



COMPARATIVE ANALYSIS OF CHOLESTEROL LEVELS IN BILE , IN PATIENTS WITH IRON DEFICIENCY AND NON-IRON DEFICIENCY BEING OPERATED FOR CHOLELITHIASIS

General Surgery

Dr. P. Rajendra Kumar

Associate Professor Department of General Surgery, Anjarkandy Medical College, Kannur, Kerala.

Dr B. Sneha

Resident in Department of General Surgery

KEYWORDS

INTRODUCTION

Gallstone disease is a prevalent condition affecting adults across both sexes. The commonly used saying, "a fat, fertile female over fifty," although somewhat accurate in describing the typical demographic, does not capture the full scope of the disease. Gallstones can also affect women after childbirth, as well as those who are underweight or thin, broadening the range of individuals at risk.

Multiple etiological factors contribute to the formation of gallstones, and there has been a growing interest in understanding the role of various nutritional trace elements in this process. Among these, iron deficiency has emerged as a particularly intriguing factor, though recent studies have yielded mixed results, leaving some questions unresolved.

The potential link between serum iron levels and gallstone formation is especially significant in populations with high rates of nutritional deficiencies, such as in many developing regions. If a clear connection between iron deficiency and gallstone disease can be established, it would open up possibilities for early detection, preventive strategies, and risk management. Given the widespread prevalence of nutritional deficiencies, further research into this area could lead to improved health outcomes through early interventions and targeted treatments.

Aim

The study aims to investigate the potential role of iron deficiency in the supersaturation of bile with cholesterol, a key factor in the formation of gallstones. Bile is a digestive fluid produced by the liver, and its primary components include cholesterol, bile salts, and phospholipids. For gallstones to form, the balance of these components can be disrupted, leading to the supersaturation of cholesterol in bile, which can then crystallize and form stones.

Iron deficiency is thought to potentially affect the biochemical processes involved in bile formation, possibly altering the solubility of cholesterol or impacting the production of bile salts that prevent cholesterol crystallization. If iron deficiency contributes to this supersaturation process, it would provide an important new insight into the pathogenesis of gallstones, particularly in populations with widespread iron deficiency.

By exploring this link, the study could help clarify whether low iron levels increase the risk of gallstone formation by making bile more prone to cholesterol supersaturation. This could ultimately provide a basis for more targeted preventive measures and treatments, especially in populations where iron deficiency is common. Understanding the role of iron could also lead to new strategies for managing gallstone disease, such as through nutritional interventions or supplementation.

Methods

The study, conducted between November 2023 to October 2024 in the Department of General Surgery, aimed to investigate the relationship between serum iron levels and gallstone formation. A total of 50 patients diagnosed with cholelithiasis (gallstones) through ultrasound (USG) were included in the study. These patients were then divided into two groups based on their serum iron levels:

- Group A: Patients with normal serum iron levels (non-anemic).
- Group B: Patients with low serum iron levels (anemic).

For Both Groups, the Following Measurements were Taken:

- Serum Iron levels.
- Biliary Cholesterol levels (the amount of cholesterol in the bile).
- Serum Cholesterol levels (the amount of cholesterol in the blood).

The study aimed to analyse whether there was a significant difference in biliary cholesterol and serum cholesterol levels between the two groups. To assess this, the Student's t-test was used, which is a statistical test commonly employed to compare the means of two groups and determine whether any observed differences are statistically significant.

The findings from this study would help to clarify whether iron deficiency (as reflected in the anemic group) is associated with changes in cholesterol levels in both serum and bile, which could potentially contribute to gallstone formation. If a significant difference was found between the two groups, it could suggest that low serum iron may play a role in the development of gallstones by promoting cholesterol supersaturation in the bile.

RESULTS

The study found interesting results regarding the relationship between iron deficiency and biliary cholesterol levels in patients with cholelithiasis (gallstones). Here's a breakdown of the key findings:

1. Patient Demographics

- o Out of the 50 patients in the study, 40 (80%) were female and 10 (20%) were male, giving a female to male ratio of 4:1.

2. Biliary Cholesterol Levels

- o The Biliary Cholesterol levels for the two groups were as follows:
 - Group A (Non-Iron Deficient): 754.5 ± 398.3 mg/dl.
 - Group B (Iron Deficient): 1184.7 ± 405.2 mg/dl.
- o The Biliary Cholesterol levels were significantly higher in the Iron Deficient group (Group B) compared to the Non-Iron Deficient group (Group A).
- o This difference was found to be statistically significant, with a p-value of <0.0004 . This indicates that the iron deficiency may play a significant role in increasing the levels of cholesterol in the bile, potentially contributing to the formation of gallstones.

3. Serum Cholesterol Levels

- o The Serum Cholesterol levels for the two groups were:
 - Group A (Non-Iron Deficient): 184.8 ± 35 mg/dl.
 - Group B (Iron Deficient): 171 ± 49.3 mg/dl.
- o An independent t-test comparing the serum cholesterol levels of the two groups did not show a statistically significant difference ($p = 0.2544$), suggesting that iron deficiency may not significantly affect cholesterol levels in the blood.

CONCLUSION

The study concluded that iron deficiency is significantly associated with higher biliary cholesterol levels. This supports the hypothesis that iron deficiency could contribute to the supersaturation of bile with cholesterol, which is a key step in the formation of gallstones. However, the serum cholesterol levels did not show a significant difference between the two groups, suggesting that the effect of iron deficiency may be more specific to biliary cholesterol rather than systemic cholesterol.

This finding reinforces the idea that iron deficiency could play a role in gallstone formation and highlights the importance of investigating nutritional factors in the pathogenesis of the disease.