

Comparative Analysis of Biliary Cholesterol Levels In Iron Deficient And Non-Iron Deficient Patients Operated For Gall Stone Disease

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Introduction:

Gallstone incidence is rising in frequency. The traditional notion that a typical gall stone patient is an obese, fertile female of 40 is only partially correct because the condition may also strike underweight and slender women shortly after giving birth. A iron deficiency affects the function of various hepatic enzymes, increasing bile saturation with cholesterol in the gall bladder and increasing the crystallisation of cholesterol.

Aim:

The purpose of this research is to determine the link between biliary cholesterol levels and blood cholesterol levels in individuals with iron deficiency.

Materials and Methods:

Cross sectional study including 50 patients with cholelithiasis conducted over a 1 year period from October 2021 to September 2022 in Maharajah's Institute of Medical Sciences, Vizianagaram District of Andhra Pradesh. Patients were divided into two groups depending upon the serum iron levels. Group A were non-anaemic and Group B were anaemic. Serum cholesterol and bile cholesterol levels were assessed in both the groups.

Results:

Biliary cholesterol levels were higher in iron deficient group whereas there was no difference between serum cholesterol levels between the two groups.

Conclusion:

It may be inferred that a low serum iron level is a risk factor for cholelithiasis, whereas a high bile cholesterol level enhances the risk of cholelithiasis.

Keywords: Biliary cholesterol, Gallstone disease, Iron levels

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I. Introduction

Gall stone disease is a widespread condition throughout the world. When the metabolism of cholesterol, bilirubin, and bile acids is aberrant, bile precipitates called choleliths occur. (1)

Gall stone disease affects 6% to 9% of adults in India, with a greater frequency among North Indians and females. (2) The major cause of the increased incidence in females appears to be oestrogen, which elevates biliary cholesterol secretion. (3)

The ancient adage that a gall stone patient is typically a fat, fertile female of 40 is only partially accurate because the condition may also strike women shortly after giving birth, as well as underweight and skinny individuals. Consequently, iron deficiency was discovered to be a novel criterion of interest in the aetiology of gall stones while looking for other factors. (3,4)

Iron deficiency alters hepatic enzyme function, increasing gallbladder cholesterol saturation and cholesterol crystal production. Iron deficiency has also been linked to cholesterol crystal production due to altered gallbladder motility that causes biliary stasis.(4)

II. Aims And Objectives

The objective of the study is to ascertain the relationship between biliary cholesterol levels levels and serum cholesterol levels with iron deficiency.

III. Materials And Methods

The study is conducted for a period of 1 year in from October 2021 to September 2022 in Maharajah's Institute of Medical Sciences, Vizianagaram District of Andhra Pradesh. 50 patients diagnosed with cholelithiasis confirmed by ultrasonography and in whom cholecystectomy was to be done were included in the study and divided into two groups A and B respectively. Group A consisted of patients with normal serum iron levels. Group B were patients who are iron deficient. Gallbladder bile cholesterol with serum cholesterol of both the groups is compared.

By using the Ferrozine kit technique for iron testing, serum iron was calculated. Males with serum iron below 60 µg/dl and females with serum iron below 35 µg/dl were designated as anaemic, respectively, using the normal reference values provided with the kit for males (60-160 µg/dl) and females (35-145 µg/dl). Serum cholesterol was estimated by the Enzopa kit method. Bile was aspirated during cholecystectomy in all patients and sent for analysing bile cholesterol. Bile was first processed using the Folch technique to extract the lipids, and then the amount of cholesterol was calculated.

Patients with empyema and mucocele of gallbladder were excluded.

IV. Results

The mean age of the study population was 34 ± 3.5 years. The most common age group was 30-40 years. 38 (76%) were females and 12 (24%) were males.

Out of the 12 men, 2 (16.66%) had Iron deficiency, where 20 (52.63%) women had iron deficiency.

Table 1:

Group	No. of patients	Serum Iron range ug/dL	Serum cholesterol mean ± SD
A (Normal serum Iron)	28	38-160	98.5 ± 28.68
B (Iron deficiency)	22	5-48	25.6 ± 6.5

The difference in serum cholesterol between patients with normal serum iron and iron deficiency is statistically significant with $p < 0.05$.

Table 2:

Group	No. of patients	Biliary cholesterol mean ± SD
A (Normal serum Iron)	28	98.5 ± 28.68
B (Iron deficiency)	22	25.6 ± 6.5

The difference in Biliary cholesterol between normal serum iron and iron deficient groups is statistically significant at $p < 0.05$.

Table 3:

Group	No. of patients	Serum cholesterol mean ± SD
A (Normal serum Iron)	28	178 ± 42.5
B (Iron deficiency)	22	170 ± 36.8

The difference in Serum cholesterol between normal serum iron and iron deficient groups is statistically not significant at $p > 0.05$.

V. DISCUSSION

Cholelithiasis is a multifactorial illness that is influenced by a complex interaction of metabolic, genetic, and environmental variables.(1)Gallstone prevalence in this analysis was more in females (76%) than in males, which was consistent with other studies' findings. Additionally, it was shown that those between the ages of 30 and 40 had a higher prevalence of gallstones, which is similar with findings from previous research.(2,5)

Low serum ferritin levels, or iron deficiency, have been demonstrated to affect the function of numerous hepatic enzymes, increasing gall bladder bile cholesterol saturation and favoring the formation of cholesterol crystals.(3)

Our study consisted of 50 diagnosed cases of cholelithiasis and 28 constituted Group A with normal serum iron levels and Group B had iron deficient patients numbered 22.

20 (52.63%) patients in Group B were females, showing a statistically significant iron deficiency prevalence in women with gallstone disease.

There was a significant difference between biliary cholesterol levels between normal iron and iron deficient groups, showing that anaemic individuals had considerably higher gallbladder bile cholesterol levels

than non-anaemic patients. These results correlated well with study by Kannan et. al. (5) in which biliary cholesterol level in non- anaemic patients was 745.5 ± 398.3 , where as the levels in anemic patients was 1184.7 ± 405.2 mg/dl.

This study reveals that iron deficiency resulting in anaemia contributes significantly to biliary supersaturation.

There was no statistically significant difference between serum cholesterol levels in both the groups. These results correlated well with studies by Dube et. al. and Kannan et. al. (2,5)

VI. CONCLUSION

According to our research, cholelithiasis affects people most frequently between the ages of 30 and 40, and it is more common in women than in men. Gallbladder stone development is significantly influenced by low serum iron levels. Raised serum cholesterol and cholelithiasis were not significantly correlated. Therefore, it can be assumed that low serum iron levels are producing biliary stasis, which in turn is increasing the prevalence of cholelithiasis. In our investigation, low serum iron levels with cholelithiasis were related with elevated bile cholesterol levels.

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