e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com

International Journal of Pharmaceutical Quality Assurance 2026; 17(2); 281-286

Original Research Article

Evaluation of Ultrasound and CT Findings in Chronic Liver Disease and Their Correlation with Clinical Severity Scores

Abhishek Mishra[1], Arbind Kumar Singh[2]

[1]MD Radio-Diagnosis, Consultant Radiologist, Sonoscan Pvt. Ltd, Malda, West Bengal, India.
[2]SMO, Department of Radio-Diagnosis, Sadar Hospital, Lakhisarai, Bihar, India.

Received: 07-12-2025 / Revised: 09-01-2026 / Accepted: 10-02-2026
Corresponding Author: Dr. Arbind Kumar Singh
Conflict of interest: Nil

Abstract:

Background: Chronic liver disease (CLD) is a progressive condition characterized by persistent inflammation, fibrosis, and structural distortion of the liver, which may ultimately lead to cirrhosis and liver failure. Accurate assessment of disease severity is essential for prognosis and management. Imaging modalities such as ultrasound and computed tomography (CT) play an important role in evaluating morphological changes and complications associated with CLD and may correlate with clinical severity scores.

Methods: This prospective observational study included 60 patients clinically suspected or diagnosed with chronic liver disease. All patients underwent detailed clinical assessment, including calculation of Child–Pugh and MELD scores. Imaging evaluation was performed using abdominal ultrasound with Doppler and contrast-enhanced CT scan. Imaging findings such as liver morphology, ascites, splenomegaly, portal vein diameter, and portosystemic collaterals were recorded. The correlation between imaging findings and clinical severity scores was analyzed using appropriate statistical methods.

Results: Most patients were middle-aged males, and common clinical features included fatigue, jaundice, abdominal distension, and hepatomegaly. Ultrasound frequently demonstrated coarse liver echotexture, surface nodularity, ascites, and splenomegaly. CT findings showed irregular liver contour, caudate lobe hypertrophy, regenerative nodules, and evidence of portal hypertension. A significant correlation was observed between imaging findings and clinical severity scores ($p < 0.05$).

Conclusion: Ultrasound and CT are valuable tools in the evaluation of chronic liver disease. Imaging findings show significant correlation with clinical severity scores and can aid in accurate assessment, staging, and management of patients with CLD.

Keywords: Ascites, Child–Pugh score, Chronic liver disease, Computed tomography, MELD score, Portal hypertension, Ultrasound.

DOI: 10.25258/Ijpqa.17.1.46

Introduction

Chronic liver disease (CLD) represents a spectrum of progressive liver pathologies characterized by persistent inflammation, fibrosis, and architectural distortion of the liver parenchyma, ultimately culminating in cirrhosis and hepatic failure [1]. Globally, CLD constitutes a major public health burden due to its high morbidity and mortality, with etiologies including viral hepatitis, alcohol-related liver disease, non-alcoholic fatty liver disease (NAFLD), autoimmune hepatitis, and metabolic disorders. Early detection and accurate assessment of the severity of liver damage are critical for prognosis, timely intervention, and monitoring therapeutic responses [2].

Clinical evaluation of CLD severity is primarily guided by validated scoring systems such as the Child-Pugh score and the Model for End-Stage Liver Disease (MELD) score. The Child-Pugh classification incorporates serum bilirubin, serum albumin, prothrombin time, ascites, and hepatic encephalopathy to stratify patients into Classes A, B, and C, reflecting mild, moderate, and severe hepatic dysfunction, respectively [3]. The MELD score, which uses serum bilirubin, creatinine, and international normalized ratio (INR), is widely applied for predicting short-term mortality and prioritizing patients for liver transplantation. While these clinical scoring systems provide functional assessment, they do not directly quantify structural and morphological changes in the liver [4].

Radiological imaging is a cornerstone in the evaluation of CLD, offering non-invasive, rapid, and reproducible assessment of liver morphology, vascular alterations, and complications such as portal hypertension, ascites, and hepatocellular carcinoma

[5]. Ultrasound (USG) remains the first-line imaging modality due to its accessibility, cost-effectiveness, and safety profile [6]. Typical ultrasonographic features of CLD include coarse and heterogeneous liver parenchyma, nodular surface, reduced liver size with relative caudate lobe hypertrophy, and signs of portal hypertension such as splenomegaly, dilated portal vein, and portosystemic collaterals. Ultrasound is also sensitive for detecting ascites, a hallmark of hepatic decompensation, and can guide interventional procedures [7].

Computed tomography (CT) provides high-resolution cross-sectional imaging, enabling detailed evaluation of liver morphology, volume changes, and vascular structures [8]. CT findings in CLD often include irregular liver contour, segmental atrophy or hypertrophy, heterogeneous attenuation, and evidence of portal vein thrombosis or collateral formation [9]. Additionally, CT is superior in identifying hepatic lesions, including early hepatocellular carcinoma, and quantifying the extent of ascites or other complications. Imaging features, when systematically analyzed, correlate strongly with clinical severity scores, providing complementary information to laboratory and clinical assessments. Studies have demonstrated that nodularity, caudate-to-right lobe ratio, presence of collaterals, and ascites on imaging correlate with advanced Child-Pugh class and higher MELD scores, indicating more severe hepatic dysfunction [10].

Methodology

Study Design: This study was designed as a prospective observational study conducted to evaluate imaging findings in patients with chronic liver disease and to correlate these findings with clinical severity scores.

Study Setting: The study was conducted in the Department of Radiology at Sadar Hospital Lakhisarai, Bihar, India and Sonoscan Pvt. Ltd, Malda, West Bengal, India.

Study Duration: The study was conducted over a period of 9 months.

Study Population: The study included patients clinically suspected or diagnosed with chronic liver disease who were referred for radiological evaluation.

Sample Size: A total of 60 patients diagnosed with chronic liver disease were included in the study to evaluate ultrasound and CT findings and their correlation with clinical severity scores.

Selection Criteria

Inclusion Criteria

- Patients aged 18 years and above.
- Patients clinically diagnosed or suspected to have chronic liver disease.
- Patients who underwent ultrasound and CT scan of the abdomen.
- Patients who provided informed consent to participate in the study.

Exclusion Criteria

- Patients with acute liver disease.
- Patients with previous liver surgery or liver transplantation.
- Patients with incomplete clinical or imaging data.
- Pregnant women (due to radiation exposure from CT scan).

Clinical Assessment: A detailed clinical history was obtained from all patients, including information regarding alcohol intake, viral hepatitis status, metabolic disorders, and presenting symptoms such as jaundice, abdominal distension, and fatigue. A comprehensive physical examination was conducted, and clinical findings including hepatomegaly, splenomegaly, ascites, and signs suggestive of portal hypertension were carefully documented. The clinical severity of liver disease was assessed using established scoring systems, namely the Child–Pugh score and the Model for End-Stage Liver Disease (MELD) score. Based on the calculated scores, patients were classified into different severity groups to evaluate the relationship between clinical status and imaging findings.

Imaging Evaluation – Ultrasound Examination: All patients underwent abdominal ultrasound examination using a high-resolution ultrasound machine equipped with a 3–5 MHz convex transducer. During the examination, various parameters were systematically evaluated, including liver size and contour, echotexture of the liver parenchyma, and the presence of surface nodularity. Additional findings such as ascites, splenomegaly, portal vein diameter, collateral circulation, and other features suggestive of portal hypertension were also carefully assessed. In addition, Doppler ultrasound was performed to further evaluate hepatic vascular dynamics. This included assessment of the direction and velocity of portal venous flow, identification of portosystemic collateral vessels, and analysis of hepatic vein waveform patterns. These imaging findings were recorded and later correlated with the clinical severity scores of chronic liver disease.

Computed Tomography (CT) Examination: All patients underwent contrast-enhanced computed tomography of the abdomen using a multidetector CT scanner. The imaging was performed in arterial, portal venous, and delayed phases whenever indicated to obtain detailed evaluation of hepatic parenchyma and vascular structures. The CT images were systematically analyzed for liver morphology and contour irregularities, as well as parenchymal attenuation changes suggestive of chronic liver disease.

In addition, specific features such as caudate lobe hypertrophy, presence of regenerative nodules, ascites, and splenomegaly were carefully assessed. Imaging findings related to portal hypertension, including portosystemic collateral circulation, were also evaluated. The scans were further examined for any focal hepatic lesions, particularly the presence of hepatocellular carcinoma. All CT findings were documented and later correlated with the clinical severity scores and ultrasound findings of the patients.

Data Collection: All relevant information was systematically recorded using a structured data collection form designed for the study. This included patients' demographic details, clinical history, and findings obtained during physical examination. Laboratory investigation results related to liver function and associated conditions were also documented. In addition, imaging findings obtained from ultrasound and computed tomography examinations were carefully recorded. Clinical severity scores, including the Child–Pugh and Model for End-Stage Liver Disease (MELD) scores, were calculated for each patient and entered into the data sheet. This organized approach ensured accurate compilation of clinical, laboratory, and radiological data for further analysis and correlation.

Statistical Analysis: The collected data were analyzed using appropriate statistical software such as Statistical Package for the Social Sciences (SPSS). Descriptive statistics were applied to summarize patient demographics, clinical characteristics, laboratory parameters, and imaging findings. Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequencies and percentages. The relationship between ultrasound and computed tomography findings with clinical severity scores was assessed using Pearson or Spearman correlation tests, depending on the distribution of the data. A p-value of less than 0.05 was considered statistically significant.

Result

The results of the study showed that most patients with chronic liver disease were middle-aged males, with common symptoms including fatigue, jaundice, abdominal distension, and hepatomegaly. Ultrasound frequently revealed coarse liver echotexture, surface nodularity, splenomegaly, and ascites, while CT demonstrated irregular liver contour, caudate lobe hypertrophy, regenerative nodules, and portosystemic collaterals. A few patients also showed lesions suggestive of hepatocellular carcinoma. Statistical analysis indicated a significant correlation between imaging findings and clinical severity scores such as Child–Pugh and MELD ($p < 0.05$). Patients with higher scores had more pronounced imaging abnormalities, particularly ascites and portal hypertension, suggesting that radiological findings closely reflect disease severity.

Table 1: Demographic Characteristics of Study Participants (n = 60)

Variable	Number of Patients	Percentage (%)
Age < 30 years	8	13.3
Age 31–40 years	12	20
Age 41–50 years	18	30
Age 51–60 years	14	23.3
Age > 60 years	8	13.3
Male	42	70
Female	18	30

Table 1 shows that the demographic distribution of patients with chronic liver disease was mainly concentrated in the middle-aged and older age groups. A higher number of male patients were observed compared to females, indicating greater exposure to risk factors such as alcohol consumption and viral infections among males. The results suggest that chronic liver disease is more prevalent in individuals with long-term exposure to hepatotoxic factors. The age pattern reflects the progressive nature of liver damage over time. This distribution also highlights the importance of early screening in high-risk populations. Overall, the demographic findings provide a basic understanding of the study population.

Table 2: Clinical Presentation of Patients with Chronic Liver Disease

Clinical Feature	Number of Patients	Percentage (%)
Jaundice	32	53.3
Abdominal distension	28	46.7
Fatigue	36	60
Hepatomegaly	30	50
Splenomegaly	26	43.3
Ascites	24	40
Signs of portal hypertension	20	33.3

Table 2 shows that most patients are presented with common clinical symptoms such as jaundice, abdominal distension, fatigue, and ascites. Physical examination frequently revealed hepatomegaly and splenomegaly, indicating advanced liver involvement. Based on Child–Pugh and MELD scores, patients were categorized into different severity groups. A considerable number of patients belonged to moderate and severe disease categories. This indicates that many patients seek medical care at a later stage of the disease. The clinical scoring systems helped in assessing prognosis and disease progression. These findings provide an important basis for correlation with imaging results.

Table 3: Ultrasound Findings in Patients

Ultrasound Findings	Number of Patients	Percentage (%)
Coarse liver echotexture	38	63.3
Surface nodularity	34	56.7
Ascites	24	40
Splenomegaly	26	43.3
Increased portal vein diameter	22	36.7
Portosystemic collaterals	18	30
Reversal of portal flow (Doppler)	10	16.7

Table 3 shows that ultrasound findings in patients commonly included irregular liver surface, coarse echotexture, splenomegaly, and presence of ascites. Portal vein dilatation and signs of portal hypertension were also noted in several cases. Doppler ultrasound demonstrated altered portal venous flow and collateral circulation in advanced cases. These findings indicate structural as well as hemodynamic changes in chronic liver disease. Ultrasound proved to be an effective initial imaging modality for evaluation. The results suggest that ultrasound can help in early detection of disease severity. Overall, the findings were consistent with clinical presentation.

Table 4: CT Findings in Patients with Chronic Liver Disease

CT Findings	Number of Patients	Percentage (%)
Irregular liver contour	36	60
Caudate lobe hypertrophy	20	33.3
Regenerative nodules	18	30
Ascites	24	40
Splenomegaly	28	46.7
Portosystemic collaterals	22	36.7
Hepatocellular carcinoma	6	10

Table 4 shows that CT examination revealed detailed morphological changes in the liver such as contour irregularity, caudate lobe hypertrophy, and regenerative nodules. Ascites and splenomegaly were frequently observed among the study participants. CT also demonstrated portosystemic collateral vessels and features of portal hypertension more clearly. In some patients, focal lesions suggestive of hepatocellular carcinoma were identified. These findings indicate the usefulness of CT in evaluating advanced liver disease. Compared to ultrasound, CT provided better anatomical visualization. Therefore, CT plays an important role in confirming and assessing disease complications.

Table 5: Correlation of Imaging Findings with Clinical Severity Scores

Parameter	Child–Pugh Score (Correlation r)	MELD Score (Correlation r)	p-value
Liver surface nodularity (USG)	0.62	0.58	<0.05
Portal vein diameter	0.49	0.45	<0.05
Ascites	0.66	0.6	<0.05
Splenomegaly	0.52	0.48	<0.05
CT evidence of portal hypertension	0.69	0.63	<0.05

Table 5 shows that there was a significant correlation between imaging findings and clinical severity scores. Patients with higher Child–Pugh and MELD scores showed more pronounced imaging abnormalities such as severe ascites, portal hypertension, and liver surface nodularity. Both ultrasound and CT findings increased with worsening disease severity. This indicates that imaging modalities are reliable tools for assessing disease progression. CT findings showed slightly stronger association with severe stages of liver disease. The results support the combined use of clinical scoring and imaging for

accurate evaluation. Overall, imaging findings reflected the clinical status of patients.

Discussion

The present study evaluated ultrasound and computed tomography (CT) findings in patients with chronic liver disease and analyzed their correlation with clinical severity scores such as the Child–Pugh and MELD scores. Chronic liver disease is a progressive condition characterized by structural and functional alterations in the liver, which can be effectively assessed through imaging techniques along with clinical evaluation. Sherlock (1990) explained that chronic liver disease involves progressive hepatic damage leading to cirrhosis and complications, which supports the clinical basis of the present study [11]. Furthermore, Angeli et al., (2018) reported that combining radiological imaging with clinical scoring systems improves the assessment of disease severity and prognosis in patients with decompensated cirrhosis [12].

In this study, the majority of patients belonged to the middle-aged and older age groups. This observation is consistent with the findings of Younossi et al., (2016) who investigated the global epidemiology of liver diseases and reported that chronic liver disease commonly develops after prolonged exposure to risk factors such as metabolic disorders, viral infections, and alcohol consumption [13]. Similarly, Blachier et al., (2013) revealed that the burden of liver disease is higher among adults with long-term exposure to hepatotoxic conditions, which explains the demographic pattern observed in the present study [14].

Clinical assessment in the present study showed that symptoms such as jaundice, abdominal distension, fatigue, and ascites were common among patients. Physical findings including hepatomegaly, splenomegaly, and signs of portal hypertension suggested advanced disease stages. These findings are supported by Kumar et al., (2014) who described that progressive liver damage leads to portal hypertension and enlargement of abdominal organs due to altered hepatic circulation [15]. In addition, D'Amico et al., (2006**)** investigated the natural history of cirrhosis and reported that clinical severity scores such as Child–Pugh and MELD are useful predictors of disease progression and survival outcomes in patients with chronic liver disease [16].

Ultrasound examination in this study revealed features such as coarse liver echotexture, irregular liver surface, splenomegaly, ascites, and increased portal vein diameter. These findings are consistent with the study conducted by Heller et al., (2014) who investigated the role of ultrasonography in chronic liver disease and reported that ultrasound is an effective initial imaging modality for detecting morphological liver changes and complications of cirrhosis [17]. Similarly, Piscaglia et al., (2001) reported that Doppler ultrasound plays an important role in evaluating portal hypertension by assessing portal venous flow and collateral circulation [18].

Computed tomography provided more detailed anatomical information and revealed findings such as irregular liver contour, caudate lobe hypertrophy, regenerative nodules, and portosystemic collaterals. These results are in agreement with the findings of Brancatelli et al., (2007) who investigated CT and MR imaging features in cirrhosis and reported that CT imaging is useful in identifying structural liver abnormalities and complications associated with chronic liver disease [19]. Additionally, Davila et al., (2011) reported that CT imaging is valuable in detecting hepatocellular carcinoma in patients with chronic liver disease and cirrhosis during surveillance programs [20].

The present study also demonstrated a significant correlation between imaging findings and clinical severity scores. Patients with higher Child–Pugh and MELD scores showed more pronounced imaging abnormalities such as severe ascites, portal hypertension, and morphological liver changes. These findings suggest that imaging modalities can effectively reflect the clinical status and progression of chronic liver disease. Therefore, the combined use of ultrasound, CT imaging, and clinical scoring systems provides a comprehensive approach for the evaluation and management of patients with chronic liver disease.

Conclusion

This study demonstrates that ultrasound and computed tomography (CT) are valuable imaging modalities for evaluating patients with chronic liver disease and assessing disease severity. Common imaging findings such as irregular liver contour, altered parenchymal echotexture, splenomegaly, ascites, and features of portal hypertension were frequently observed and increased with disease progression. Ultrasound served as an effective initial screening tool due to its accessibility and non-invasive nature, while CT provided more detailed visualization of liver morphology and complications. A significant correlation was noted between imaging findings and clinical severity scores, indicating that radiological changes reflect the clinical status of patients. Therefore, the combined use of clinical scoring systems and imaging techniques can improve the diagnosis, staging, and management of chronic liver disease.

References:

1. Schuppan D, Afdhal NH. Liver cirrhosis. Lancet. 2008;371(9615):838–851. doi:10.1016/S0140-6736(08)60383-9.
2. Asrani SK, Devarbhavi H, Eaton J, Kamath PS. Burden of liver diseases in the world. J Hepatol. 2019;70(1):151–171. doi:10.1016/j.jhep.2018.09.014.

3. Pugh RN, Murray-Lyon IM, Dawson JL, Pietroni MC, Williams R. Transection of the oesophagus for bleeding oesophageal varices. Br J Surg. 1973;60(8):646–649. doi:10.1002/bjs.1800600817.
4. Kamath PS, Wiesner RH, Malinchoc M, Kremers W, Therneau TM, Kosberg CL, et al. A model to predict survival in patients with end-stage liver disease. Hepatology. 2001;33(2):464–470. doi:10.1053/jhep.2001.22172.
5. Brancatelli G, Federle MP, Grazioli L, Golfieri R, Lencioni R. Imaging findings in cirrhosis and chronic liver disease. Radiographics. 2007;27(3):839–854. doi:10.1148/rg.273065097.
6. Colli A, Fraquelli M, Casazza G, Massironi S, Colucci A, Conte D, et al. Accuracy of ultrasound in the detection of cirrhosis in chronic liver disease: A systematic review. Dig Liver Dis. 2003;35(8):593–601. doi:10.1016/S1590-8658(03)00208-1.
7. Bolondi L, Gaiani S, Li Bassi S, Zironi G, Benzi G, Santi V, et al. Diagnosis of portal hypertension by Doppler ultrasound. Gastroenterology. 1991;100(6):1605–1611. doi:10.1016/0016-5085(91)90657-A.
8. Yu JS, Kim KW, Lee HJ, Kim SH, Lee JY, Han JK, et al. CT and MR imaging of cirrhosis and its complications. Radiographics. 2003;23(3):795–812. doi:10.1148/rg.233025712.
9. Kudo M, Zheng RQ, Kim SR, Okabe Y, Osaki Y. Diagnostic accuracy of imaging for hepatocellular carcinoma. Liver Cancer. 2014;3(1):19–31. doi:10.1159/000343854.
10. Lim JH, Kim CK. Imaging features of cirrhosis and portal hypertension. Clin Radiol. 2008;63(7):701–710. doi:10.1016/j.crad.2007.11.015.
11. Sherlock S. Diseases of the liver and biliary system. Journal of Clinical Gastroenterology. 1990 Aug 1;12(4):486-7.
12. Angeli P, Bernardi M, Villanueva C, Francoz C, Mookerjee RP, Trebicka J, Krag A, Laleman W, Gines P. EASL Clinical Practice Guidelines for the management of patients with decompensated cirrhosis. Journal of hepatology. 2018 Aug 1;69(2):406-60.
13. Younossi ZM, Koenig AB, Abdelatif D, Fazel Y, Henry L, Wymer M. Global epidemiology of nonalcoholic fatty liver disease—Meta-analytic assessment of prevalence, incidence, and outcomes. Hepatology. 2016;64(1):73–84.
14. Blachier M, Leleu H, Peck-Radosavljevic M, Valla DC, Roudot-Thoraval F. The burden of liver disease in Europe: A review of available epidemiological data. Journal of Hepatology. 2013;58(3):593–608.
15. Kumar V, Abbas AK, Fausto N, Aster JC. Robbins and Cotran pathologic basis of disease, professional edition e-book. Elsevier health sciences; 2014 Aug 27.
16. D'Amico G, Garcia-Tsao G, Pagliaro L. Natural history and prognostic indicators of survival in cirrhosis: A systematic review of 118 studies. Journal of Hepatology. 2006;44(1):217–231.
17. Heller MT, Tublin ME. The role of ultrasonography in chronic liver disease. Radiologic Clinics of North America. 2014;52(6):1163–1175.
18. Piscaglia F, Donati G, Serra C, Muratori R, Solmi L, Gaiani S, et al. Value of Doppler ultrasound in the evaluation of portal hypertension. Ultrasound in Medicine & Biology. 2001;27(7):893–899.
19. Brancatelli G, Federle MP, Ambrosini R, Lagalla R, Carriero A, Midiri M, Vilgrain V. Cirrhosis: CT and MR imaging evaluation. European journal of radiology. 2007 Jan 1;61(1):57-69.
20. Davila JA, Henderson L, Kramer JR, Kanwal F, Richardson PA, Duan Z, El-Serag HB. Utilization of surveillance for hepatocellular carcinoma among hepatitis C virus–infected veterans in the United States. Annals of internal medicine. 2011 Jan 18;154(2):85-93.