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Original Research Article

Thyroid Dysfunction & Lipid Abnormalities in Patients with Cholelithiasis

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Abstract:

Introduction: Disturbances in lipid metabolism that occur during hypothyroidism, particularly cholesterol pathway, changes the rate of bile excretion and lead to the formation of gall stones. The current study was conducted to find association between hypothyroidism and CBD stones.

Materials & Methods: This prospective study included 100 patients with CBD stones who underwent ERCP and 100 healthy individuals in the control group. Thyroid profile, lipid profile and symptom of hypothyroidism were evaluated in all patients.

Results: Lipid profile (Cholesterol, TG, HDL and LDL) was deranged in case group as compared to control group. Mean serum TSH levels among case group (7.79 ± 3.23 µIU/ml) was significantly higher than control group (3.14 ± 1.23 µIU/ml, p - 0.001). Sub clinical hypothrodism was noted higher in case group (12.0%) than control group (4.0%, p -0.02).

Conclusion: Thyroid dysfunction and deranged lipid profile are more common among patients with CBD stones. Therefore, we recommend checking for the lipid profile and TSH level in every patient with gallstones.

Keywords: Cholelithiasis, Cholesterol, hypothyroidism, Triglyceride, Thyroid stimulating hormone.

Introduction

The most prevalent abdominal illness is cholelithiasis, which affects 5% to 26% of people worldwide.[1] Cholelithiasis has not a unique pathophysiology that may involve multiple factors.[1,2] Gall stones can develop as a result of alterations in the rate of bile excretion due to disturbances in lipid metabolism that take place during hypothyroidism, particularly those that affect the cholesterol pathway. [3,4] When serum cholesterol levels in hypothyroidism increase, the bile may become too saturated with cholesterol, which can cause impaired intestinal motility, weakened contractility, and reduced emptying in the gallbladder.

This might help keep cholesterol crystals in place, allowing mature gallstones to form over an extended period of time and expand continuously. Additionally, bile's ability to remove precipitates from biliary ducts and gastrointestinal arteries may be hampered by diminished bile secretion. Additionally, thyroxin has a pro-relaxing impact on the oddi's sphincter, which is a receptor for thyroid hormone. Low bile flow and malfunction of the sphincter of Oddi are two significant functional factors that may encourage the production of gall stones. Biliary stasis, which can be brought on by the stenosis of the sphincter of Oddi, dyskinesia, or bile duct strictures, is a critical component in the development of bile duct stones. [5]

Some researchers have reported a higher prevalence of both hypothyroidism and subclinical hypothyroidism in common bile duct (CBD) stones which supports a possible relation between low T4 levels and CBD stones. [4,6] The current study was conducted to find association between hypothyroidism and CBD stones.

Materials & Methods

This hospital based case–control study was conducted in the department of general surgery in collaboration with department of biochemistry at tertiary care hospital, Gujarat after approval from the

institutional Ethical Committee. The case constituted of 100 patients with CBD stones who underwent ERCP. The control group consisted of 100 healthy individuals with clinically euthyroid and matched by sex and age without history of liver diseases, asymptomatic bile duct stones. Patients with a thyroid function abnormalities, thyroidectomy, pregnancy, sepsis or cholanlangitis and taking medication affecting thyroid function test such as phenytoin, carbamazepin, metoclopramide, amiodarone, and lithium were excluded. All participants underwent abdominal ultrasonography.

Data was collected through a questionnaire that included demographic and anthropometric data, symptoms, medical histories and drug history after written informed consent. Morning blood samples were taken after 12 hours of fasting to measure serum total thyroxin (T4), serum thyroid stimulating hormone (TSH), fasting blood sugar (FBS), triglyceride (TG), total cholesterol, low density lipoprotein (LDL) and high density lipoprotein (HDL) levels. Serum T4 and TSH were measured by an immunofluorometric method.

The normal range for serum T4 was 6-12 Mu/l; for TSH, it was 0.25-5 Mu/ml. Subclinical hypothyroidism is defined as symptom free patient with TSH concentration above upper limit of normal range and T3/T4or both decrease below normal limit. Clinical hypothyroidism is defined as patients with symptoms of hypothyroidism with TSH level above the upper limit and T3/T4or both decrease below normal limit. Whereas clinical and lab tests within normal range is considered as euthyroid. Subjects with FBS greater than 126 mg/dl , confirmed by repeated measurement, were considered as diabetic.8 Dyslipidemia was defined as LDL levels greater than 130 mg/dl in diabetics and greater than 100 mg/dl in non-diabetics, HDL levels less than 50 mg/dl in females and less than 40 mg/dl in males, and TG more than 150 mg/dl.

Statistical analysis: Data was analysed with Epi info version 7.1.4.0 software. Quantitative data was described as mean and standard deviation (SD); Qualitative data was described as frequency and percentage. We used chi square test for comparison of categorical data and independent t-tests for comparison of quantitative data. p value less than 0.05 was considered as significant.

Results

Table 1: Socio demographic profile of patients

Characteristics	Case	Control	p value
Age (years)	47.02 ± 10.32	48.22 ± 08.42	0.18
Gender			
Male	41 (41.0%)	43 (43.0%)	0.96
Female	59 (59.0%)	57 (57.0%)	
BMI (kg/m^2)	28.57 ±3.28	24.51 ± 3.42	0.02

Mean age of case group was 47.02 ± 10.32 years and of control group was 48.22 ± 08.42 years. Total 59.0% and 57.0% patients were female in case and control group respectively. There was no any significant difference between case and control group in respect to age and gender (p-0.18 and 0.96 respectively). BMI was significantly higher in case group (28.57 ±3.28 kg/m^2) than control group (24.51 ± 3.42 kg/m^2, p -0.02)

Table 2: Comparison of lipid profile between case and control group

Lipid profile	Case	Control	p value
Cholesterol (mg/dl)	183.06 ± 18.34	155.22 ± 12.34	0.001
TG (mg/dl)	173.05 ± 23.45	113.23 ± 15.45	0.002
HDL (mg/dl)	45.31 ± 5.45	50.15 ± 6.32	0.01
LDL (mg/dl)	119.22 ± 22.34	92.11 ± 15.43	0.02

As shown in table 2, cholesterol was significantly higher in case group (183.06 ± 18.34 mg/dl) as compared to control group (155.22 ± 12.34, p – 0.001). Similarly TG and LDL were significantly higher in case group than control group.

Table 3: Comparison of thyroid profile between case and control group

Thyroid profile	Case	Control	p value
T3 (pg/ml)	1.54 ± 0.98	3.51 ± 0.65	0.001
T4 (ng/dl)	1.03 ± 0.45	1.34 ± 0.62	0.02
TSH (μIU/ml)	7.79 ± 3.23	3.14 ± 1.23	0.001

Mean serum TSH levels among case group (7.79 ± 3.23 μIU/ml) was significantly higher than control group (3.14 ± 1.23 μIU/ml, p - 0.001). Mean serum T4 and T3 level between case group and control group were statistically significant.

Table 4: Comparison of Thyroid status between case and control group

Thyroid status	Case	Control	p value
Subclinical hypothyroid	12 (12.0%)	4 (4.0%)	0.02
Clinical hypothyroid	4 (4.0%)	0 (0.0%)	0.12
Hyperthyroid	1 (1.0%)	0 (0.0%)	1

Euthyroid	83 (83.0%)	96 (96.0%)	0.005

Sub clinical hypothrodism was noted higher in case group (12.0%) than control group (4.0%, p -0.02). Euthyroid, hyperthyroid and clinical hypothyroid were observed in 83.0, 1.0% and 4.0% patients of case group. Whereas, euthyroid was observed in 96.0% patients of control group. Hyperthyroid and clinical hypothyroid were not detected in control group.

Discussion

Cholelithiasis affects 24% of people in affluent countries, although its prevalence is low in impoverished regions of the world. It is a major cause of morbidity throughout the world. [7–10] In this study, thyroid dysfunction in patients with CBD stones was assessed. CBD stones were frequently reported in the fifth decade of the current study (47.02 10.32 years). The age-wise distribution in the studies by Modi et al.[11] and Thamil et al. [12] was similar. In the current study, more females (59.0%) than males (41.0%) experienced cholelithiasis. Female CBD stone prevalence was reported to be 58.3% and 71.0%, respectively, by Ajdarkosh et al.[13] and Channa et al. [8]

Serum TSH is the primary marker of thyroid dysfunction. The subclinical form of hypothyroidism is characterised by elevated serum TSH levels and normal serum T4 levels in the absence of overt symptoms. The mean TSH levels in the present study among the case group (7.79 ± 3.23 μIU/ml) were higher than the control group (3.14 ± 1.23 μIU/ml, p - 0.001). Subclinical hypothyroidism was also more common in patients with CBD stones (12%) than control group (4%, p -0.02). According to study of Laukkarinen J et al. [4], subclinical hypothyroidism to be a common problem among patients with CBD stones. Hypothyroidism contributed to the development of CBD stones as a result of its effects on sphincter of Oddi relaxation, which may have an impact on biliary system emptying. The pro-relaxing effect of T4 on SO has been previously reported.[4,6,14] In the present study, there was a close relation between T4 levels according to binary analysis with choledolithiasis ($p<0.05$) which was similar to earlier studies. [6,14] Some studies have reported that thyroxin replacement therapy has a positive effect on cholesterol level, cardiovascular, neuromuscular and choledolithiasis.[5,15–17]

Obesity increases risk of gallstones. Supersaturated bile among obese subjects may be a cause of this phenomenon. In the present study, BMI was significantly higher in case group (28.57 ±3.28 kg/m2) than control group (24.51 ± 3.42 kg/m2, p - 0.02). Ajdarkosh et al.[13] also observed that patients with CBD stone were more likely to be overweight as compared to control groups. This observation corroborated the findings of previous studies.[18,19]

Several studies have examined the impact of food, including caloric intake, cholesterol, lipids, fibre, carbohydrates, vitamins, and minerals, as a potential risk factor for the development of gallstones. Recent research has shown that orphan nuclear receptors regulate the metabolism of lipids and hepatic cholesterol, opening up new avenues for understanding how food components contribute to the formation of cholesterol gallstones.[6]

In the present study, cholesterol level was significantly higher in case group (183.06 ± 18.34 mg/dl) than control group (155.22 ± 12.34, p – 0.001). Similarly TG, HDL and LDL were significantly different between case and control group. In the study of Modi G et al.[11] , serum total cholesterol (193.01± 36.83mg/dl) in cholelithiasis cases were higher than in control group (159.28±18.26 mg/dl) ($p<0.05$) and low serum HDL level in patients with cholelithiasis (49.32±8.12mg/dl) than control group (52.15.±6.32 mg/dl), ($p>0.05$). He also observed significantly higher serum TG level in case group (187.01± 66.01mg/dl) than control group (107.84±19.67mg/dl). LDL levels were higher 142.01± 37.98 mg/dl in cases and lower in controls (95.12± 14.97 mg/dl), ($p<0.05$). In the study of Ajdarkosh et al.[13], mean TG, and LDL levels in the case group were significantly higher than control group. Patients with hypothyroidism are more prone to have high serum cholesterol levels. The mechanism of thyroid hormones on cholesterol metabolism is multifactorial. The synthesis, absorption, and utilisation of cholesterol are all influenced by thyroid hormones.

Conclusion

Thyroid dysfunction and deranged lipid profile are more common among patients with CBD stones. Therefore, we recommend checking for the lipid profile and TSH level in every patient with gallstones.

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