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Original research article

Cholelithiasis and Hypothyroidism: The synchrony

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Abstract

Objective: To know the prevalence of hypothyroidism with cholelithiasis.
Methodology: A cross-sectional observational study of 142 cases was conducted at ESICMC & PGIMSR Rajajinagar, Bangalore. Study period was from 2023 January to 2023 September. All patients who presented to our department with symptoms of cholelithiasis were included in the study.
Results: Among the study group 69.7% i.e.; 99 patients are females and 30.3% i.e.; 43 patients are males. Among the study group 57.7% i.e.; 82 patients were in the age group of >40 years. Among the study group 18% patients had hypothyroidism and 87% were euthyroid.
Conclusion: There is an increase in prevalence of hypothyroidism in cholelithiasis in this study. The prevalence was more among age > 40 years age group. That is patients more than 40 years of age with cholelithiasis are more likely to have hypothyroidism. This increase in prevalence could have an effect on the diagnostic and therapeutic workup of cholelithiasis patients. Hypothyroidism should be considered as a separate risk factor like age, sex, obesity in cholelithiasis patient and early treatment of subclinical hypothyroidism may help prevent the burden of cholelithiasis.
Keywords: Cholelithiasis, hypothyroidism, sphincter of Oddi dysfunction

Introduction

Gallstones are the most common form of biliary pathology, characterized by the formation of small, hard crystalline stones within the gallbladder. These stones primarily develop from cholesterol, calcium salts, and bile pigments, and their presence can lead to various complications in the biliary system. The pathogenesis of gallstones involves several contributing factors, including bile supersaturation, stasis due to dysfunction of the sphincter of Oddi, and imbalances in the chemical composition of bile.

In parallel, thyroid disorders represent a prevalent endocrine pathology, with hypothyroidism being particularly significant due to its influence on lipid metabolism. Hypothyroidism results in elevated cholesterol levels by reducing the activity of the enzyme HMG-CoA reductase, a key regulator of cholesterol synthesis. This metabolic dysfunction leads to hypercholesterolemia and dyslipidemia, which in turn contribute to bile supersaturation-a primary factor in the formation of cholesterol gallstones.

Furthermore, hypothyroidism is associated with decreased motility of the gallbladder and impaired relaxation of the sphincter of Oddi, which leads to reduced bile clearance and stasis. These mechanisms create an environment conducive to the prolonged accumulation of bile, increasing the likelihood of gallstone formation. Given the intertwined roles of thyroid function and biliary pathology, understanding the relationship between hypothyroidism and gallstone development is crucial for better management of patients at risk.

Gallbladder stones, also known as cholelithiasis, represent the most frequent biliary pathology. These stones are small, hard crystalline masses that develop abnormally from calcium salts, bile pigments, and cholesterol. The prevalence of gallstones varies across the globe, with about 10% in Western countries and 4% in India. This prevalence is increasing in India due to factors like westernization in dietary habits, improved diagnostic methods, and greater affordability.

Gallstones can be classified into three main types:

- Cholesterol Stones.
- Pigment Stones (which can be black or brown).
- Mixed Stones.

Geographical Differences in Gallstone Types

- **Western Populations:** Cholesterol and mixed stones account for approximately 80% of cases.

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- **Asian Populations:** Pigment stones are more prevalent, comprising around 80% of cases.

Factors Contributing to Gallstone Formation

Gallstone formation is influenced by several factors:

1. **Bile Supersaturation:** Increased concentration of cholesterol in bile is a key contributor.
2. **Crystal Nucleation:** The crystallization process of cholesterol in bile.
3. **Gallbladder Motility:** Abnormal gallbladder contraction or biliary stasis (slowing of bile flow) plays a crucial role in stone formation.

Thyroid Dysfunction and Gallstone Formation

Research over the past decade has focused on the potential link between thyroid dysfunction and gallstone development. Hypothyroidism, in particular, has been suggested as a contributing factor for the following reasons:

- **Altered Lipid Metabolism:** Hypothyroidism leads to hypercholesterolemia and dyslipidemia by affecting cholesterol metabolism in the liver.
- **Sphincter of Oddi Dysfunction:** Thyroid hormone influences the function of the sphincter of Oddi, a muscular valve controlling bile flow. In hypothyroidism, this dysfunction leads to bile stasis.
- **Gallbladder Hypomotility:** Reduced gallbladder contractility in hypothyroid patients causes prolonged accumulation of bile, which contributes to stone formation.

Cholesterol Stone Formation

The primary factor for cholesterol stone formation is bile supersaturation, which is often influenced by elevated cholesterol levels seen in hypothyroid patients. Thyroid hormone impacts cholesterol metabolism by regulating enzymes like HMG Co-A reductase, which controls cholesterol levels. In hypothyroidism, reduced thyroid hormone leads to hypercholesterolemia and bile supersaturation, contributing to stone formation.

Clinical Significance

Gallstones are often asymptomatic and may be detected incidentally during imaging for other reasons or during surgeries like laparotomies. However, the increased prevalence of thyroid dysfunction in patients with gallstone disease has significant implications for diagnosis and treatment. Understanding the link between hypothyroidism and cholelithiasis can help healthcare professionals provide better management strategies for at-risk populations.

Materials and Methods

A cross-sectional observational study of 142 cases was conducted at ESICMC &PGIMSR Rajajinagar, Bangalore. Study period was from 2023 January to 2023 September. All patients who presented to our department with symptoms of cholelithiasis were included in the study.

Inclusion Criteria

- Age >18 years and <80 years.
- Patients with radiological finding of gallstone disease.
- Patients with controlled comorbid conditions.

Exclusion Criteria

- Patients with previous history of hypothyroidism on treatment.
- Previous history of thyroid surgery.
- Case of choledocholithiasis.
- Pregnant Women.
- Patients on drugs causing hypothyroidism.

All patients were presented to OPD with symptoms of right upper abdomen pain and USG confirmed cholelithiasis were included in the study. Sociodemographic data was collected. Written and informed consent was taken from patients and attenders. Patients were evaluated for thyroid function test and baseline investigations .For analysis of the patients thyroid status ,a morning fasting blood sample was sent to the biochemistry laboratory and analysed using the chemiluminescence method. The patient's thyroid status is noted. Patients with TSH between 0.5 and 4.9 mIU/L were considered normal. TSH concentrations greater than 10 mIU/L were considered clinical hypothyroidism. The collected datas entered in excel sheet and analysed.

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS version 25.0) software was used for statistical analysis. The Chi-square test was applied for non-parametric values, and a p-value of <0.05 was

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considered significant.

Results

Distribution According to Gender

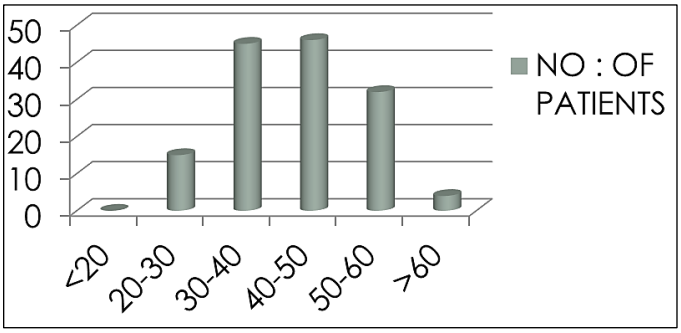
	Frequency	Percent
Males	43	30.3
Females	99	69.7
Total	142	100

Among the study group 69.7% i.e.; 99 patients are females and 30.3 % ie;43 patients are males.

Distribution According to Age

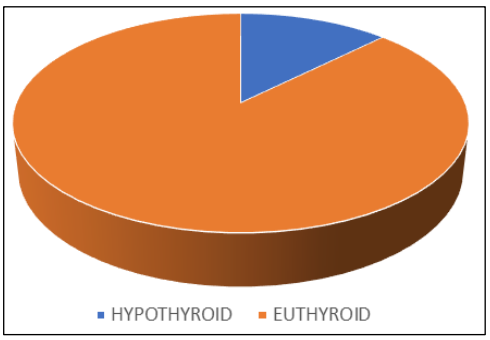
Age	Number	Percentage
<20	0	0
21-30	15	15
31-40	45	31.7
41-50	46	32.4
51-60	32	22.5
>60	4	2.8
Total	142	100

Among the study group 57.7% i.e.; 82 patients were in the age group of >40 years 31.7% i.e.; 45 patients in 30-40 age group 50-60, 32 patients i.e.; 22.5% and >60 years 4 patients i.e.; 2.8%.



Distribution of Patients According to Thyroid Function

	Frequency	Percentage
Hypothyroid	18	12.7
Euthyroid	124	87.3
Total	142	100



Among the study group 18% patients had hypothyroidism and 87% were euthyroid.

Hypothyroidism and Gender

Gender	Frequency	Percentage
Male	2	11.1
Female	16	88.9
Total	18	100

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11% among hypothyroid group are males and 89% were females.

Discussion

This study was conducted in 142 patients who presented with right sided upper abdominal pain and USG confirmed cholelithiasis.

Among the study group 69.7% i.e.; 99 patients are females and 30.3% i.e.; 43 patients are males. Among the study group 57.7% i.e.; 82 patients were in the age group of >40 years, 31.7% i.e.; 45 patients in 30-40 age group, 50-60, 32 patients i.e.; 22.5% and >60 years 4 patients i.e.; 2.8%. Among the study group 18% patients had hypothyroidism and 87% were euthyroid. Among the total hypothyroid patients 11% are females and 89% are males.

Gall stone formation is a complex process involving various mechanisms affecting the flow of bile and bile content. Hypothyroid patients are found to have biliary stasis because of slowed emptying of bile from the biliary tract. The hallmark laboratory investigation to detect hypothyroidism and also a sensitive indicator for diagnosing early thyroid dysfunction is serum TSH level.

In a study done by Hassan H Zaini and Kussay M Zwain, the results were as follows. Prevalence of hypothyroidism in Hassan study was 10.6% and peak age group was between 51-60 years.

In this study prevalence of hypothyroidism is 12.7% and peak age group is >40 years.

The results of this study are comparable with a study conducted by Ahmmed *et al*. who demonstrated that among 232 patients with cholelithiasis, 13.2% were hypothyroid and among those 68.8% were subclinical hypothyroid and 31.2% were clinical hypothyroid. The strong influence of thyroid hormones on both lipid metabolism as well as in the motor function of the biliary system paves way for this high incidence in hypothyroidism.

This increase in prevalence could have effect on the diagnostic and therapeutic work up of cholelithiasis patient. So we should be aware of the thyroid status of cholelithiasis patient. Hence hypothyroidism should also be considered as a separate risk factor in cholelithiasis patients.

Conclusion

There is an increase in prevalence of hypothyroidism in cholelithiasis in this study. The prevalence was more among age > 40 years age group. This increase in prevalence could have an effect on the diagnostic and therapeutic workup of cholelithiasis patients. Hypothyroidism should be considered as a separate risk factor like age, sex, obesity in cholelithiasis patient. So we should be aware of thyroid status in patients of cholelithiasis and should be screened for thyroid function.

Limitations

The limitations of this study are small sample size, conducted in a single centre and patients with choledocholithiasis were excluded from this study. We propose to conduct a multi-centric, large population-based studies in order to provide a higher level of evidence.

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