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# FATTY LIVER EVALUATION: CORRELATION BETWEEN ULTRA SONOGRAPHY & COMPUTED TOMOGRAPHY

**Radiodiagnosis**

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## ABSTRACT

Fatty liver is a common abnormality among patients undergoing cross-sectional imaging of the abdomen. Its spectrum ranges from simple steatosis and steatohepatitis to fibrosis and long-term complications like liver cirrhosis and hepatocellular carcinoma. The reliable quantification of hepatic steatosis is of clinical relevance, because increasing steatosis may lead to progression of fibrosis & complications. The gold standard for the assessment of hepatic steatosis is liver biopsy. Non invasive imaging techniques such as ultrasonogaphy (USG ), Computed tomography (CT) have been used for assessment of fatty liver. The accuracy & reproducibility of USG is high in evaluation of early fatty liver disease. Unenhanced CT is best imaging modality in evaluation of moderate to severe fatty liver disease.

## KEYWORDS

Fatty Liver, Ultrasonography, Computed Tomography.

## INTRODUCTION :

Fatty liver is the most prevalent chronic liver disease in the Western world and affects up to 30% of the population . Its spectrum ranges from simple steatosis and steatohepatitis to fibrosis and long-term complications like liver cirrhosis and hepatocellular carcinoma. The reliable quantification of hepatic steatosis is of clinical relevance, because increasing steatosis may lead to progression of fibrosis & complications[1,2]and limit treatment response, e.g. in patients with viral hepatitis[3,4]. With social development and lifestyle change, fatty liver disease has now become a major cause of liver related morbidity and mortality, with the incidence of around 20% worldwide [5,6]. The gold standard for the assessment of hepatic steatosis is liver biopsy. However, results can be limited by sampling errors, intra- and inter-observer variability and difficulties in acquiring repetitive data, complications like bleeding due to the invasiveness of the procedure[7,8]. Non invasive imaging techniques such as ultrasonogaphy (USG ), Computed tomography (CT) , Magnetic resonance imaging (MRI) have been used for assessment of fatty liver[9]

Fatty liver is a term applied to a wide spectrum of conditions characterized histologically by triglyceride accumulation within the cytoplasm of hepatocytes. The two most common conditions associated with fatty liver are alcoholic liver disease and nonalcoholic fatty liver disease. Alcoholic liver disease is caused by excess alcohol consumption, whereas the nonalcoholic variant is related to insulin resistance and the metabolic syndrome. Other relatively common conditions associated with fat accumulation in the liver include viral hepatitis and the use or overuse of certain drugs. Rarer associated conditions include dietary and nutritional abnormalities and congenital disorders. These conditions all cause a triglyceride accumulation (steatosis) within hepatocytes by altering the hepatocellular lipid metabolism, in particular, by causing defects in free fatty acid metabolic pathways . Hepatocytes in the center of the lobule (near the central vein) are particularly vulnerable to metabolic stress and tend to accumulate lipid earlier than those in the periphery[4]. Consequently, in many of these conditions, steatosis tends to be most pronounced histologically in the zone around the central veins and less pronounced in zones around the portal triads. In advanced cases, there is diffuse, relatively homogeneous involvement of the entire lobule[4]

## AIM & OBJECTIVE

The main aim of this study -

Correlation of diagnosed fatty liver patients on USG with unenhanced CT .

Prevalence of fatty liver in Males &Females .

Prevalence of different grades of fatty liver

## MATERIALS AND METHODS :

**Place:** This study was carried out from the cases collected from the Department Of Radiodiagnosis, Alluri Sitaram Raju Academy of Medical Sciences, Eluru.

**Duration:** 18 months between October 2016 and March 2018

**Study Design:** cross sectional study.

**Source Of Data:** 50 patients between 20-60 yrs, of age . Both men and women were selected with normal renal function i.e., Se.cr <1.2mg/dl and who had undergone an abdominal CT for indications other than renal complaints. We carried out USG and CT on these patients only after clearance from ethical committee and patient's consent.

**Study Population :**50 cases

**Technique:**

Before performing the scan , patient's height , weight , BMI calculated & LFT , Lipid profiles checked . BMI is defined as weight (Kg) divided by height in Meter[2]

For the purpose of USG, "PHILIPS AFFINITY 50G" machinewas used .Multiple transverse and longitudinal grayscale images of the abdomen acquired by radiologists using commercially available equipment with either a 4-MHz or 8-MHz transducers. Patients were scanned in the supine and left lateral decubitus position, utilizing subcostal and intercostal approaches. Sonograms were performed under fasting conditions. The radiologist unaware of clinical features & CT findings evaluated the degree of liver steatosis as: 0 (absent), 1 (mild), 2 (moderate), and 3 (severe) based on liver echogenicity, using a standard grading system described earlier by Acikel and coworkers[10,11]. A representative sagittal sonographic plane of section demonstrating the hepatic parenchyma and the adjacent right kidney selected to determine liver echogenicity by the radiologist.The overall assessment of liver echogenicity bedescribed using the internal standard of echogenicity of the right renal cortex, beam attenuation with standard settings, visualization of the echogenicity of the walls surrounding intrahepatic vessels, and the degree of reflectivity from the diaphragm.Normal liver echotexture recorded in the absence of steatosis.

Grading of Liver Echogenecity on Ultrasound (from Acikeletal[10,11])

| Grades | FATTY LIVER |
|---|---|
| 0 | No fatty liver |
| I (mild) | Minimal diffuse increase in hepatic echogenity; diaphragm, and intrahepatic vessel contours seen normal |

| | |
|---|---|
| II (moderate) | Medium grade diffuse increase in hepatic echogenity, mild deterioration in the image of diaphragm and intrahepatic vessels |
| III(severe) | Apparent increase in echogenity. Posterior segment of the right hepatic lobe is difficult to display. Intrahepatic vessel structure and diaphragm contours are vague or not seen |

For the purpose of COMPUTED TOMOGRAPHY ,"SIEMENS SOMATOM SENSATION MULTISLICE (40) MULTIDETECTOR HELICAL COMPUTED TOMOGRAPHY MACHINE was used (mAs 25-75, KV 120, rotation time 0.5 sec, Slice thickness 5 mm, Detector collimation 0.6, Pitch 1 mm). Images were obtained after ultrasound scan of the patient .RECON images were obtained by using 3 D Multi-planar reformations (3D-MPR), which had been temporarily saved on the workstation, were sent to the Picture Acquisition and Communication System (PACS).

The radiologist recorded the mean Hounsfield density measurement using regions of interest placed on the liver and spleen. For each scan, three regions of interest obtained from the liver, one in the right hepatic lobe above the portal vein, one in the right hepatic lobe below the portal vein, and one in the left lobe. Three circular regions of interest placed within the spleen at matched levels to the liver measurements in order to obtain the density of the spleen. The mean size of the regions of interest kept as 40–60 mm2. The area of the region of interest kept constant for all measurements within each patient. Large vessels, focal masses, and artifacts were avoided. The mean density of the liver and spleen were calculated from the regions of interest. The mean liver to spleen attenuation difference for each patient was obtained by subtracting the mean splenic attenuation from the mean liver attenuation.

## RESULTS

Out of 50 patients number of patients with grade I, II and III were 30, 12, 08 respectively

| Fatty Liver Grades | Males | Females | Total |
|---|---|---|---|
| I | 14 | 16 | 30 |
| II | 08 | 04 | 12 |
| III | 05 | 03 | 08 |

30 Out of 50 patients showed mild increased echogenicity of liver echotexture compared to renal echotexture with very well visualization of intrahepatic vessels & diaphragmatic outline.

17 out of 30 grade I fatty liver patients on unenhanced CT showed normal liver attenuation values (mean HU value 62) i.e. less than spleen attenuation values & 13 patients showed slightly low liver attenuation values (mean HU 51 ) as compared to spleen attenuation values. The mean spleen attenuation value was 58. So we observed that there is poor correlation between USG & unenhanced CT in grade I fatty liver diagnosed patients .

12 out of 50 patients in our study showed moderate increase in liver echogenicity with obscuration of intrahepatic vessels with very well visualization of diaphragmatic outline .

08 out of 50 patients showed apparent increase in liver echogenicity with non-visualisation of intrahepatic vessels , diaphragmatic outline. Same number of patients on unenhanced CT showed low liver attenuation values (mean HU value 40-42) as compared to spleen attenuation values. So we observed that there is good correlation between USG& unenhanced CT findings in moderate to severe cases .

### Correlation between different age groups and fatty liver

| Fatty Liver Grades | Age Groups (Yrs ) | | | |
|---|---|---|---|---|
| | 20-30 | 30-40 | 40-50 | 50-60 |
| I | 13 | 07 | 09 | 01 |
| II | 04 | 01 | 03 | 04 |
| III | 02 | 02 | 02 | 02 |

The Prevalence of grade I & grade II liver steatosis on USG were more in the age group of 20-30 yrs, & 30-40 yrs, 50-60 yrs respectively. The prevalence of grade III fatty liver was equal in all age groups in our study . Overall the prevalence of fatty liver disease was highest in the age group of 20- 30 yrs.

### Correlation between grades of fatty liver and sex distribution

| Fatty liver grades | Males | Females |
|---|---|---|
| I | 14 | 16 |
| II | 08 | 04 |
| III | 05 | 03 |

In this study group both male & female patients were identified as having fatty liver disease .Number of male patients having grade I, II , III fatty liver were 14,08,05 respectively & number of female patients having grade I, II , III fatty liver were 16,04,03 respectively . Prevalence rate of disease was found to be higher in male (27) than in female (23). Prevalence of grade I fatty liver disease was more in both males & females than Grade II & III fatty liver disease

### Mean CT attenuation values

| USG | MEAN CT ATTENUATION VALUES (HU) | | |
|---|---|---|---|
| | 58-60 | 36-38 | 30-32 |
| I | 30 | - | - |
| II | -12 | - | |
| III | - - | 08 | |

Patients with grade I, II &III fatty liver on USG found to have mean CT attenuation values 58-60, 36-38 & 30-32 HU respectively.

The percentage of patients for USG imaging technique with grade I steatosis was 60% (30/50), with grade II steatosis was 24% (12/50) & with grade III was 16% (o8/50).

### USG & CT Correlation

50 patients in our study have fatty liver on USG , out of which only 33 patients found to have fatty liver on plain CT, rest of patients found to have normal liver attenuation. The percentage of correlation between USG & CT was 66 %.

| USG (50) | CT (50) |
|---|---|
| 50 Fatty liver | 33 Fatty liver |

## DISCUSSION

In this study average fatty liver in both the gender is Grade I Fatty liver on USG On unenhanced CT most of the patients have normal liver attenuation values i.e. more than spleen attenuation & most of them have fatty liver So we observed that USG is more sensitive & best imaging technique in evaluation of early changes of fatty liver disease.

Although several imaging techniques can be used to assess liver steatosis, sonography is the most commonly applied and cost-effective. Sonographic findings of fatty liver include increased echogenicity of liver, blurring of vascular margins, and increased acoustic attenuation[12]. However, sonography is an operator-dependent technique and lacks the capacity for objectively quantifying liver steatosis.

We also observed that there is good correlation between USG &unenhanced CT in moderate to severe changes of fatty liver disease.Those patients with grade II & III fatty liver found to have liver attenuation values between 32-38 HU represents moderate to severe fatty liver disease on unenhanced CT. Those patients showing mild fatty changes on unenhanced CT found to have spleen –liver attenuation difference between 10-15 HU .Few studies found that unenhanced CT can show fatty change by a reduced attenuation of liver density. Fatty change is suspected when the density of liver is more than 10 H below that of the spleen attenuation value[13].

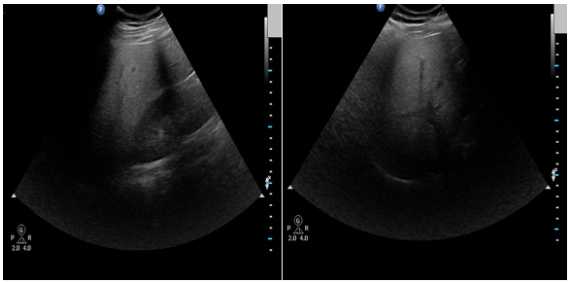
So both USG & unenhanced CT are best imaging techniques in evaluating moderate to severe changes of fatty liver disease.

Some studies found that CT provides fast, re- producible, objecive, and noninvasive assessment, it also correlates well with USG only in moderate to severe fatty liver disease. Liver attenuation value of ≤ 40 HU has been shown to be the most indicative of moderate-to-severe macro- vesicular steatosis[14].Because this atteuation threshold excludes cases with milder degrees of steatosis that are of doubtful clinical relevance. Few studies found that the best method of predicting pathologic fat content in the liver is simple measurement of liver attenuation on unenhanced CT scans & had shown unenhanced CT images to be good for prediction of the degree of fatty infiltration of the liver[15].

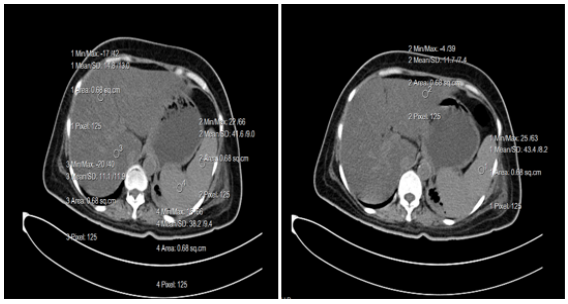
There are a number of limitations to our study . This was a cross-sectional investigation and not a longitudinal evaluation. Therefore, we cannot yet ascertain whether the 34% of individuals with normal liver attenuation truly represent fatty liver disease or not . Another limitation is the lack of histologic correlation such that we cannot absolutely exclude the coexistence of nonalcoholicsteatohepatitis or early cirrhosis . Further- more, it is conceivable that iron deposition could mask some cases of steatosis.

## REPRESENTING CASES

USG –Grade II Fatty Liver showing obscuration intrahepatic vessel wall and diaphragmatic outline



CT Showing moderate –severe Fatty Liver



## CONCLUSION

1) The result of the study indicate the accuracy & reproducibility of USG is high in evaluation of early fatty liver disease.
2) Unenhanced CT is best imaging modality in evaluation of moderate to severe fatty liver disease.
3) There is good correlation beween USG & unenhanced CT in moderate to severe fatty liver disease .
4) There is poor correlation between USG & unenhanced CT in early fatty liver disease.
5) Prevalence rate of fatty liver is higher in male than in female.
6) Prevalence rate of grade I is higher than grade II & III fatty liver .

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