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## STUDY OF THE RELATIONSHIP BETWEEN SERUM URIC ACID AND CHILD–TURCOTTE–PUGH SCORES IN CHRONIC LIVER DISEASE

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### ABSTRACT

**Background:** Chronic liver disease (CLD) is a major cause of morbidity and mortality worldwide. Serum uric acid has recently been recognized as a marker of inflammation, oxidative stress, and tissue injury. The present study was conducted to evaluate the relationship between serum uric acid levels and Child–Turcotte–Pugh (CTP) scores in patients with chronic liver disease.

**Methodology:** This hospital-based observational study was conducted in the Department of General Medicine at Sree Mookambika Institute of Medical Sciences from November 2024 to January 2026. Fifty patients aged above 20 years diagnosed with chronic liver disease and cirrhosis were included. Patients with chronic kidney disease, diabetes mellitus, hypothyroidism, hepatorenal syndrome, chemotherapy exposure, and those on uric acid-altering drugs were excluded. Serum uric acid, bilirubin, albumin, liver enzymes, and INR were measured using standard laboratory methods. CTP scores were calculated, and statistical analysis was performed to determine correlations.

**Results:** Patients with serum uric acid levels  $>7.2$  mg/dL had significantly higher bilirubin, AST, ALT, ALP, and INR levels with lower albumin levels ( $p < 0.05$ ). Mean uric acid levels increased progressively from CTP Class A ( $4.39 \pm 1.09$  mg/dL) to Class C ( $8.19 \pm 2.24$  mg/dL), showing a significant association between hyperuricemia and disease severity ( $p = 0.012$ ).

**Conclusion:** Elevated serum uric acid levels are significantly associated with worsening liver dysfunction and higher CTP scores in chronic liver disease. Serum uric acid may serve as a simple and cost-effective biomarker for assessing disease severity.

**Keywords:** Chronic Liver Disease, Serum Uric Acid, Child–Turcotte–Pugh Score, Cirrhosis, Hyperuricemia, Liver Dysfunction.

### INTRODUCTION

Chronic liver disease (CLD) is a major global health burden associated with significant morbidity and mortality. It encompasses a spectrum of progressive hepatic disorders characterized by persistent inflammation, hepatocellular injury, fibrosis, and eventual cirrhosis. The major etiological factors contributing to CLD include chronic alcohol consumption, viral hepatitis, non-alcoholic fatty liver disease, metabolic disorders, and autoimmune diseases. Alcohol-related liver disease remains one of the leading causes worldwide, accounting for

More than half of all cases, while viral infections, particularly hepatitis B and C, contribute to approximately 30–70% of cases depending on geographic variation and population characteristics [1,2]. As liver disease progresses, complications such as portal hypertension, hepatic encephalopathy, ascites, coagulopathy, and hepatorenal syndrome develop, substantially worsening patient outcomes. Assessment of disease severity in CLD is essential for prognostication and therapeutic decision-making. The Child–Turcotte–Pugh (CTP) scoring system is one of the most widely used clinical tools for evaluating the severity and prognosis of chronic liver disease and cirrhosis. The score incorporates serum bilirubin, serum albumin, prothrombin time, ascites, and hepatic encephalopathy to classify patients into CTP classes A, B, and C according to the extent of hepatic dysfunction [3]. Higher CTP scores are associated with poorer prognosis, increased risk of complications, and reduced survival.

In recent years, increasing attention has been directed toward the role of serum uric acid in chronic inflammatory and metabolic disorders, including



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chronic liver disease. Uric acid is the final product of purine metabolism in humans and certain primates and is primarily excreted through the kidneys [4]. The enzyme xanthine oxidase plays a crucial role in uric acid synthesis by catalyzing the oxidation of hypoxanthine to xanthine and subsequently xanthine to uric acid [5]. Traditionally considered merely a metabolic waste product resulting from nucleic acid degradation, uric acid is now recognized to have significant biological and pathological functions.

Emerging evidence suggests that elevated serum uric acid levels may contribute to oxidative stress, endothelial dysfunction, inflammation, and tissue injury [6]. Uric acid has been shown to stimulate inflammatory pathways through activation of inflammasomes and generation of reactive oxygen species, thereby promoting cellular damage and fibrosis [7]. Hyperuricemia has also been implicated in metabolic syndrome, cardiovascular disease, chronic kidney disease, and non-alcoholic fatty liver disease [8]. In liver disorders, increased xanthine oxidase activity and impaired hepatic metabolism may result in elevated serum uric acid concentrations, reflecting both hepatic dysfunction and systemic inflammation.

Several studies have demonstrated a positive association between serum uric acid levels and the severity of liver disease. Elevated uric acid concentrations may correlate with worsening hepatic function, increased fibrosis, and poor clinical outcomes in patients with CLD [9]. Therefore, serum uric acid could potentially serve as a simple, inexpensive, and readily available biomarker for assessing disease severity in chronic liver disease. The present study aims to evaluate the relationship between serum uric acid concentrations and Child-Turcotte-Pugh scores in patients with chronic liver disease and to determine whether serum uric acid can be used as an indicator of disease severity.

#### **Aim**

To evaluate the relationship between serum uric acid concentrations and Child-Turcotte-Pugh (CTP) scores in patients with chronic liver disease.

#### **Objectives**

1. To estimate serum uric acid levels in patients diagnosed with chronic liver disease.
2. To assess the severity of chronic liver disease using the Child-Turcotte-Pugh scoring system.

#### **MATERIALS AND METHODS**

This hospital-based observational study was conducted in the Department of General Medicine at Sree Mookambika Institute of Medical Sciences over a study period extending from November 2024 to January 2026. The study included patients aged 20 years and above who were diagnosed with

chronic liver disease and cirrhosis of the liver. Both male and female patients were enrolled in the study. Patients receiving medications known to alter serum uric acid levels, such as allopurinol, thiazide diuretics, furosemide, and febuxostat, were excluded from the study. Patients with co-existing chronic kidney disease, hypothyroidism, diabetes mellitus, hepatorenal syndrome, and those undergoing chemotherapy were also excluded to avoid confounding factors affecting serum uric acid concentrations.

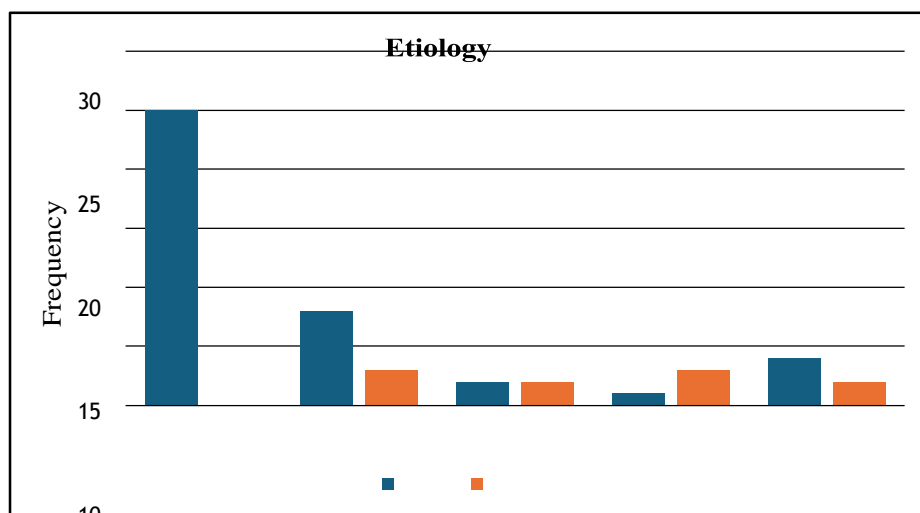
After obtaining informed consent, detailed clinical history and relevant examination findings were recorded for all participants. Blood samples were collected under aseptic precautions and analyzed for various biochemical parameters related to liver function. The investigations included serum uric acid, serum bilirubin, and serum albumin levels. Serum uric acid estimation was performed to assess the level of uric acid, which is the end product of purine metabolism. Serum bilirubin was measured as an indicator of hepatic excretory function, while serum albumin levels reflected the synthetic function of the liver. All biochemical investigations were carried out using the dry chemistry method on the VITROS 5600 chemistry analyzer. In addition, prothrombin time was measured separately to assess hepatic synthetic capacity and coagulation status.

The severity of liver disease was assessed using the Child-Turcotte-Pugh (CTP) scoring system, which incorporates serum bilirubin, serum albumin, prothrombin time, ascites, and hepatic encephalopathy. Based on the calculated score, patients were categorized into Child-Pugh classes A, B, and C according to disease severity.

The collected data were entered into Microsoft Excel and analyzed using appropriate statistical software. Quantitative variables were expressed as mean  $\pm$  standard deviation, while qualitative variables were presented as frequencies and percentages. The association between serum uric acid levels and Child-Turcotte-Pugh scores was analyzed using correlation analysis. Comparison of serum uric acid levels among different Child-Pugh classes was performed using appropriate statistical tests such as one-way ANOVA or Chi-square test wherever applicable. A p-value of less than 0.05 was considered statistically significant.

#### **RESULT**

This study included 50 cases of chronic liver disease. The majority of them (60%) were in the age group of 41 – 50 years. The mean age of the population was  $45.25 \pm 5.5$  years. Males were 40(80%) and females were 10(20%) of cases. The male-to-female ratio was 4:1



**Figure 1:** Showing the Etiological Factors Responsible For Chronic Liver Disease in Cases of the Study

Figure 1 shows the etiology of chronic liver diseases in cases of the study. *Alcohol:* The most common cause of CLD is alcohol, affecting 25 males (50% of male patients) and no females. *Hepatitis C:* The second most prevalent cause is Hepatitis C, with 8 male patients (16% of males) and 3 female patients (33.33% of females). *NAFLD:* NAFLD is relatively evenly distributed across genders, affecting 2 males and 2 females. *Autoimmune Hepatitis:* This appears to be more common in females, with 1 male patient and 3

female patients (100% of female cases). The category "Others" includes a combined total of 4 males and 2 females. This data suggests that alcohol consumption is a major risk factor for CLD, particularly in males. Hepatitis C is also a significant cause, affecting both genders but with a higher proportion of males. NAFLD seems to be less gender-specific. Autoimmune Hepatitis appears to be more prevalent in females in this study population.

**Table 1:** Comparison of Mean Baseline Biochemical Parameters among Patients Based On Uric Acid Levels

Parameter	Serum Uric Acid Level < 7.2 Mg/Dl	Serum Uric Acid Level > 7.2 Mg/Dl	P Value
Bilirubin (Mg/Dl)	2.13 ± 1.08	4.97 ± 2.12	0.001
Ast (U/L)	45.67 ± 19.67	60.27 ± 29.14	0.012
Alt (U/L)	50.33 ± 27.64	85.91 ± 38.32	0.019
Alp (Iu/L)	119.52 ± 35.46	151.27 ± 42.97	0.022
Albumin (G/Dl)	3.67 ± 0.43	2.41 ± 0.48	0.001
Inr	1.21 ± 0.11	1.57 ± 0.20	0.014

A critical analysis of Table 2 shows that patients with higher uric acid levels (> 7.2 mg/dL) generally have worse liver function compared to those with lower uric acid levels (< 7.2 mg/dL). This is reflected in all the parameters measured: Bilirubin, AST, ALT, and ALP levels are all significantly higher (p-value < 0.05) in the high

uric acid group. Albumin levels are significantly lower (p-value < 0.05) in the high uric acid group, indicating poorer protein synthesis by the liver. INR is also significantly higher (p-value < 0.05) in the high uric acid group, suggesting potential abnormalities in blood clotting.

**Table 2:** Mean Uric Acid Levels CP Class among the 50 Cases of Chronic Liver Disease

Cp Class	Cp Score	Frequency	Minimum	Maximum	Mean Uric Acid	P Value
A	5 – 6	10	3.32	6.15	4.39 ± 1.09	0.012*
B	7 – 9	19	5.15	7.88	5.48 ± 1.55	
C	10 – 15	21	7.56	11.25	8.19 ± 2.24	

Table 3 shows the CP scores and mean uric acid levels in the cases of the study. Critical analysis of the table shows that there's a trend of increasing mean uric acid levels with higher CP scores (severity). Class A (least severe) has the lowest mean uric acid level ( $4.39 \pm 1.09$  mg/dL). Class B has a moderately higher mean uric acid level ( $5.48 \pm 1.55$  mg/dL). Class C (most severe) has the highest mean uric acid level ( $8.19 \pm 2.24$  mg/dL). The P-value (0.012\*) indicates a statistically significant difference in uric acid levels between the groups. This data suggests a potential association between the severity of chronic liver disease and uric acid levels. Patients with more severe liver dysfunction (higher CTP score) tend to have higher uric acid levels. Uric acid might be a marker of disease severity in CLD

## DISCUSSION

The present study evaluated the association between serum uric acid levels and the severity of chronic liver disease as assessed by the Child–Turcotte–Pugh (CTP) score. The findings of the study demonstrated that patients with elevated serum uric acid levels had significantly worse liver function parameters and higher CTP scores, suggesting a strong relationship between hyperuricemia and disease severity in chronic liver disease.

In the current study, patients with serum uric acid levels greater than 7.2 mg/dL showed significantly elevated bilirubin, AST, ALT, ALP, and INR values along with significantly lower serum albumin levels when compared to patients with lower uric acid levels. Elevated bilirubin and liver enzyme levels indicate worsening hepatocellular injury and impaired hepatic excretory function, whereas reduced albumin levels reflect poor synthetic capacity of the liver. Increased INR values further indicate impaired hepatic synthesis of clotting factors and progression of liver dysfunction. These findings are in agreement with previous studies which reported that hyperuricemia is associated with hepatic inflammation, oxidative stress, and progression of liver injury [10,11].

Uric acid is increasingly recognized not merely as an end product of purine metabolism but also as a mediator of inflammation and oxidative stress. Experimental studies have demonstrated that elevated uric acid levels can induce endothelial dysfunction, activate inflammatory cytokines, and stimulate oxidative pathways, thereby contributing to tissue injury and fibrosis [12]. In chronic liver disease, increased xanthine oxidase activity and impaired hepatic metabolism may lead to elevated serum uric acid concentrations. Furthermore, reduced renal perfusion and systemic inflammation seen in advanced liver disease may contribute to

decreased uric acid clearance and subsequent hyperuricemia [13].

The present study also demonstrated a statistically significant increase in mean serum uric acid levels with worsening Child–Turcotte–Pugh class. Patients in CTP Class A had the lowest mean serum uric acid levels, whereas those in Class C had markedly elevated levels. This progressive rise in serum uric acid with increasing disease severity suggests that uric acid may serve as an indirect marker of hepatic dysfunction. Similar findings were reported by Wu et al., who observed a positive correlation between serum uric acid levels and liver fibrosis severity in patients with chronic liver disease [14]. Li et al. also reported that elevated serum uric acid levels were significantly associated with hepatic steatosis, inflammation, and fibrosis [15].

The statistically significant p-values observed in the present study support the existence of a meaningful association between serum uric acid and liver disease severity. Since serum uric acid estimation is inexpensive, readily available, and routinely performed in clinical laboratories, it may serve as a useful adjunctive biomarker in assessing the prognosis and severity of chronic liver disease. Monitoring uric acid levels may help clinicians identify patients at higher risk of disease progression and complications.

However, the study has certain limitations. The sample size was relatively small, and the study was conducted at a single tertiary care center, which may limit the generalizability of the findings. In addition, long-term follow-up was not performed to evaluate the prognostic implications of hyperuricemia in chronic liver disease. Further large-scale multicentric prospective studies are required to establish serum uric acid as an independent prognostic marker in chronic liver disease.

## CONCLUSION

The present study demonstrated a significant association between elevated serum uric acid levels and the severity of chronic liver disease as assessed by the Child–Turcotte–Pugh score. Patients with higher serum uric acid levels showed worsening liver function parameters, including elevated bilirubin, liver enzymes, and INR, along with reduced serum albumin levels. Mean serum uric acid levels increased progressively with advancing Child–Pugh class, indicating a positive correlation between hyperuricemia and hepatic dysfunction severity. These findings suggest that serum uric acid may serve as a simple, inexpensive, and useful biomarker for assessing disease severity and prognosis in patients with chronic liver disease.

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