



EVALUATION OF FATTY CHANGES IN LIVER BY COMPUTED TOMOGRAPHY

Radio-Diagnosis

Dr. Sudarsan. S	Final Year Post-graduate, Department Of Radiodiagnosis, KS Hegde Medical Academy, Mangalore, Karnataka, India.
Dr. Abishek. D	Senior Resident, Department Of Radiodiagnosis, KS Hegde Medical Academy, Mangalore, Karnataka, India.
Dr. Jude Jacob	Final Year Post-graduate, Department Of Radiodiagnosis, KS Hegde Medical Academy, Mangalore, Karnataka, India.

ABSTRACT

Background: Fatty liver disease is a growing concern, and accurate diagnosis is crucial for timely intervention. **Objective:** To evaluate the sensitivity and specificity of multidetector computed tomography (MDCT) in detecting fatty changes in the liver and correlate findings with liver function tests (LFT). **Methods:** This retrospective study analyzed 100 patients who underwent contrast-enhanced CT (CECT) scans from October 2023 to October 2024. Hounsfield unit (HU) values were measured on non-contrast (NCCT) and spleno-portal venous phases. LFT results were correlated with liver densities. **Results:** Abnormal LFT results are more common in severe liver density cases. Abnormal LFT rates increased with liver severity, with 29% (mild), 70% (moderate), and 86% (severe) of patients exhibiting abnormal LFT results. **Conclusion:** CECT is more sensitive in detecting the fatty liver while NCCT is more specific in the detection of fatty liver.

KEYWORDS

Fatty liver disease, Liver function tests, Computed tomography, Hounsfield unit, Liver density.

INTRODUCTION

- Fatty liver is excessive accumulation of triglycerides in the hepatocytes and is hepatic manifestation of a number of medical conditions and medications use.
- Imaging studies like ultrasonography (USG) and computed tomography (CT) can show characteristic features of fatty liver but the final diagnosis requires liver biopsy.
- Liver biopsy shows the presence of fatty changes along with any associated inflammation and fibrosis. It is an invasive procedure and has associated complications, sometimes requires hospitalization.
- Liver biopsy may not be a suitable screening diagnostic tool to test prevalence in an asymptomatic population.(1)
- CT scans have proven to be useful in diagnosing the presence and quantifying the severity of liver fat noninvasively.
- The Hounsfield Unit (HU) attenuation of liver on CT scans is usually higher than the spleen; when this ratio is reversed, this can be used to diagnose the presence of liver fat.(2)
- Liver-to-spleen ratio (L/S) <1.0 can be used effectively to diagnose the presence of liver fat.
- Studies have also shown liver HU attenuation <40 HU to reliably represent >30% of liver fat content
- In this study, we are trying to compare the HU values of liver taken in non-contrast, arterial and venous phases with SGOT and SGPT levels of the liver function test.(3)

Literature Survey

- Jawarhal A et al¹** performed a study on 200 patients and found out there was statistically significant associations with higher levels of LFTs and fatty liver.
- RJ Johnston et al²** concluded in their study that moderate and severe fatty infiltration were more reliably diagnosed than mild fatty infiltration in CECT.
- David A. Lawrence et al³** conducted a study on 500 patients to assess the sensitivity of CT in diagnosing fatty liver. Their study showed NCCT and CECT shows sensitivity of 66 % and specificity of 100%.

MATERIALS AND METHODS

- Type Of Study** – Observational study
- Study Design** - Cross sectional descriptive study
- Study Duration** – October 2023 to October 2024 in Justice KS Hegde charitable hospital
- Sample Size** – 100 patients

Inclusion Criteria: Patients who underwent CECT for conditions other than liver pathology

Exclusion Criteria:

- Patients with hepatic malignancies.
 - Patients who had liver transplantation.
 - Patients with multiple hepatic cysts.
- HU values of NCCT and CECT in spleno-portal venous phase attenuation differences were obtained.
 - Liver function tests done within a week from CT study were included in the study.
 - Based on recent studies, NCCT HU value of liver < 40 and CECT HU value difference between spleen and liver > 20 are considered cut off values to detect fatty liver.
 - The densities of liver and LFT were compared and tabulated.
 - Statistical analysis was done using SPSS software.

RESULTS

- Out of 100 patients, 61 are men and 39 are women.
- 21 patients are in 20 – 30 years age group, 37 patients are in 31 – 40 age group and 42 patients are in 41 – 50 age group.

Table 1. Comparison of HU value of liver in NCCT with LFT

Severity	LFT		Total
	Normal	Abnormal	
Mild (31-40HU)	15	8	23
Moderate (21-30 HU)	17	10	27
Severe (<20HU)	3	15	18
TOTAL	35	33	68

Table 2. Comparison of Liver and Spleen attenuation differences in CECT with LFT

Severity	LFT		Total
	Normal	Abnormal	
Mild (21-40 HU diff)	22	9	31
Moderate (41-60 HU diff)	9	21	30
Severe (>60HU diff)	2	12	14
TOTAL	33	42	75

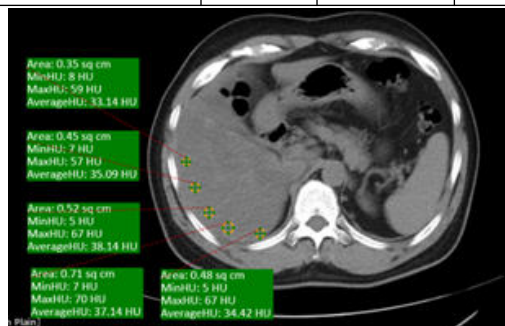


Figure 1. Plain CT axial image shows that the average HU values of the liver were falling below 40 HU.

Table 3. Sensitivity and specificity of NCCT and CECT

	NCCT	CECT
Sensitivity	70%	81%
Specificity	95.2%	91%

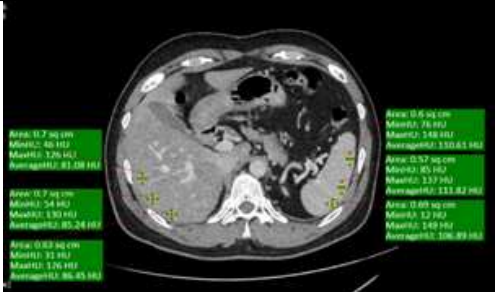


Figure 2. Axial venous phase showing the liver to spleen differentiation is more than 20HU suggestive of mild fatty liver.

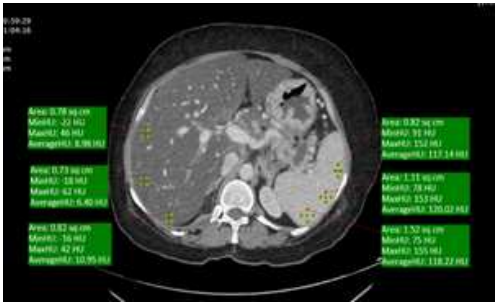


Figure 3. CECT axial venous phase image showing that the liver to spleen differentiation is that 110 HU indicating severe fatty liver.

DISCUSSION

Fatty liver disease is characterized by excessive triglyceride accumulation in hepatocytes, often associated with various medical conditions and medication use. Imaging studies like ultrasound (USG) and computed tomography (CT) can identify characteristic features, but liver biopsy is traditionally considered the gold standard for diagnosis. However, CT scans offer a non-invasive alternative, using Hounsfield Unit (HU) attenuation to quantify liver fat. A liver-to-spleen ratio (L/S) <1.0 or liver HU attenuation <40 indicates significant liver fat (>30%). This study compares non-contrast, arterial, and venous phase liver HU values with liver function tests (SGOT and SGPT). While liver biopsy provides detailed information on fatty changes, inflammation, and fibrosis, its invasive nature and potential complications limit its use, especially in asymptomatic populations. In our retrospective study, 100 patients who had CECT done for conditions other than liver pathology and their LFTs were correlated to assess fatty changes in liver by CT.

Table 1. shows the correlation between Liver Function Tests (LFT) and liver density measured in Hounsfield Units (HU) in plain CT, categorizing liver severity.

- Abnormal LFT results are more common in severe liver density cases (<20 HU).
- Moderate liver density cases (21-30 HU) have the highest frequency.
- Normal LFT results are slightly more common than abnormal ones.

This is in concordance with the study conducted by **Jawarhal A et al¹** that concluded there was statistically significant associations with deranged LFTs and fatty infiltration of liver assessed by CT.

LFT Abnormality Rate: Abnormal LFT rates increase with liver severity:

- Mild: 35% (8/23)
- Moderate: 37% (10/27)
- Severe: 83% (15/18)

HU Value Distribution: Mean and median HU values decrease with increasing severity:

- Mild: 35.5 HU (mean), 36 HU (median)

- Moderate: 25.5 HU (mean), 25 HU (median)
- Severe: 14.5 HU (mean), 15 HU (median)

Table 2. shows the relationship between spleno-portal differentiation density measured in CECT and liver function tests (LFT) in patients. Our results demonstrate a significant correlation between spleno-portal differentiation density and LFT abnormalities.

- Abnormal LFT rates increased with liver severity, with 29% (mild), 70% (moderate), and 86% (severe) of patients exhibiting abnormal LFT results.
- The overall abnormal LFT rate was 56%, indicating a substantial proportion of patients with liver dysfunction.

This is in concordance with study conducted by **RJ Johnston et al²** which concluded that moderate and severe fatty infiltration were more reliably diagnosed than mild fatty infiltration in CECT.

Table 3. shows Diagnostic Performance of NCCT and CECT for Fatty Liver Detection

NCCT: High specificity (95.2%) indicates excellent accuracy in ruling out fatty liver disease when NCCT results are normal. However, moderate sensitivity (70%) suggests some false negatives may occur.

CECT: Improved sensitivity (81%) indicates better detection of fatty liver disease compared to NCCT. Specificity (91%) remains high, although slightly lower than NCCT.

In a study conducted by **David A. Lawrence et al³** on 500 patients to assess the sensitivity of CT in diagnosing fatty liver, it showed NCCT and CECT shows sensitivity of 66% and specificity of 100%. But our study showed CECT outperforms NCCT in sensitivity, while NCCT excels in specificity. This disparity can be due to the small sample size of our study.

CONCLUSION

- NCCT and CECT is a non-invasive procedure and can be used in the diagnosis of fatty liver in all the patients.
- Also in patients who are asymptomatic, CT helps in incidental pick up of the fatty liver and aids in the further management of the patients at an early stage.
- NCCT is a reliable tool for ruling out fatty liver disease, but may miss some cases.
- CECT offers better detection rates, but may result in slightly more false positives. There was derangement in the LFT's only in moderate and severe stages of fatty liver indicating that CT is better in detecting the disease at a very mild stage.

REFERENCES

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