complications like ascites, splenomegaly and IHV obliteration. When duration was compared to liver size; it showed that majority of the patients who presented within 6 months [51/92] and most of those [7/13] who had duration of more than 6 years presented with normal liver size; hence, association was statistically non-significant with p=0.182. Same results were seen when duration was compared with echo pattern and echogenicity of liver parenchyma. Patients in the group of disease duration of less than 6 months most commonly presented with coarse echo patterns similar to those who belonged to disease duration of more than 6 years; hence, association between these two variables was statistically not significant. Same was the case seen when duration of the disease was compared to nodularity. About 125 of the cases had no nodularity on their liver surface; and when compared to duration then association was insignificant with p = 0.268.

When comparison was made between duration and complications then results showed that those who presented within 6 months of duration showed a wide range of patterns of complications. Those presenting within 6 months of duration, between 6 months to 2 years; and between 2 years to 6 years had no any complication whereas in duration of 6 years to 12 years most common pattern of complication seen was ascites with splenomegaly. Excluding those who had no complications, within 6 months of duration, the most common pattern of complication seen was ascites, splenomegaly and IHV obliteration; between 6 months to 2 years it was ascites and splenomegaly; and from 2 years to 6 years, common pattern seen was IHV obliteration with ascites. On associating duration with complications, results came out to be insignificant (p=0.164). These results point out a very crucial fact that
whether the duration of CLD be of one month or one year or 20 years, it has no effects over the sizes of liver, nodularity of the surface, its parenchymal echo textures and echogenicity and its progression towards complications like IHV obliteration, splenomegaly and ascites in our setup.

Previously, studies have been conducted for assessment of ultrasonographic parameters towards the diagnosis of CLD; however, very few have correlated those parameters with the course and progression of the disease. Gaiani in late 90's had evaluated CLD by providing an ultrasonographic scoring system which included liver size, spleen size, echogenicity, etc.\textsuperscript{21} Hung had established a correlation between the ultrasound findings with the histopathology of liver.\textsuperscript{22} A recent study conducted in Rawalpindi, Pakistan has confirmed the validity of ultrasound scoring systems with diagnostic accuracy of 92.98\%.\textsuperscript{23} Therefore, this study is innovative because it not only evaluates the main ultrasonographic findings in CLD patients but gives an association of these findings with duration of the disease.

There are few limitations to this study. Most common cause of CLD in our setup is chronic hepatitis caused by hepatitis B and C viruses so only those cases were included in the study. Secondly, the estimation of liver size on the basis of a single parameter, is limited by various hepatic morphology types,\textsuperscript{24} and thirdly determination of findings of CLD on ultrasound abdomen can vary since ultrasonography is a user dependent technique which might lead to bias in results. Few other findings were not included in this study like PV diameter, intrahepatic ducts and complications like varices, hepatorenal syndrome and pleural effusion, secondary to CLD because of lack of technique and resources.

**CONCLUSION**

The duration of CLD had no significant association with the ultrasound findings of CLD.

**REFERENCES**