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Original Article

# Pattern of Thyroid Function Abnormalities in Patients with Chronic Liver Disease: A Cross-Sectionalstudy from a Tertiary Care Centre

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## ABSTRACT

**Background:** liver plays an important role in thyroid hormone metabolism, including conversion, binding, and clearance. Patients with chronic liver disease frequently demonstrate alterations in thyroid function tests, reflecting disease severity. However, differentiating true thyroid dysfunction from euthyroid sick syndrome remains a clinical challenge.

**Objective:** To evaluate the prevalence and patterns of thyroid function abnormalities in patients with chronic liver disease and to assess their association with the severity of liver disease.

**Methods:** A cross-sectional observational study was conductedduring a period of 6 months on 100 adult patients with established Chronic liver disease at a tertiary care centre. Patients with known thyroid disease, pregnancy, renal failure, recent exposure to drugs affecting thyroid function were excluded. Demographicdetails, clinical and laboratory data were collected, including Child–Pugh classification. Thyroid function tests (TSH, FT4, FT3) were analysed, and thyroid status were categorized as euthyroid, low T3 syndrome, hypothyroidism and hyperthyroidism. Statistical analysis was done using Chi-square and ANOVA, with $p < 0.05$ considered significant.

**Results:** The mean age was 52 ± 10 years; 65% were male. Child–Pugh class distribution was: A (30%), B (45%), C (25%). Overall, 45% of patients exhibited thyroid abnormalities: low T3 syndrome (30%), overt hypothyroidism (8%), subclinical hypothyroidism (5%), and hyperthyroidism (2%). Abnormal thyroid function increased with liver disease severity ($p = 0.0205$). Mean FT3 levels declined progressively across Child–Pugh classes (2.6 ± 0.4 in A, 2.1 ± 0.5 in B, 1.7 ± 0.4 pg/mL in C; ANOVA $p < 0.0001$).

**Conclusion:** Thyroid dysfunction is common in chronic liver disease with low T3 syndrome being the predominant abnormality. The prevalence of thyroid abnormalities correlates with worsening Child–Pugh class, underscoring the importance of careful interpretation of thyroid function test inchronic liver disease. Routine thyroid screening can be helpful in comprehensive management, as treatment decisions help to differentiate between sick euthyroid state and true thyroid disease.

***Keywords****: Chronic liver disease, thyroid dysfunction, low T3 syndrome, hypothyroidism, Child–Pugh score.*

## INTRODUCTION

The liver plays a pivotal role in the metabolism, transport, and clearance of thyroid hormones[1]. It is involved in the synthesis of thyroid hormonebinding proteins such as thyroxine-binding globulin, transthyretin, and albumin, as well as in the peripheral conversion of thyroxine (T4) to the biologically active triiodothyronine (T3) through type 1 deiodinase activity [2]. In addition, hepatic conjugation and biliary excretion also constitute important pathways for thyroid hormone

clearance[2,3]. Consequently, liver dysfunction can significantly alter thyroid hormone homeostasis even in the absence of intrinsic thyroid disease [4]. Chronic liver disease is associated with complex endocrine and metabolic derangements, of which thyroid function test abnormalitiesare the most frequent. Patients with chronic liver diseaseoften exhibit reduced serum T3 levels, normal or low-normal T4 levels, and relatively preserved thyroid-stimulating hormone (TSH), a pattern commonly referred to as "low T3 syndrome" or non-thyroidal illness syndrome [5,6]. These changes are due to adaptive metabolic response to chronic systemic illness rather than true thyroid dysfunction [7]. However, overt and subclinical hypothyroidism as well as hyperthyroidism, have also been reported in patients with cirrhosis [7,8]. The interpretation of thyroid function tests (TFTs) in chronic liver diseasehas a clinical challenge. Distinguishing euthyroid sick syndrome from true thyroid disease is essential, as inappropriate treatment may lead to adverse outcomes [9,10,11]. Moreover, several studies have suggested that the degree of thyroid hormone alteration correlates with the severity of liver dysfunction and may have prognostic implications [12,13]. Despite this, data from Indian populations remain limited, and reported prevalence rates vary widely across studies due to differences in patient characteristics, etiology of liver disease, and severity scores used. Our study was done to evaluate the prevalence and patterns of thyroid function abnormalities in patients with chronic liver disease at a tertiary care centre and to assess their association with the severity of liver disease as determined by the Child–Pugh classification.

## MATERIALS AND METHODS

This was a cross-sectional observational study conducted over a period of six months at a tertiary care hospital. The study protocol was approved by the Institutional Ethics Committee, and informed written consent was obtained from all participants prior to data collection. A total of 100 adult patients (≥18 years) with established chronic liver disease were considered for study. Chronic liver disease was diagnosed based on parameters like clinical features, biochemical abnormalitiesand imaging findings suggestive of chronic liver disease.

### Inclusion criteria

- Adults aged 18 years and above
- Diagnosed cases of chronic liver disease
- Stable inpatients or outpatients willing to provide informed consent

### Exclusion criteria

- Known thyroid disease or prior thyroid surgery
- Pregnancy
- Chronic kidney disease or renal failure
- Recent (<3 months) acute illness unrelated to liver disease
- Use of drugs known to affect thyroid function (eg: amiodarone, lithium, corticosteroids)

### Data collection

Detailed demographic data, clinical history and laboratory parameters were collected using a structured proforma. The etiology of chronic liver disease was documented wherever available and included alcoholic liver disease, metabolic dysfunction–associated steatotic liver disease (MASLD), viral hepatitis (HBV/HCV), autoimmune liver disease, and other causes. Severity of liver disease was assessed using the Child–Pugh classification, including serum bilirubin, serum albumin, international normalized ratio (INR), presence of ascites, and hepatic encephalopathy. Patients were categorized into Child–Pugh class A, B, or C accordingly.

### Thyroid function assessment

Venous blood samples were collected under standardized conditions. Thyroid function tests included serum TSH, free thyroxine (FT4), and free triiodothyronine (FT3), measured using standard immunoassay techniques available at the institutional laboratory.

Based on TFT results, patients were categorized as:

- Euthyroid
- Low T3 syndrome (isolated low FT3 with normal TSH and FT4)
- Overt hypothyroidism
- Subclinical hypothyroidism
- Hyperthyroidism

### Statistical analysis

Data were entered into an excel spreadsheet and analyzed using SPSS software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as percentages. Associations between thyroid dysfunction and Child–Pugh class were analyzed using the Chi-square test. Comparison of mean thyroid hormone levels

across Child–Pugh classes was performed using one-way analysis of variance (ANOVA). A p-value of <0.05 was considered statistically significant.

**RESULTS**

The study included 100 patients with chronic liver disease, of whom 65 were male and 35 were female. The mean age of the study population was 52 years. The most common etiology of chronic liver disease was alcoholic liver disease, followed by metabolic dysfunctionassociated steatotic liver disease, viral hepatitis, autoimmune liver disease, and other causes. The mean duration of liver disease was four years. The mean Child–Pugh score was 8.1. Distribution according to Child–Pugh class was: class A in 30%, class B in 45%, and class C in 25% of patients (Figure 1). The mean serum bilirubin was 3.2 mg/dL, mean serum albumin was 3.0 g/dL and mean INR was 1.7.

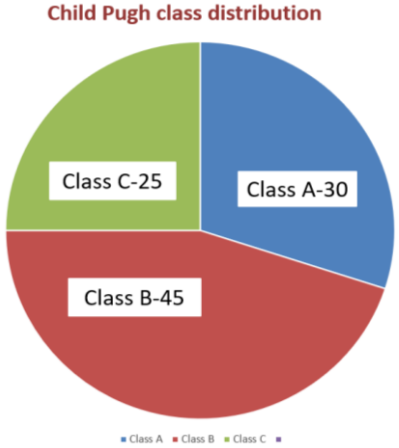


Figure 1: Distribution according to Child Pugh Score

Mean serum TSH was 2.4 µIU/ml, mean FT4 was 1.2 ng/dL and mean FT3 was 2.5 pg/ml. Overall, 45% of patients had abnormal thyroid function tests. Low T3 syndrome was the most frequent abnormality which was observed in 30% of patients. Overt hypothyroidism was seen in 8%, subclinical hypothyroidism in 5%, and hyperthyroidism in 2% of patients. The remaining 55% were euthyroid (Figure 2).

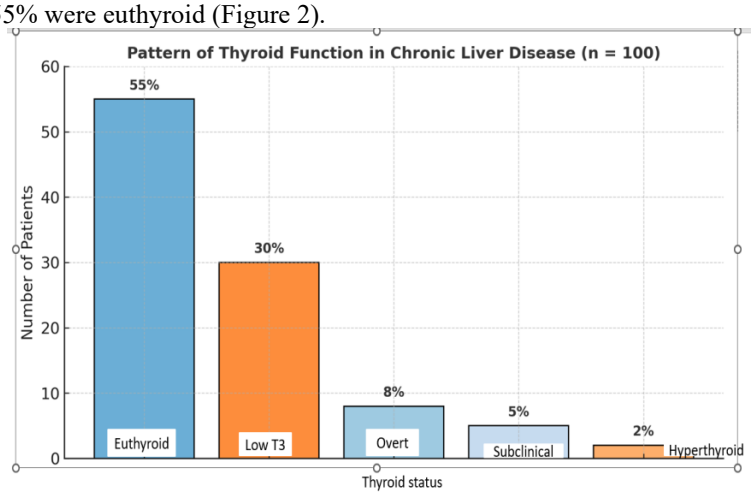


Figure 2: Pattern of thyroid function in chronic liver disease

The prevalence of thyroid dysfunction increased progressively with worsening child pugh class. Low T3 syndrome was present across all child pugh classes, rising from approximately 20% in class A to 40% in class C. Also, another observation was the proportion of euthyroid patients declined from 73% in class A to 36% in class C (Figure 3). The association between thyroid dysfunction and Child–Pugh class was statistically significant (p = 0.0205).

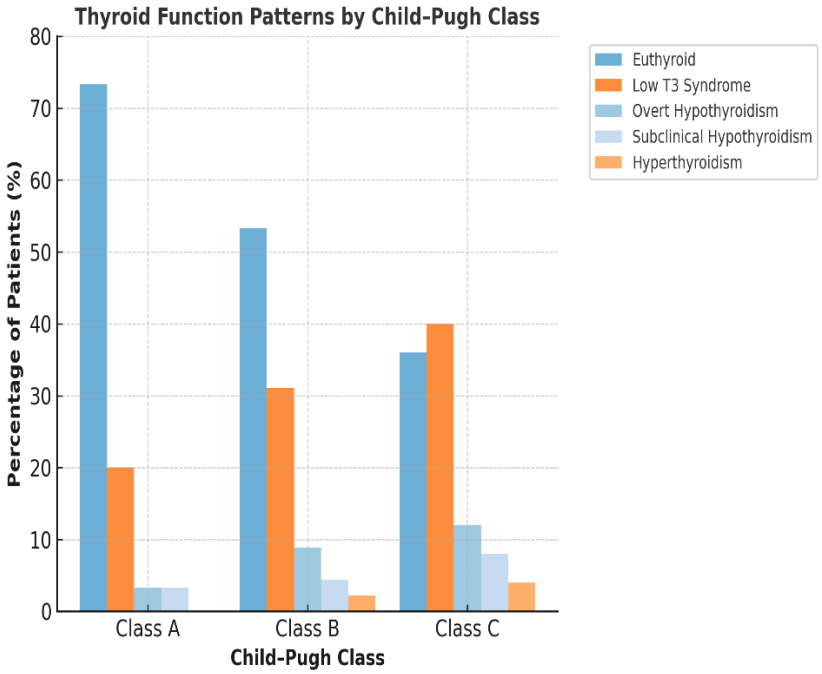


Figure 3: Pattern of thyroid function by child pugh class

Mean FT3 levels showed a significant declining trend with increasing severity of liver disease: 2.6 ± 0.4 pg/mL in childPugh class A, 2.1 ± 0.5 pg/mL in class B, and 1.7 ± 0.4 pg/mL in class C (ANOVA $p < 0.0001$) (Figure 4). No statistically significant differences were observed in mean TSH or FT4 levels across Child–Pugh classes.

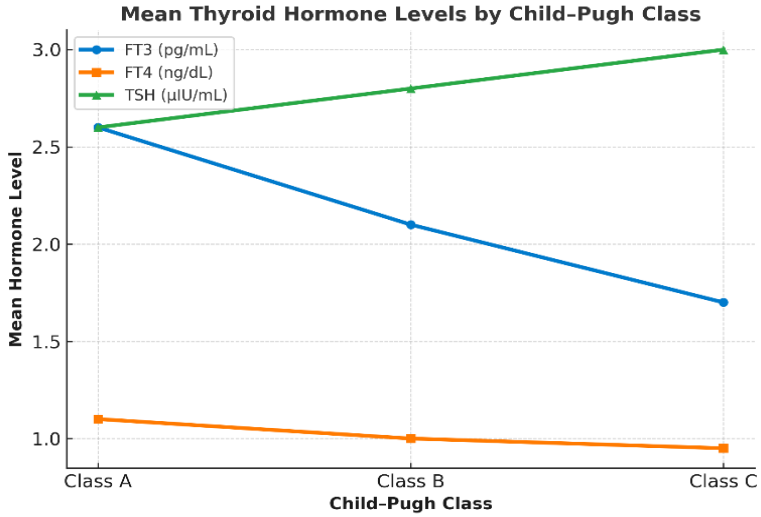


Figure 4: Mean thyroid hormone levels by child pugh class

## DISCUSSION

This cross-sectional study showed a high prevalence of thyroid function abnormalities in patients with chronic liver disease, with nearly half of the study population exhibiting derangedthyroid function tests. Low T3 syndrome was observed as the predominant abnormality and showed a clear association with increasing severity of liver dysfunction. The findings are consistent with the known pathophysiology of thyroid hormone metabolism in chronic liver disease [12, 13]. Reduced hepatic deiodinase activity, impaired conversion of T4 to T3 and altered binding protein synthesis contribute to low circulating FT3 levels [14]. Also, chronic systemic inflammation and cytokine-mediated suppression of peripheral thyroid hormone metabolism can also cause these changes [15]. Several Indian studies have reported similar observations.

Choudhury et al. demonstrated a significant association between thyroid dysfunction and severity of cirrhosis, with low T3 syndrome being the most common abnormality [1]. Suman et al. reported progressive decline in FT3 and FT4 levels with increasing child pughscores [3]. Our studyalso observed these findings and highlights the importance of FT3 as a marker in reflecting hepatic functional reserve. In contrast, overt and subclinical hypothyroidism were less common. This supports the concept that most thyroid test abnormalities in chronic liver disease show adaptive metabolic changes rather than primary thyroid pathology [12]. The lack of significant variation in TSH and FT4 levels across child pugh classes also support this interpretation. Interestingly, a few studies from non-cirrhotic MASLD populations have failed to demonstrate a consistent relationship between thyroid function and disease severity, suggesting that etiology and stage of liver disease may influence thyroidliver interactions. This study underscores the importance in interpretation of thyroid function tests in patients with chronic liver disease. From a clinical perspective, routine screening for thyroid dysfunction in chronic liver disease may help identify patients with true thyroid disease. Careful differentiation between non-thyroidal illness and true thyroid dysfunction is crucial to avoid unnecessary interventions.

## CONCLUSION

Thyroid function abnormalities are common in patients with chronic liver disease, with low T3 syndrome being the most prevalent pattern. The frequency and severity of thyroid abnormalities increase with worsening child pugh class, showing the impact of hepatic dysfunction on thyroid hormone metabolism. Interpretation of thyroid function tests in chronic liver disease requires caution, and therapeutic decisions should distinguish between adaptive metabolic changes and true thyroid disease. Routine thyroid assessment can help in comprehensive patient evaluation in chronic liver disease.

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