

# Does Hypothyroidism Promote Gallstone Formation?

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## Abstract

**Introduction:** Gallstone disease is a very common disorder affecting humans, particularly fertile females. Although there are numerous established risk factors in the development of gallstones, hypothyroidism is a commonly associated entity seen in clinical practice, not well established in literature.

**Purpose:** The aim of this study is to find out the association of hypothyroidism with gallstone formation.

**Methods:** A total of 124 patients with gallstone disease were included in the study. Thyroid function tests were performed in all of them. The incidence of hypothyroidism was found out and compared with the established incidence of hypothyroidism in adult population. The results were compared statistically.

**Results:** Of the 124 patients included in the study, 28.5% were found to be hypothyroid. Based on a national study, the prevalence of hypothyroidism in general population was 10.95%. Statistically, hypothyroidism was found to be significantly higher in patients with gallstone disease.

**Conclusion:** The incidence of hypothyroidism is significantly higher in patients with gallstone disease. Hence, thyroid testing is recommended in these patients as it has anesthetic implications.

**Key words:** Anesthetic complications, Gallstone disease, Hypothyroidism, Thyroid function tests

## INTRODUCTION

Gallstone disease is the most common disorder affecting the biliary system and is a relatively common problem in patients presenting to the outpatient. Through the ages, there have been various risk factors that are associated with gallstone formation such as gender, obesity, pregnancy, dietary factors, Crohn's disease, terminal ileal resection, gastric surgery, hereditary spherocytosis, sickle cell diseases, and thalassemia. In the course of clinical practice, it was observed that a number of patients with gallstones had hypothyroidism in their medical history. Although it appeared to be a constant finding not many previous studies<sup>[1-3]</sup> on this particular topic was found, the objective

of this study was to identify the possible relation between diagnosed hypothyroidism and gallstone disease.

## MATERIALS AND METHODOLOGY

This is a prospective study done from October 2015 to August 2017. This study included patients, with cholelithiasis or choledocholithiasis diagnosed through radiological studies, who were admitted for the same in the department of general surgery in our hospital. After excluding patients with a history of medical or surgical thyroid intervention, the patients were investigated by analyzing blood samples for thyroid function tests. According to the hospital standard values, patients with thyroid stimulation hormone (TSH) between 0.35 and 4 IU/ml were considered euthyroid, TSH >4 as hypothyroid and TSH <0.35 as hyperthyroid.

### Hypothyroidism and Its Association with Cholelithiasis

The pathogenesis of gallstones is a complex process involving mechanisms affecting bile content and bile flow. There are

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various factors that contribute to the formation of gallstones in hypothyroid patients.<sup>[2]</sup> Moreover, current investigations fail to differentiate primary from secondary common bile duct stones developing in hypothyroidism. However, hypothyroidism possibly increases the risk of primary as well as gallbladder-originated stones through various mechanisms. In hypothyroidism, the lack of thyroxine

1. Produces a decrease in liver cholesterol metabolism<sup>[4]</sup> which results in supersaturation of bile cholesterol. This impairs gallbladder motility,<sup>[5]</sup> contractility,<sup>[6]</sup> and filling,<sup>[7]</sup> thus producing retention of cholesterol crystals and nucleation and growth of gallstones;<sup>[5]</sup>
2. Produces impairment of precipitate clearance due to decreased bile secretion from hepatocytes;<sup>[8]</sup>
3. Reduces sphincter of Oddi relaxation<sup>[9,10]</sup> resulting in delayed bile flow,<sup>[11]</sup> and hence, the formation and accumulation of ductal stones.<sup>[12]</sup>

## RESULTS

Based on the above-mentioned methodology, blood investigations were sent for patients and the results interpreted. A total of 124 patients were tested, 4 were found to be in hyperthyroid state, 85 euthyroid, and 35 hypothyroid were identified. It accounts to 3.2%, 68.5%, and 28.5%, respectively [Figure 1]. A Chi-square test was done with comparison to the epidemiological study in eight cities of India<sup>[13]</sup> [Table 1]. It was found to be statistically significant ( $P > 0.01$ ).

T3 studies with a normal parameter of 2.35–4.2  $\mu$ IU/mL were considered normal,  $>4.2 \mu$  IU/mL high, and  $<2.35 \mu$  IU/mL low serum fT3 levels. Of the 81 patients tested for T3 levels, 11 were found to have low T3, 68 normal, and 2 high levels of serum T3. It accounts to 13.6%, 84%, and 2.5%, respectively. Low serum T4 (level  $< 0.8 \mu$  IU/mL) was found in 9.7% of the population.

## DISCUSSION

A few studies have been conducted in the past to establish the connection between thyroid function and cholelithiasis.<sup>[1-3]</sup> In our study, we analyzed the association of cholelithiasis with hypothyroidism. We then compared it with preexisting prevalence data.

Overall, 143 patients were included in this study, of which 124 thyroid profile was taken and interpreted using standard data analysis.

Of the 124 patients with cholelithiasis in the thyroid study, 28.2% were in hypothyroid, 3.2% in hyperthyroid, and 68.5% in euthyroid states.

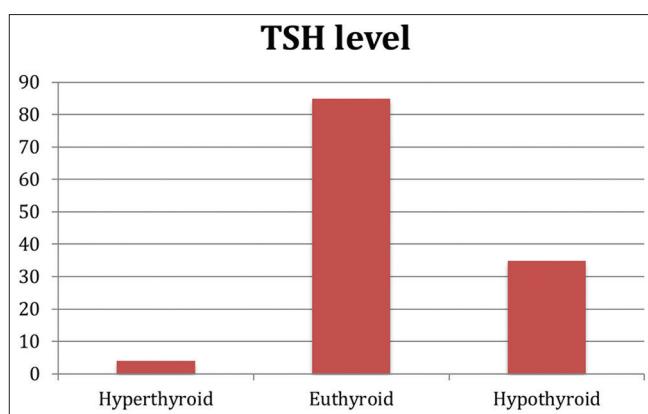


Figure 1: Thyroid stimulating hormone levels

Table 1: Statistical analysis

Thyroid status	TSH in cholelithiasis and general population		
	Observed N	Expected N	
Hypothyroid	35 14.06 (31.16)	587 607.94 (0.72)	622
Euthyroid	85 107.49 (4.71)	4669 4646.51 (0.11)	4754
Hyperthyroid	4 2.44 (0.99)	104 105.56 (0.02)	108
	124	5360	5484

$\chi^2=37.719$  df=2  $\chi^2/\text{df}=18.86$   $P (\chi^2>37.719)=0.0000$ . Expected values are displayed in *italics*. Individual  $\chi^2$  values are displayed in parentheses, TSH: Thyroid stimulation hormone

Based on “a study of prevalence of hypothyroidism in adults: An epidemiological study in eight cities of India.”<sup>[13]</sup> The national prevalence data were acquired and were compared with our study.

An overall of 5360 patients were studied. The national prevalence of hyperthyroidism was noted to be 1.9%, i.e., 104 patients out of 5360, and 587 patients were found to have hypothyroidism which accounted for 10.95% of the general population.

Whereas, in our study of cholelithiasis patients, it was found to be 28.2% which is statistically significant with  $P < 0.01$ . This showed a significant association of cholelithiasis with hypothyroidism.

Furthermore, based on the national study,<sup>[13]</sup> it was found that thyroid levels in Chennai were 9.77% which is 36 patients out of 5360 as the coastal regions were usually places of less incidence. However, our study showed 28.2% in Chennai, thus showing an even greater significance.

Hypothyroidism reduces oxygen consumption and affects hemodynamic, cardiac, respiratory, and renal functions

because of low metabolism. Myocardial dysfunction reduced ventilatory responses to hypoxia and hypercapnia, abnormal baroreceptor function, and decreased plasma volume, may be present in hypothyroidism and impaired drug metabolism adversely affects anesthesia. Hence, for safe anesthetic management of these patients, hypothyroidism needs to be identified preoperatively.<sup>[14]</sup>

Hence, based on the findings of our study, it can be established that hypothyroidism is a risk factor to the formation of gallstones. The need to evaluate the thyroid status in patients with gallstone disease is absolutely essential, as surgery on a hypothyroid patient could lead to complications pertaining to the anesthesia.<sup>[14]</sup>

## CONCLUSION

There is a definite association between cholelithiasis and hypothyroidism. Thyroid testing in all patients with gallstones is recommended because hypothyroidism may be a predisposing factor for stone formation. Furthermore, early detection and treatment of hypothyroidism can prevent complications during surgery.

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