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A CROSS-SECTIONAL STUDY OF OBSERVATION OF SERUM IRON AND LIVER FUNCTION TEST IN CHOLELITHIASIS, BIHAR, INDIA.

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ABSTRACT

Objectives
Cholelithiasis, the formation of gallstones within the gallbladder, is a common gastrointestinal disorder.This study aimed to investigate the biochemical changes in cholelithiasis and identify the appropriate diagnosis that would aid the treatment plan for cholelithiasis.

Materials and Methods
A cross-sectional study was conducted on 150 participants, including 75 patients diagnosed with cholelithiasis and 75 age and gender-matched healthy controls. Serum iron, ferritin and various liver enzymes e.g. SGPT, SGOT and ALPwere measured using a colorimetric method. Data obtained were analyzed using appropriate statistical tests.

Results
The outcomes of this study discovered that people with cholelithiasis had lower values of serum iron (Mean ± SD: 60.74 ± 10.21 µg/dL) in comparison to the control group (mean ± SD: 78.29 ± 9.16 µg/dL) ($p< 0.001$). Additionally, the cholelithiasis group exhibited increased levels of liver function enzymes e.g. SGPT, SGOT, alkaline phosphatase, ferritin, bilirubin as comapred to that of the control group.

Conclusion
Cholelithiasis is related to lower serum iron contents and changes in various other biochemical parameters which include higher levels of SGPT, SGOT, alkaline phosphatase(ALP) and bilirubin. These findings propose that cholelithiasis may additionally result in iron deficiency, which could be associated with chronic inflammation or other mechanisms.

Recommendations
This study highlights the significant biochemical changes associated with cholelithiasis, including lower serum iron levels and elevated liver enzymes. These findings suggest a potential link between cholelithiasis and iron deficiency, emphasizing the importance of early diagnosis and treatment planning for this common gastrointestinal disorder. Further research is warranted to explore the underlying mechanisms and clinical implications of these observations.

Keywords: Cholelithiasis, Serum iron, Serum Glutamic Pyruvic Transaminase, Serum Glutamic Oxaloacetic Transaminase, Alkaline Phosphatase
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INTRODUCTION
Cholelithiasis, the formation of gallstones inside the gallbladder, is a standard and clinically important gastrointestinal disorder affecting thousands globally [1]. Gallstones may be either LDL cholesterol or pigment stones, and their formation is associated with multiple hazard factors, including genetics, diet plan, weight problems, and hormonal imbalances [2]. These stones can vary in types and their composition. They can lead to a spectrum of scientific manifestations, ranging from asymptomatic instances to excessive complications with cholecystitis, choledocholithiasis, and gallstone-associated pancreatitis [3]. The analysis and management of cholelithiasis remain crucial topics in gastroenterology and hepatology. It is crucial to discover capacity biomarkers that could aim in early detection, threat evaluation, and higher pathophysiological adjustments related to this condition [4].

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One such research access is the evaluation of serum iron contents in people with cholelithiasis [5]. Serum iron is a fundamental indicator of iron measurement, and alterations can provide insights into iron deficiency or overload, both of which have scientific implications [6]. Understanding the modifications in biochemical parameters in the context of cholelithiasis could affect the systemic effects of this situation and its timings with the hematological profile [7].

Despite the superiority of cholelithiasis and its medical relevance, there is a restricted body of research targeted at the affiliation between serum iron level and cholelithiasis [8]. This study seeks to deal with this information by investigating those precise biomarkers in people with cholelithiasis and evaluating them in a managed organization. By doing so, the study intends to gain a more profound knowledge of the systemic consequences of cholelithiasis. The study finds valuable insights that could aim in the diagnosis, danger assessment, and control of this not-unusual gastrointestinal ailment.

MATERIALS AND METHODS

Study design

A cross-sectional study.

Study setting

The study was conducted at Bhagwan Mahavir Institute of Medical Sciences, Pawapuri, Nalanda, Bihar, India, in a time duration of March 2022 to January 2023.

Study size

Individuals attending OPD of department of surgery of this institution had been enrolled in this study which consisted of 75 individuals recognized with cholelithiasis, showed through clinical assessment, abdominal ultrasound, and different applicable imaging modalities. The management organization has chosen 75 age and gender-matched individuals with no records of cholelithiasis or excellent clinical conditions. Participants with a history of iron deficiency anemia or different hematological disorders were excluded from each group.

Participants

A total of 150 patients were included in the study.

Bias

There was a chance that bias would arise when the study first started, but it was avoided by giving all participants the identical information and hiding the group allocation from the nurses who collected the data.

Data Collection

Serum Iron Measurement

Fasting venous blood samples were collected from all participants in the morning. Serum iron levels were measured using a colorimetric technique with commercial iron assay kits. The assay was achieved according to the producer's instructions. The consequences were expressed in micrograms consistent with deciliter (µg/dL).

Liver Function Tests

Liver characteristic assessments were conducted to assess the liver's enzymatic activity and function in iron metabolism.Status of liver was evaluated by measuring liver enzymes, consisting of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) and alkaline phosphatase(ALP). Blood samples collected in serum separator tubes were centrifuged to obtain serum. The ranges of AST,ALP and ALT had been quantified using popular enzymatic strategies. Elevated content of those enzymes can suggest liver disorder, which may additionally impact iron metabolism.

Serum Bilirubin test

The laboratory procedure for measuring serum bilirubin degrees involves collecting a blood sample, isolating serum through centrifugation, and the use of methods just like the diazo or Jendrassik-Grof approach to create a colored compound. The intensity of this coloration, measured spectrophotometrically, correlates with bilirubin awareness, pronounced in units together with mg/dL for clinical interpretation.

SGPT/ SGOT test: The protocol for SGPT (Serum Glutamic Pyruvic Transaminase) and SGOT (Serum Glutamic Oxaloacetic Transaminase) tests included collecting a blood sample from the patient, normally through venipuncture. The blood was centrifuged to collect serum, after which specific reagents are introduced to degree the levels of these enzymes. The assay assesses liver function, with expanded SGPT indicating liver problem or damage, even as multiplied SGOT levels also can indicate liver problems or coronary heart muscle damage.

Alkaline Phosphatase test

The alkaline phosphatase assay involved collecting a blood sample through venipuncture and setting apart serum through centrifugation. The serum was mixed with precise reagents containing substrates that, in the presence of alkaline phosphatase, produce a coloured product. The intensity of this color change is measured spectrophotometrically, with higher enzyme ranges leading to a more intense color, permitting quantification of alkaline phosphatase activity.

Ferritin Levels

Serum ferritin level were measured to provide extra records of approximately the iron content. Ferritin is an intracellular protein that stores iron in a non-toxic form. Blood samples collected in serum separator tubes were processed, and the concentration of ferritin was decided by the usage of commercially available Enzyme-Linked Imunosorbent assay (ELISA) kits following the developer's instructions. Elevated ferritin levels can

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propose iron overload, even as low ranges may indicate iron deficiency.

Statistical Analysis

Statistical analysis is accomplished using an appropriate software program (e.g., SPSS). Descriptive statistics, along with Standard Deviation, were calculated for continuous variables. Student's t-tests or Mann-Whitney U tests were employed to examine differences among the cholelithiasis group and the control group, as appropriate. A $p < 0.05$ change is considered to be statistically significant.

Ethical considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

RESULTS

Table 1: Hemoglobin Levels and Hematocrit in Cholelithiasis Group by Gender

Gender	Number of Participants	Mean Hemoglobin (g/dL)	Mean Hematocrit (%)
Male	30	14.5	42.2
Female	45	14.1	41.8

In Table 1, the study examines a gender-primarily based breakdown of hemoglobin stages and hematocrit values in the Cholelithiasis Group. Among male contributors (n=30), the implied hemoglobin stage is 14.5 g/dL, and the suggested hematocrit is 42.2%. In assessment, amongst female individuals (n=45), the suggested hemoglobin stage is rarely decreased at 14.1 g/dL, with a corresponding suggested hematocrit of 41.8%. These statistics indicate that, on average, males inside the Cholelithiasis Group generally tend to have better Hemoglobin and hematocrit values compared to their female group. However, each corporation is in the ordinary physiological range for those parameters.

Table 2: Comparison of Serum Iron Levels between the Cholelithiasis Group and Control Group

Group	Number of Participants	Mean Serum Iron (µg/dL)	Standard Deviation (µg/dL)	p value
Cholelithiasis Group	75	60.74	10.21	<0.001
Control Group	75	78.29	9.16	

In Table 2, an evaluation of serum iron content between the Cholelithiasis Group and the Control Group is identified. The Cholelithiasis Group, such as 75 participants, exhibits a considerable decrease, suggesting a serum iron stage of 60.74 µg/dL with a widespread deviation of 10.21 µg/dL. At the same time, the Control Group, along with 75 individuals, indicates a better mean serum iron degree of 78.29 µg/dL with a deviation of 9.16 µg/dL. The p-value, much less than 0.001, suggests a considerable difference in serum iron contents between the two groups, with the Cholelithiasis Group showing a pronounced lower serum iron concentration than the Control Group. This shows that cholelithiasis may be associated with alterations in iron metabolism or availability, contributing to iron deficiency in affected individuals.

Table 3: Liver Function Test Results

Group	Number of Participants	Mean AST (U/L)	Mean ALT (U/L)
Cholelithiasis Group	75	32.5	27.3
Control Group	75	26.8	24.1
p-value		<0.05	<0.05

Table 3 provides the outcomes of liver function checks inside the Cholelithiasis Group and the Control Group. In the Cholelithiasis Group, comprising 75 individuals, the suggested aspartate aminotransferase (AST) level is 32.5 U/L, and the suggested alanine aminotransferase (ALT) level is 27.3 U/L. In evaluation, the Control Group, also consisting of 75 members, demonstrates a decrease in AST (26.8 U/L) and ALT (24.1 U/L) stages. The p-values,

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which might be much less than 0.05, indicate that those differences in AST and ALT ranges between the 2 groups are statistically significant. Elevated AST and ALT levels inside the Cholelithiasis Group advocate impaired liver function, possibly related to the outcomes of cholelithiasis at the hepatobiliary device. Thus, these findings can help in monitoring liver in individuals with cholelithiasis and might have scientific implications for controlling this condition.

Table 4: Serum Ferritin Levels

Group	Number of Participants	Mean Ferritin (ng/mL)	Standard Deviation (ng/mL)
Cholelithiasis Group	75	75.2	18.6
Control Group	75	68.7	15.9
P value	>0.05		

Table 4 compares serum ferritin ranges between the Cholelithiasis Group and the Control Group. The Cholelithiasis Group, comprising 75 individuals, indicates a slightly higher suggested serum ferritin level of 75.2 ng/mL with a widespread deviation of 18.6 ng/mL, at the same time as the Control Group, which includes 75 members, exhibits a slight decrease suggest serum ferritin count of 68.7 ng/mL with a standard deviation of 15.9 ng/mL. Notably, the p-value > 0.05, suggests that the observed variations in serum ferritin count among the two groups are not statistically significant. These findings show no variation inside the iron contents using serum ferritin between individuals with cholelithiasis and the control group.

Table 5: Serum bilirubin test

Group	Number of Participants	Serum bilirubin
Cholelithiasis Group	75	0.76
Control Group	75	0.28
p-value		<0.05

The mean serum bilirubin level was 0.28 in the case group whereas the control group had 0.76. this indicated that during cholelithiasis the bilirubin level decreased significantly. The decrease in the serum bilirubin when correlated with cholelithiasis, the p-value was less than 0.05 (Table no.5)

Table 6: Alkaline phosphate test

Group	Number of Participants	Alkaline phosphate test
Cholelithiasis Group	75	126.49
Control Group	75	61.54
p-value		<0.05

The mean alkaline phosphate level was 126.49 in the case group whereas the control group had 61.54.This indicated that during cholelithiasis the alkaline phosphate level increased significantly. The increase in the alkaline phosphate level when correlated with cholelithiasis, the p-value was less than 0.05 (Table no.6)

DISCUSSION

Influence of Liver Function in Cholelithiasis

The liver function study results verified increased levels of both aspartate aminotransferase (AST) and alanine aminotransferase (ALT) within the Cholelithiasis Group compared to the Control Group. Elevated AST and ALT ranges are indicative of liver damage or inflammation. Cholelithiasis can cause complications with choledocholithiasis, cholecystitis, or gallstone pancreatitis, which may also cause liver dysfunction. These findings assist previous studies [13], highlighting the effect of cholelithiasis on liver characteristics [14]. Regular tracking of liver enzymes in individuals with

cholelithiasis is essential to detect and control hepatobiliary complications directly.

Serum Ferritin and Iron Status

Surprisingly, serum ferritin levels did not show a statistically significant difference between the Cholelithiasis Group and the Control Group. This result contrasts with a few previous studies that have recommended associations between cholelithiasis and iron metabolism [15-17]. It is essential to observe that serum ferritin may not wholly represent iron content, as it could be influenced using various factors, which include infection. The differences observed in serum iron level may be implemented in people with cholelithiasis, with similar research [17].

Serum bilirubin level and alakaline phosphate level

When the serum bilirubin level and alkaline phosphate level of the cholelithiasis group and control group was compared the serum bilirubin level and alkaline phosphate level increased significantly. The findings of serum bilirubin level and alkaline phosphate level was consistent with other study conducted in this domain [16].

Clinical Implications and Further Research

The findings of this study underscore the systemic effects of cholelithiasis on biochemicaland liver function parameters. Monitoring and handling these alterations are crucial for clinical exercise [10]. Regular assessment of Hemoglobin, and biochemical test such as serum iron, ferritin level, bilirubin, alkaline phosphatase level etc. of individuals with cholelithiasis should be done [17]. Additionally, similar research is needed to explore the underlying mechanisms of those determined biochemical changes and their clinical implications [18, 19]. In summary, this study contributes precious insights into the complicated interplay between cholelithiasis and biochemical parameters, emphasizing the significance of a multidisciplinary method to its management.

Generalizability

The study's findings on liver function and biochemical parameters in cholelithiasis may have broader relevance to settings involving liver dysfunction and altered iron metabolism. While elevated AST and ALT levels suggest liver inflammation, serum ferritin's lack of significant change highlights the complexity of iron metabolism. The increased serum bilirubin and alkaline phosphate levels could apply to contexts where these markers indicate hepatobiliary issues, underscoring the importance of monitoring and further research.

CONCLUSION

In conclusion, this study provides valuable insights into the systemic effects of cholelithiasis on the various biochemcial parameters, mainly liver enzymes.These findings have medical implications, highlighting the importance of comprehensive monitoring and control of biochemical and liver parameters in people with cholelithiasis.

Limitations

The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendations

This study highlights the significant biochemical changes associated with cholelithiasis, including lower serum iron levels and elevated liver enzymes. These findings suggest a potential link between cholelithiasis and iron deficiency, emphasizing the importance of early diagnosis and treatment planning for this common gastrointestinal disorder. Further research is warranted to explore the underlying mechanisms and clinical implications of these observations. Overall, a multidisciplinary technique is essential in addressing the complexities of cholelithiasis and its impact on the fitness of affected people.

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List of abbreviations

SGPT- Serum Glutamic Pyruvic Transaminase
SGOT- Serum Glutamic Oxaloacetic Transaminase
ALP- alkaline phosphatase
AST- aspartate aminotransferase
ALT- alanine aminotransferase
SD- standard deviation
ELISA- Enzyme-Linked Imunosorbent assay

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Conflict of interest

The authors have no competing interests to declare.

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