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# Evaluation and Comparison of Pre and Postoperative Liver Function Test in Laparoscopic Cholecystectomy

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## Abstract

Since the introduction of the laparoscopic cholecystectomy, knowledge about the difficulties associated with the procedure and awareness of the potential complications have grown. Modernization of technical skills to overcome the difficulties and early detection of the complications and their timely management are keys to the success of this procedure. The frequency and type of biliary injuries during laparoscopic cholecystectomy vary, and timely diagnosis and management is critical for the well-being of the patient. With this approach, we designed this study to investigate the Liver function tests (LFTs) that includes include total serum bilirubin, direct serum bilirubin, aspartate transaminase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP), serum total protein, serum albumin, serum globulin, albumin-globulin ratio pre and post-operative cholecystectomy.

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## Keywords

Gallstones, cholelithiasis, gastrointestinal conditions, cholesterol, bilirubin.

## Introduction

Gallstones or cholelithiasis are one of the most common gastrointestinal conditions that come across in surgical practice. They are composed of cholesterol, bilirubin, and bile. These stones are asymptomatic in most cases with stones discovered incidentally. Symptomatic patients present with right upper abdominal pain after eating greasy or spicy food, nausea, vomiting, pain in epigastrium that radiates to the right scapula or mid-back. The occurrence of hepatocellular damage in patients with gallstone disease has been the subject of debate for many years (Chang *et al.,* 2009). Evidence has presented that structural and functional changes of liver were observed in patients of cholangitis due to any cause which leads to partial extra-hepatic large bile duct obstruction (Geraghty *et al.,* 1994). These changes may subside by removal of the obstruction, which restores flow of bile within the biliary ductal system and resolution of the inflammatory process. This suggests a direct relationship between the degree of inflammation in the liver and obstruction in biliary tree (George *et al.*, 2002). Although open cholecystectomy has largely been replaced by the laparoscopic technique, the potential for iatrogenic duct injuries is higher in the latter procedure (Richardson *et al.*, 1996). The frequency and type of biliary injuries during laparoscopic cholecystectomy vary, and timely diagnosis and management is critical for the well-being of the patient (Khan *et al.*, 2007). Therefore, this study has been done to determine the liver changes associated with gallstone disease before and after laparoscopic cholecystectomy. Liver function tests (LFTs) include total serum bilirubin, direct serum bilirubin, aspartate transaminase (AST), alanine

transaminase (ALT), alkaline phosphatase (ALP), serum total protein, serum albumin, serum globulin, albumin-globulin ratio.

## Materials and Methods

The present study was conducted in the Department of Surgery at Al-Falah University, Haryana. This study was approved by the institutional ethics committee. Total 33 patients of cholelithiasis undergoing laparoscopic cholecystectomy were included in this study.

On admission, a detailed history of each patient was taken and a thorough general and local physical examination was done and informed consent was taken. In this study, liver function test (LFT) was examined pre- and post-operatively. It has been done before one day, after 1 week and after 1month of laparoscopic cholecystectomy. Cholecystectomy was performed under general anaesthesia with intravenous anaesthesia induction followed by continuous volatile anaesthesia under mechanical ventilation.

### Inclusion Criteria

All gallstone patients presenting with signs and symptoms of the disease and diagnosed for the same with the help of imaging modality.

### Exclusion Criteria

Patients with viral hepatitis, alcoholic liver disease, carcinoma of biliary tree and known cirrhotic patients, where there arose any contraindications to the intervention.

### Statistical analysis

Statistical analysis was performed using the software SPSS 20.0 with appropriate statistical tests. Categorical variables were analysed using a chi-square test. p value of less than 0.05 was considered statistically significant.

## Results and Discussion

Thirty three patients undergoing for laparoscopic cholecystectomy participated in this study. The participants are adult and middle aged belonging to age group of 19 to 60 years. The mean age is 37.3 years.

Among them male participants are 07 (21%) and rest 26 (79%) are female patients. There is no co-morbidity taken into consideration. Table 1 shows the mean values and standard deviation of the examined parameters of liver function test in patients undergoing laparoscopic cholecystectomy.

### Total Serum Bilirubin

Pre-lap cholecystectomy, the total serum bilirubin level ranges from 0.40-1.40 mg/dl with mean value of 0.61±0.33 mg/dl. This level decreases to a mean value 0.54±0.22 (range of 0.40-1.40mg/dl) after one week post-operatively and level goes on further inclining up to a mean level of 0.58±0.60 (ranging from 0.40-0.90mg/dl) one month post-operatively but still lesser than pre-operative value. Total bilirubin level has been decreased insignificantly post-operatively as compare to pre-operatively ($p>0.05$).

### Serum Bilirubin (Direct)

Direct serum bilirubin level in pre-opeartive patients ranges from 0.20-0.70 mg/dl with mean value of 0.29±0.02 mg/dl. This level decreases to a mean value 0.27±0.12 (range of 0.1-0.7 mg/dl) after one week post-operatively and level goes on further declining up to a mean level of 0.26±0.07 (ranging from 0.2-0.5 mg/dl) one month post-operatively, however this decrease is insignificant ($p>0.05$).

### Serum Bilirubin (Indirect)

Indirect serum bilirubin level ranges from 0.20-0.70 mg/dl with mean value of 0.31±0.03 mg/dl in pre-operative. This level decreases to a mean value 0.30±0.03 (range of 0.2-0.7 mg/dl) after one week post-operatively and significantly increased ($p<0.05$) after one month of post-operative cholecystectomy with a mean value of 0.32±0.50 (ranging from 0.20-0.50 mg/dl). Figure 1 shows the serum bilirubin (Total, Direct and Indirect); Pre-operatively, one week and one month post-operatively.

### Serum Aspartate Transaminase (AST)

Pre-operatively the level of serum aspartate transaminase ranges from 13.80-71.80 IU/L with mean value of 30.30±0.34 IU/L. After 7 days of surgery, this level significantly rises to a mean level 34.26±0.20 IU/L (range: 12.2-98.3 IU/L). However, after one month level declined significantly ($p<0.05$) up to 28.60±3.60 IU/L (range: 15.2-49.7 IU/L) and it is lesser than 1 week of pre-operative cholecystectomy.

### Serum Alanine Transaminase (ALT)

Mean serum alanine transaminase level pre-operatively found to be 36.0±0.60 (IU/L) ranging from 18.20-69.40(IU/L). This level significantly inclines ($p<0.05$) following one week of surgery up to 41.0±0.32 (IU/L) with range of 8.10-139.80(IU/L). Though, this inclined level decreases to 36.30±12.50 (IU/L) (range 15.70-74.80)(IU/L) which is almost approaching pre-operative level.

### Serum Alkaline phosphatase (ALP)

Pre-operative level of serum alkaline phosphatise ranges from 122-205 (IU/L) with a mean value of 112.5±10.2 (IU/L). This level rises significantly ($p<0.05$) to range of 110-279 (IU/L) with mean value 123±56 (IU/L) one week post-operatively and remains same subsequently one month post-operatively ranging from 1.4-177 (IU/L) with mean value 123.6±48 (IU/L) which is still more than pre-operative value. Figure 2 shows the serum aspartate transaminase (AST), alanine transaminase (ALT) and alkaline phosphatase (ALP); Pre-operatively, one week and one month post-operatively.

### Serum Total Protein (g/dl) Level

Pre-operative level of serum total protein ranges from 6-7.8 g/dl with a mean value of 8.96±0.42 g/dl. This level insignificantly decreases ($p>0.05$) slightly to range of 2.6-8.3g/dl with mean value 7.05±0.3 g/dl one week post-operatively and remains almost same one month post-operatively ranging from 6.3-8.4 g/dl with mean value 7.2±2.4 g/dl which is lesser than pre-operative value.

### Serum Albumin (g/dl) Level

Pre-operative level of serum albumin ranges from 3.3-4.8 g/dl with a mean value of 3.8±0.26 g/dl. This level remains the same almost to range of 1.5-4.7 g/dl with mean value 3.8±1.3 g/dl one week post-operatively and further increasing one month post-operatively ranging from 3.4-4.7 g/dl with mean value 4.03±1.5 g/dl which is slightly more than pre-operative value however this increase is not significantly ($p>0.05$).

### Serum Globulin (g/dl) Level

Pre-operative level of serum globulin ranges from 2-3.7 g/dl with a mean value of 4.02±0.03 g/dl. This level decreases slightly to range of 1.1-4.7 g/dl with mean value 3.21±1.4 g/dl one week post-operatively and further declining insignificantly ($p>0.05$) one month post-operatively ranging from 1.9-4.5 g/dl with mean value 3.1±1.7 g/dl which is lesser than pre-operative value.

### Serum A/G Ratio

Pre-operative level of A/G Ratio ranges from1-1.68 g/dl with a mean value of 1.32±0.01. This level decreases significantly to range of 0.98-1.68 g/dl with mean value 1.24±0.6 one week post-operatively and further increasing significantly ($p<0.05$) one month post-operatively ranging from 1.2-1.64 g/dl with mean value 1.35±0.8 almost similar to pre-operative value which is slightly more than pre-operative value.

LFT has been used as a routine preoperative evaluation for gallbladder surgery as a tool to check for functional status of the liver. In our study, we have found that total bilirubin level has been decreased insignificantly post-operatively as compare to pre-operatively ($p>0.05$). However, we examine that pre and post cholecystectomy liver enzymes aspartate transaminase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP) has been disrupted significantly ($p<0.05$). This has been correlated with a study done by Ahmad (2011). Thapa *et al.,* (2010) also stated that in patients of choledocholithiasis, serum level of alkaline phosphatase was raised by 1.69±0.118 fold with significant statistical difference. However, alkaline phosphatase is a non-specific indicator of cholestatic liver disease because of its multiple sources like bone, placenta besides its production from the biliary canalicular membrane. Yang *et al.,* (2008) suggested that gamma glutamyl transferase, alkaline phosphatase, and total bilirubin were independent predictors of liver damage and gamma glutamyl transferase appeared to be the most powerful predictor (odds ratio 3.20).

Disturbances in liver enzymes after laparoscopic cholecystectomy were first studied by Halevy *et al.,* in 1994. The possible explanations included increased intra-abdominal pressure, squeeze pressure effect on the liver, excessive use of diathermy, pulling on the gallbladder (Halevy *et al.,* 1994) or it may be attributed to injury to CBD stones. Higher biliary tree pressures can lead to impaired bile secretion, retention of bile acids and consequent apoptosis or necrosis of hepatocytes (Rangaswamy *et al.,* 2017). Gallbladder surgery is not the only procedure associated with elevated postoperative LFTs.

**Table.1** Liver function test pre-operatively, 1 week and 1 month post-operativelaparoscopic cholecystectomy

| Parameters | Pre-operative | 1 week post-operative | 1 month post-operative | p-value |
|---|---|---|---|---|
| **Serum Bilirubin (Total) (mg/dl)** | 0.61± 0.33 | 0.54±0.22 | 0.58±0.60 | 0.547 |
| **Serum Bilirubin (Direct) (mg/dl)** | 0.29±0.02 | 0.27±0.12 | 0.26±0.07 | 0.90 |
| **SerumBilirubin (Indirect) (mg/dl)** | 0.31±0.03 | 0.30±0.03 | 0.32±0.50 | 0.004 |
| **Aspartate Transaminase (AST) (IU/L)** | 30.30±0.34 | 34.26±0.20 | 28.6±3.60 | 0.031 |
| **Alanine Transaminase (ALT) (IU/L)** | 36.0±0.6 | 41±0.32 | 36.3±12.5 | 0.038 |
| **Alkaline phosphatase (ALP) (IU/L)** | 112.5±10.2 | 123.0±56 | 123.6±48 | 0.026 |
| **Serum Total Protein (g/dl)** | 8.96±0.42 | 7.05±0.3 | 7.2±2.4 | 0.158 |
| **Serum Albumin (g/dl)** | 3.8±0.26 | 3.8±1.3 | 4.03±1.5 | 0.495 |
| **Serum Globulin (g/dl)** | 4.02±0.03 | 3.21±1.4 | 3.1±1.7 | 0.09 |
| **A/G Ratio** | 1.32±0.01 | 1.24±0.6 | 1.35±0.8 | 0.017 |

**Fig.1** Bar diagram of Serum Bilirubin (Total, Direct and Indirect); Pre-operatively, one week and one month post-operatively

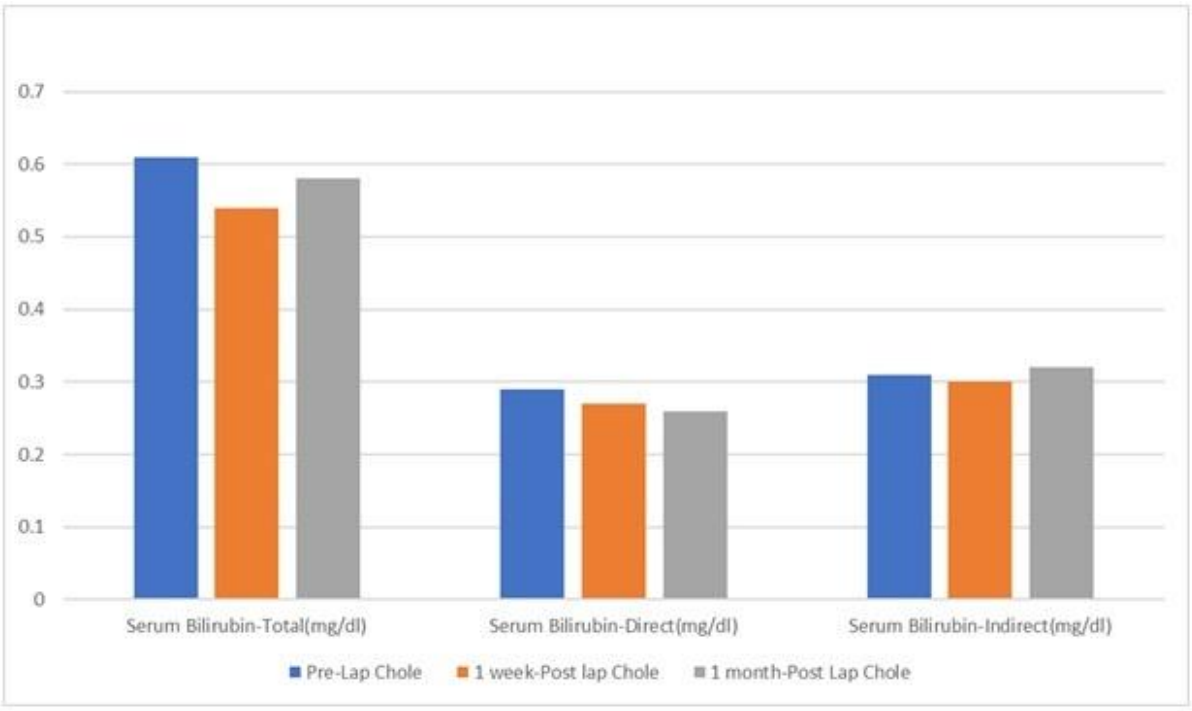


**Fig.2** Bar diagram of Serum Aspartate Transaminase (AST), Alanine Transaminase (ALT) and Alkaline Phosphatase (ALP); Pre-operatively, one week and one month post-operatively

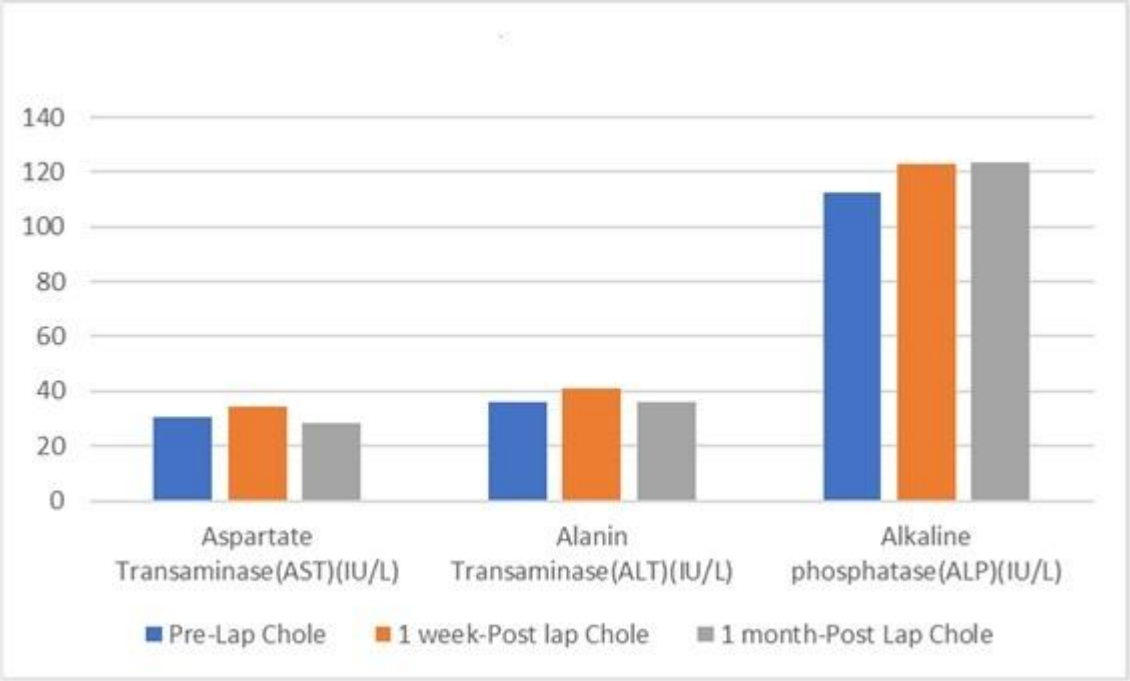
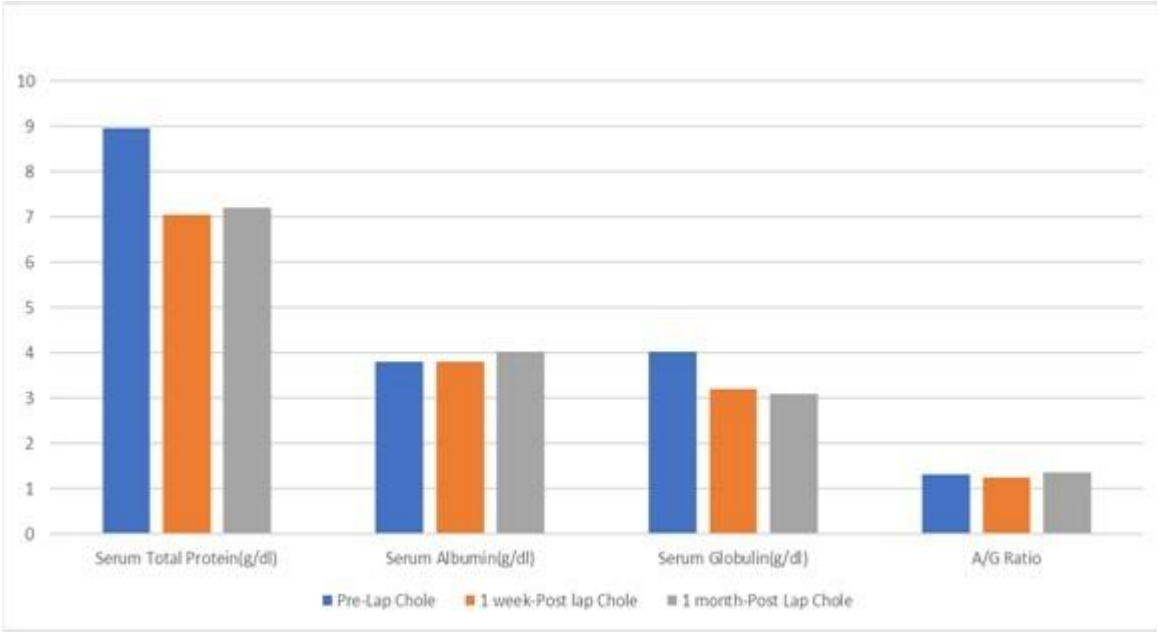



**Fig.3** Bar diagram of Serum Total Protein, Albumin, Globulin and Albumin Globulin Ratio (A:G); Pre-operatively, one week and one month Post-operatively




Other laparoscopic procedures like colorectal, gastric, or other abdominal surgery have also been associated with altered postoperative liver function tests (Jakimowicz *et al.*, 1998; Nguyen *et al.*, 2003). Early elevation of LFTs soon after surgery should not cause major concern as they usually return to normal without intervention. In the case of laparoscopic cholecystectomy, close monitoring by performing serial biochemical analyses can be done

when there is increased suspicion of an iatrogenic duct injury or slipped stone as indicated by elevated levels of alkaline phosphatase and bilirubin (Andrei *et al.*, 1998). An elevation of the liver enzymes is not always suggestive of retained stones. In earlier studies, a change in liver function tests of up to 70% has been reported with no adverse clinical outcome (Halevy *et al.*, 1994).

It can be summarized that this study interprets that the parameters like Serum Total Bilirubin, Serum Bilirubin (Direct), Serum Aspartate transaminase, Serum Total Protein and Serum Globulin levels are declined significantly after one month of laparoscopic cholecystectomy compared to pre-operative level. Few parameters like Serum Alkaline Phosphatase and Serum Albumin levels are raised significantly whereas Serum Bilirubin (Indirect), Alanine Transaminase levels and Serum A:G Ratio remain almost the same level one month post surgical as compared to their respective pre-operative levels.

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