E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/16.02.113

Research Article

Prevalence of Thyroid Dysfunction in Patients with Gallstone Disease: A Cross-Sectional Study from a Tertiary Care Hospital in South India

A. Kasturi[1], Channanna C.[2*], Nikhil Kumar Das[3]
[1]Junior Resident-3, Department of General Surgery, PES Institute of Medical Sciences and Research.
[2*,3]Professor, Department of General Surgery, PES Institute of Medical Sciences and Research.
Corresponding Author: Dr. A. Kasturi
Junior Resident-3, Department of General Surgery, PES Institute of Medical Sciences and Research.
Email: kasturiandelageneralsurgeon@gmail.com
Received: 22.05.26, Revised: 20.06.26, Accepted: 24.07.26

ABSTRACT

Background: Gallstone disease (GSD) is a common hepatobiliary condition in India, and emerging evidence suggests thyroid dysfunction, particularly subclinical hypothyroidism, may contribute to its pathogenesis through altered lipid metabolism, delayed biliary emptying, and reduced gallbladder motility. Indian studies have reported thyroid dysfunction in 17-42% of gallstone patients, yet thyroid screening is not routinely performed in this population.

Aim: To determine the prevalence of thyroid dysfunction, particularly hypothyroidism, among patients diagnosed with gallstone disease at a tertiary care hospital.

Methods: This cross-sectional observational study was conducted over 18 months at the Department of General Surgery, PES Institute of Medical Sciences and Research (PESIMSR), Kuppam. Seventy-nine adults with ultrasound-confirmed cholelithiasis were recruited by convenience sampling. Patients with known thyroid disease, prior thyroidectomy, or thyroid-altering medication were excluded. Serum T3, T4, and TSH were estimated for all participants, and data were analysed using SPSS v23.0, with chi-square and ANOVA tests applied as appropriate ($p<0.05$ significant).

Results: The majority of participants were female (65.82%) and aged 41-50 years (26.58%). Overall, 82.28% of patients were euthyroid, 11.39% had subclinical hypothyroidism, and 6.33% had overt hypothyroidism. Thyroid dysfunction was more prevalent among females (23.08% combined) than males (7.41%), and was most frequent in the 41-50 year age group. Uncomplicated gallstone disease carried the highest burden of thyroid dysfunction (20.64%) compared with gallstones with common bile duct stones (10.0%) and acute calculous cholecystitis (0%).

Conclusion: Nearly one in five patients with gallstone disease demonstrated some form of thyroid dysfunction, predominantly subclinical hypothyroidism among middle-aged women. Routine thyroid function screening in gallstone patients, particularly in high-risk subgroups, may aid early detection and holistic management.

Keywords: Gallstone Disease, Cholelithiasis, Hypothyroidism, Subclinical Hypothyroidism, Thyroid Dysfunction, Thyroid Stimulating Hormone.

INTRODUCTION

Gallstone disease (GSD), or cholelithiasis, is a major burden in gastrointestinal surgical practice across India.[1] Its incidence has risen steadily with increasing use of ultrasonography, changing dietary habits, sedentary lifestyles, and a surge in metabolic disorders such as obesity and diabetes mellitus.[2] In India, the prevalence of gallstone disease ranges from 2% to 29%, with a higher incidence among females (65%) than males (35%), giving a male-to-female ratio of 1:1.88. The condition is most common in the fourth and fifth decades of life, with a mean age of presentation of 43.56 years.[3]

Gallstones are broadly classified into cholesterol, black pigment, and brown pigment stones; Indian cohorts show a relatively higher proportion of pigment stones than Western populations, although the proportion of cholesterol stones is rising with urbanization.[4] Recognised risk factors include female gender, obesity, multiparity, rapid weight loss, and genetic predisposition.[5] Recent evidence suggests that endocrine dysfunction, particularly of the thyroid gland, may also contribute to gallstone pathogenesis.[6]

Thyroid hormones — thyroxine (T4) and triiodothyronine (T3) — are key regulators of lipid metabolism, hepatic cholesterol turnover, and bile secretion, and also influence

gallbladder motility and sphincter of Oddi relaxation through β-adrenergic mechanisms.[7] In hypothyroid states, delayed biliary emptying, bile stasis, and altered bile composition predispose to gallstone formation.[8] Indian studies report a prevalence of hypothyroidism ranging from 10-33% among patients diagnosed with gallbladder stones.[9]

Dangi C et al. found that 41.9% of patients undergoing cholecystectomy for gallstone disease had thyroid dysfunction, predominantly subclinical hypothyroidism.[10] Similarly, Kulkarni V et al. (Central India), Koujalagi RS et al. (Belagavi), and Patil V et al. (Davangere) observed thyroid dysfunction in 17.3%, 29%, and 38% of gallstone cases respectively.[11,12,13] These findings suggest that thyroid dysfunction, particularly subclinical hypothyroidism which often goes undiagnosed, may be an important but overlooked risk factor for gallstone disease in the Indian population.

Physiologically, hypothyroidism is associated with increased hepatic cholesterol biosynthesis, reduced bile flow, and impaired conversion of cholesterol to bile acids; it also reduces gallbladder contractility and sphincter of Oddi relaxation, leading to bile stagnation.[14] Molecular studies have further shown differential gene expression in thyroid dysfunction, including upregulation of TRβ in hypothyroidism and altered expression of LXRα, RXR, and CYP7A1 in hyperthyroidism, contributing to lithogenesis.[15] Despite this evidence, thyroid function testing is not routinely performed in Indian gallstone patients undergoing cholecystectomy, reflecting a gap in preventive gastro-endocrine care.[16]

Gallstone disease itself remains one of the most common hepatobiliary conditions worldwide, affecting an estimated 6.1% of the population, with higher prevalence in females (7.6%) than males (5.4%) and marked regional variation — highest in South America (11.2%) and lowest in Asia (5.1%).[17] Cholesterol stones account for 75-90% of cases in Western populations, while black and brown pigment stones together comprise the remainder and are more common with hemolytic disorders and biliary infection respectively.[18] Elevated TSH has also been shown to influence hepatic lipid metabolism through body-brain signalling pathways relevant to lithogenesis.[19] In central India, demographic and risk-factor profiling of gallstone patients has similarly highlighted the contribution of metabolic and endocrine factors to disease burden.[20]

From a mechanistic standpoint, thyroid hormones regulate hepatic 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase activity and the conversion of cholesterol to bile acids via cholesterol 7α-hydroxylase (CYP7A1); reduced thyroid hormone availability in hypothyroidism lowers CYP7A1 activity, favouring cholesterol-supersaturated, lithogenic bile.[20] Concurrently, hypothyroidism slows gallbladder emptying and prolongs gallbladder residence time for bile, allowing greater opportunity for cholesterol crystal nucleation and stone growth.[14] These complementary hepatic and motor effects provide biological plausibility for the epidemiological association reported between thyroid dysfunction and gallstone disease across multiple Indian and international cohorts.

Given this background, the present study was undertaken to determine the prevalence of thyroid dysfunction among patients diagnosed with gallstone disease at PES Institute of Medical Sciences and Research (PESIMSR), Kuppam, and to describe the pattern of thyroid abnormalities and their clinico-demographic correlates.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional observational study was conducted in the Department of General Surgery, PES Institute of Medical Sciences and Research (PESIMSR), Kuppam, Andhra Pradesh, a tertiary care teaching hospital, over a period of 18 months (May 2023 to May 2024).

Study Population and Sample Size

The study population comprised adult patients (aged above 18 years) diagnosed with gallbladder stones, confirmed by ultrasonography. A minimum of 79 participants was targeted based on prevalence estimates and sample size calculation for cross-sectional studies, and recruited using convenience sampling.

Inclusion and Exclusion Criteria

Patients aged above 18 years with sonographically confirmed cholelithiasis were included. Patients with a known history of thyroid disease or prior thyroid treatment, a history of thyroidectomy, or use of medications known to affect thyroid function (such as phenytoin, carbamazepine, metoclopramide, amiodarone, and lithium) were excluded.

Data Collection and Procedure

After institutional ethical clearance, patients presenting to the outpatient and emergency departments who satisfied the inclusion and exclusion criteria were recruited following written informed consent. Data were collected using a structured case proforma capturing demographic details, symptoms and signs suggestive of hypothyroidism, physical examination findings, routine blood investigations, ultrasound abdomen findings (number, size, and location of gallstones), and thyroid function tests (T3, T4, and TSH) to assess thyroid status.

Statistical Analysis

Data were entered into Microsoft Excel 2007 and analysed using SPSS version 23.0 (Chicago, IL, USA). Categorical variables were expressed as frequencies and percentages, and continuous variables as mean ± standard deviation. The chi-square test was applied for categorical variables and ANOVA for continuous variables, with a p-value <0.05 considered statistically significant.

RESULTS

A total of 79 patients with ultrasound-confirmed gallstone disease were enrolled in the study. The majority of participants fell within the 41-50 years age group (26.58%), followed closely by those aged 31-40 years (25.32%) and 51-60 years (24.05%). Fewer participants were in the younger (21-30 years, 10.13%) and older (>60 years, 13.92%) age groups (Table 1).

Table 1: Age Distribution of Participants

Age Group	Frequency (N)	Percentage (%)
21-30 years	8	10.13
31-40 years	20	25.32
41-50 years	21	26.58
51-60 years	19	24.05
> 60 years	11	13.92
Total	**79**	**100.00**

A clear female predominance was observed, with 65.82% of participants being female compared to 34.18% male, giving a female-to-male ratio of approximately 1.9:1 (Table 2).

Table 2: Gender Distribution of Participants

Gender	Frequency, N (%)
Male	27 (34.18%)
Female	52 (65.82%)
Total	**79 (100.00%)**

On thyroid function testing, the majority of participants (82.28%) were euthyroid. Subclinical hypothyroidism was present in 11.39% of participants, while 6.33% had overt hypothyroidism (Table 3). Correspondingly, 75.95% of participants had T3 levels within the normal range (2.3-4.1 pg/mL), while 22.78% had subnormal T3 levels; 96.20% had normal T4 levels (0.8-1.8 ng/dL); and 87.34% had normal TSH levels (0.4-4 mIU/L), with 12.66% showing elevated TSH (>4 mIU/L).

Table 3: Distribution of Thyroid Status among Participants

Thyroid Status	Frequency, N (%)
Euthyroid	65 (82.28%)
Subclinical Hypothyroidism	9 (11.39%)
Overt Hypothyroidism	5 (6.33%)
Total	**79 (100.00%)**

On stratifying thyroid status by gender, subclinical hypothyroidism was seen in 7.41% of males and 13.46% of females, while overt hypothyroidism was observed exclusively among females (9.62%); no male participant had overt hypothyroidism (Table 4). Thyroid dysfunction was also more frequent among participants in the 41-50 year age group (subclinical hypothyroidism 14.29%, hypothyroidism 4.76%) than in other age brackets.

Table 4: Association between Gender and Thyroid Status

Gender	Subclinical Hypothyroidism N (%)	Euthyroid N (%)	Hypothyroidism N (%)	Total N
Male	2 (7.41%)	25 (92.59%)	0 (0.00%)	27
Female	7 (13.46%)	40 (76.92%)	5 (9.62%)	52

With respect to clinical diagnosis, gallstones alone were the most common finding (79.75%), followed by gallstones with common bile duct (CBD) stones (12.66%) and acute calculous cholecystitis (7.59%). Thyroid dysfunction was most frequent among patients with uncomplicated gallstones (12.70% subclinical hypothyroidism, 7.94% overt hypothyroidism), lower among those with gallstones and CBD stones (10.00% subclinical hypothyroidism, no overt hypothyroidism), and absent among patients with acute calculous cholecystitis, all of whom were euthyroid (Table 5).

Table 5: Association between Clinical Diagnosis and Thyroid Status

Diagnosis	Subclinical Hypothyroidism N (%)	Euthyroid N (%)	Hypothyroidism N (%)	Total N
Gallstone alone	8 (12.70%)	50 (79.37%)	5 (7.94%)	63
Gallstone with CBD stone	1 (10.00%)	9 (90.00%)	0 (0.00%)	10
Acute Calculous Cholecystitis	0 (0.00%)	6 (100.00%)	0 (0.00%)	6

DISCUSSION

This cross-sectional study assessed the prevalence of thyroid dysfunction among 79 patients with ultrasound-confirmed gallstone disease at a tertiary care hospital in South India, using serum T3, T4, and TSH estimation alongside clinico-demographic correlation.

Age Distribution

In the present study, the majority of patients were middle-aged, with the highest proportion in the 41-50 years group (26.58%), followed by the 31-40 years (25.32%) and 51-60 years (24.05%) brackets. Comparable age trends were noted by Dangi C et al., where 32.6% of participants were aged 40-49 years and 24.4% were aged 30-39 years.[10] Koujalagi RS et al. similarly reported a substantial proportion of patients in the older age group (34% aged 61-80 years and 28% aged 41-60 years), reinforcing the vulnerability of individuals over 40 years of age.[12] Patil V et al. found that the 31-60 years age group accounted for 72% of cases, further supporting the middle-age dominance observed in the present data.[13] Singh AK et al. observed that 75% of patients were aged 41 years and above.[4] Taken together, these findings consistently indicate that the burden of gallstone disease predominantly affects individuals between 30 and 60 years, likely reflecting the convergence of hormonal, metabolic, and lifestyle factors that accumulate with age.

Gender Distribution

A clear female predominance was observed in the present study (65.82% female versus 34.18% male), consistent with the well-documented higher prevalence of gallstone disease among women.[5] Dangi C et al. reported that 61.2% of their study population was female,[10] while Singh AK et al. reported 60% female participants,[4] and Patil V et al. documented an even more marked disparity, with females comprising 82% of their sample.[13] Koujalagi RS et al. reported a comparatively narrower gender gap (60% female, 40% male), though female predominance persisted.[12] This recurring pattern across studies likely reflects the combined influence of estrogen-mediated cholesterol excretion into bile, multiparity, and possibly greater healthcare-seeking behaviour among women, and underscores the importance of gender-sensitive screening strategies.

Thyroid Status and Hormone Profile

In the present study, 82.28% of participants were euthyroid, 11.39% had subclinical hypothyroidism, and 6.33% had overt hypothyroidism. This pattern of predominant euthyroidism, with a meaningful minority

showing thyroid dysfunction, is broadly consistent with the literature, although the proportion of dysfunction in the present cohort was somewhat lower than in several other Indian studies. Dangi C et al. reported that only 58.1% of participants were euthyroid, with 29.1% having subclinical hypothyroidism and 12.8% having clinical hypothyroidism — a substantially higher burden of thyroid dysfunction than observed here.[10] Koujalagi RS et al. documented 71% euthyroid, 23% subclinical hypothyroid, and 6% clinical hypothyroid participants,[12] while Patil V et al. found 62% euthyroid, 26% subclinical hypothyroid, and 12% clinical hypothyroid participants.[13] Kulkarni V et al., in a Central Indian cohort, reported thyroid dysfunction in 17.3% of gallstone patients, closer to the 17.72% combined prevalence of subclinical and overt hypothyroidism observed in the present study.[11] These differences may reflect variation in dietary iodine intake, population-level nutritional status, sample size, or regional prevalence of autoimmune thyroiditis across the different study settings.[16]

Gender and Age-Related Variation in Thyroid Dysfunction

Thyroid dysfunction was more prevalent among female participants (23.08% combined subclinical and overt hypothyroidism) compared to males (7.41%), with overt hypothyroidism observed exclusively in females. This is consistent with the known female preponderance of autoimmune and age-related thyroid disorders, and mirrors the higher rates of thyroid dysfunction reported among women in the comparative literature.[4] Age-stratified analysis also showed that thyroid dysfunction, especially subclinical hypothyroidism, was more frequent in middle-aged participants, particularly the 41-50 years group, in keeping with the physiological decline in thyroid reserve with advancing age.[15]

Diagnosis and Thyroid Dysfunction

Notably, thyroid dysfunction was concentrated among patients with uncomplicated gallstone disease (20.64% combined subclinical and overt hypothyroidism) rather than among those with gallstones and CBD stones (10.00%) or acute calculous cholecystitis (0%, all euthyroid). This pattern suggests that thyroid dysfunction, and hypothyroidism in particular, may be more closely associated with the chronic, indolent process of gallstone formation — through sustained biliary stasis and altered bile composition — rather than with acute inflammatory events such as cholecystitis, which are more likely triggered by mechanical obstruction and secondary infection regardless of thyroid status.[14] This observation aligns with the proposed mechanism by which hypothyroidism promotes lithogenesis through reduced bile acid synthesis, impaired gallbladder motility, and delayed biliary emptying over a prolonged period rather than as an acute event.[18,19]

Clinical Implications

These findings reinforce a possible contributory link between thyroid dysfunction, particularly subclinical hypothyroidism, and gallstone disease, especially among middle-aged women with uncomplicated gallstones. Although the majority of patients in this cohort were euthyroid, nearly one in five patients demonstrated some form of thyroid dysfunction, a proportion large enough to warrant clinical attention. Incorporating thyroid function testing as part of the routine work-up for gallstone disease, particularly in high-risk subgroups such as middle-aged women, could facilitate early identification of subclinical hypothyroidism, allow for timely correction, and potentially reduce the risk of gallstone recurrence following treatment.[20] Limitations of this study include its single-centre, cross-sectional design, modest sample size, and use of convenience sampling, which may limit generalisability; larger multi-centric studies with longitudinal follow-up are needed to establish causality between thyroid dysfunction and gallstone formation.

Strengths and Future Directions

The principal strength of this study lies in its systematic, protocol-driven assessment of thyroid function using all three key parameters (T3, T4, and TSH) in every enrolled patient, rather than relying on TSH alone, allowing more granular classification into euthyroid, subclinical hypothyroid, and overtly hypothyroid categories. This comprehensive biochemical characterisation, combined with detailed clinico-demographic correlation, adds to the relatively limited body of Indian data specifically examining thyroid status in surgical gallstone patients. Future research should ideally adopt a prospective, multi-centric design with a larger sample size, longer follow-up to capture post-cholecystectomy outcomes and gallstone recurrence rates, and inclusion of anti-thyroid peroxidase antibody testing to characterise the contribution of autoimmune thyroiditis. Cost-effectiveness analyses of universal thyroid

screening in gallstone patients would also help translate these epidemiological observations into actionable clinical policy.

CONCLUSION

The present study demonstrates that thyroid dysfunction, especially subclinical hypothyroidism, is relatively common among patients with gallstone disease, with the highest prevalence observed in middle-aged women and among those with uncomplicated gallstones. While the majority of patients were euthyroid, the presence of thyroid abnormalities in a notable proportion of participants suggests a potential contributory role in gallstone formation. Incorporating routine thyroid function testing into the diagnostic evaluation of gallstone patients, particularly in high-risk groups, may facilitate early intervention and potentially reduce disease-related complications.

REFERENCES

1. Stinton LM, Shaffer EA. Epidemiology of Gallbladder Disease: Cholelithiasis and Cancer. Gut Liver. 2012 Apr 15;6(2):172-87.
2. Nair KP, S. SG, S. V, Manickam R. Thyroid function and gallstone disease: is there an association? Int Surg J. 2021 Apr 28;8(5):1670.
3. Bansal A, Akhtar M, Bansal AK. A clinical study: prevalence and management of cholelithiasis. Int Surg J. 2014;1(3):134-9.
4. Singh AK, Kaul RK, Singh NK, Sinha SP. Prevalence of Thyroid Disorders in Patients of Gall Bladder Stones: A Prospective Study. Ann Int Med Dent Res. 2018 Jun 24;4(4).
5. Pak M, Lindseth G. Risk Factors for Cholelithiasis. Gastroenterol Nurs. 2016 Jul;39(4):297-309.
6. Ravi PC, Thugu TR, Singh J, Dasireddy RR, Kumar SA, Isaac NV, et al. Gallstone Disease and Its Correlation With Thyroid Disorders: A Narrative Review. Cureus. 2023 Sep 12;15(9):e45116.
7. Liao C, Huang P, Chien H, Lin T, Yeh C, Lin K. Effects of Thyroid Hormones on Lipid Metabolism Pathologies in Non-Alcoholic Fatty Liver Disease. Biomedicines. 2022 May 25;10(6):1232.
8. Dhoka G, Kumar NA, Yatheendranathan GD. Gall stones and hypothyroidism: a double jeopardy. Int Surg J. 2021 Jul 28;8(8):2307.
9. Duntas LH, Brenta G. A Renewed Focus on the Association Between Thyroid Hormones and Lipid Metabolism. Front Endocrinol. 2018 Sep 3;9:511.
10. Dangi C, Mehta N, Patel MV, Labana U, Patel Y, Patel DD, et al. Prevalence of Thyroid Dysfunction in Patients with Gallstone Disease: A Cross-sectional Study. JCDR. 2023;17(10):PC01-PC03.
11. Kulkarni V, Ramteke H, Lamture Y, Nagtode T, Gharde P, Rewale V. Correlation Between Hypothyroidism and Gallstone Disease in Central India. Cureus. 2024 Mar 23;16(3):e56799.
12. Koujalagi RS, Karagi V, Gogate AS, C. A. Prevalence of undiagnosed hypothyroidism in patients with gall bladder stones in Belagavi. Int Surg J. 2021 Dec 28;9(1):124.
13. Patil V, Kailas CT, Sagar K. A study on prevalence of thyroid dysfunction in patients diagnosed with cholelithiasis. Int J Sci Res. 2023 Mar;12(3):17-18.
14. Laukkarinen J, Sand J, Nordback I. The Underlying Mechanisms: How Hypothyroidism Affects the Formation of Common Bile Duct Stones - A Review. HPB Surg. 2012 Sep 19;2012:1-7.
15. Wang Y, Yu X, Zhao Q, Zheng S, Qing W, Miao C, et al. Thyroid dysfunction, either hyper or hypothyroidism, promotes gallstone formation by different mechanisms. J Zhejiang Univ Sci B. 2016 Jul;17(7):515-25.
16. Tabassum S, Durishetty S, Uddin MS, Komal T, Anusha A. A review on comprehensive consequences of gall stones as concomitant disease in hypothyroidism (CCCCH). Asian J Res Rep Endocrinol. 2023;6(1):151-156.
17. Sun H, Warren J, Yip J, Ji Y, Hao S, Han W, et al. Factors Influencing Gallstone Formation: A Review of the Literature. Biomolecules. 2022 Apr 6;12(4):550.
18. Thamer SJ. Pathogenesis, Diagnosis and Treatment of Gallstone Disease: A Brief Review. BCS. 2022 Apr 1;1(2):70-7.
19. Wang X, Wu Z, Liu Y, Wu C, Jiang J, Hashimoto K, et al. The role of thyroid-stimulating hormone in regulating lipid metabolism: Implications for body-brain communication. Neurobiol Dis. 2024 Oct;201:106658.
20. Patel AM, Yeola M, Mahakalkar C. Demographic and Risk Factor Profile in Patients of Gallstone Disease in Central India. Cureus. 2022 May 14;14(5):e24993.