World Journal of Gastroenterology, Hepatology and Endoscopy ISSN 2766-788X | Volume 31

Clinical Paper Open Access

Changes and Clinical Significance of Thyroid Function in Different Stages of Chronic Liver Disease

Yujie Qin[1*], Letong Zhang[2*], Nan Wang[3], Xue Han[3], Jiaxi Yao[4,5]

[1]Day Surgery Centre of Zhangye People's Hospital Affiliated to Hexi University, Zhangye 734000, China;

[2]Department of Clinical Medicine, Chengdu University, Chengdu, Sichuan 610000, China;

[3]Hexi University College of Medicine;

4Department of Urology, Zhangye People's Hospital Affiliated to Hexi University, Zhangye, Gansu 734000, China

[5]Institute of Urology, Hexi University, Zhangye, Gansu 734000, China

***Corresponding author:**

Jiaxi Yao,
Department of Urology, Zhangye People's Hospital Affiliated to Hexi University, Zhangye, Gansu 734000, China
ORCID: 0000-0002-8023-4338

Received: 18 July 2026
Accepted: 30 July 2026
Published: 03 Aug 2026
J Short Name: WJGHE

Keywords:

Thyroid Hormone; Chronic Liver Disease; Different Stages; Different Etiologies

Citation:

Jiaxi Yao, Changes and Clinical Significance of Thyroid Function in Different Stages of Chronic Liver Disease.World Jour of Gastro and Hepatology® 2026; V31(8): 1-4

1. Abstract

1.1. Purpose

To explore the differences and clinical significance of thyroid hormone levels at different stages and causes of chronic liver disease.

1.2. Patients and Methods

Overall, 255 and 30 patients with various chronic liver diseases and normal physical examination results admitted to the Zhangye People's Hospital Affiliated to Hexi University between January 2019 and October 2022, respectively, were enrolled. Peripheral blood thyroid-stimulating hormone (TSH), free triiodothyronine (FT3), free thyroxine (FT4), alanine aminotransferase (ALT), aspartate aminotransferase (AST), total bilirubin (TB), albumin (A), and choline esterase (CHE) were compared.

1.3. Results

Thyroid hormone levels differed significantly across chronic liver disease stages. Compared with the chronic hepatitis group, ALT was significantly decreased in the compensated and decompensated stages of liver cirrhosis and in the acute-on-chronic liver failure and chronic liver failure groups, whereas ALT was significantly higher in the acute-on-chronic and chronic liver failure groups than in the decompensated stage of liver cirrhosis. Compared with the chronic hepatitis group, TB was significantly increased and A and CHE were significantly decreased in the acute-on-chronic liver failure and chronic liver failure groups. TSH, FT3, and FT4 levels in the chronic liver failure group were significantly lower than those in the chronic hepatitis and liver cirrhosis groups. The acute-on-chronic and chronic liver failure groups had higher Child-Pugh scores compared to the compensated and decompensated liver cirrhosis groups. Drug-induced liver injury showed the most significant ALT and AST increases and the most significant TSH decrease, whereas alcohol-induced liver injury demonstrated the most significant A and CHE decreases. In Spearman correlation analysis, FT4 was not correlated with Child Pugh score (r=0.1038, P=0.2173), whereas TSH and FT3 were negatively correlated with Child Pugh score (r=-0.2102, P=0.0118; r=-0.2343, P=0.0048).

1.4. Conclusion

Monitoring thyroid hormone indicators such as TSH and FT3 in chronic liver disease is clinically meaningful for evaluating liver reserve and synthesis function.

2. Introduction

The thyroid gland produces two related hormones, thyroxine (T4) and triiodothyronine (T3). Through thyroid hormone receptor α and β development and differentiation, the body maintains metabolic homeostasis. Circulating T4 concentrations are approximately 20-fold higher than T3 concentrations. Both hormones are bound to plasma proteins, and the liver participates in thyroid hormone binding and excretion, as well as thyroid-binding globulin (TBG) synthesis. Moreover, T4 and T3 regulate the basal metabolic rate of all cells, including liver cells, thereby regulating liver metabolism [1,2]. Non-thyroidal illness syndrome (NTIS) is characterized by metabolic disorders that affect thyroid hormone levels, leading to non-thyroidal dysfunction [3], specifically, it is closely related to the prognosis of many critical and chronic diseases, such as tumours, sepsis, end-stage renal disease, and heart failure [4]. Notably, the

liver is an important thyroid hormone target organ, participating in thyroid hormone production, excretion, and peripheral deiodination, as well as TBG synthesis. When liver function is severely impaired, thyroid hormone levels change [5]. Importantly, studies have demonstrated that T3 concentration is closely related to non-alcoholic liver disease [6]. Mansour Ghanaei et al. [7]. Reported that patients with liver cirrhosis who had lower serum total T3 had a higher mortality rate [7]. Therefore, thyroid hormone concentrations may be related to liver disease severity.

To date, no definitive studies have evaluated correlations between FT4 and thyroid-stimulating hormone (TSH) levels and liver disease severity. Additionally, it remains unclear whether TSH, free triiodothyronine (FT3), free thyroxine (FT4), and liver injury severity are closely related, and how these parameters change in liver injury due to different reasons and at different times. This study examined biochemical indicators and TSH, FT3, and FT4 levels across groups with normal physical examination results, hepatitis B, compensated and decompensated liver cirrhosis, liver failure, and other hepatitis at different stages, to reflect changes in liver injury biochemical indices and thyroid hormone levels, and to explore patterns across liver injury types and liver failure due to different reasons.

3. Materials and Methods

3.1. Research Subjects

Overall, 255 patients with chronic liver diseases and 30 subjects with normal physical examination results were recruited from the Zhangye People's Hospital Affiliated to Hexi University, between January 2019 and October 2022. Among them, 79 patients had chronic hepatitis (31 cases of hepatitis B and 48 cases of other etiologies, including drug-induced, alcoholic, and autoimmune causes), 32 had compensated liver cirrhosis, 47 had decompensated liver cirrhosis, 97 had liver failure, and 48 had other types of hepatitis (drug-induced, alcoholic, and autoimmune). All patients signed an informed consent form. The clinical research data followed the Declaration of Helsinki standards and were approved by the hospital ethics committee.

Inclusion criteria were as follows: ① Diagnosis according to the guidelines for the prevention and treatment of chronic hepatitis B,8 the guidelines for the prevention and treatment of alcoholic liver disease,9 and the diagnostic and treatment guidelines for autoimmune hepatitis10; ② confirmation based on computed tomography, pathogenological examination, and pathological tissue examination, among others; ③ availability of complete clinical case data; and ④ patients or family members signed an informed consent form. Exclusion criteria were as follows: ① Previous history of endocrine diseases, such as thyroid, pituitary, and hypothalamus diseases; ② use of drugs that affect thyroid hormone metabolism (such as interferons, levothyroxine, and beta-blockers); and ③ severe diseases, such as tumours, kidney diseases, and heart diseases.

4. Methods

4.1. Data Collection

Patient data included age, sex, medical history, medication history, and relevant test results. The Child-Pugh scoring standard was used to assess liver reserve function in patients with liver cirrhosis. The Child-Pugh score was evaluated by three physicians with seniority of associate professor or higher, and the average score was taken as the final score.

4.2. Laboratory Test Indicators

From 8 p.m. on the day of admission, patients were required to fast. At approximately 7 a.m. the next day, blood samples (5 ml) were collected from a peripheral vein in the fasting state. Blood samples were incubated at room temperature for 30 min and centrifuged at 3000 rpm for 5 min. Serum after centrifugation was sent to the laboratory for detection using an automatic biochemical analyser (Abbott, Architectcil6200) (Reference range: TSH: 0.27–4.20 uIU/ml, FT3: 3.10–6.80 pmol/L, FT4: 12.00–22.00 pmol/L, alanine aminotransferase (ALT): 5–34 U/L, aspartate aminotransferase (AST): 5–34 U/L, total bilirubin (TB): 1.7–17.1 μmol/L, albumin (A): 35–40 g/L, cholinesterase (CHE): 4000–13000 U/L).

4.3. Statistical Analysis

Statistical analyses were conducted using the SPSS 24.0 software. Normal distribution data were expressed as $x \pm s$, while non-normal distribution data were represented by the median. One-way analysis of variance was used for comparisons among multiple groups, and the least significant difference t-test and nonparametric tests were implemented for multiple comparisons between groups. Statistical significance was set at $P < 0.05$. significant.

5. Results

Comparison of biochemical indicators and Child-Pugh scores among different severity groups and different etiological subgroups

Compared with the normal group, ALT and AST in the hepatitis group were significantly elevated. Relative to the hepatitis group, ALT and AST in the liver cirrhosis group and liver failure group were significantly decreased. Compared with the normal group, TB in the hepatitis group, liver cirrhosis group, and liver failure group was significantly increased, with the most significant increase in the liver failure group. In the liver cirrhosis decompensation group and liver failure group, A and CHE were significantly lower than those in the normal group and hepatitis group, and the liver cirrhosis compensated group, and the Child-Pugh score was higher in the liver failure group than in the liver cirrhosis compensated group and decompensation group ($P<0.05$) (Table 1). Compared with the normal group, liver injury caused by any reason led to ALT, AST, and TB elevation, with the most significant elevation in drug-induced liver injury; relative to the normal group, liver injury caused by any reason led to A and CHE decreases, with the most significant decreases in viral and alcoholic liver injury ($P<0.05$) (Table 2).

Comparison of TSH, FT3, and FT4 levels among different severity groups and different etiological subgroups

The TSH level in the liver failure group was lower than that in the hepatitis and liver cirrhosis groups, and decreased progressively with disease progression. FT3 and FT4 levels in the compensated liver cirrhosis, decompensated liver cirrhosis, and liver

failure groups were significantly lower than those in the normal group; moreover, FT3 and FT4 levels in the decompensated liver cirrhosis and liver failure groups were lower than those in the hepatitis and compensated liver cirrhosis groups. The decline was most pronounced in the liver failure group and followed a stepwise decreasing trend with disease progression ($P < 0.05$) (Table 3). When stratified by liver injury etiology, drug-induced liver injury showed the greatest decrease in TSH, FT3 levels decreased across all etiologies, and viral and alcoholic liver injury demonstrated the greatest decrease in FT4 compared with the normal group ($P < 0.05$) (Table 4).

Comparison of biochemical indicators and TSH, FT3, and FT4 levels in different stages of liver failure

ALT and AST levels in patients with liver failure were closely related to disease course, with the most marked increases observed in acute liver failure. ALT, AST, and TB levels were significantly lower in chronic liver failure than in acute liver failure, whereas A and CHE levels in chronic liver failure were lower than those in subacute liver failure ($P < 0.05$) (Table 5). TSH levels in patients with liver failure were lower than those in the normal group; nonetheless, TSH levels in subacute, acute-on-chronic, and chronic liver failure were higher than those in acute liver failure. FT4 levels in acute-on-chronic and chronic liver failure were lower than those in subacute liver failure ($P < 0.05$) (Table 6).

5.1. Correlation Analysis of TSH, FT3, and FT4 Levels with Child-Pugh Score

Spearman correlation analysis indicated that the FT4 level was not correlated with the Child-Pugh score ($r = 0.1038$, $P = 0.2173$). Conversely, TSH and FT3 levels were negatively correlated with the Child-Pugh score ($r = -0.2102$, $P = 0.0118$; and $r = -0.2343$, $P = 0.0048$, respectively).

6. Discussion

The liver is an important organ in thyroid hormone metabolism and a key site for the synthesis, transformation, degradation, and excretion of multiple hormones in the human body. Besides regulating metabolism, detoxification, immunity, and biological transformation, the liver controls the synthesis and metabolism of insulin-like growth factors, various hormone-binding proteins, and transport proteins, thereby playing a crucial role in thyroid hormone metabolism. The thyroid gland, the largest endocrine gland in the human body, secretes thyroid hormones that regulate growth, development, and basal metabolism through multiple mechanisms. Thyroid hormones are also important for maintaining normal liver function and bilirubin metabolism [5].

The liver is the main site of thyroid hormone metabolism, after which thyroid hormones are inactivated throughout the body. T4 secreted by the thyroid gland is mainly deiodinated by hepatic 5'-deiodinase to form active T3. Abnormal liver function may cause thyroid hormone disorders, leading to abnormal thyroid function. Notably, non-thyroidal diseases that shift thyroid hormone levels are called "NTIS". Several causes exist for this pathological change, including liver lesions, trauma, surgery, infection, renal failure, and heart failure. These primary diseases affect multiple links from the hypothalamus-pituitary-thyroid axis to peripheral tissues, resulting in abnormal thyroid hormone synthesis, transport, and metabolism [11]. Evaluating liver lesion severity through relevant indicators is a key concern in clinical research; therefore, studying liver lesion-related changes in thyroid hormone levels has important clinical significance for assessing liver lesion severity.

This study demonstrated that, compared with the normal group, ALT and AST levels were significantly increased in the hepatitis group, whereas these levels were significantly decreased in the liver cirrhosis and liver failure groups. TB in the hepatitis, liver cirrhosis, and liver failure groups was significantly higher than that in the normal group, with the largest increase in the liver failure group, suggesting a bilirubin-enzyme dissociation phenomenon. With disease progression, ALT and AST levels did not necessarily increase sharply; however, TB levels increased markedly, indicating severe hepatocyte injury with functional loss. The liver failure and liver cirrhosis decompensation groups had significantly lower A and CHE levels compared to the normal and hepatitis groups, and the Child-Pugh score in the liver failure group was higher than that in the liver cirrhosis compensation and decompensation groups. Overall, patient biochemical indicators exhibited a consistent upward or downward trend. Compared with the normal group, liver injury caused by any reason led to ALT, AST, and TB increases, with the drug-induced liver injury demonstrating the most significant increase. Compared with the normal group, liver injury caused by any reason caused a decrease in A and CHE, with alcohol-induced liver injury demonstrating the most significant decrease. Moreover, the liver failure group had lower TSH levels compared to the hepatitis and liver cirrhosis groups, which decreased with disease severity. The liver failure group had the most significant decrease in FT3 and FT4.

The liver is the main site for deiodination and conversion of T4 to T3. Protein-bound T3 and T4 are physiologically inactive; only FT3 and FT4 are biologically active.5 After liver lesions, hepatic deiodination and thyroid hormone degradation are directly affected, reducing conversion of T4 to T3 and lowering T3 levels. In liver cirrhosis, hepatocyte pathological changes lead to abnormal thyroid hormone inactivation and metabolism, causing low T3 and T4 syndrome with decreased FT3 and FT4 levels that continue to decline as the disease progresses. The liver failure group demonstrated a more marked decrease than the hepatitis and liver cirrhosis groups; nonetheless, no significant differences were observed among liver failure subgroups. The thyroid gland and liver interact in a complex manner, and these changes are related to liver disease severity. Liver function damage degree in patients with liver cirrhosis can be assessed by measuring serum TSH, T3, and T4 levels. Spearman correlation analysis showed that TSH and FT3 levels were negatively correlated with the Child-Pugh score, indicating that TSH and FT3 levels could predict liver cirrhosis severity and serve as indicators for liver damage severity.

Subgroup analysis by ethology showed that the TSH level decreased most markedly in patients with drug-induced liver injury,

whereas TSH levels in patients with viral, alcoholic, and autoimmune liver injuries exhibited no significant change compared with the normal group. FT3 levels decreased the least in patients with drug-induced liver injury, and the decrease in ALT levels was also the lowest; these results were consistent. This finding may reflect that a reduction in thyroid hormone FT3 decreases metabolism, thereby reducing protein consumption to help maintain normal physiological functions during disease. It has been reported that, in patients with liver cirrhosis and markedly reduced thyroid hormone levels, small-dose thyroid hormone therapy can effectively correct the low thyroid hormone state and may help eliminate abdominal distension, increase appetite, and improve liver function. In patients with liver failure, ALT and AST levels are closely related to disease course: ALT levels increased most markedly in acute liver failure, whereas ALT, AST, and TB levels in chronic liver failure were significantly lower than those in acute liver failure. In chronic liver failure with severe liver function damage, ALT and AST levels did not show significant abnormal increases. Levels of A and CHE were lower in chronic liver failure than in subacute liver failure. TSH levels in subacute, acute-on-chronic, and chronic liver failure were slightly increased compared with acute liver failure, but remained below the normal level. FT4 levels in chronic liver failure were lower than those in subacute liver failure.

During liver failure, liver function is severely impaired, and thyroid hormone deiodination metabolism becomes disordered. Conversion of T4 to T3 decreases, and hepatic synthesis of TBG decreases. Here, FT3 levels in patients with liver failure were significantly lower than those in other groups, and the decrease was more pronounced than that in FT4 levels. During liver failure, hepatocytes demonstrate severe impairment in coagulation factors and plasma protein synthesis and secretion, along with nutritional disorders, water-electrolyte metabolism disorders, and increased protein breakdown. Stress states can lead to decreased thyroid hormone levels.12 Therefore, TSH and FT3 levels change across liver disease stages, with differences between stages. TSH and FT3 levels gradually decreased as the disease progressed and were negatively correlated with the Child-Pugh score; with increasing disease severity, these measures may serve as predictors of liver cirrhosis severity and mortality in patients with liver cirrhosis.

In conclusion, the thyroid gland is an important endocrine human organ, and thyroid hormones participate broadly in substance metabolism. Thyroid dysfunction can also lead to abnormal liver function. The liver is a key metabolic and detoxification organ and a target organ of thyroid hormones. Liver diseases can cause abnormal thyroid function, and liver function impairment is associated with changes in thyroid hormone levels. Therefore, a close correlation and mutual influence exist between the two organs, indicating that liver disease specialists should screen thyroid function in patients with liver damage and closely monitor thyroid lesions and thyroid hormone level changes during liver damage treatment. These measures may help assess liver damage severity and guide the selection of more active and effective treatment plans for patients with liver disease.

7. Funding

This study was funded by grants from Hexi University President's Fund(2025YB044). Natural Science Foundation Project of Gansu Province(23JRRG0021).

Reference

1. Salas-Lucia F, Bianco AC. T3 levels and thyroid hormone signaling. Front Endocrinol (Lausanne). 2022; 13: 1044691.
2. CA Spencer. Laboratory Thyroid Tests: A Historical Perspective, Thyroid. 2023; 407-419.
3. L Langouche, A Jacobs, G Van den Berghe. Nonthyroidal Illness Syndrome Across the Ages, J Endocr Soc. 2019; 2313-2325.
4. S Sciacchitano, C Capalbo, C Napoli. Coluzzi, M. Rocco, Nonthyroidal Illness Syndrome: To Treat or Not to Treat? Have We Answered the Question? A Review of Metanalyses, Front Endocrinol (Lausanne). 2022.
5. MJ Ritter, I Amano, A N Hollenberg. Thyroid Hormone Signaling and the Liver, Hepatology. 2020; 742-752.
6. M Zhao, H Xie, H Shan. Development of Thyroid Hormones and Synthetic Thyromimetics in Non-Alcoholic Fatty Liver Disease, Int J Mol Sci. 2022.
7. F Mansour-Ghanaei, M Mehrdad, S Mortazavi. Decreased serum total T3 level in hepatitis B and C related cirrhosis by severity of liver damage, Ann Hepatol. 2012; 667-671.
8. Wong GL, Lemoine M. The 2024 updated WHO guidelines for the prevention and management of chronic hepatitis B: Main changes and potential implications for the next major liver society clinical practice guidelines. J Hepatol. 2025; 82(5): 918-925.
9. European Association for the Study of the Liver (EASL); European Association for the Study of Diabetes (EASD); European Association for the Study of Obesity (EASO). EASL-EASD-EASO Clinical Practice Guidelines on the management of metabolic dysfunction-associated steatotic liver disease (MASLD). J Hepatol. 2024; 81(3): 492-542.
10. Heneghan MA, Lohse AW. Update in clinical science: Autoimmune hepatitis. J Hepatol. 2025; 82(5): 926-937.
11. S Vincken, H Reynaert, J Schiettecatte. Velkeniers, Liver cirrhosis and thyroid function: Friend or foe?, Acta Clin Belg. 2017; 85-90.
12. Y Tu, F Ji, J Yang. Weighted thyroid-stimulating hormone disturbance in prognosis of hepatitis B virus-related acute-on-chronic liver failure, Hepatol Res. 2023.